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OVERVIEW

• The Integrated Pest Management Plan provides detailed information on how to prevent and manage pests on lands within the City of Calgary.

• Effective and environmentally-sound land stewardship is a fundamental component of the City's park maintenance management and environmental policy.

• This responsibility is also stated in Calgary Parks & Recreation's Business Plan Mission Statement and Goals: “Calgary Parks & Recreation will contribute to personal well being through protecting and enhancing our natural and recreational environments ... We will advocate and support development and management of attractive, livable communities.”

• Controlling invasive pests while promoting healthy growth of desirable species helps to fulfill this responsibility by:
  - reducing health dangers caused by insect or disease infestations
  - maintaining native vegetation
  - supporting citizens’ activities i.e. sports, aesthetic enjoyment
  - maintaining wildlife habitat

• The City of Calgary proposes an Integrated Pest Management (IPM) Plan to promote healthy vegetation and guide pest control activities on all public land and within civic structures and facilities.

• The City of Calgary will promote IPM principles through public education and work to encourage private land owners, school boards, and others to incorporate IPM principles in their operations.

• Integrated Pest Management (IPM) is a decision-making model used to prevent and manage pest problems.

• The City of Calgary's Plan promotes the use “traditional” IPM tactics (cultural, biological, mechanical, chemical, legal, genetic) to improve plant health, prevent and manage pest infestations.

• The IPM Plan will apply to all City departments and contractors who directly or indirectly manage vegetation or pests; or plan, design, renovate or construct landscapes and facilities.

• One of the goals of the IPM policy is to keep pests at acceptable levels through effective, economical, and environmentally-sound methods.

• Pesticide use can be reduced by increasing cultural practices to improve long-term vegetation health. Healthy vegetation successfully competes with weeds and disease.

• For the purposes of this plan, “pests” are any injurious insects, plants, diseases and animals.
NEED FOR PLAN & POLICY

- With no formal pest control guidelines in place, The City of Calgary has used varied pest control techniques. City Council recognizes the need for a formal policy and set of procedures for City-wide use.

- High levels of weeds in park areas and the subsequent deterioration of turf quality, are two of the most important challenges facing The City.

- Many citizens are concerned about the amount and location of pesticide application within Calgary, and its associated health and environmental impacts.

- Historically, facilities and parks have not been designed to minimize pesticide use and long-term maintenance requirements.

PLAN AND POLICY DEVELOPMENT

- City Council’s Environmental Advisory Committee (EAC) directed the Pesticide Advisory Task Force (PATF) to work with the public and Calgary Parks & Recreation – the primary steward of park land and open space – to develop and implement a comprehensive IPM policy. The PATF, working with expertise in Calgary Parks & Recreation solicited, public input and prepared the IPM policy section of the IPM Plan.

- The IPM Plan is based on similar principles and techniques as outlined in the Council- approved Natural Area Management Plan (NAMP) which protects vegetation communities by improving site conditions and fostering healthy conditions for optimal growth and plant health.

- In addition to referring to NAMP, the IPM Plan uses extensive technical knowledge of individual pests and their relationships to the environment.

- The IPM Plan is also guided by legislation and bylaws (see Legislative Context).

- Citizens presented their concerns and opinions about a draft IPM policy at public forums held in November 1996 and January 1997, and through written submissions to the Pesticide Advisory Task Force.

INTEGRATED PEST MANAGEMENT (IPM) PLAN

Principles

- Use an ecological approach to vegetation and pest management that strives to reduce reliance on pesticides as well as integrate preventative measures and alternative control technology.

- Minimize the risk to human health and the environment.
• Consider cost-effectiveness and operational feasibility.
• Consider community values
• Take a leadership role by educating citizens and private landowners about, and promoting an environmentally-sound, integrated approach to pest management.
• Apply IPM principles when planning, designing, constructing and renovating projects.
• Ensure accountability in pesticide use through a regular reporting system.

**Procedures**

1. Identify the pest problem(s).
2. Determine action level by considering:
   - acceptable damage tolerance levels
   - current infestation level
   - the most effective timing for treatment(s)
3. Review all possible treatment techniques to promote healthy vegetation and control pests and then select the most appropriate technique(s). Selected techniques are called “IPM prescriptions.”
4. Evaluate the IPM prescription’s effectiveness.

**Scope**

• The IPM Plan directly guides the management of civic land and sites within and around structures. The IPM Plan provides a complementary plan to manage structures and lands excluded from the Natural Area Management Plan. Together these plans will address land management issues for all corporately owned lands.

• The IPM Plan applies to all civic land including:
  - Parks & Playgrounds - sports fields, cemeteries, park grounds, pathways, paved areas, and storm water retention ponds
  - Urban Forest - trees in park areas and boulevards
  - Golf Courses - trees, fairways, roughs, greens, cart and pedestrian paths and irrigation systems
  - Natural Environment Parks - e.g. Nose Hill, Weaslehead, Bowmont Park
  - Societies - The Calgary Zoological Society, Heritage Park Historical Village, Fort Calgary Interpretive Centre, Calgary Science Centre
  - Nursery Facilities - Devonian Gardens, the Zoo Conservatory
- Non-park Areas - roadway green spaces, agricultural roadways, undeveloped civic-owned properties

• The IPM Plan applies to vertebrate and invertebrate pest control activities including rodent and mosquito control operations.

• The IPM Plan applies to other City departments including:
  - Calgary Parks & Recreation - manage park lands throughout Calgary
  - Calgary Transit - weed control along some sections of LRT tracks and around some bus stations
  - Calgary Police Services, Calgary Fire Department, Calgary Public Library & Engineering - maintain lawns and horticultural assets on property adjacent to their facilities
  - Corporate Properties - manages vegetation on and around City Hall, other vacant lands
  - Engineering & Environmental Services - manage land at water treatment plants

Implementation

• The City will implement the IPM Plan throughout its operations over a five-year period. Implementing the IPM Plan will start with Calgary Parks & Recreation’s operational units.

Roles & Responsibilities

• City Council will have the final approval authority for the IPM Plan, prescriptions and departmental IPM programs.

• The Environmental Advisory Committee will:
  - review IPM policy implementation and advise City Council, as required
  - recommend approval or rejection of departmental IPM programs and prescriptions to City Council through the S.P.C. on Operations and Environment

• Calgary Parks & Recreation (through the IPM Coordinator) will:
  - coordinate for the Corporation compliance with the IPM program through applicable laws, rules, regulations and policies
  - help develop design and construction criteria for use in landscape and facility development projects
  - coordinate the development and implementation of the IPM Plan with any other vegetation and pest management operations
  - coordinate the research needed to implement an IPM program
- assist in developing and implementing a public education program that promotes awareness and understanding of The City's ecologically sound vegetation and pest management practices
- help evaluate the IPM Plan and departmental programs, as required
- stay apprised of new and modified legislation and regulations that make it necessary to amend the IPM Plan. The Law Department are responsible for monitoring, identifying, and providing synopses and interpretations of new and modified environmental legislation and regulations. The Office of the Environment, Engineering and Environmental Services Department are responsible for circulating those synopses and interpretations to departments on a "need to know basis".
- report to City Council on IPM Plan related issues, as required
- evaluate, approve and rank all pesticide products that City departments wish to use, following these criteria:
  * Prescription Evaluation
  * Federal Registration

RESOURCES

- A successful IPM program requires an IPM coordinator, staff training, research trials, park design and development guidelines, park inventory and site evaluation, improved maintenance recording systems, increased level of cultural practices, annual program evaluation and a public education program.
CONCLUSIONS

• Site planning, rehabilitation and long-term management are the three cornerstones of a successful IPM program.

• The main changes between current pest-control operations and an Integrated Pest Management program are:
  - greater emphasis on assessments
  - increased level of cultural practices
  - greater emphasis on preventing pest problems through site design
  - establishing tolerance levels of infestation

• Some recommendations are only valid for sites that are already in good, healthy condition. Where pest problems already exist at high levels, it may be necessary to consider pesticide treatment with appropriate notification, or temporary closures to rehabilitate infested sites.
2. Integrated Pest Management Issues

The following integrated pest management issues were identified through a series of interviews with City of Calgary staff, meetings with the Pesticide Advisory Task Force, submissions from the public, and comments collected during IPM policy open houses. The data collected from the review were used to develop the plan’s framework and identify areas of concern to be addressed within the policy and plan.

1. PERCEPTION

A. Pesticide Use

Issue: There is a perception that all park land is treated with pesticides each year and that the City indiscriminately uses pesticides.

Response: The frequency of pesticide application on a given parcel of land is dependent on turf vigor and quality, location, and maintenance standards and type of park. On average, a parcel of land will be treated with a pesticide application once every four years - this figure is based on the annual volume of pesticides used each year by the City of Calgary. The maintenance standards for different parcels of land direct the efforts needed to maintain that site. The City of Calgary does not condone indiscriminate use of pesticides. This type of inappropriate conduct contradicts the provincial Environmental Codes of Good Practice for pesticide applications and is subject to prosecution by the provincial government.

Issue: The City should ban all pesticide use.

Response: Integrated pest management promotes utilizing the best strategy to address a specific pest problem, which includes using pesticides when necessary. Banning pesticides would reduce the number of management tools and also prevent the use of most biological agents that received approval by the Federal Government. There are various toxicological differences between pesticides available for use in Canada. Since some products are less toxic than others, the IPM plan proposes to establish a ranking system to group pesticides into one of three categories: Red (Eliminate), Yellow (Reduce), Green (Allow). This ranking system would facilitate the elimination of toxic products to be replaced with products that are environmentally compatible and less toxic.

B. Cosmetic Use of Herbicides in Parks

Issue: There is a perception that broadleaf weeds such as dandelions are not invasive and do not pose a threat to civic land. There are others that contact the City to undertake spraying operations in the parks to control weeds.

Response: Unhealthy turf is susceptible to diseases and weeds including dandelions. Turf maintenance is required to protect the financial investment placed in park land and inventory. Turf that is left unattended will suffer and result in a significant financial loss of the inventory - long term negligence may create a situation where it will be too costly to reclaim a site. The
IPM Plan recommends establishing injury and action levels for different pests which will address pest tolerance issues such as the level of weed infestations in civic facilities and sites.

C. Fungicide Use on Golf Courses

**Issue:** Fungicides are unnecessarily used on City golf course greens.

**Response:** Fungicides are used on golf course greens and tee boxes to control and prevent the establishment of turf diseases. Fungicide applications generally occur in the spring during low use periods and in the fall, prior to and after the courses are closed for the season. Summer applications are beginning to occur more frequently to address new plant diseases that have not been prevalent in previous years e.g. Pythium spp. Golf course greens are a unique environment and are subject to specific management practices. Golf course users pay for the privilege of using the facility and are informed of maintenance operations, including pesticide applications, in the club house and at specific sites on the course. The financial viability of the City's golf course operation would likely be at risk without playable golf greens.

D. Human Health Concerns

**Issue:** There are concerns that the products presently used by the City represent long term potentially dangerous hazards to individuals using public lands.

**Response:** The Pest Management Regulatory Agency of Health Canada is the governing body that approves and grants registration for pesticides in Canada. Prior to receiving Federal registration, the manufacturers are required to demonstrate that the products do not pose a significant health risk, as long as they are used in the manner they are registered for. The City of Calgary only uses pest control products that have received Federal registration.
Issue: Children that use tot lots and playgrounds can not comprehend pesticide warning signs and as a result are likely targets for secondary pesticide exposure.

Response: A larger sign format and two more symbols have been added to improve the legibility of the pesticide application site warning signs. A public education campaign will be initiated to teach park users, home owners, and children how to recognize the symbols and information on the warning signs. The IPM Plan also recommends that the City maintain “pesticide-free” buffer zones in and around playground, tot lots and public outdoor swimming pools.

E. Public Notification of Pesticide Applications

Issue: The concerns that the present notification system does not adequately address all potentially susceptible park users.

Response: There are several initiatives within the IPM Plan directed to improve public notice on pesticide applications. These include the following: 1) community residents receive a 4 day pre-notification of herbicide applications; Large warning signs would be posted at the main entrances to each community; 2) The physical size of pesticide warning signs will increase to 40cm x 56cm; 3) The City establish a volunteer pre-notification telephone registry for environmentally sensitive individuals.

2. RESOURCE MANAGEMENT

A. Formal Pest Management Plan

Issue: Present pest management practices differ throughout the corporation. There is no formal pest management plan or policy in place.

Response: Although there are no formal departmental IPM programs in place, Calgary Parks & Recreation has utilized different management strategies within their operational units that are fundamentally IPM based. However, there is a real need to have IPM standards and practices implemented throughout the Corporation to ensure that landscape maintenance standards and management practices, including pesticide use, are followed in an environmentally responsible manner. In 1997, The Calgary Zoological Society was the first society to formalize a 5 year plan to implement an IPM program into their operations.
B. Community Interest in Pest Management

**Issue:** There are a number of individuals that participate in parks maintenance within their communities. Individual communities have expressed interest in becoming “pesticide-free”.

**Response:** Presently, there is little coordination and continuity between the City and communities interested in reducing pesticide use within their parks. The IPM Plan would establish a framework to encourage and facilitate community involvement in park maintenance.

C. Pest Classification/Categories

**Issue:** There are provincial regulations and civic bylaws that are used to identify pests. These lists are not all inclusive.

**Response:** Citizens would like to assist the City in determining pest categories and tolerance levels of various pests within Calgary. Initial pest management objectives within the plan will be based on the legal pest definitions in the Agricultural Pest Act and Weed Control Act. Further review of these pest species will be determined in future IPM program reviews through the Environmental Advisory Committee.

3. PLANNING

A. Development Industry

**Issue:** At present, there is little effective formalized structure outlining the methods to build in IPM principles in structure, landscape, and facility designs.

**Response:** The IPM Plan recommends that IPM principles be included in development guidelines and standard specifications for landscape design and construction. These IPM guidelines will facilitate long term reduction in resources required for maintenance. It will be necessary to educate and train civic staff and private contractors that are directly involved with the planning and design of corporate facilities and structures.

B. Other Departments

**Issue:** Other departments do not necessarily have within their mandate the maintenance of civic landscapes, nor recognize Calgary Parks & Recreation as the primary land steward.

**Response:** Different priorities can create conflict between the use of pesticides and other management strategies on civic land. The IPM Plan recommends that Calgary Parks & Recreation establish an IPM coordinator who’s duties can include assisting other departments in preparing their IPM programs.
4. EDUCATION AND LEADERSHIP

A. Public Education and Interpretation

**Issue:** Information regarding pest management is not consistent, or coordinated. The City needs to become a leader in environmentally sound pest management.

**Response:** The IPM Plan would establish a framework to develop departmental IPM programs. This would occur through collaborative efforts between the IPM coordinator and departmental representatives. The IPM Plan also recommends that the City initiate a public education campaign and educational materials to inform Calgarians of current and alternative pest management practices.

B. Community Education and Interpretation

**Issue:** There are few formal educational opportunities which would enable communities to understand the methods and principles needed to participate in pest management of civic or private landscapes.

**Response:** Different levels of cooperation and participation will result from apparent contradictory messages received both in the communities and the department. The IPM Plan would establish an educational program on Calgary's IPM Plan and how home owners can utilize IPM principles and practices on their properties.

C. Staff Education and Training

**Issue:** There is little opportunity for staff to effectively learn how to implement IPM strategies within the corporation.

**Response:** Insufficient IPM training and a lack of participation by civic staff will prevent the implementation and long term success of the IPM plan. This would also prevent the anticipated long term reduction in life cycle costs at each site. The IPM Plan recommends that the City of Calgary establish an educational training program for civic employees, society employees, volunteers and private contractors involved with various aspects of pest management.

D. Marketing of the IPM Plan

**Issue:** Presently, there is a low public understanding about the initiatives undertaken by Calgary Parks & Recreation in managing our landscapes.

**Response:** Poor public perception could prevent the wide spread acceptance of IPM Plan through the Corporation and further prevent private citizens from adopting similar management strategies on their property. Corporate commitment is essential to ensure the success of the IPM Plan. The IPM Plan would establish a program to educate Calgarians on the IPM Plan and the various IPM program initiatives.
3. Background

Calgary Parks & Recreation manages approximately 7,000 ha of land which includes roadway greens, decorative parks and natural environment parks (1997 data). Each year the City of Calgary, through Calgary Parks & Recreation, inspects and finally assumes responsibility for managing newly-acquired property - increasing the land inventory by two to three percent (200 to 300 hectares). These properties are classed as environmental reserves (ER), municipal reserves (MR), and municipal and school reserve (MSR). These properties can be further developed into various facilities including natural environment parks, schools sites, decorative parks, tot lots, etc...

Calgary is located within the chinook belt, resulting in variable and often unpredictable weather patterns. Chinook winds limit the number of native and non-native plant species that are able to tolerate the variable climatic patterns.

The highest level of precipitation and daily average winds are during June, July and August. These two climatic factors seriously restrict pesticide application timing, unlike other cities (e.g. Vancouver) where the lowest levels of precipitation and daily wind occur during the same time period. Calgary's unpredictable weather conditions make notification prior to pesticide applications very difficult which in turn increases manpower costs and costs to reschedule applications, as well as the likelihood of missing optimal growth stages of target vegetation.

Herbicides have been successfully used to control weed populations. Generally, parks are sprayed on a rotational basis depending on need with no more than 3000 hectares of the total parks sprayed in any given year. The large land base physically prohibits annual applications of each park. Spot treatments or site-specific herbicide applications generally have less impact on the environment and are cost-effective. In some cases, annual application for 2 or 3 consecutive years has been needed to reclaim or restore parks. Once park maintenance reaches a desirable level, alternative and cultural controls can replace herbicide applications.

INTEGRATED PEST MANAGEMENT (IPM) PLAN DEVELOPMENT PROCESS

In the fall of 1994, The City of Calgary administration was requested to review the current pest management practices within the Corporation. The pesticide application procedures at that time were of particular concern to a number of citizens. An initial investigation revealed the need for a formal pest management plan to address issues throughout the Corporation. Subsequently, civic administration were directed by City Council to develop a comprehensive pest management plan.

The Integrated Pest Management (IPM) Plan was developed through a systematic process that included discussions with internal staff and public interest groups. The initial step was to set program goals and management objectives through a consultative process with operational staff and external public groups. The Integrated Pest Management (IPM) Plan was externally reviewed and endorsed by the IPM coordinators in the City of Victoria, B.C., and the Province of British Columbia, respectively.

The Pesticide Advisory Task Force (PATF), a sub-committee of the Environmental Advisory Committee (EAC), facilitated the public participation throughout the development of the Integrated Pest Management (IPM) Plan. During their two year mandate, 22 meetings and 3 open houses were held to
clarify public issues and perception on pest management and pesticide use. The PATF submitted 27 recommendations to the EAC for consideration by the S.P.C. on Operations and Environment and City of Calgary Administration.


The following is a brief overview of the common pest problems faced in The City, the legislation, policies, and bylaws currently in place and the IPM related features practiced in other Canadian cities.

WHAT IS A PEST?

There are governing provincial and federal legislation that provides a legal perspective to determine whether an organism is a pest. The City of Calgary has a legal responsibility to comply with these governing Acts and regulations (See Legislative Context).

A pest is defined in the Federal Pest Control Products Act as “any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal pest, and includes any injurious, noxious or troublesome organic function of a plant or animal”. The definition is also related to the situation or size of the pest population that adversely interferes with the aesthetic, health, environmental, functional, or economic goals of humans. The federal definition essentially states that a pest is any organism that poses a threat to our resources, human health, and/or exists in an undesirable location.

The Provincial Weed Control Act and Agricultural Pest Act contain regulations that identify various plants as weeds and animals as pests, respectively. These lists are by no means comprehensive, particularly in relation to introduced species that have negatively impacted our natural environment parks (e.g. Caragana spp.) or introduced mammals that continue to out compete native species (e.g. Grey squirrel).

COMMON PEST PROBLEMS FOR THE CITY OF CALGARY

Effective and efficient departmental IPM programs within the City of Calgary result from initial investigation of the following components: identification of key pest problems, factors that improve or promote health of desirable vegetation, factors that influence the presence of pests, and cost-effective IPM options for managing and preventing pests and undesirable vegetation. Each City department directly or indirectly involved with vegetation and pest management will be required to prepare an initial investigation of these factors. Clarifying these factors will help to determine the most appropriate management strategies in their IPM program.

Information about Calgary’s pest problems on public lands was developed through a series of focus group meetings with operational and line personnel; discussions with technical staff from specific operational units within Calgary Parks & Recreation; and inspections with field personnel of common plant health and pest management problems.
In individual and group interviews, staff identified, described, and ranked pest problems. During site visits, common problems were reviewed and discussed in the field. Primary pests pose a significant economic, physical, legal or health risk to parks land inventory or personnel. Secondary pests, if left unattended, will over time create a significant economic, physical, legal or health risk to parks land inventory or personnel.

**SUMMARY OF CALGARY’S COMMON PEST PROBLEMS**

These pest problems are found throughout Calgary in various locations including decorative parks, annual and perennial display gardens in Olympic Plaza, cemeteries, sport fields, roadway green spaces, operational compounds, City owned buildings and facilities. Generally each use site has different maintenance and pest management requirements.

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<td>Pests</td>
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- turf
- garbage cans
- sports fields
- natural areas
COMMON PEST PROBLEMS - URBAN FORESTRY

The urban forestry program involves the promotion and care of trees on Calgary's public lands which include boulevards, facility sites, and park areas. There are also unique management challenges within natural environment parks, the Heritage tree nursery (City-owned), along bike paths and trail right-of-ways.

Environmental factors such as chinook winds, snow cover, and soil conditions can predispose the urban forest to dieback, sun scald, chlorosis, and damage to root systems (lack of snow cover). These conditions threaten the integrity of the certain tree species within the City but can be minimized through proper site selection and nutrient supplements for new tree plantings.

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<th>INSECTS / OTHER INVERTEBRATES</th>
<th>DISEASES</th>
<th>ENVIRONMENTAL &amp; PHYSICAL</th>
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<tbody>
<tr>
<td><strong>Primary Problems</strong></td>
<td><strong>Secondary Problems</strong></td>
<td><strong>Primary Problems</strong></td>
</tr>
<tr>
<td>Pests</td>
<td>- yellowheaded sawfly (also larch sawfly)</td>
<td>- pear slug</td>
</tr>
<tr>
<td></td>
<td>- western ash bark beetle</td>
<td>- leaf miner various spp.</td>
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<tr>
<td></td>
<td>- smaller European elm bark beetle and native elm bark beetle</td>
<td>- scale</td>
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<tr>
<td></td>
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<td>- pine weevil</td>
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<tr>
<td></td>
<td></td>
<td>- forest tent caterpillars</td>
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<td></td>
<td></td>
<td>- ugly nest caterpillars</td>
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<td>- ants</td>
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| Hosts/Sites | | Hosts/Sites | | |
|-------------|---|-------------|---|
| - various tree species | - various tree species | - various tree species | - various tree species | - various tree species |
COMMON PEST PROBLEMS - GOLF COURSE OPERATIONS

Golf course operations include a variety of sites with a range of maintenance requirements: tee boxes, fairways, roughs, greens, cart and pedestrian paths, and irrigation systems. There are secondary maintenance requirements for practice greens and driving ranges.

Major pest problems at the golf courses are turf diseases which damage specialized features such as greens and tee boxes. Although weeds are found in golf course areas, these have not been a serious pest problem in most circumstances.

GOLF COURSE MAINTENANCE

The City's golf courses are subject to significantly higher stress based on an average of 55,000 rounds per season compared to 38,500 rounds on private courses. Healthy, playable golf greens are necessary to attract and maintain regular clientele; unhealthy, patchy greens do not attract return customers and therefore directly impact the success and viability of golf course operations.

The City's golf course operations has been proactive by voluntarily reducing use of pesticides, including mercury-based fungicides which are still actively used within the private golf course sector. Maintenance standards are designed to promote healthy, vigorous turf. An integrated approach to turf maintenance includes higher than standard fairway turf height at selected golf courses (3/4" vs. 1/2"), bi-annual soil testing to ensure each hole receives the optimal amount of nutrients, using mixed grass varieties, and automatic irrigation systems. Combining these non-chemical options maintains turf

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<th>WEEDS</th>
<th>INSECTS / DISEASES</th>
<th>VERTEBRATES</th>
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<tr>
<td>Primary Problems</td>
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<td>Primary Problems</td>
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<tr>
<td>Pests</td>
<td>broadleaf weeds</td>
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vigour and minimizes the impact of high volume use. Fungicides are used to prevent and control turf diseases that if left alone will negatively effect the turf.

The public has frequently expressed concerns about chemical use on golf courses. Alberta Environmental Protection’s Pesticide Management Branch conducted three studies to gather information on pesticide use throughout the province with these results:

- **Pesticide Use** - A 1990 survey of golf course superintendents conclude that Alberta golf courses use a lower volume of pesticides (83-87% lower on a per unit basis) as compared to American golf courses. Civic golf courses tend to use lower volumes of pesticides than the home and garden sector in residential areas (Alberta Environmental Protection Fact Sheet “Pesticide Use in Alberta 1997”).

- **River Sampling** - Four golf courses adjacent to rivers in the Banff-Calgary corridor were sampled for pesticides in 1991 and 1992. Trace amounts of four pesticides were detected infrequently in the river water samples at levels of up to 1/100 of the Canadian Drinking Water Guideline. These detections were not conclusively associated with the golf course operations.

- **Ground Water Sampling** - Samples collected from a network of shallow monitoring wells at five courses during 1992 and 1993, indicate that pesticides appear to have minimal impact on shallow ground water quality. In ground water, average nitrate levels associated with fertilizer application were well below the Canadian Drinking Water Guideline.

### COMMON PEST PROBLEMS - DEVONIAN GARDENS

The Devonian Gardens is a unique horticultural environment that contains over 20,000 individual plants and over 255 plant varieties. The entire facility is housed in-doors and must deal with various structural pest, biological and environmental management issues.

The principle pest problems are almost exclusively insects and diseases.

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<thead>
<tr>
<th>INSECTS / OTHER INVERTEBRATES</th>
<th>DISEASES</th>
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<tr>
<td><strong>Primary Problems</strong></td>
<td><strong>Secondary Problems</strong></td>
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<td><strong>Primary Problems</strong></td>
<td><strong>Secondary Problems</strong></td>
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<td><strong>Primary Problems</strong></td>
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<td><strong>Primary Problems</strong></td>
<td><strong>Secondary Problems</strong></td>
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</thead>
<tbody>
<tr>
<td>Hosts/Sites</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
<td>- various plant species in Devonian Gardens</td>
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</table>
COMMON PEST PROBLEMS - NATURAL ENVIRONMENT PARKS

Definition of problem wildlife and pest species in relation to natural environments along with specific control recommendations are listed on pages 70-71 of the Natural Area Management Plan. Weed and pest control guidelines for specific natural environment park categories are list on pages 77-78 of the plan.

COMMON PEST PROBLEMS - CALGARY ZOO

Most of the pests that occur in other civic facilities are also dealt with on the Calgary Zoo lands (see Table "Common of Pest Problems in Calgary"). The Calgary Zoo is also affected by structural and wildlife pests such as cockroaches and mice, and fox and mink, respectively. Complex structures are a source of food and shelter for pests and wildlife along the river valley.

CAUSES OF PEST PROBLEMS

In Calgary, the major causes of pests are:

- **Readily available sources for infestation** - seeds, eggs, adults, spores, host sites (open soil, mulch) or plants.
- **Environmental conditions** - insufficient irrigation, fluctuation in temperatures
- **Plants under stress** - due to poor maintenance or cultural practices, poor soil conditions, too little/much shade and/or moisture; insufficient nutrients, inappropriate site selection, vandalism; overuse of facilities/features; salt/mechanical damage from ice/snow removal

Other sources of pest problems:

- People are a common cause of landscape problems. Pedestrians and cyclists travel across shrub beds and turf areas, causing wear and tear on plants to the point where they cannot recover. Residents that operate maintenance equipment can damage turf or injure adjacent trees.
- Design and construction practices are also an important factor in creating or aggravate pest problems in urban areas. As they relate to Calgary's public lands, a variety of these situations were noted by the Parks operational staff.
- Increasingly, the growing constraints on municipal budgets coupled with the ever-growing level of public land development creates a situation where there is more to care for with fewer dollars. This conflict can seriously impede pest control and site quality, particularly on those sites or features which receive intensive use.
- Seasonal or localized site problems also influence the presence and severity of pest problems. For example, snow removal practices (which can include salt and/or mechanical damage) impede a plant's ability to resist insects and diseases.
Turf health is affected by mowing factors such as height, frequency of cut, mowing equipment and efficiency of equipment.

Unattended properties adjacent to civic land including annexed land and undeveloped land provide an abundant source of wind-borne weed seeds. Seeds, spores, eggs or other sources of pest infestation impacts pest problems in sports fields and peripheral areas. Turf diseases are spread from site-to-site on the turf maintenance machinery. Pesticide applications can be kept to a minimum provided the cultural practices effectively maintain turf and tree vigour.

### Causes of Pest Problems in Calgary

<table>
<thead>
<tr>
<th>Pests</th>
<th>Factors that Cause Plant Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeds</td>
<td>Insects / Other Invertebrates</td>
</tr>
<tr>
<td>- available seed sources</td>
<td>- general presence</td>
</tr>
<tr>
<td>- peripheral areas</td>
<td>- host plants</td>
</tr>
<tr>
<td>- open sites</td>
<td>- favourable environment - plant stress - tolerance levels</td>
</tr>
<tr>
<td>- type of mulch</td>
<td>- plant stress - tolerance levels</td>
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<tr>
<td>- irrigation</td>
<td></td>
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<tr>
<td>turf stress</td>
<td></td>
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<tr>
<td>- tolerance levels</td>
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The table above summarizes the causes of pest problems in Calgary, categorizing pests into different groups and their associated factors affecting plant stress.
CAUSES OF PEST PROBLEMS - URBAN FORESTRY

Preventative strategies are one of the primary methods to reduce or eliminate the potential pest sources. Plant Health Care (PHC) is important to urban forestry because optimal conditions improve the viability of trees and minimizing pest problems. Cultural practices include proper tree selection, planting, and maintenance in the establishment phase of tree development. Efforts placed on plant health care are an essential requirement in maintaining a healthy urban forest.

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<thead>
<tr>
<th>PESTS</th>
<th>FACTORS THAT CAUSE PLANT STRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeds</td>
<td>Insects / Other Invertebrates</td>
</tr>
<tr>
<td>-NA</td>
<td>-general presence</td>
</tr>
<tr>
<td></td>
<td>-host plants</td>
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<tr>
<td></td>
<td>-favourable environmental conditions</td>
</tr>
<tr>
<td></td>
<td>-plant stress</td>
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<td></td>
<td>-tolerance levels</td>
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CAUSES OF PEST PROBLEMS - DEVONIAN GARDENS

Devonian Garden’s pest problems are largely influenced by importing unwanted insects and diseases and the well-established presence of chronic pests. Seed in the soil on-site and those which are imported in material used for potting plants provide a ready source of weed pests.

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<thead>
<tr>
<th>PESTS</th>
<th>FACTORS THAT CAUSE PLANT STRESS</th>
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<tbody>
<tr>
<td>Weeds</td>
<td>Insects / Other Invertebrates</td>
</tr>
<tr>
<td>-available seed sources</td>
<td>-general presence</td>
</tr>
<tr>
<td>-open sites</td>
<td>-host plants</td>
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<tr>
<td>-irrigation</td>
<td>-favourable environmental conditions</td>
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<td>-tolerance levels</td>
<td>-plant stress</td>
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<td>-tolerance levels</td>
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CAUSES OF PEST PROBLEMS - GOLF COURSE OPERATIONS

As with other operations, recurrent pest problems on the golf courses are affected by the availability of seeds, spores, eggs or other sources of pest infestations that are already present throughout these landscapes and surrounding areas. Golf course greens are also susceptible to new diseases introduced on golf shoe spikes. For example, someone could complete a golf game in the southern United States and then fly back to Calgary to golf the following day on a civic course.

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<tr>
<th>PESTS</th>
<th>FACTORS THAT CAUSE PLANT STRESS</th>
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<tr>
<td>Weeds</td>
<td>Insects / Other Invertebrates</td>
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<tr>
<td>- available seed sources</td>
<td>- poor plant health</td>
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<tr>
<td>- irrigation</td>
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<tr>
<td>- turf stress</td>
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<td>- open sites</td>
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<td>- tolerance levels</td>
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CAUSES OF PEST PROBLEMS - NATURAL ENVIRONMENT PARKS

Management issues and concerns dealing with the impact of pest and weed species along with control methods for natural environments are discussed on page 22 of the Natural Area Management Plan.

CAUSES OF PEST PROBLEMS - CALGARY ZOO

Zoo horticultural operations also utilize Plant Health Care principles. Cultural practices include plant selection, planting maintenance such as aerating, mulching and fertilization. As with other operations, recurrent pest problems at the Zoo are affected by the availability of other sources of pest infestations adjacent to the facility. The causes of pest problems at the Calgary Zoo are similar to those listed in the table “Causes of Pest Problems in Calgary”.

The abundance of food and water within structures attracts structural pests such as rodents and cockroaches. Preventative techniques include exclusion/removal of habitat and improved sanitation. Maintenance personnel repair structures sealing cracks and crevices, repairing mesh, and fixing fences. If pesticides are used, the applicator selects the least toxic product. Secondary poisoning of non-target organisms is given the highest priority due to the proximity of endangered species on the Zoo grounds.

The river valley setting of the Zoo is attractive to wildlife who compete with zoo animals for food and prey upon them. In addition, wildlife and commensal animals (dog & cats) are a potential reservoir for disease.
GENERAL OBSERVATIONS

• Virtually all of the pest problems found on Calgary's public lands are common to this region of Alberta.

• While insect and disease problems are present and create serious maintenance requirements for some of Calgary's landscape management operations, weeds are the major pest problem on The City's public lands.

• Effective IPM prescriptions are available to minimize and prevent pest problems on Calgary's public lands.

• Pesticide use will be necessary to manage specific existing problems (e.g. recurrent disease problems on golf greens). The extent of pesticide is directly dependent on the available management resources which determine how effectively IPM strategies are applied.

• The City may need to use herbicides to rehabilitate existing sites before moving on to a maintenance mode using IPM strategies.

• Inadequate information about site inventories, site and feature-specific data (such as fertilizer requirements), and features maintained by each operational group, impedes efforts to analyze current pest management operations and develop cost effective IPM programs.

• In Calgary, as with many urban communities, design and construction are a major factor in creating or minimizing the occurrence or management of pest problems on public lands.

LEGISLATIVE CONTEXT

Vegetation and pest management operations are directed by the provincial Weed Control Act and Agricultural Pest Act which are legislated guidelines used by municipalities to manage and maintain their land inventories in accordance with legal guidelines.

Weed Control Act

The Weed Control Act places plants in three categories: restricted, noxious and nuisance. The list of weeds is not inclusive and should not be considered the final authority on problematic weeds but rather a guideline for municipal operations. The Act protects citizens from economic and invasive losses caused by weeds. For example, uncontrolled plant growth may interfere with lines of sight at intersections, rail or utility line control devices, as well as create fire hazards.

The Act defines municipalities weed control actions, methods of serving notices, who notices should be served on, and the conditions necessary for appeal. The Act also defines municipal inspectors' actions when confronting plants that are considered restricted, noxious or nuisance weeds.
Agricultural Pest Act

The Agricultural Pest Act places vertebrate, invertebrate and disease organisms into two categories: pest (which pose a more serious threat to Alberta landscapes) and nuisance.

The Environmental Protection and Enhancement Act

The Environmental Protection and Enhancement Act and its supporting regulations, governs pesticide handling, storage and application. Alberta Environmental Protection enforces the regulations that apply to pesticide use. The City of Calgary makes a conscious effort to ensure all its departments comply with the Alberta Environmental Protection’s regulations. In order to comply with provincial regulations, The City has routinely applied and has been granted approvals for pesticide applications within 30 horizontal metres of open bodies of water. In addition, The City has also received provincial special approvals to apply mosquito control products in open bodies of water near Calgary.

The Wildlife Act of Alberta and Migratory Birds Act of Canada

Some occasional pests fall under the guidelines of the Alberta Wildlife Act or the Federal Migratory Birds Act. As part of Calgary’s IPM Plan, provincial and federal wildlife authorities are consulted prior to any pest control actions dealing with these species e.g. Canada Geese.
**Provincial IPM Support**

Although The Province of Alberta has not created or established provincial guidelines or recommendations for implementing urban IPM programs, Calgary is actively pursuing an urban IPM program. However, municipalities do require provincial support and direction to ensure successful urban IPM programs.

For example, The Province of British Columbia actively supported and assisted Vancouver, Victoria and Burnaby in creating their own urban IPM program; this support is on-going. In fact, one of the primary goals of B.C.’s Environment Pesticide Management Program is to encourage and promote integrated pest management strategies within the province. A provincial IPM coordinator was established to coordinate pest management activities throughout the province.

British Columbia cities have also created Bylaws to address public concern over pesticide applications within the urban environment. For example, Burnaby developed a prior notification Bylaw in 1990, directing anyone using pesticides on public land or on the grounds of multiple family dwelling to post warning notices 72 hours prior to application until 72 hours after application.

**MUNICIPAL BYLAWS AND POLICIES**

**Bylaws**

In addition to provincial legislation, four municipal Bylaws direct Calgary’s pest control measures: the Mosquito Control Bylaw 8050, the Weeds, Grasses and Plants Bylaw 30M80, the Agricultural Pest Bylaw 5M94, and the Nuisance Bylaw 9025.

Mosquito control stops the development of immature mosquitos to minimize the impact of adult mosquito activity on Calgary residents. The Bylaw allows City staff to control mosquito activities on private properties throughout Calgary.

The Weed, Grasses and Plants Bylaw enables The City to meet the requirements of the provincial Weed Control Act. The City has elevated the “nuisance” weeds to “noxious” as well as added tall grass and weedy plants to the enforcement list. Weedy plant control is important because it: reduces the volume of weed seeds in soil; the spread of undesirable plants into areas where they disrupt livelihoods; the amount of plant material which can become fire fuel loads; clears sight lines at intersections, rail lines and along road right-of-ways; and improves aesthetics.

Weed notices are issued at the discretion of the weed inspector who follows established unit guidelines and considers the location and severity of infestation, the area/community, proximity to areas where the plant could spread (waterways), and potential impact on adjacent natural areas. Restricted weeds are always destroyed; whereas noxious weeds are controlled; and notices are always issued for Canada thistle, toadflax, scentless chamomile, leafy spurge and foxtail barley.
**Other Policies**

The Natural Area Management Plan’s (NAMP) primary goals are to ensure long-term viability of natural environments and to support their appropriate public use. The Plan established natural area management techniques founded on the basis that by protecting the viability of resources (vegetation communities, topography, soils and ecological associations), species will use natural areas as wildlife habitat. The preventative strategies recommended within the IPM policy are consistent with the NAMP’s strategies. Together, the NAMP and IPM policies address the management challenges within the majority of Calgary’s decorative and natural environment parks.

**IPM INITIATIVES IN OTHER CITIES**

Several Canadian cities have adopted and implemented IPM policies and programs to address local pest management concerns. Each program has been the result of extensive research to determine the most effective pest control and prevention methods based on factors such as environmental impact, long-term objectives, human health and exposure concerns:

**Waterloo, Ontario**

- Maintains 385 hectares.
- Developed a turf management program called Plant Health Care with strong emphasis on non-chemical strategies such as mowing and mulching, soil testing, top dressing, irrigating, over seeding, aerating and fertilizing.
- The Program’s main components include monitoring, maintenance schedules, extensive mapping and record keeping.
- Waterloo uses reel mowers to cut sport fields 20 times per season and park areas 8 times per season. Sport fields are routinely closed for short periods of time during the summer season to help turf heal and recover from extensive use.
- Waterloo has significantly reduced pesticide use over the Program’s 16 years of operation.

**Ottawa, Ontario**

- Manages a land base of approximately 372 hectares.
- Several years ago, pesticide use on civic property was banned.
- Today, general turf health and vigour does not adequately compete with weeds and Ottawa estimates $20 million to return the turf to a healthy, competitive state.
**Vancouver, British Columbia**

- Employ a full time IPM coordinator.
- Created a by-law to address pre-notification for pesticide application
- Adopted the provincial guidelines for implementing an IPM program and created a civic IPM policy.

**Victoria, British Columbia**

- Employ a full time IPM coordinator.
- Utilize pre-notification for pesticide application
- Adopted the provincial guidelines for implementing an IPM program but has not created a civic policy to date.

**Burnaby, British Columbia**

- Employ a full time IPM coordinator.
- Utilize pre-notification for pesticide application
- Hired a third party IPM consultant to develop their IPM policy and management plan.
4. Integrated Pest Management (IPM) Policy

VISION

The City of Calgary will contribute to personal health and well being by protecting and enhancing our natural, recreational, and non-recreational environments.

CONSIDERATIONS

The City must consider a range of issues and responsibilities when implementing vegetation and pest management in landscape and park environments, including:

- **Safety** - A primary management consideration is the safety of people using, maintaining, and developing the City's park facilities and other non-recreational corridors, i.e., roadway green spaces. Vegetation and pest management operations must be developed and implemented in a manner that protects the health and safety of the public and City personnel.

- **Education** - Education of City staff and the public is an important component of implementing the IPM policy. The City shall keep current with pest management strategies and incorporate them where applicable into the IPM program.

- **Water Quality** - Activities to manage vegetation and pests in the City of Calgary's landscape, park facilities, and land could impact surface and ground water quality.

- **Aesthetics** - The natural and developed beauty of Calgary is reflected in the diversity of its park system. For Calgarians and visitors, the aesthetic values of the City's park environments are a primary purpose for their acquisition, development, maintenance, and use. As growth pressures change the landscapes of Calgary and the surrounding area, the aesthetic benefits provided by the City's park system will become increasingly important.

- **Recreational Opportunities** - Calgary's park system provides citizens with a wide variety of recreational opportunities. Vegetation and pest management plans and operations must facilitate and enhance the opportunity to pursue and enjoy recreational activities.

- **Heritage Features** - Calgary's park environments include natural and introduced vegetation and features that are an important part of Calgary's history.

- **Natural Environment Parks** - Calgary's park environments provide valuable wildlife and native plant habitats. The importance of park environments as harbourages and conduits for wildlife and native plants will increase as areas of the city continue to be developed.

- **Restricted, Noxious and Nuisance Weeds** - Restricted, noxious, and nuisance weeds create serious negative impacts on both natural landscapes and developed lands. Weeds are classified as restricted, noxious, and nuisance by the Provincial Ministry of Agriculture Food, and Rural Development under the Weed Control Act, and by Municipal Weeds, Grass & Plants Bylaw 30M80. The provincial act and municipal bylaw require property owners to control (restricted and noxious) weeds to prevent their propagation and further spread.
Agricultural Pests - Pests (animal, bird, insect, plant or disease) can create serious negative impacts on the ecology of the natural and developed lands. Those organisms classified as either pests or nuisances by the Provincial Ministry of Agriculture, Food, and Rural Development under the Agricultural Pests Act and within the Municipal Agricultural Pests Bylaw 30M96 must be controlled by property owners.

Design Criteria - Site design significantly influences landscape maintenance requirements, costs, and environmental impacts.

Contracted Work - Private contractors hired by The City must carry out activities in accordance with the IPM Policy as well as follow IPM principles in design and construction.

**PURPOSE OF IPM POLICY**

To provide implementation guidelines for City departments and contractors directly involved with managing vegetation and pests, planning, design, or construction of new and renovated landscapes, facilities, and civic land.

To provide administrative guidelines for committees of Council, boards, and staff indirectly involved with vegetation and pest management.

To provide guidelines for the City of Calgary and set an example for all citizens and businesses in Calgary in implementing an IPM program and informing City staff and the public about IPM principles.

To minimize use of pesticides in the City of Calgary while controlling pests.

**PRINCIPLES**

The City of Calgary will manage vegetation and pests in a manner that:

- Promotes safe conditions for the public and city personnel.
- Provides opportunities for education and information about integrated pest management methods.
- Protects surface and ground water quality. The City of Calgary will continue to routinely monitor water quality for pesticide and fertilizer contamination.
- Maintains and enhances the aesthetic beauty of the City’s natural and developed park environments.
- Facilitates and enhances opportunities to pursue and enjoy recreational activities in park environments.
- Sustains, preserves and enhances heritage features to provide recreational opportunities to the citizens of Calgary.
- Sustains and enhances natural environment parks to provide recreational opportunities to the citizens of Calgary.
And The City of Calgary will:

- Control restricted, noxious, and nuisance weeds and pests in accordance with federal, provincial, and municipal regulations using an integrated pest management approach.
- Promote the use of IPM practices by the public in residential and commercial sectors.
- Develop and incorporate IPM design and construction standards and practices in its landscape planning and implementation programs.
- Ensure that contractors for each department carry out activities in accordance with the requirements of Calgary’s IPM Policy and incorporate IPM design and construction principles and practices in all park and facility development projects.
- Ensure developers adhere to IPM design and construction standards in new subdivision developments.

**POLICY STATEMENTS**

The City of Calgary will manage vegetation and pests using IPM principles that:

- minimize the risk to human health and the environment
- use an ecological approach
- minimize the use of pesticides
- determine cost-effectiveness inclusive of life cycle maintenance of various park features and amenities
- consider community values in establishing standards of maintenance for public land

The City of Calgary will maintain a pesticide-free buffer zone in and around playground, tot lot areas, and public outdoor pools.

The City of Calgary will notify the public prior to herbicide applications in park areas.
IMPLEMENTATION

Principles

• Implementation shall be coordinated among impacted City of Calgary policies and department programs.

• All departments and private contractors shall follow the City of Calgary’s IPM policy while performing City work.

• The City of Calgary shall provide on-going staff training to facilitate effective implementation of this policy.

• The City of Calgary shall promote development and implementation of landscape designs that are not only aesthetic and functional, but also provide opportunities for ecological approaches to and cost-effective management of vegetation and pests.

• The City of Calgary shall provide opportunities for public education and information regarding the use of ecologically sound methods of vegetation and pest management.

• The City of Calgary shall promote IPM strategies on major private land holdings such as private golf courses, school boards and industrial parks.

• The City of Calgary, including all of its departments and contractors, shall be aware of and comply with all laws, regulations, Bylaws, and policies that are directly or indirectly related to vegetation and pest management operations.

• City departments directly involved with managing vegetation and pests will implement and evaluate IPM programs in accordance with the requirements of this policy.

• City departments involved with the development, review, and implementation of landscape and facility design will implement and evaluate urban IPM programs in accordance with the requirements of this policy.

NECESSARY RESOURCES

Maintenance Management Information System

Calgary Parks & Recreation is reviewing its computerized maintenance program in preparation for a new computerized program which will effectively track all maintenance for each parcel of land throughout the season. Long-term benefits include an accurate log of historical information unique to each parcel of land. Initial estimates for developing and implementing a suitable computerized management information system are approximately $75,000 - $100,000.
Accurate and accessible information on maintenance requirements, resource use, and treatment results is critical to effectively and efficiently implement Calgary’s IPM Plan.

Data on the potential and actual use of maintenance resources (cultural practices such as mowing frequency, irrigation frequency, and fertilizer rates) and pesticides for vegetation and pest management problems are essential to focus the activities of the IPM program to minimize pesticide applications and reduce long-term maintenance costs.

Data would be used to:

* Identify predisposing factors that prevent plant health and detail optimal conditions to reverse and improve those conditions
* Identify sites and features that involve high labour and/or material maintenance requirements by determining their actual maintenance costs.
* Estimate the costs and benefits of modifying existing maintenance sites to reduce long-term costs.
* Determine the extent to which pesticides are necessary to rehabilitate existing sites and features to restore conditions that will permit cost-effective implementation of a Plant Health Care (PHC) maintenance program.
* Project the long-term need for pesticide use in the PHC maintenance program.
* Determine the cost-effectiveness of incorporating IPM design and construction practices in new facilities and landscapes to help minimize long-term maintenance costs and pesticide use.
* Develop department and operational group budgets for annual IPM program

Areas of the IPM program that are affected by gaps in information and reporting include:

* Monitoring for predisposing plant health conditions
* Monitoring for vegetation and pest management problems.
* Evaluation of the results of implementing IPM and PHC practices.
* Improvement of implementation strategies and practices.
* Developing estimates of the cost of maintenance for landscapes included in designs for new development projects.

**Recommendation:** Update the Parks Maintenance Management System to accommodate additional essential data for implementing Calgary’s IPM program. This should be further supplemented with a Global Position Satellite (GPS) method of data collection.
**Training**

Training is essential for all personnel involved with field implementation of plant health and pest management operations. Because IPM is ecologically and technically sophisticated and its application to urban landscape systems is still developmental, this training must be specific and regular.

Calgary Parks & Recreation staff will train first; staff from other departments will train during the second and third years of implementation. Initial estimates of developing a training manual and training staff are approximately $5,000 per year, over a five year period. Training all departments involved with pest management will promote understanding and a consistent approach to implementing IPM. Further training may be required to address the specific nature of work unique to each department.

IPM training and experience requirements should be added to the job descriptions for corporate personnel involved with plant health care and pest management. Calgary Parks & Recreation will develop a IPM training manual, and train operational staff directly involved with the IPM implementation.

Currently, the Natural Area / Pest Management Technical Group discusses operational and technical issues. However, there is no technical group to deal with IPM Turf management issues. It is recommended that a new technical group be established with representatives from the District Foreman 4, Tree Foreman 4, Devonian Gardens, Facilities Division, Golf Course operations, Zoo foreman, and the Parks Horticulturalist. The IPM coordinator should be appointed the chair and also act as a liaison between this group and the Natural Area / Pest Management Technical Group.

**Recommendation:** Technical IPM training will be required for all personnel involved with implementation of vegetation and pest management operations.

**IPM Development Guidelines and Standard Specifications for Landscape Construction**

Preventing problems through the design and construction of facilities and landscapes is an essential component of IPM and cost-effective maintenance, but right now, park and facility design circulations are not discussed with technical or operational staff involved with IPM. Furthermore, information on implementing various IPM design and construction options has not been made readily accessible.

IPM Design and construction guidelines should be amalgamated into the Urban Development Institute's document “Development Guidelines and Standard Specifications for Landscape Construction”. The guidelines can be used as a principal tool for incorporating preventative measures. These guidelines will be used by Calgary Parks & Recreation's Planning, Design and Development, Marketing and Systems section as well as other City departments. The guidelines could also be used to encourage developers, contractors, and citizens to use IPM principles when they develop and maintain facilities and landscapes on private land.

It is also recommended that where appropriate, future park and facility designs circulations include the IPM Coordinator to allow for comments or additional recommendations on park design or use of planting materials.
A significant amount of research work is required to develop an initial data base to provide departmental design and planning staff with a wide range of readily-accessible, useful information.

**Recommendation:** Develop a set of IPM Design and Construction Guidelines to facilitate the use of preventive IPM concepts and techniques to help minimize long-term pest management requirements and costs.

### Maintenance Standards

Maintenance standards determine the intensity and type of management applied to sites and features.

Where different types of landscapes connect, maintenance practices may conflict. To this end, departments and operational groups should work together to develop IPM training and standards.

Where minimum maintenance standards are acceptable to the public and maintenance staff, pesticide use can usually be avoided by applying alternative management practices and tolerating less managed conditions.

However, where standards are high and tolerance for pest damage is low (e.g. areas with aesthetic importance, functional purpose, historical value, or extensive public investment), it may be difficult to avoid chemical use: applying alternative management strategies and practices may not work; fiscal resources may inhibit intensive application of effective non-chemical methods; maintenance personnel may feel compelled to use pesticides to meet expected levels of quality or protect the integrity of the site or feature.

When there are concerns about pesticide use but non-chemical approaches are ineffective or too expensive, the City must decide how to manage sites with established high standards:

* Should pesticides be applied, but limited by some restrictions?

* Should the standard be amended to accept the presence of more pests (e.g., weeds in turf) or more pest damage?

* Can/should the feature be modified to minimize or prevent pest problems and pesticide use?

Calgary Parks & Recreation is reviewing its maintenance to provide a further component of the IPM program. The cost of completing the review will be assumed during the course of regular operations, and will not require additional funds.

**Recommendation:** Park Maintenance Standards should be reviewed and updated to re-establish a common vision and implementation guidelines for maintaining Calgary’s park facilities and features.

### Staffing

Current staff levels provide adequate vegetation and pest management to maintain existing standards, however, IPM programs require additional staff time to monitor, evaluate and implement IPM prescriptions. These will be evaluated on a routine basis. One of the likely benefits of a successful IPM
program is reduced reliance on pesticides. Therefore, the funds once used for pesticide use should be re-directed to supplement cultural or other alternative management practices.

A large portion of IPM duties such as routine monitoring, mapping, and evaluating IPM maintenance practices should be assigned to one permanent IPM gardener in each district. Once the implementation is complete, each area will have as many as five IPM gardeners.

**Recommendation:** Adequate staffing levels will be required to provide the operational capability necessary for implementing departmental IPM programs.

**IPM Coordinator**

Several communities in western Canada and north-western USA have created full-time IPM Coordinator positions to facilitate the complex and difficult transition to integrated pest management following years of infrastructure development and maintenance that relied on conventional management.

**Recommendation:** Appoint or hire an IPM Program Coordinator to provide continuing program leadership, coordination, and development of the City's IPM programs.

**ROLES & RESPONSIBILITIES**

- **City Council** will have the final approval authority for the IPM Plan, prescriptions and departmental IPM programs.
- **The Environmental Advisory Committee** will:
  - review IPM policy implementation and advise City Council, as required
  - recommend approval or rejection of departmental IPM programs and prescriptions to City Council through the S.P.C. on Operations and Environment
- **Calgary Parks & Recreation (through the IPM Coordinator)** will:
  - coordinate for the Corporation compliance with the IPM program through applicable laws, rules, regulations and policies
  - help develop design and construction criteria for use in landscape and facility development projects
  - coordinate the development and implementation of the IPM Plan with any other vegetation and pest management operations
  - coordinate the research needed to implement an IPM program
  - assist in developing and implementing a public education program that promotes awareness and understanding of The City's ecologically sound vegetation and pest management practices
  - help evaluate the IPM Plan and departmental programs, as required
- stay apprised of new and modified legislation and regulations that make it necessary to amend the IPM Plan. The Law Department are responsible for monitoring, identifying, and providing synopses and interpretations of new and modified environmental legislation and regulations. The Office of the Environment, Engineering and Environmental Services Department are responsible for circulating those synopses and interpretations to departments on a “need to know basis”

- report to City Council on IPM Plan related issues, as required

- evaluate, approve and rank all pesticide products that City departments wish to use, following these criteria:
  * Prescription Evaluation - application methods, scale of application, exposure elements, buffer zones
  * Federal Registration - adverse human health effects, animal exposure data, mobility and persistence in the environment, potential impact on non-target organisms, inert ingredients, data gaps, pesticide classification, information obtained from the Ministry of Health Canada and Alberta Environmental Protection.

CORPORATE GOALS

To ensure operations involving vegetation and pest management are implemented through a classical integrated pest management program that emphasizes an ecological approach, reduces the reliance on pesticides through preventive and alternative methods, and considers long-term costs in evaluating the effectiveness and economic feasibility of vegetation and pest management prescriptions.

• To ensure public accountability in any pesticide use under its IPM Plan and programs.

• To ensure that any pesticide use minimizes adverse impacts on human health or the environment.

• To ensure compliance with all pertinent laws, regulations, by-laws, and policies regarding the use of pesticides on public lands.

• To ensure that community values are considered in the development and implementation of vegetation and pest management plans.

• To ensure that training is provided for staff who develop and implement the City of Calgary’s IPM programs.

• To ensure that ecologically-sound vegetation and pest management principles, concepts, and techniques are promoted in the design and implementation of development projects on public lands.
• To ensure that opportunities are developed and promoted for public education and information regarding environmentally-sound methods of vegetation and pest management.

• To establish an IPM program for effective, economical, and environmentally-sound management of vegetation and pests.

• To promote long-term, cost-effective management of vegetation and pests.

• To provide IPM training for department personnel directly and indirectly involved with vegetation and pest management.

• Provide opportunities for public education and information about implementation of IPM.
LEGISLATIVE AUTHORITY FOR THE REGULATION OF PESTICIDES

Pest control products are regulated in Canada under the authority of the Pest Control Products (PCP) Act and Regulations. The intent of the legislation is to ensure the safety, merit and value of pest control products used in this country. This fundamental principle focuses specifically on the protection of human health and the environment, and product performance.

Control Product

In the PCP Act, a “control product” is defined as “any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, mitigating, attracting, or repelling any pest, and includes:

- Any compound or substance that enhances or modifies or is intended to enhance or modify the physical or chemical characteristics or a control product to which it is added,
  AND
- Any active ingredient used for the manufacture of a control product.”

Pest

The term “pest” is defined as “any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal pest, and includes any injurious, noxious or troublesome organic function of a plant or animal.” This directly relates when the situation or size of the pest population adversely interferes with the aesthetic, health, environmental, functional, or economic goals of humans.

As such, products regulated under the PCP Act cover a wide spectrum. As well as herbicides, fungicides, and insecticides, they include biological agents such as bacteria and viruses that are used to control pests; antimicrobial agents used in oil wells, wood preservation, non-potable water purification systems and material preservation; and growth regulators that control and “injurious, noxious or troublesome organic function of a plant or animal.”

The PCP Act and Regulations require that all pest control products used or imported into Canada be registered. This includes all active ingredients and manufacturing concentrates, and all subsequent formulations (end-use products) containing active ingredients.

At the working level, product registration is a consultative process involving experts within Agriculture and Agri-Food Canada, Environment Canada, Health Canada, and Natural Resources Canada.

In addition to the PCP Act, a number of other federal acts may have implications in regulating or limiting the use of pesticides. The Food and Drug Act sets limits for permissible maximum residue levels of agricultural pesticides in food; the Canadian Environmental Protection Act, the Fisheries Act...
and the Migratory Birds Convention Act provide for protection of the environment from toxic chemicals, including pesticides. The provinces and territories also regulate pesticide through licensing and sale of products within their respective boundaries. They may apply more stringent controls, although they may not permit the use of products not registered by the federal authority. Furthermore, municipalities may enact by-laws which limit the use of pesticides on a local level.

In Alberta, the Provincial Government’s Environmental Protection and Enhancement Act defines a pesticide as:

(i) Any substance intended, sold or represented for use in preventing, destroying, repelling or mitigating any insect, nematode, rodent, predatory animal, parasite, bacteria, fungus, weed or other form of plant or animal life or virus, except a virus, parasite, bacteria, or fungus in living people or animals,

(ii) Any substance that is a pest control product within the meaning of the Pest Control Products Act (Canada) or is intended for use as such a pest control product,

(iii) Any substance that is a plant growth regulator, a defoliant or a plant desiccant,

(iv) A fertilizer within the meaning of the Fertilizers Act (Canada) that contains a substance referred to in subclause (i), or (ii) or (iii), and

(v) Any other substance designated as a pesticide in the regulations, but does not include a substance that is intended, sold or represented for use in potable water to prevent or destroy bacteria, parasites or viruses if the substance is not a pest control product within the meaning of the Pest Control Products Act (Canada).

Pesticides can be subdivided into different classes:

**Herbicide**

A chemical substance or cultured biological organism used to kill or suppress the growth of plants. Also defined as chemical compounds used to kill or inhibit undesirable plant growth.

**Insecticide**

A chemical substance used to control insects.

**Fungicide**

A chemical substance used to control or prevent the development of fungi.

**Rodenticide**

A chemical substance used to control or prevent the development of rodents.
FEDERAL AND PROVINCIAL LEGISLATION

The Environmental Protection and Enhancement Act (EPEA) addresses pesticide use within Alberta, including storage, handling, application, and use. Environmental Protection and Enhancement Act AR 24/97 Section 5 directs that “(1) No person shall (a) use, apply, supply, handle, transport, display, store or dispose of (i) a pesticide, (ii) seed that has been treated or mixed with a pesticide, or (iii) wood that has been treated with a pesticide or (b) operate any machine, equipment or vehicle, aircraft or vessel in connection with the use, application, handling, transportation, storage or disposal of a pesticide in a manner or a time or place that causes or is likely to cause an adverse effect. (2) For the purpose subsection (1), “adverse effect” does not include an effect that results from the application of a pesticide in a manner that conforms with the label and this Regulation”.

Pesticides are not covered under the WHMIS (Workplace Hazardous Materials Information System). However, they are classified under the Transportation of Dangerous Goods (TDG) categories.

Pesticide use, storage, transportation, and handling must comply with the provisions of the Public Health Act, Nuisance and General Sanitation Regulation (AR 242/85). The regulation states that “No person shall create, commit or maintain any condition that is or might become injurious or dangerous to the public health or that might hinder in any manner the prevention or suppression of disease.” Similar provisions appear in the EPEA, AR 24/97 Section 5.

Service Registrations and Special Use Approvals

Alberta Environmental Protection’s Chemicals Assessment & Management Division issues service registrations and special-use approvals to municipalities that apply pesticides. The City of Calgary holds a service registration and two special-use approvals:

1. For mosquito control operations within 30 horizontal metres of an open body of water in the Municipal District of Foothills.

2. For pesticide applications within 30 horizontal metres of open bodies of water within the City of Calgary.

Approvals are valid for two years. Copies of service registrations and special-use approvals are kept on file at Central Parks Services.

Prior to the start of a seasonal pesticide application campaign, employees ensure that their operations comply with the regulations and the conditions outlined in the special-use approvals.

Provincial Certification Requirements

Alberta Environmental Protection regulates pesticide sales, handling and applications throughout the province. The categories of pesticide applicator certificates which may apply to the Corporation include: agricultural, aquatic, biting fly, forestry, greenhouse, industrial, landscape, structural, and special (including stump treatment).
All pesticide applicators must pass a certification exam to qualify for an Alberta Pesticide Applicator Certificate. Alberta Environmental Protection, in cooperation with Lakeland College, has authorized a training program to prepare prospective candidates for the certificate exam. Training may be provided through completing the Home Study Course independently, or by attending a tutorial offered by several institutions. These classroom tutorials are intended to reinforce the candidate's understanding of the course material by means of discussions, presentation, and lectures. To obtain the maximum benefit from the tutorials, course materials should be reviewed thoroughly prior to attending. It is strongly recommended that any civic employee wishing to obtain an Alberta Pesticide Applicator Certificate complete the Lakeland College Pesticide Applicator Home Study Course prior to writing a certification examination. Anyone failing a certification examination will be required to complete an approved training program before an examination re-write can be attempted.

Civic employees that require a pesticide certificate for their operation and are interested in obtaining the Lakeland College Pesticide Applicator Home Study Course or attending a tutorial can contact Central Parks Services #75 for further information. If you receive a new certificate or if there has been a change in the status of your present certificate, please contact Central Parks Services #75. A list of all civic certified applicators is kept on file at Central Parks Services.

CITY ENVIRONMENTAL POLICIES AND PROCEDURES FOR PESTICIDE HANDLING AND STORAGE

Environmental Regulatory Compliance Policy

In March 1994, Council adopted The City of Calgary Environmental Regulatory Compliance Policy and the Board of Commissioners adopted an Implementation Plan for the Policy. The Policy delegates the responsibility for making duly diligent effort to ensure that corporate operations and activities are undertaken in accordance with federal and provincial environmental regulatory requirements to individual departments. The Implementation Plan requires that departments develop their own implementation plans, practices or procedures for ensuring environmental regulatory compliance.

The Law Department has the general responsibility to take environmental regulatory requirements into account when providing legal advice and services to Council, the Board of Commissioners, departments and other boards, commissioners, and authorities under the jurisdiction of The City of Calgary. The Law Department also has a specific responsibility pursuant to paragraph 5 of the Implementation Plan to monitor and to prepare summaries and interpretations of new, and amendments to existing, environmental regulatory requirements, which are then to be provided to the Office of the Environment, Engineering and Environmental Services Department, for circulation to departments on a "need to know" basis.

Material Safety Data Sheets and WHMIS Training

All pesticides must have a WHMIS approval number before City of Calgary employees, including private contractors hired by the Corporation, use them. Approvals are obtained by submitting a Request for
Authorization To Purchase A Controlled Material form (X-180) along with a current pesticide label and material safety data sheet (MSDS) to Calgary Parks & Recreation, Central Parks Services #75. Once a WHMIS approval number is obtained, staff must receive product-specific WHMIS training before using the product to ensure they can safely handle the product.

**Transportation of Dangerous Goods (TDG)**

All pesticides transported within the Corporation - even those transported internally during daily operations - must be accompanied by TDG documentation. Central Stores warehouses only accept pesticide shipments accompanied by the appropriate, corresponding TDG documents.

Civic staff involved with transportation of pesticides must have received internal TDG training and certification.

**Pesticide Purchase**

Employees only use products that are reviewed and have a City WHMIS approval number.

Only staff that hold a current pesticide applicators certificate can purchase pesticides. In addition, purchases must correspond to their certificate e.g. an employee with a landscape certificate can purchase turf or landscape related products, but not products for mosquito control. Products can be obtained by submitting a requisition to Warehouse 791 (Mail Code #75), 111 - 17 St. SE (221-4693).

**Pesticide Storage**

All storage facilities must meet the minimum storage requirements as outlined in Alberta Regulation 24/97 which does not differentiate between temporary and permanent storage sites. Presently all provincially inspected City of Calgary storage facilities meet or exceed these requirements.

Although pesticides are housed in various locations throughout The City, Warehouse 791 is the primary year round storage location. Unheated, summer storage sites are also used, especially during the operational season.

In consultation with Alberta Environmental Protection, Calgary Parks & Recreation recycles empty residential freezers and uses them to hold small volumes of pesticides during the summer. The freezers are retrofitted with locks and warning signs, and placed within a fenced compound to make for an economical and ecologically-sound small pesticide storage facility. Certain pesticides are not able to withstand freezing, and therefore must be stored in heated storage throughout the winter.

Future storage compartments or buildings should always comply with Alberta's Safety Codes Act and pesticide storage requirements as outlined in Pesticide Sales, Handling, Sales and Application Regulation 24/97.
Pesticide Container Disposal

Pesticide containers are accepted for disposal at the Forest Lawn land fill site if the plastic containers are triple rinsed and accompanied by an Industrial Chemical Waste Disposal Permit form (E-395). Contact Engineering and Environmental Services Department, Solid Waste Services 230-6616 between 8-10 a.m. to arrange for a permit and to book a time for disposal.

Environmental Release (Pesticide Spill)

In the event of a chemical release, please refer to your departmental emergency response protocols.

Each departmental environmental release requirements should be stated with reference to the requirements of Part 4, Division 1 of the Environmental Protection and Enhancement Act, the accompanying Release Reporting Regulation and the City of Calgary’s Release Reporting Policy. Although the Release Reporting Policy establishes Corporate policy for release reporting requirements under Section 99 of the Environmental Protection and Enhancement Act, at present there is no Corporate policy for the immediately following requirements to take remedial measures under Section 101. Recently the Board of Commissioners assigned initial responsibility for long-term re-mediation.
GENERAL PESTICIDE APPLICATION AND PRE-NOTIFICATION PROCEDURES

Pesticide Application by Civic Employees

Provisions within the Environmental Protection and Enhancement Act state that individuals receiving payment for application or applying a pesticide on a right-of-way, park, boulevard, campground or picnic area located on public land, must hold a service registration (approval) and follow the provisions as described in Alberta Regulation 43/97 which require that no person shall:

Use or apply a pesticide in Schedule 1 or 2 unless that person:

• Holds an applicator certificate in one or more of the classes of application certificate listed in Schedule 5

OR

• Works under the supervision of an applicator and in accordance with the latest edition of the Environmental Code of Practice for Pesticides published by the Department.

AND

No person other than an applicator with the appropriate certificate or a person working under the supervision of an applicator in accordance with the latest edition of the Environmental Code of Practice for Pesticides published by the Department shall “use or apply a pesticide in Schedule 3 in or on the grounds of a school, hospital, nursing home or day care facility.”

FURTHER

No person shall, unless that person holds a pesticide service registration, offer or provide a service involving the use or application of a pesticide for hire or reward,

OR

Use or apply a pesticide listed in Schedule 1, 2 or 3 whether or not for hire or reward

(i) on a right-of-way;

(ii) on a park, boulevard, campground or picnic area located on public land;

Only City employees or private contractors who hold a valid and applicable pesticide applicators’ certificate or work under the direct supervision of a provincially-certified applicator, may apply pesticides on civic property. Furthermore, they must follow the Alberta “Environmental Code of Practice for Pesticides.” The City will ensure that an experienced, conscientious applicator will be used in applications in environmentally sensitive or special use areas.
Posting and Notification - External Sites

Pesticide applicators must comply with all safe application methods as listed within The Environmental Code of Practice for Pesticide, Regulations 24/97 and 43/97, including wearing safety equipment as well as applying products under optimal environmental conditions and within the parameters as directed on the pesticide label.

Large prenotification signs will be posted at the main entrances to each community 4 days prior to herbicide applications.

Before pesticide application, applicators must post warning signs at all major entrances in parks that have a discreet perimeter, as well as two additional signs in the middle of the park. On land that does not have discreet perimeters, signs are posted approximately every 100 metres in and around the area of application. Where appropriate, signs are also posted in heavy traffic, non-paved pathways such as accesses to bus stops or sidewalks. The signs remain in place until 48 hours after application.

Posting and Notification - Internal Sites

Do not apply pesticides within the structural perimeters of public facilities unless notices have been posted at all public entrances to the site a minimum of 24 hours prior to the intended application. Such notices should remain posted for 48 hours or more after treatment. Where treatments occur in areas of public use areas not accessible to the public (e.g. working area of a restaurant), notices are only required at staff entry way(s).

Prior notification is not required for applications of wettable powders to perimeter baseboards and/or cracks and crevices within the structural perimeters of a public facility, unless such notification is a requirement of the pesticide label or such posting has been requested by the manager, owner or relevant authority.

Pesticide Application Near Open Bodies of Water

Pesticide applications within a specified distance from “open bodies of water”, as defined under the Environmental Protection and Enhancement Act and the Environmental Code of Practice for Pesticides, will only be undertaken by experienced, certified applicators.

An “open body of water” means the bed and shore of an irrigation canal, drainage canal, reservoir, river, stream, creek, lake, marsh or other body of water, but does not include the following:

(i) waterworks systems;

(ii) reservoirs, lakes, marshes or other bodies of water that are completely surrounded by private land, that have an area of less than 4 hectares and have no outflow of water beyond the private land;

(iii) reservoirs, lakes, marshes or other bodies of water that are located on public land, that have an area of less than 0.4 hectares and have no outflow of water;
(iv) irrigation and drainage canals that are completely surrounded by private land and have no outflow beyond private land;
(v) roadside ditches;
(vi) wastewater systems;
(vii) storm drainage systems;
(viii) dry streams having a bed and shore averaging 0.5 metres or less in width within the boundaries of the treatment area.

A “bed and shore” means land that is or has been covered by water to the extent that:

(i) no vegetation grows on the land, or

(ii) the vegetation that grows on the land is aquatic vegetation that must be partially submerged in water for part of its life cycle to survive.

Record Keeping for Pesticide Applications

After each application, the applicator records all pertinent information in a biocide report (X-135) or approved form. At year end, applicators send a copy of each biocide and a summary of all products used in that calendar year (volumes consumed, total area treated) to Central Parks Services #75. Copies of all biocides are kept on file for five years, as directed by the Environmental Protection and Enhancement Act.

Pesticide Application Procedures for Golf Course Operations

Golf course maintenance presents unique challenges including four-day advanced electronic booking, higher than average daily use, and client demand for highly manicured turf. Furthermore, golf courses operations commence at 6:00 am and continue until sunset each day throughout the outdoor season.

All pesticides used on civic golf courses are only applied by provincially certified pesticide applicators.

Over the past several years, golf course operations have successfully reduced the level of pesticide use - including mercury-based compounds - by following these application protocols designed to minimize customer exposure while still allowing for open access throughout the season:

Herbicide Applications on Golf Course

Generally only one application per season is required throughout the course. To minimize potential exposure to golfers, temporary tees and greens will be created during the period prior to application. Temporary tees and greens will remain in effect until the permanent tees and greens are dry and suitable for resuming golf activities. Fairways and rough areas are spot-treated during the day when the hole is still in use. Applicators use shrouded application equipment designed to minimize spray drift.
Fungicide Applications on Golf Course

There are generally 1-2 fungicide applications per year on the greens. To minimize exposure to golfers, golf course operations creates temporary greens during the period just prior to application. Temporary greens remain in effect until the permanent greens are dried and suitable for resuming golf activities.

Pesticide Application by Private Contractors

Every two years a private pesticide applicator tender is created by Supply Management Services, in conjunction with Calgary Parks & Recreation and Fleet Management. Guidelines for private applicators ensure that private contractors meet the specific requirements and qualifications required to carry out responsible pesticide applications on civic land. Specific requirements that are not in the current tender, may be placed in a subsequent tender.

Application Protocols for other Operations

Notification guidelines ensure that the general public are fully aware of the City's integrated pest management operations. There can be variations on these guidelines, as long as City departments maintain the original intent of keeping the public aware of pesticide applications.

RECOMMENDATIONS:

1. All pesticides used by the City of Calgary employees, including private contractors hired by the Corporation, must first receive a WHMIS approval number.

2. Prior to using any pesticide, all staff working with that product must receive product specific WHMIS training. Assistants must also receive the training required in Environmental Code of Practice for Pesticides at least once.

3. Prior to the start of a seasonal pesticide campaign, employees must ensure that their operations comply with the conditions outlined in the pesticide service registration and special use approvals.

4. Only staff who hold a current pesticide applicators certificate may purchase pesticides which are consistent with the parameters of the applicator’s certificate.

5. Pesticides shall only be stored in facilities that comply with Alberta’s Safety Codes Act and Environmental Protection and Enhancement Act Regulations 24/97

6. City operations shall only use private contractors that are on the existing Private Contractors Tender, unless an exemption is granted by Fleet and Facilities. This is to ensure that the Private Contractors will possess a valid service registration for the period employed by the City of Calgary.
7. Any pesticides applied on civic properties shall only be done by employees or private contractors holding a valid and applicable pesticide applicators certificate or by uncertified employees working under the direct supervision of a provincially certified applicator. Civic employees will require an applicator’s certificate to apply Schedule 3 products in right-of-ways, on a park, boulevard, campground or picnic area located on a public land.

8. Site warning signs must be posted prior to the pesticide application. The applicator shall provide the necessary information on the sign. The signs shall remain in place and be retrieved 48 hours after application. Warning signs must also be posted prior to spraying pesticide rinsate from any application equipment.

9. Site warning signs will not be required in areas that prohibit access by the public such as along the LRT tracks and in transformer enclosures. In these instances, written notice should be advertised in a daily newspaper a minimum of 4 days prior to application.

10. Large pre-notification signs will be posted to warn communities of impending pesticide applications.

11. Upon completion of each application, the applicator shall record all pertinent information in a biocide report (X-135). One copy of each biocide record along with a complete summary of all products used (volumes consumed, total area treated) for that calendar year shall be submitted by year end to Central Parks Services #75.

12. Empty pesticide containers must be disposed of in a manner consistent with provincial regulations (such as triple rinsed) and disposed of in the City landfills.

13. Chemical spills must be dealt with in a manner consistent with departmental emergency response procedures.

14. Establish a pesticide ranking system to classify pesticide use into 3 categories:
   a) Red. Eliminate the use of products that are most toxic and/or persistent.
   b) Yellow. Reduce the use of products that are moderately toxic and/or persistent. These would be justifiable in an IPM program under certain circumstances, such as when a certain threshold is exceeded, a playing field must be renovated, or in case of an unforeseen pest outbreak.
   c) Green. Allow the use of products that are least toxic and/or persistent. These would be allowed within an IPM program and under certain circumstances might even be allowed to increase, especially if they replaced red or yellow products.
6. Glossary

These terms have been collected from a number of sources and those sources have been identified where possible at the end of each definition. The following abbreviations apply to the approved document source:

(NAMP) Calgary Parks & Recreation Natural Area Management Plan
(PRPP) Parks and Recreation Policy and Systems Plan 1988-1922

Abiotic - Not living

**Action Levels** - Action level is the level of development of a vegetation and pest population at a specific site at which action must be taken to prevent the population from reaching the injury level.

Acute - Short term

**Agricultural Pest Act** - An Alberta provincial act that contains the legal framework to address nuisance and pest organisms.

Biocide Report - An internal City of Calgary (X-185) document used to record pertinent information related to each pesticide application

Biotic - living

**Biological Control** - The use of living organisms (parasites, predators, pathogens) to reduce or maintain pest populations to acceptable levels.

**Chemical Control** - The use of a control product such as a pesticide to suppress or control a pest.

Chronic - long term

Community - A group of populations of plants and animals in a given area. Also relates to a group of individuals living within a legal or political boundary.

**Control Product** - Any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, mitigating, attracting, or repelling any pest.

**Cultural Practices** - Management practices that focus on the prevention of pest by maintaining healthy hosts through proper planting, pruning, mulching, sanitation practices (also referred to as Plant Health Care (PHC))

**Diversity** - The variety of species, vegetation communities, habitats or landform in a given area

**Ecology** - The study of relationships between living things, with each other and with environments

**Ecological Approach** - A systems approach to prevention and management where control strategies are determined based on the relationship between the target's organisms life cycle and its environment.

**Ecosystem** - A community of organisms and their physical environment
Education - The knowledge and development arising from training.

Environmental Advisory Committee (EAC) - A sub-committee of City Council

Environmentally Sound Methods - IPM strategies and prescriptions that provide a desired result at reducing the impact of pest populations. These strategies are chosen based on the selection criteria to ensure minimal impact on the general environment and non-target organisms.

Environmental Protection and Enhancement Act (EPEA) - The purpose of the Act is to support an promote the protection, enhancement and wise use of the environment. The Act also recognizes the need for protection of the environment is essential to the integrity of ecosystems and human health and to the well-being of Society. The Act also provides legal framework for various environmental issues including the use of pesticides within Alberta (AR 126/93 and 127/93).

Evaluation - Involves analysis of treatment strategies and prescriptions to help determine the effectiveness of the control program. These records are useful in developing future pest management plans.

Fungicide - A chemical substance or cultured biological organism used to kill or suppress or prevent the development of fungi.

Genetic Control - Management practices that focus on the prevention of pests by selecting plant material that has desirable genetic predisposing features such as resistance to pests, suitable for the environmental conditions of the site, suited to the hardiness zone and geographic location, and features that are ideal for their intended use.

Herbicide - A chemical substance or cultured biological organism used to kill or suppress the growth of plants. Also defined as chemical compounds used to kill or inhibit undesirable plant growth.

IPM Prescriptions - Integrated pest control or eradication plans that are specific to a variety of pest management situations and/or pests and vegetation; these plans are based on the principles of IPM.

IPM Programs - Department, Division, and/or Operational Section level programs which are designed and developed to implement the Integrated Pest Management Plan; individual programs are geared to the specific administrative and operational requirements and responsibilities of that specific working group.

Insecticide - A chemical substance or cultured biological organism used to kill or suppress the growth of insects.

Inventory - A survey of selected natural resources not necessarily including an assessment.

Integrated Pest Management (IPM) - Integrated Pest Management is an ecological approach to suppressing pest populations (i.e. weeds, insects, diseases, etc) in which all necessary techniques are consolidated in a unified program, so that pests are kept at acceptable levels in effective, economical, and environmentally sound methods. Since pest problems are often symptomatic of ecological imbalances, the goal is to attempt to plan and manage ecosystems to prevent organisms from becoming pests.
Injury Levels - Injury level refers to the point in growth of a vegetation or pest problem where it will cause an unacceptable impact on: public safety, recreation, or health; natural and/or managed ecosystems; aesthetic values; economic injury to desirable plants; or the integrity, function, or service life of facilities.

Legal Control - The use of Acts, Bylaws, or other legal statutes that limit the development of pest populations by restricting or regulating human activities i.e. quarantine programs.

Life-Cycle Maintenance (Principles) - The management activities required to maintain or rehabilitate a site or facility over its projected lifetime.

Management - To direct to a degree, the outcome of a particular project or land area.

Management Plan - A planning study and resulting document where the concern is to identify issues and create a management and implementation strategy. (NAMP)

Material Safety Data Sheet (MSDS) - A listing of chemical, technical, and hazard information for the specific product it names. It states health hazards of product use and a list of all hazardous ingredients (unless a specific exemption has been granted). The sheet details safe handling and usage procedures for all applications.

Miticide - A chemical substance or cultured biological organism used to kill or suppress the growth of mites.

Monitoring - Involves the regular surveying of sites and/or features to understand and identify the location and extent of potential pest management problems.

Native - Species of animals or plants that have not been introduced by people or their direct activities.

Natural Area - Any land and/or water area that has existing characteristics of a: natural/native plant or animal community; portions of a natural ecological and or geomorphic system. It retains or has reestablished a natural character although it need not be completely natural. (NAMP)

Natural Environment Park - A natural area class to be included in the Open Space Classification. (NAMP)

Noxious (weed) - Plants which have potential for rapid spreading and major economic impact. Weeds in this category are to be controlled to prevent their spread. They are well established in some areas of the province. Efforts must be undertaken to prevent spread to other locations within the province.

Non-Park Areas - Parcels of civic land that are managed by Calgary Parks & Recreation but are owned by another Department within The City of Calgary. This includes roadway green spaces and undeveloped land. These properties will be managed within the framework of the IPM Plan.

Non-target Organism - Any plant or animal other than the intended target of a pest management strategy

Nuisance (organism) - Common animals which are widespread across the province. They are found on nearly all land and while they do cause economic losses their further spread is virtually impossible since they already occupy every area to which they are biologically suited. Further legislation is of no value.
**Nuisance (weed)** - The most common weeds which are widespread across the province. They are found on nearly all land and while they do cause economic losses their further spread is virtually impossible since they already occupy every area to which they are biologically suited. Further legislation is of no value.

**Organism** - Each individual living thing: animal, plant, fungus, bacterium, or one of the single-celled creatures called protists.

**Parasite** - An organism (parasite) that lives in or on another (host), from which it obtains food, shelter, or other requirements.

**Park** - A specific use open space area which is managed to provide opportunities for recreation, education, cultural or aesthetic use. The main type of parks are:

1. **City-wide** - a park, also referred to a special interest park that offers historical, zoological park, botanical, cultural and educational opportunities for the residents of and visitors to the city (e.g.) zoo, planetarium, historic sites.

2. **Regional Recreational Parks** - a park, large and basic to the park system. It offers diverse or special activities to the entire city. These currently include athletic parks and natural environment parks.

3. **Community Parks** - a large park having facilities intended for local use. It includes school grounds, community athletic fields and natural environment parks.

4. **Neighborhood Parks** - a small passive park offering spontaneous recreation to the local resident. It can include tot lots and playground. (PRPP)

**Park Reserve** - An open space area, publicly owned, intended for use as a park. (PRPP)

**Park (or Parkland) Zone** - A resource management technique involving distinguishing units for varied management objectives, within a specific park (e.g.) recreational experiences, preservation etc. (PRPP)

**Pathogen** - A disease-causing organism.

**Pathways** - A route that provides designated access by a variety of compatible multiple or single travel modes (excluding automobiles). It is designed for the pursuit of outdoor recreational experience and activities. Pathways may be for bicycles, cross country skiing, pedestrian or equestrian use unless otherwise identified.

**Pest** - Any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal pest, and includes any injurious, noxious or troublesome organic function of a plant or animal. Where by the situation or size of its population adversely interferes with the aesthetic, health, environmental, functional, or economic goals of humans.

**Pesticide** - A substance that is intended, sold or represented for use in preventing, destroying, repelling or mitigating any insect, nematode, rodent, predatory animal, parasite, bacteria, fungus, weed or other form of plant or animal life or virus, except a virus, parasite, bacteria in living people or animals. A substance that is a pest control product within the meaning of the Pest Control Products Act (Canada) and is granted federal registration by Pest Management Regulatory Agency, Health Canada. e.g. herbicides, insecticides, fungicides, rodenticides, and miticides.
**Pest Control Products Act (Canada)** - A Federal Act administered by Health Canada. The Act and
regulations cover the following areas: registration, labeling, classification, import/export control,
storage, packaging, advertising, display, distribution, and use. All pesticides used in Canada must be
registered under the Pest Control Products Act.

**Pesticide Advisory Task Force (PATF)** - A sub-committee of the Environmental Advisory Committee
(EAC) created to facilitate public sector involvement in the review and development of the Integrated
Pest Management Policy section. The PATF held 22 meetings and 3 open houses to gather information,
public submissions, and comments. The PATF submitted 27 recommendations to the EAC for
consideration (see Appendix II). The PATF were comprised of members from the following sectors:
Industrial Vegetation Management Association of Alberta (IVMAA), Calgary Minor Soccer Association,
Pesticide Working Group (2 members), Landscape Alberta and Nursery Trades Association (L.A.N.T.A.),
Crop Protection Institute (C.P.I.), Alberta Environmental Protection, Alberta Agriculture, Food and
Rural Development, Calgary Parks & Recreation, Calgary Health Services, Southern Alberta Turf Grass
Association (S.A.T.A.), River Valleys Committee, Environmental Advisory Committee, Calgary Board of
Education (C.B.E.), Calgary Catholic Board of Education, Citizen-at-Large (2 members).

**Plant Health Care (PHC)** - A holistic approach to plant (turf and tree) care that focuses on the health,
growth, and beauty of plants. Utilizes a comprehensive matrix of information to facilitate decision
making.

**Preventative Measures** - Management practices that are directed towards preventing the establishment
of pests (e.g. site design, genetic materials, optimal site selection for plant materials)

**Primary Pest** - A pest that poses a significant economic, physical, legal or health risk to the land
inventory or personnel.

**Record-keeping** - Involves maintenance of written records of specific pest management factors observed
during monitoring, information on labour and materials used in implementation of the urban IPM
program, results of applied pest management strategies, and comprehensive data on pesticide
applications.

**Restricted (weed)** - These weeds must be eradicated. Weeds in this category possess highly competitive
characteristics, inherent for rapid spread, and may pose difficulties for control. These weeds are known
to be very serious problems in other countries or provinces, but are not well established in Alberta.
**Rodenticide** - A chemical substance or cultured biological organism used to kill or used to control or prevent the development of rodents.

**Secondary Pest** - A pest, if left unattended, will over time create a significant economic, physical, legal or health risk to the land inventory or personnel.

**Selection of Optimal Strategies** - The criteria for selecting treatment tactics and developing pest management strategies include:

A. Least disruptive of natural controls;  
B. Least hazardous to human health;  
C. Minimizes negative impacts to non-target organisms;  
D. Least damaging to the general environment  
E. Best preserves natural or managed ecosystems;  
F. Most likely to produce long-term reductions in pest control requirements;  
G. Effective implementation is operationally feasible;  
H. Cost-effectiveness in the short and long term.

**Special-Use Approvals** - An approval issued by Alberta Environmental Protection for projects in specific locations. This includes pesticides that are excluded from the Environmental Code of Practices for Pesticides but used within 30 horizontal metres of open bodies of water.

**Species** - A genetically distinctive group of natural populations that share a common gene pool that are reproductively isolated from all other such groups

**Timing** - Involves a treatment action during the most vulnerable time in the life cycle of the vegetation or pest with the least impact on natural predators and/or other non-target organisms.

**Transportation of Dangerous Goods (TDG)** - An international system of identification so that dangerous goods may be handled, stored and shipped safely. This is enforced by a Federal Act. It applies to all persons who handle or offer dangerous goods for transport (i.e. shipper, mover, receiver)

**Undeveloped Land** - Corporately owned land that does not contain any permanent buildings, structures or facilities.

**Weed** - Generally a herbaceous plant not valued for use or beauty, growing wild, and regarded as using ground or hindering the growth of useful or desirable vegetation.

**Weed Control Act** - A provincial Act intended to protect land from the invasion and establishment of weeds. Powers of enforcement have been delegated to the local municipality.

**Workplace Hazardous Materials Information System (WHMIS)** - A Federally/Provincially legislated information system designed to supply workers with the information needed to use workplace hazardous materials safely. This includes pesticides and controlled products while regulated by TDG regulations.
7. Suggested Reading


Fushtey, S.G. and M.K. Sear. Turf Grass Diseases and Insects Pests.Sear Publication AGDEX 273, University of Guelph, Ontario


IPM strategies and prescriptions are necessary to manage pest problems:

Strategies are a combination of short and long-term approaches to managing a pest problem. For example, using direct, manual methods to control weeds in tree wells, while planning to install tree mulch by the end of the season to eliminate the need for further weed control (Ard and Proul, 1995).

Prescriptions describe the implementation plans for one or more practices. For example, a prescription for turf grass management might include a strong cultural program consisting of increased mowing heights and frequency, fertilizing, irrigating, top dressing, aerating, over seeding, and allow for regular rest periods to recover from heavy use (Ard and Proul, 1995). IPM prescriptions may be a single strategy or a combination of different treatments within each strategy.

IPM prescriptions may be comprised of a single strategy or a matrix of different treatments within each strategy. The primary pest management strategies available are outlined in Figure 6-1 (pest). The current pest management practices are outlined in Figure 6-2 and 6-3 (vegetation and insect & disease).

General prescriptions outline a full range of treatments that have shown merit and may be useful for preventing or managing a pest problem. They do not indicate the precise set of practices, techniques, or materials, that will be cost-effective.
The City of Calgary will consider these criteria when selecting IPM prescriptions and developing pest management strategies:

1. Human health and safety.
2. Be least disruptive of natural controls.
3. Minimize negative impacts to non-target organisms.
4. Be least damaging to the general environment.
5. Best preserve the natural or management ecosystem.
6. Most likely produce long-term reductions in pest control requirements.
7. Be operationally feasible and effective.
8. Be cost-effective in the short and long term.

Site-specific prescriptions require analysis and evaluation of the particular site conditions and circumstances. This information is used in reviewing potential options outlined in general prescriptions to help determine the most appropriate treatment methods, tools, materials, timing, that together provide cost-effective and environmentally sound results.

IPM prescriptions are continually subject to review and revision. Technology advancements, field research, registration and availability of control products, resources, as well as changes in site conditions impact the long-term success and viability of an IPM prescription. The maintenance of an accurate site inventory, routine monitoring, and routine evaluation of historically successful prescriptions provides enough information to select prescriptions that address changes in the present and future pest populations.

PRESCRIPTION COMPONENTS

**Categories of Facilities**

The assignment to a category is based upon the level of management that will be applied to that site/facility, with High Profile sites receiving the most intensive management. There are examples for each type of category, however, the list is by no means exhaustive. Some park types such as natural areas are eligible for all management categories. Management levels are determined through a combination of different factors including site location, park type, and available resources.

**Identification**

It is important to identify the problem correctly, so that prescriptions are effective. Life-cycle information can help determine when management strategies and preventative measures have the greatest effect.

Reference guides complete with sketches and/or photographs are an invaluable aid for plant identification. Should further assistance be required, a leaf, stem, or complete plant may be submitted to Central Parks Services for identification.
Monitoring

Monitoring helps staff decide if treatments are necessary, the best timing of treatments, and their effectiveness. Successful management programs include regular inspections for unwanted vegetation and pests, as well as their growth rate.

Quantitative samples (e.g. 0.25m² weed counts) are normally collected when the level of a specific pest infestation is considered to be at treatment threshold. If precise monitoring methods have not been developed, visual inspections may be the only viable alternative.

Visual site inspections are needed to assess and record conditions. Use a map and highlighting pen to update general areas for control methods. Site plans and evaluations forms for recording specific information should include:

1. Location.
2. Type of pest (i.e. vegetation, insect, disease, vertebrate, etc.).
3. Stage of growth or development (e.g. pre-bolting, larval stage).
5. Reason for treatment, if required.

The frequency of site inspections per growing season depends on several factors including park type, established action and injury thresholds, and historical problems. Inspections may be required before treatments to ensure controls are applied at the optimum time. Variations in the target and non-target populations should be noted (e.g., recently germinated, seed head formations, population density of ladybird beetles in elm trees or aquatic predacious insect in mosquito control).

Establish Impact Assessment and Action Levels

A variety of factors should be evaluated when deciding how the site should be managed:

Determine thresholds for each area, quantitative where possible. For example a percentage of weed / vegetative cover suitable to each site could be established as thresholds for determining when treatments may be needed.

Plant injury and pest populations are directly related to a site or facility's maintenance regime of and the consequences of leaving target organisms untreated. The action level (AL) defines when a particular treatment should be applied to deter pest levels from rising above the predetermined impact or injury level (IL). The allowable level of damage (ALD) is similar to the action level but represents a measure of damage rather than the size of the pest population. It can be used in place of the action level when pest populations are difficult to monitor or with pests for which it is difficult to correlate the size of the pest population with the amount of damage that is occurring. The ALD can be difficult to establish due to its subjective nature. As with maintenance standards, participation from operational and administrative staff is essential in setting allowable levels of damage.
Select Treatment Techniques

A management program may include one or more treatments. Wherever possible, non-chemical treatments should be used as they have less impact on the environment. If pesticides must be used, applicants should first review monitoring records and site plans to determine factors that could affect treatment, and then use careful timing and precise equipment. Non-chemical management techniques include the following items:

1. Preventative/Cultural Measures: Design, development and construction of landscape facilities prevent or minimize pest problems. Cultural practices - such as routine irrigation, fertilizing, and top dressing - also provide similar benefits.

2. Physical and Mechanical Controls: These control methods require operational equipment and staff, and their effectiveness is often limited by insufficient funding. Examples include manual weeding, string trimming and mowing around fence-lines and site perimeters, chainsaws or heavy-duty mowers to control woody perennials, repetitive mowing, or cutting of top-growth of bushy weed species.

3. Chemical Controls: Control products are selected according to specific criteria, with preference given to low toxicity and highly selective products. Selected herbicides must be compatible with an IPM program and must be applied with target-specific techniques whenever practical. Justification for using broadcast applications must be indicated on the PMP form.

   For plant species that vigorously re-sprout after cutting (e.g. quack grass), applying herbicides to the fresh re-growth, often reduces the amount of herbicide needed.

   The most target-specific application techniques available should be used. This includes using back-pack or hand-held sprayers, low-volume closed-system applicators (e.g., the Expedite system), wick applicators (e.g., the Rod Weeder), and covered boom or shrouded applicators.

Evaluation

After treatments, it is necessary to determine the results through follow-up inspections. Frequency and timing of inspections varies according to the treatments and the site(s) category: optimal timing may be within days, weeks, or months of treatment. Review monitoring records and site plans to determine factors that affected the treatment(s). A historical database of previous monitoring and evaluation inspections can be used to determine effectiveness of treatment methods and the need for re-treatment. Examples of factors include the rate of regrowth after mowing and percentage of stems killed by herbicides.

Summarize Minimum Action Necessary

To maintain a service level for a particular site, a series of minimum actions are outlined within each section. This should serve as a “starting” point when developing an IPM program. An enhanced service level includes the minimum actions along with any additional treatments necessary to retrofit, improve, or maintain a parcel of land at the desired maintenance level.
FIGURE 6-1. TREATMENT STRATEGIES FOR IPM PROGRAMS

- Problem Prevention
  - Incorporates IPM standards in Park & Facility development criteria
  - Plan a comprehensive cultural management program
  - Education: Corporate staff, private contractors, public

- Direct Control Methods
  - Pesticides
    - Insecticides
    - Fungicides
    - Herbicides
    - Rodenticides
  - Physical methods
    - Manual methods
    - Mechanical methods
    - Biological methods
    - Physical methods
  - Chemical methods
    - Environmental methods
  - Environmental methods
  - Install retrofit design to prevent or mitigate impacts of key pests
  - Institute comprehensive cultural management programs for site with pest problems
  - Education: Corporate staff, private contractors, public, private landowners
FIGURE 6-2. VEGETATION CONTROL TREATMENT STRATEGIES

Vegetation Control

Undeveloped Lands
- Pesticide application for restricted and noxious weed control

Neighbourhood paths & parks
- Control Prescriptions
  - Minimum cultural practices
  - Minimal use of pesticides

Parkland
- Control Prescriptions
  - High level of cultural practices
  - Minimal use of pesticides

Boulevards & Roadways
- Control Prescriptions
  - Minimal level of cultural practices - land subject to harsh conditions
  - Pesticide use where appropriate

Golf courses, sports fields & play grounds
- Control Prescriptions
  - High level of cultural practices
  - Minimal use of pesticides

Natural Environment Parks
- Preserve the integrity of the ecosystem
  - Control Prescriptions
FIGURE 6-3. INSECT & DISEASE CONTROL TREATMENT STRATEGIES

- **Golf Courses**
  - **Control Prescriptions for Greens and Tee Boxes**
    - **Fungicide applications for disease prevention**
  - **Control Prescriptions for Roughs and Fairways**
    - **Selective herbicide application for weed control**

- **Insects & Disease**
  - **Urban Forest**
    - **Plant Health Care Prevention**
      - **Disease Control Prescriptions**
  - **Boulevards & Roadways Parkland Turf**
    - **Control Prescriptions**
      - **Moderate level of cultural practices**
      - **Minimum use of pesticides**
  - **Preserve the integrity of the ecosystem**
    - **Control Prescriptions**
      - **High level of cultural practices**
      - **Minimal use of pesticides**
      - **Selective herbicide application for weed control**
      - **Disease Control Prescriptions**
    - **High level of cultural practices**
      - **Fungicide applications for disease prevention**
      - **Control Prescriptions**
        - **High level of cultural practices**
          - **Pesticide application for restricted and noxious weed control**
          - **Control Prescriptions**
            - **High level of cultural practices**
              - **Pesticide use as determined via monitoring insect populations**
              - **Control Prescriptions**
                - **Moderate level of cultural practices**
                  - **Minimum use of pesticides**
CURRENT IPM PROGRAMS

MOSQUITO CONTROL PRESCRIPTIONS AND STRATEGIES

Categories of Mosquito Breeding Sites

Seasonal: Premium level of service
A body of water that changes in size and volume throughout the year, such as ditches, a small marsh, or dugouts. One that is generally large in the spring and dry by fall. May support some other invertebrates, and the occasional vertebrate e.g. ducks.

Temporary: High to Moderate level of service
A body of water that is present only after spring thaw or a rain fall, only lasts for a short period of time and dries up completely until the next rain fall. Usually does not support any other invertebrates. e.g. a roadside ditch or tire tracks

Permanent: Minimal level of service
A large or deep body of water that contains water all summer and freezes over in the winter. Generally supports numerous other invertebrates, and some other vertebrates such as ducks, otters or even fish. e.g. a lake or large pond

Identification
Identification of mosquito larvae is important because treatment will only be applied to temporary and seasonal bodies of water that contain appropriate numbers of mosquito larvae. Habitat conditions will also help to aid in larval identification. Life cycle information can be used to determine when suppressive measures will have the greatest effect and what preventative measures would be most effective.

Adult mosquitoes present a potential medical threat to Calgarians. Two local species are known vectors of the Western Equine Encephalitis virus. When Western Equine Encephalitis appears regular species identification will be required. Larval and adult mosquitoes must be collected, identified, and preserved for serotype evaluation.

Summary of minimum actions necessary:

a. Invertebrates must be identified as mosquitoes before breeding site is targeted for treatment
b. Identify the life stages when specific treatment or suppressive measures will be most effective.
c. Indicate on the sampling form the identification procedures that will be used.
**Monitoring**

Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Mosquito monitoring programs include regular inspections and sampling of breeding sites which may include monitoring for beneficial species, ongoing sampling of adults, and public mosquito complaints.

1. **Larval Monitoring:**
   a. Survey the 5 to 8 kilometre buffer zone outside of city limits
   b. Map potential breeding sites
   c. Take samples from edge of potential breeding sites using a dipper cup
   d. Record findings
   e. Larva samples may be required to determine predominant species.

2. **Adult Monitoring:**
   a. Adult mosquito abundance was monitored with a series of New Jersey Light Traps (NJLT) located throughout the city and buffer zone.
   b. Landing/biting counts,
   c. Personal observations by mosquito abatement personnel
   d. Complaints/comments from citizens.

Adult abundance can be used to determine the effects of larviciding, species distribution, species habitat preference, and to provide long term predictions for determine outbreaks of nuisance or disease carrying mosquitoes.

**Established Action Levels**

At present there are accepted action levels that result in initiating mosquito control activities. City wide larviciding activities commence when the weekly average of adult females captured in the NJLT is greater than 25 adult female mosquitoes per night. Local activities commence when the number of larval mosquitoes captured in a dip sampler exceeds 25 larvae in 10 dips.

**Selection of Treatment Techniques**

Presently, the mosquito control district is approximately 1050 square km. The sheer size presents several different management challenges. The aerial program relies extensively on traditional residual insecticides, but also utilizes biological products in environmentally sensitive areas. The following are some of the available control options.

1. **Preventative/Cultural Measures:**
   a. Renovations of poorly drained wet areas to minimize larval breeding sites.
   
   There will be IPM design guidelines within Calgary Parks & Recreation to eliminate any potential problem areas during the design, development and construction of landscape facilities.
2. Physical & mechanical controls:
   a. Mowing of long grass to reduce available resting sites for adult mosquitoes.

3. Chemical Controls:
   The efforts undertaken by mosquito control staff are towards the minimizing the impacts of successful larval development. Unless otherwise directed by Alberta Environment, Calgary Health Services, or Calgary Parks & Recreation administration, adulticiding activities will not be initiated in Calgary.
   a. Dursban 2.5 G and 50 EC
   b. Abate 2G
   c. Vectobac 200 G
   d. Altosid briquettes and sand pellets

Evaluation of Mosquito Control Strategies
Follow up evaluations are made within 4 days post applications. Larval samples are taken throughout the mosquito abatement district. Adult mosquito activity is monitored each week during the months of May to the end of August.

VERTEBRATE CONTROL

Beaver Control Prescriptions and Strategies

Identification
The beaver, Castor canadenis, is North America’s largest rodent. A few rare individuals reach over 45 kgs. The weight of most adults range from 16-23 kgs with some rarely reaching 32-39 kgs. The beaver is a stocky rodent adapted for aquatic environments.

An important factor about beaver biology is their territoriality. A colony generally consists of four to eight beavers, who resist additions or outsiders to the colony pond. Young beavers commonly are displaced from the colony shortly after they become sexually mature, at about 2 years old. They often move to another area to begin a new pond and colony. However, some become solitary hermits and inhabit old abandoned ponds or a farm pond.

Monitoring
Determine the number of beavers in each site. Tree damage is directly related to the number of beavers active within that site. Determine the number of trees removed, as well as potential hot spots from previous years. Watch for movement of beavers into new areas that will affect parks.
Establishing Impact Assessment and Action Levels

The daily food consumption of one beaver has been estimated to be 662 grams of woody vegetation. One beaver is estimated to cut 216 trees in a year and that one acre of aspen trees will support one beaver for a year. The actual number of trees cut each year is dependent on the length of warren establishment.

The beaver cuts down complete groves of aspen for feed, felling trees up to fifteen inches in diameter. Usually a single beaver cuts a tree, but occasionally two may work on a large one. After a tree has been felled, the branches are trimmed into convenient lengths for dragging to the pond. The beaver does its feeding in the water or in the lodge. It trims off all the leaf-bearing branches, leaving only the main trunk on the ground. Whole sapling are dragged to the water’s edge. The beaver will work some distance away from water depending upon the safety of the site. Where large predators are absent, they have been know to work over 140 metres from the pond.

The food consists of the bark cut from the soft cambium layer, and leaves twigs and buds, as well as much herbaceous pond vegetation, including submerged root stalks. Its favourite food is undoubtedly the trembling aspen; then willows, white birch, balsam poplar, rowanwood, maples, ash, hawthorns, cherries, and apple trees, Conifers such as pines are occasionally cut, but spruce bark is considered starvation diet. In the summer time eelgrass, duckweed, pondweed, and cattails are also eaten.

Presently there are no clear guidelines to determine the injury and action level for beaver damage. The allowable level of damage should be determined. Control measures are primarily in response to complaints.

Summary of minimum actions necessary:

a) Develop written impact assessment guidelines and action level thresholds for beaver damage using monitoring data for each site.

b) A research project to review pertinent published work on beaver management strategies that include ecology, alternative management strategies, and positive aspects of maintaining resident beaver populations.

Selection of Treatment Techniques

One or several strategies may be co-ordinated into a management program for beavers that reside in lodges or in bank dens.

1. Preventative/Cultural Measures:

   a) Habitat Modification. Reduce planting of desirable species. Plant more spruce in decorative parks. Problem being that spruce may not be the ideal species to plant, depending on the location.

   b) Tree Wrapping. This consists of wrapping trees in areas where the trees receive a significant amount of feeding damage. The most promising results have been achieved from using 19 gauge, 48” stucco wire. Chicken wire is not effective because the beavers can dislodge the wire.
and get to the tree. The wire should be put on very loosely in order to allow for growth. Routine monitoring of wrapped trees is necessary to prevent further mechanical injury.

Wrapping all available trees will likely force beavers further inland for susceptible trees. Further understanding of the ecology of beavers will be necessary to determine a long term successful, management strategy.

c) Water Level Control Without Beaver Removal. Where flooding is the major problem, the use of a “beaver drain pipe” is a viable solution.

d) Static Population Monitoring. Leaving mature pairs in habitat to lessen the impact from territorial cutting.

2) Physical & Mechanical Controls:

a) Conibear Traps. These instantly destroy the beaver once it hits the trap. This method is very efficient and minimizes the threat to the trapper.

b) Leg Hold Traps. These traps contain the beaver by direct contact to their leg. The new traps cause minimum tightening on the leg which results in less suffering to the beavers. The City of Calgary does not use this trap.

c) Hancock Live Traps. Live traps contain the beaver alive until it is picked up by the trapper. The trap is constructed like a big metal suitcase. The beaver will later be destroyed and removed.

d) Firearms. This is proven to be the most direct method of control. Beavers are destroyed with a .22 calibre rifle. The beaver trapper makes arrangements with Calgary Police Services prior to discharging the rifle.

e) Blasting. Explosive devices are used to blow apart the beaver dam. The beaver is trapped prior to blowing the dam apart. Most rural municipalities use this method.

3) Chemical Controls.

At present, there are no effective chemical repellents registered for beavers, however, there is a need to further research this option.

Summary of minimum actions necessary:

a. Develop a written plan for the integrated management of beavers along the Bow, Elbow, and Nose Creek waterways including role or impacts in restoration projects.

b. Provide written rationale for each method selected based on specific monitoring and impact assessment for each major site.
Evaluation of Beaver Control Strategies

After each beaver is removed, re-inspection occurs the following season. We tend to be complaint driven and time has not allowed a systemic approach. Program evaluation is difficult without specific information on; issues affecting Parks goals and objectives, inventory of possible management, recording of results, and the completion of a survey of trees and beaver warrens along the city's waterways.

Research needs include an annual survey to determine tree losses and replacement costs as necessary. Population management (instead of eradication) may provide the answer for minimizing feeding damage to an area i.e. leave an area alone and record the damage levels from one resident family of beavers.

Richardson Ground Squirrel Control Prescriptions and Strategies

Identification

Richardson’s ground squirrel is one of the more familiar small mammals in Calgary, though it is more commonly known as the ‘gopher’. It is a plump-bodied animal about 30 cm in length, with short legs, and a stubby tail. The short coat is a buffy-grey to yellowish colour, and the tail is brown.

Monitoring

Visual inspections will provide a reliable evaluation of any observable turf damage. Watch for movement from older established sites onto newly established land. Determine the number of main burrow entrances in each site. Turf damage is directly related to the number of active gophers.

Establishing Impact Assessment and Action Levels

The gopher excavates complicated burrows, consisting of several galleries and chambers. The burrows are 7.5 cm in diameter and vary from 3.5-15 m in length. There are typically eight entrances to each burrow system. The burrowing in turf causes economic damage to established turf, irrigation systems, and maintenance equipment. Open burrows present a physical injury threat to people using parks, athletic fields, and golf courses.

Early season cold temperatures can cause a marked reduction in population. Population crashes have been a direct result from other environmental influences including drought or excessive precipitation.

The gopher is the chief prey of several large buteos such as Swainson’s hawk and the red-tailed hawk. Burrowing owls are known to use old ground squirrel burrows to raise young, will feed on young ground squirrels. Other predators include long-tailed weasels, the red fox, great-horned owl and the coyote.
Presently there are no clear guidelines to determine the action level for gopher damage. Control measures are primarily in response to complaints and potential for personal injury.

Summary of minimum actions necessary:

a. Develop written impact assessment guidelines and action level thresholds for gopher damage using monitoring data for each park class.

b. Initial site inspections will be required to evaluate the population density, the area covered, and other areas potentially affected.

**Selection of Treatment Techniques**

One or several strategies may be co-ordinated into a management program for gophers.

1. **Preventative/Cultural Measures**
   a) Landscape modification. Allow grasses to grow to a height greater than 6-7”. Over grazed areas, disturbed and manicured sites are preferred gopher locations.
   b) Natural predation. Maintaining natural areas that encourage and support natural predators will provide minor population control.
   c) Filling holes. Gopher holes that lie within a high traffic areas can be filled in with loam.

2) **Physical & Mechanical Controls:**
   a) Trapping. This labour intensive option is available and may be used in situation where the other options are too invasive.

3) **Chemical Controls.**
   a) Anticoagulant baits. Generally the best time to control gophers is just before vegetation begins to turn green in the spring when they are frequently under-nourished. Do not bait at first signs of activity in the spring because adults males emerge 10-14 days from hibernation prior to adult females. Control of gophers will probably be less effective during late spring and summer. They do not readily accept grain after green vegetation is available, and adults begin hibernating in mid-July. Bait that is more than a few months old should not be used. The toxicity of the bait does not diminish, but its acceptability by gophers does. Grain baits can be made more acceptable by adding 5 percent icing sugar.
   b) Sulfur-dioxide cartridges. These should generally be used on discreet populations or in areas where there is a greater likelihood of secondary contamination.

Summary of minimum actions necessary:

a. Develop a written plan for the integrated management of Richardson’ ground squirrel in the different park classes, except for Park Class “N”.

b. Provide written rationale for each method selected based on specific monitoring and impact assessment for each park class.
Evaluation of Richardson Ground Squirrel Control Strategies

Re-inspection occurs 24-48 hours post application. Deceased animals are placed back into their burrows and the holes are subsequently filled with loam.

Gopher control is primarily complaint driven and present time restraints have not facilitated sufficient resources to develop a systemic management approach. Program evaluation is difficult without specific information on issues affecting Parks goals and objectives, inventory of possible management and recording of results.

PLANT HEALTH CARE (PHC)

GENERAL VEGETATION: NON-SELECTIVE CONTROL PRESCRIPTIONS AND STRATEGIES

This category includes all herbaceous monocot and dicot, annual, biennial, perennial species, as well as woody plants and moss, in areas such as fence-lines, parking lots, signs, lamp posts, hard surface areas, utility areas, etc.

CATEGORIES OF FACILITIES

- High Profile/Premium level of service. e.g. formal displays, high profile/intensively managed facilities, high traffic areas
- Medium Profile/High to Moderate level of service. e.g. boulevards and medians, general park and playground areas/ fence lines, parking lot perimeters
- Low Profile/Moderate to Low level of service. e.g. utility areas, works yards, naturalized areas and trails

Identification

Identification is essential because most treatments must be tailored to a particular species. Once a species causing a problem or potential problem is identified, information about its life cycle can be used to identify when suppressive measures will have the greatest effect and what preventative measures would be most effective. To aid in identification, a number of variables may be examined, including:

HERBACEOUS WEEDS
1. Growing site location
2. Leaf shape, size and colour
3. Growth habit
4. Flower shape, size and colour
5. Seed head form
WOODY PLANTS
1. Growing site location
2. Leaf shape, size and colour
3. Bark colour, texture
4. Growth habit
5. Flowers, fruit, seed head

Reference guides complete with sketches and/or photographs are an invaluable aid for plant identification. Should further assistance be required, a leaf, stem, or complete plant may be submitted to Central Parks Services for identification.

Summary of minimum actions necessary:
a. Ensure weeds are correctly identified through use of reference materials or extension services.

Monitoring
Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Successful management programs are based on regular inspection for the presence of unwanted plants and their growth rate.

Visual site inspections are a necessity to assess and record conditions. Reduced site plans (e.g. maps), used in conjunction with a high-lighting pen, can aid in updating general areas for control methods. Site plans and evaluations forms for recording specific information should include:
1. Location
2. Type of vegetation
3. Stage of vegetative growth
4. Quantity of weeds present
5. Reason for treatment, if required
6. Desirable vegetation, if present

Generally, 2-4 site inspections per growing season is sufficient, with additional inspections conducted before treatment to ensure controls are applied at the optimum time. Different stages of vegetative growth should be noted (e.g., recently germinated, seed head formations, re-growth of previously treated vegetation and growth vigour).

Summary of minimum actions necessary:
a. Regular inspection and sampling programs should be established for each class of facility. Determine frequency prior to the start of each season.
b. Records of the extent of weed infestation and population density of weeds should be kept for each major site.
c. Describe frequency of inspections and monitoring methods on the evaluation form.
Establishing Impact Assessment and Action Levels

How much damage is tolerable depends on how intensively the facility is managed and the consequences of leaving weeds untreated. The action level is when a particular treatment should be applied to deter weed levels from rising above the predetermined impact level.

The various areas that have been recorded during monitoring must be assessed with regard to the mandate of the organization in charge of the site. When making decisions on how the facilities should be managed, a variety of factors should be evaluated. They include:

1. Safety and Security:
   a. Degree of trip/slip hazards presented by weeds.
   b. Impairment of sight-lines on roadways and parking lot exits.
   c. Coverage of signs, curbs and light standards/luminaries by weeds.

2. Aesthetics/Site Location:
   a. Traffic levels.
   b. Nature of area (rural or urban area).
   c. Adjacent facilities that might be affected.
   d. Proximity to sensitive natural areas.

3. Damage to Structures:
   a. Hard surfaces such as sidewalks, tennis courts.
   b. Overgrown fence-lines, sign posts.
   c. Building foundations.

Individual areas must be assessed according to these and possibly other factors, to determine thresholds that are acceptable to the organization. A percentage of weed / vegetative cover suitable to each site could be established as thresholds for determining when treatments may be needed.

Summary of minimum actions necessary:

a. Develop written treatment thresholds using monitoring data for each class of site. These thresholds should be quantitative where possible.

b. Indicate on the evaluation form the criteria used to establish thresholds for each class of site, such as percentage of weed cover, location of weeds, risk of spread to adjacent areas, etc.
Selection of Treatment Techniques

One or several treatments may be co-ordinated into a management program for a target pest or for the entire complex of weeds at a site or facility. Substituting biological, physical or cultural controls for chemicals is promoted wherever feasible to reduce impacts on the environment, if these non-chemical alternatives have lower potential environmental impacts. When pesticides are used, they should be applied as efficiently as possible, through careful timing and use of precise, accurate equipment.

Treatments can be accomplished through spraying onto actively growing plant material. When dealing with species that vigorously resprout after cutting (e.g., quack grass), a useful technique is to apply herbicides to the fresh re-growth after the plant resprouts. This approach often results in significantly less herbicide being used.

The most target-specific application techniques available should be used. This includes using back-pack or hand-held sprayers, low-volume closed-system applicators (e.g., the Expedite system) and “wipe-on” applicators (e.g., the Red Weeder.)

An alternative to spraying is to “paint” the stump of the plant with a systemic herbicide (e.g., glyphosate) after cutting back stems. This treatment is often most effective in fall when plants actively transport such materials to their roots.

1. Preventative/Cultural Measures:

   a. Regular mowing and string trimming of fence-lines and site perimeters can help prevent perennial and brush weed species from becoming established.

   b. Renovations of areas to provide a better environment for more desirable plant material (including better selection of plant material).

   c. Regular sweeping, flushing with water and cleaning of hard surface areas to prevent the build-up of organic material in cracks, which provides a growing medium for unwanted vegetation.

   d. Filling cleaned cracks and crevices with a sealant; this will remove potential germination sites on asphalt and concrete surfaces.

   e. Apply organic mulches, leaves, wood chips etc. in areas likely to be infested by persistent weed species (e.g., Canada thistle).

   It is important that there should be strict guidelines established within the City to eliminate any potential problem areas during the design, development and construction of landscape facilities.

2. Physical & mechanical controls:


   b. String trimming and mowing around fence-lines and site perimeters. These operations should be timed to prevent seed head formation and maintain acceptable aesthetic levels.
c. Flame weeding can be conducted on narrow, weed-infested strips where there are no nearby flammable materials.

d. Pressure washing and sweeping removes organic material where weed seed and/or moss may germinate and root.

e. Cultivation and grading reduce the ability of weeds to become established.

f. Use chainsaws, brushsaws or heavy-duty mowers to control woody perennials. Repetitive mowing or cutting of top growth of bushy weed species such as will deplete the energy reserves of the root.

g. In areas where it is feasible, complete removal of the roots is a highly effective method for long term control of weed species that resprout after cutting.

3. Chemical Controls:

Preferred Herbicides

a. Fatty acid herbicides are of low toxicity and can be effectively applied to annual weeds, especially shortly after germination. If chemical controls are necessary, the least toxic, effective herbicide should be used. Weeds should be treated while in an actively growing stage prior to seed head formation.

Summary of minimum actions necessary:

a. Develop a written plan for the integrated control of weeds for each major class of site and summarize it on the PMP form. The primary weed management program should be based on preventative and cultural controls.

b. Provide a written rationale for each chemical to be used, based on specific monitoring and impact assessment data for each major site.

c. Herbicides selected for use must be compatible with an IPM program and must be applied with target specific application techniques whenever practical; justification for using broadcast applications must be indicated on the PMP form.

Evaluation of Non-Selective Control Strategies

After treatments have been applied to vegetation, it is necessary to determine results of the methods undertaken. Records and site plans from the monitoring process should be used in addition to notes on the effectiveness of the treatment(s) employed. Examples of factors to evaluate include the rate of regrowth after mowing and percentage of stems killed by herbicides.

Frequency and timing of evaluation inspections will vary according to the different treatments employed and the category of site(s) being managed. Maintain on-going records of monitoring and evaluation inspections to be used in determining effectiveness of treatment methods and the need for re-treatment.
Summary of minimum actions necessary:

a. Visually survey facilities at appropriate intervals after specific treatments.

b. Specify when these inspections will be conducted and maintain written records of results, including assessments of treatment effectiveness.

GENERAL VEGETATION: SELECTIVE CONTROL PRESCRIPTIONS AND STRATEGIES

This category consists primarily of both monocot and dicot, annual, biennial and perennial herbaceous weeds.

CATEGORIES OF FACILITIES

- High Profile/Premium level of service. e.g. formal displays, botanical gardens, high profile sites
- Medium Profile/High to Moderate level of service. e.g. city boulevards and medians, general park and playground areas, perennial borders
- Low Profile/Moderate to Low level of service. e.g. natural parks, low use recreational areas, natural display beds

Identification

Follow protocols as directed in previous section.

Monitoring

Follow protocols as directed in previous section.

Establishing Impact Assessment and Action Levels

Follow protocols as directed in previous section.

Selection of Treatment Techniques

One or several treatments may be coordinated into a management program for a target pest or for the entire complex of weeds in a site or facility. Substituting biological, physical or cultural controls for chemicals is promoted wherever feasible to reduce impacts on the environment, if these non-chemical alternatives have lower potential environmental impacts. When pesticides are used, they should be applied as efficiently as possible, through careful timing and improved equipment. It is important that there should be strict guidelines established within the organization to eliminate any potential problem areas during the design, development and construction of landscape facilities.
1. Preventative/Cultural Measures:
   a. Plant aggressive ground-covers and mass plantings to reduce the space, nutrients and light available to weeds.
   b. Use landscape fabrics in perennial ornamental display beds to prevent germination by blocking light from reaching the soil.
   c. Use organic materials (e.g., leaves, wood chips and bark) as mulches to prevent weed establishment and emergence.
   d. Provide ideal growing conditions, including light, fertilizer, water and other conditions for desired plants so that they out compete the weeds.
   e. Use weed-free nursery stock to prevent the importation of weed seeds to new planting areas.
   f. Anticipate renovation of areas and plan to provide a better environment for more desirable plant material (including better plant material selection).
   g. Eliminate potential problem areas during the design and landscape construction stages.

   Cultural measures often apply before establishing a planting bed. For example, proper selection of plant material occurs during the design stage and soil preparation designed to provide optimum growing conditions occurs before planting. Other measures, such as landscape fabrics and other mulches, may be used during construction and establishment of planting areas or at any time during renovation activities.

2. Physical & Mechanical Controls:
   a. Manual weeding, which is most appropriate on smaller, more intensively managed sites.
   b. Mechanical cultivation used to prevent weeds from become established; this is especially useful in preparing new planting beds.

   Physical and mechanical controls may be used throughout the entire growing seasons. Weeds should be removed or controlled before seed heads form.

3. Chemical Controls:
   If chemical controls are necessary, the least toxic, effective herbicide should be used. Weeds should be treated while in an actively growing stage prior to seed head formation.

   Preferred Herbicides
   a. Fatty acid herbicides are of low toxicity and can be effectively applied to annual weeds, especially shortly after germination.

   Pre-emergent herbicides should be applied before weed seeds germinate as they will not kill established plants. Post-emergent, selective herbicides can be effective in controlling annual, biennial and perennial material while in an actively growing stage, before seed heads form. Post-
emergent, non-selective, herbicides may be appropriate for use as spot treatments on deep rooted or rhizomatous perennial weeds in open ground, where there is no desirable vegetation present. Apply to actively growing weeds before seed heads form.

The most target-specific application techniques available should be used where practical. This includes using back-pack or hand-held sprayers, low-volume closed-system applicators (e.g., the Expedite system) and “wipe-on” applicators (e.g., the Red Weeder). An alternative to spraying is to paint the stump of the plant with a systemic herbicide after cutting back stems. This treatment is often most effective in fall when plants actively transport such materials to their roots.

Summary of minimum actions necessary:

a. Determine the most effective weed control strategy for each major class of site. The primary weed management program should be based on preventative and cultural controls.

b. Provide a written rationale for each chemical to be used, based on specific monitoring and impact assessment data for each major site.

c. Herbicides selected for use must be compatible with Calgary's IPM program and must be applied with target specific application techniques whenever practical; justification for using broadcast applications must be indicated.

**Evaluation of Selective Control Strategies**

Follow protocols as directed in previous section.

**TURF: WEED CONTROL PRESCRIPTIONS AND STRATEGIES**

This category include all sports fields, fine ornamental lawns, golf and bowling greens, general park areas, residential and commercial lawns, boulevards, meadows, picnic areas and rough grass areas.

**CATEGORIES OF FACILITIES**

- High Profile Display - Premium level of service. e.g., irrigated sports fields, fine ornamental lawns, golf/bowling greens, golf courses
- Medium Profile Display - High to Moderate level of service. e.g., general park areas, residential/commercial lawns
- Open green space - Moderate to low level of service. e.g., non-irrigated meadows, picnic areas and rough grass, boulevards

**Identification**

Follow protocols as directed in first section.
**Monitoring**

Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Successful turf management programs are based on regular inspections and counts to determine the proportion of weed cover in the turf.

Confirm extent of weed infestation and population density by visual inspection. Record numbers as percentage of area by species to arrive at total weed cover of site. Examples of sampling methods for weeds in turf:

1. **Transect system** - lay out a 10 m transect (straight line) through a representative section of turf and record the plants observed in a 10 cm² area at 10 points along this transect; check 5-10 transects per site. Averaging the scores from each type of site gives a percentage of weeds in the turf.

2. **Grid system** - count all of the weeds in a 1 m square area of turf; count 5-10 squares per site. Average the scores to arrive at a percentage of weed cover.

3. **Centerline system** - walk the centre of sports fields from goal post to goal post and estimate percent weed cover every second step.

Schedule monitoring periods to coincide with periods of active vegetative growth or flowering cycle. Weed counts should occur in early spring and again in August.

**Summary of minimum actions necessary:**

a. Establish regular inspection and sampling programs for each class of facility.

b. Record of the extent of weed infestation and population density of weeds for each major site.

**Impact Assessment/Action Level**

How much damage is tolerable depends on the cost of treatments and the value of the plant or the aesthetic values that would be lost if not treated. The action level is when a particular treatment should be applied to deter pest populations from rising above the predetermined injury level. In parks other public facilities, the need for treatment often depends on how much weed cover the public will tolerate, rather than on the harm to a plant or to a site. On sports turf, safety considerations will influence the action levels.

**High Profile Display** - Premium level of service. Maintain “weed free”. Playability, safety, wear resistance, and changes in weed infestation level trends should be considered in determining action levels. Turf with 5-10% weed cover may be accepted by the public as “weed free”; acceptable thresholds may be 10-15% weed cover.

**Medium Profile Display** - High to Moderate level of service. Some weeds are acceptable providing public safety and/or functional use of facility is not compromised. Acceptable thresholds may be 20-30% weed cover.
Summary of minimum actions necessary:

a. Determine thresholds using monitoring data for major each class of site. These thresholds should be quantitative where possible.

b. Determine and record the criteria used to establish thresholds for each major site, such as percentage of weed cover, risk of spread to adjacent turf, etc.

Selection of Treatment Techniques

One or several treatments may be coordinated into a management program for a target pest or for the entire complex of pests in a site or facility. Substituting biological, physical or cultural controls for chemicals is promoted wherever feasible to conserve native beneficial species and reduce impacts on the environment. When pesticides are used, they should be applied as efficiently as possible, through careful timing and improved equipment.

a. Annual weeds - Control should focus on preventing seed spread and germination of dormant seeds already in the soil or migrating in from adjacent areas.

b. Perennial weeds - Top growth of established stands of perennials should be controlled before blossoming, when root nutrient reserves are at their lowest and the plant is least capable of regenerating new top growth. Roots must also be destroyed to achieve effective control if eradication is desired.

1. Preventative/Cultural Measures:

When weed populations exceed tolerance levels it is usually because competing turf grasses have been thinned out by stress, leaving openings to be colonized by weeds.

Prevention is the cornerstone of a successful IPM program and will prevent pest problems from developing. Ensure proper turf management practices are adhered to; these include proper soil management, nutrient and watering programs. When weed populations become consistently too high and require routine control, re-evaluate the management program for the site to determine how to improve turf health and how to prevent the problem in the future.

a. Ensure that seed type selected is suitable for local climatic conditions. Select the best seed available that is appropriate to functional use. Examples include:

- Shade tolerant fescue species for general park use in shady areas.
b. Optimize irrigation:

- Water deeply, infrequently; avoid shallow watering, which promotes shallow rooting, accumulation of thatch and germination of weed seeds on exposed soil areas.
- Test for moisture requirements rather than relying on timed responses. Relate irrigation cycles to soil and turf demands and knowledge of local evapo-transpiration rates, soil type, drainage characteristics and species of turf.
- Provide for manual overrides for controls on automatic watering systems.

c. Keep thatch to a minimum through periodic removal by verti-cutting or raking. Where Poa annua is a problem, avoid de-thatching operations in early fall or spring when weed seeds are germinating. De-thatch when weed seeds are dormant and leave as much soil covered as possible to reduce areas for germination. Microbial amendments which may reduce thatch levels are also available.

d. Provide for regular aeration to reduce soil compaction; frequency depends on the type of turf and usage. Use deep tine aerating to a depth of 6 1/2”.

e. Avoid compaction from overuse. If possible, rotate goal mouth areas and entrance points to turf areas for pedestrians and equipment; rotate players benches and bleachers or install them on permanent hard surfaces. Alternate directions of mowing.

f. Promptly repair worn or damaged areas by over seeding, re-seeding or re-sodding.

g. Select and apply fertilizers appropriate to turf grass nutritional requirements. For sports fields and bent grass greens, regular soil testing and tissue analysis is recommended to ensure that lime and fertilizer requirements are sufficient to promote optimal plant vigour. Adjust application rates to ensure that nutrient imbalances do not occur and to prevent leaching beyond the root zone.

h. Avoid overuse of sports field surfaces through implementation of a field closure policy during inclement weather. Limit play on sensitive or stressed sports field surfaces whenever possible.

i. Sports field grass cultivars should have the following desirable characteristics: disease resistant; ability to withstand cutting heights of 3/4 - 21/2” ; high wear tolerance; rapid healing abilities from aggressive rhizomes; drought resistance; good colour.

j. Avoid planting a single grass cultivar since a monostand lacks the genetic variation required for successful disease resistance.

2. Physical & Mechanical Controls:

a. Keep mowing height as high as possible for turf species and usage. Most turf grass species in recreational and athletic areas can be mowed at a height of 5-6 cm (2-2.5 inches) without sacrificing vigour or usability. Mowing height and frequency should be adjusted to seasonal variations and grass growth or use patterns (e.g. baseball infields often require more frequent cutting and shorter turf than outfields).
b. Hand pull small populations of weeds prior to seed production. Well-designed hand tools now available make weed pulling faster and easier. Remove weeds growing on gravel/sand all-weather fields with a front end loader through scraping them off with the loader’s bucket. This is often sufficient to kill many weeds.

3. Chemical Controls:

Ensure that product selected is effective for specific weed type and use spot treatments instead of general boom spraying wherever possible or feasible. Ensure that product selected is not phytotoxic to desirable turf species (e.g., dicamba can harm bent grasses) and that low volatility formulations of herbicides are used. Select proper time of application to maximize effect to target species and minimize effect of spray on other species.

Summary of minimum actions necessary:

a. Determine the most effective control measures for each major class of site. The primary weed control measures should be based on preventative and cultural controls.

b. Provide a written rationale for use of herbicides for each facility/site category (i.e., Categories A, B, and if relevant, C) that is based on specific monitoring and impact assessment data.

c. Herbicides selected for use must be compatible with Calgary’s IPM program and must be applied with target specific application techniques whenever practical; justification for using broadcast applications must be indicated.

Evaluation of Weed Control Strategies

Follow-up monitoring or inspections are necessary to find out how successful an IPM strategy has been. It is essential to review records to determine what worked, where improvements should be made and what preventative steps may be possible in future. Frequency of evaluations should be determined by facility classification type.

Evaluation of weed control effectiveness should be continuous. Accurate record keeping of visual inspections and sample counts is essential. Incorporate visual inspection and recording of weed problems into the duties of maintenance staff who are on site most frequently. Schedule visual inspection and evaluation of turf areas which have been treated with herbicide 7-14 days after treatment.

Summary of minimum actions necessary:

a. Develop a written plan for follow up inspections.

b. Visually survey facilities at appropriate intervals after specific treatments.

c. Specify when these inspections will be conducted and maintain written records of results, including assessments of treatment effectiveness.
TURF: INSECT CONTROL PRESCRIPTIONS AND STRATEGIES

This category includes all sports fields, fine ornamental lawns, golf greens, general park areas, boulevards, natural areas, meadows, picnic areas and rough grass areas.

CATEGORIES OF FACILITIES

- **High Profile Display** - Premium level of service. e.g., irrigated sports field, fine ornamental lawns, golf courses
- **Medium Profile Display** - High to Moderate level of service. e.g., general park areas, boulevards
- **Open green space** - Moderate to low level of service. e.g., non-irrigated meadows, picnic areas and rough grass

**Identification**

Identification is essential because most treatments must be tailored to a particular species. Once a species causing a problem or potential problem is identified, information about its life cycle can be used to identify when suppressive measures will have the greatest effect and what preventative measures would be most effective.

Insects rarely cause serious injury to Calgary turf. Most insects species found in turf are beneficial.

If insect or mite activity is suspected to be the cause of an area of turf damage, search carefully among leaves and in thatch, dig up a section of sod and inspect roots and soil for larvae, pupae and adult insects. Collect insects and preserve for expert identification or identify from guides or other references.

**Summary of minimum actions necessary:**

a. Insects and other arthropods targeted for treatment must be accurately identified before treatments are planned.

b. Identify the life stages when specific treatment or suppressive measures will be most effective.

c. Indicate on the evaluation / monitoring form the identification procedures that will be used.

**Monitoring**

Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Most monitoring programs are based on regular inspection for pests, pest damage or signs of their presence and may include monitoring for beneficial species. Most monitoring would be conducted on Class A sites. Insects are rarely a problem in Class C turf.
1. Utilize visual inspections to determine:
   a. Area of damage, which may show up as a wilting, yellowing or bare area.
   b. Symptoms of chewing or sucking.
   c. Webbing in thatch.
   d. Presence of larvae and/or pupae in soil

2. Examples of specific quantitative sampling methods developed for some pests include:
   Yellow Headed Spruce Sawfly
   a. In late spring, visually inspect the new growth on spruce trees. Damage is particularly noticeable on young spruce trees. Count numbers of larvae that you see on 5-10 branches and record. Take at least 2 samples per site.

**Establishing Impact Assessment & Action Levels**

How much damage is tolerable depends on what part of the plant is affected, the cost of treatments and the value of the plant or the aesthetic values that would be lost if not treated. The action level is when a particular control should be applied to deter pest populations from rising above the predetermined injury level.

**Summary of minimum actions necessary:**

a. Inspections for pests and/or damage must be conducted regularly; frequency will depend on the class of site and nature of the pests.

b. Describe frequency of inspections, sampling procedures and the use of other monitoring methods on the evaluation form.

Class A Sites: Will have low tolerance for serious infestations of insects due to potential for loss of investment because of deterioration of playing surfaces, safety and aesthetics.

Class B Sites: Higher insect counts should be allowed on Class B turf unless their presence is affecting functional use of turf or their presence is attracting secondary pests, such as crows and raccoons digging up turf to find white grubs or leatherjackets.

Class C Sites: Generally insects are not a concern.

Examples of specific action thresholds established for some pests include:

1. Yellow Headed Spruce Sawfly
   a. Counts of less than 15 larvae per sample on healthy trees in spring may be acceptable.
      Counts of 6-10 larvae on unhealthy trees or in late spring and early summer may be the treatment threshold.
Selection of Treatment Techniques

One of several treatments may be coordinated into a management program for a target pest or for the entire complex of pests in a site or facility. Substituting biological, physical or cultural controls for chemical is promoted wherever feasible to conserve native beneficial species and reduce impacts on the environment.

Summary of minimum actions necessary:

a. Determine the treatment thresholds using monitoring data for each major class of site. These thresholds should be quantitative where possible.

b. Indicate on the evaluation form the criteria used to establish thresholds for each major site, such as number of pests, populations of beneficial species, amount of plant damage, etc.

1. Preventative/Cultural Measures:

   Calgary's IPM program recognizes that changes in the management of plants and habitats are required to prevent pest problems from developing. When a pest problem re-occurs that must be treated, re-evaluate the management program for the pest/site/plant to determine how to improve plant health and how to prevent the pest problem in future.

   a. Proper water management, drainage and aeration of the root zone and minimizing the thatch layer are important cultural practices. Thick thatch layers can also absorb soil treatments (chemical and biological), preventing them from reaching insects feeding in the soil layer below the thatch.

   b. Aeration to relieve compaction will provide good oxygen content in the root zone, thereby producing more vigorous, healthy turf that can remain unaffected by moderate amounts of insect damage.

   c. Avoid blanket applications of pesticides, which reduce natural populations of beneficial insect and mites.

   d. On sites where chewing insects, such as sod webworm, are a chronic problem, consider re-seeding with endophytic grasses. Some cultivars of perennial rye grass and tall, turf-type fescues have high levels of endophytic fungi in the leaves, which repel or kill leaf- and stem-feeding insects (but has no effect on root feeding species, such as white grubs or leatherjackets).

2. Biological Controls:

   a. Bt (Bacillus thuringiensis) is effective against larval stages of forest tent caterpillar.

   b. Insect parasitic nematodes, now widely available, are registered for control of white grubs, leatherjackets, and cutworms when drenched into the soil.
3. **Chemical Controls:**

Use spot treatments rather than broadcast sprays wherever possible. Organo-phosphate insecticides should only be used as a last resort if in the event of major infestations that cannot be controlled using other methods.

**Future Products**

a. Products containing azadiractin (extracted from the neem tree) are being tested as a repellent or anti-feedant for some insects.

**Summary of minimum actions necessary:**

a. Evaluate available options for control of each targeted pest.

b. Develop a written plan for the integrated control of these pests or pest complexes, including preventative/cultural measures.

c. Provide a written rationale for each chemical to be used, based on specific monitoring and impact assessment data for each major site.

d. Pesticides selected for use must be compatible with Calgary’s IPM program and, except in certain circumstances, nonpersistent. These products must be applied with target specific application techniques whenever practical.

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**Evaluation of Insect Control Strategies**

Follow-up monitoring or inspections are necessary to find out how successful an IPM strategy has been. It is essential to review records to determine what has worked, where improvements should be made and what preventative steps may be possible in future.

Use visual inspections and drenches of soap and/or pyrethrins (as above) to monitor insect populations of undesirable species after control measures have been applied. Check problem areas the following season at critical times in the life cycle of the insects.

**Summary of minimum actions necessary:**

a. Develop a written plan for follow-up inspections, describing the monitoring methods and criteria that will be used for determining treatment effectiveness for each site.

b. Specify when these inspections will be conducted and maintain written records of results, including assessments of treatment effectiveness.
TURF: DISEASE CONTROL PRESCRIPTIONS AND STRATEGIES

This category includes all sports fields, fine ornamental lawns, golf and bowling greens, general park areas, boulevards, meadows, picnic areas and rough grass areas.

CATEGORIES OF FACILITIES

- High Profile Display - Premium level of service. e.g., irrigated sports field, fine ornamental lawns, golf courses and bowling greens.
- Medium Profile Display - High to Moderate level of service. e.g., general park areas, boulevards
- Open green space - Moderate to low level of service. e.g., non-irrigated meadows, picnic areas and rough grass

Identification

Identification is essential because most treatments must be tailored to a particular species. Once a species causing a problem or potential problem is identified, information about it’s life cycle can be used to identify when suppressive measures will have the greatest effect and what preventative measures would be most effective.

Highly managed, highly specialized or monoculture turf installations are more prone to fungal organisms than other turf areas.

Symptoms are often difficult to diagnose, especially because turf diseases may be mistaken for nutritional deficiencies or other environmental/management factors.

To aid in identification, consider such factors as:

1. Management practices
2. Physical and mechanical damage use patterns
3. Insect injury
4. Nutrient deficiency or excess
5. Drought
6. Temperature stress
7. Irrigation amounts and timing
8. Dog urine damage

Accurate diagnosis will usually require careful collection of affected turf roots, stems, leaves and crowns. Examine turf from along the margin of healthy and disease tissue. Carefully separate out individual plants and determine which part of the plant was infected: first - roots, crown, leaves.
Symptoms should then be compared with identification guides using:

1. Signs of the disease, such as fruiting bodies, spores, mycelium.
2. Symptoms of disease, such as wilting, colour of leaf, leaf spots, shape, colour and size of infected patches of turf.

If unable to positively identify a disease from guides, a field sample should be collected and sent (including the complete plug) to a diagnostics laboratory, extension office or turf expert for analysis, or samples should be isolated and cultured for identification, where lab facilities are available. When sending samples to a lab provide background information about grass species, cultivar, pesticide use, management practices, etc.

Given the turn-around time for diagnoses from professional laboratories, the recommended approach is to periodically follow up any diagnosis that has been done on the basis of symptoms with a laboratory identification of the causal organism.

Keep photographs and descriptions of disease symptoms that occur on various sites to assist in future identification.

Summary of minimum actions necessary:

a. Diseases that require treatment must be identified through plant symptoms and evidence of the disease on affected plants.

b. Specify on the evaluation form how diseases will be identified, how disease symptoms will be distinguished from nutritional problems or other factors, and when samples will be sent to a disease identification laboratory.

Monitoring

Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Most monitoring programs are based on regular inspection for symptoms or signs of disease.

- High Profile Display - Premium level of service. Regular and routine monitoring is required. It should be intensified during weather conditions favourable to spread of disease organisms.

- Medium Profile Display - High to Moderate level of service. As in Class A sites.

- Open green space - Moderate to low level of service. Diseases rarely impact this type of turf, therefore monitoring may not be required.

Many turf fungal organisms can infect turf and begin an incubation period without displaying visual symptoms of development, therefore monitoring starts with keeping track of weather conditions, such as temperature range, rainfall, relative humidity and light levels.
Use a standardized monitoring form to record the following information:

1. Maps/diagrams of extent of infection.
2. Weather, including precipitation, temperatures and sunshine.
3. Irrigation timetables.
4. Dates, timing and type of recent fertilizing.
5. Physical or mechanical injury.

Coordinate disease inspection visits with weather or climatic conditions that favour disease development. When inspecting sites for disease, a number of monitoring methods are available. Examples include:

1. Collect pre-determined number of leaf blades and determine percentage of blades with disease symptoms (e.g., spots, reddish colour streaks etc.).
2. Note the number of disease patches per unit area and measure the width of the active disease ring to indicate rate of spread.

If difficult to quantify diseases like Pythium are suspected, it may be advisable to send turf samples to a diagnostic laboratory (e.g., Brooks Diagnostic or University of Calgary) for confirmation.

Summary of minimum actions necessary:

a. Regular inspection and sampling programs should be established for each class of facility; frequency will depend on the pathogens, weather conditions and affected plants.

b. Determine the frequency of inspections, sampling procedures and monitoring methods

**Establishing Impact Assessment & Action Levels**

How much damage is tolerable depends on what part of the plant is affected, the cost of treatments and the value of the plant or the aesthetic values that would be lost if not treated. The action level is when a particular treatment should be applied to deter pest populations from rising above the predetermined injury level. Action levels or thresholds should be related to facility classification.

- **High Profile Display - Premium level of service.** A very low threshold may be required as intensively managed facilities are often more prone to common turf diseases, especially if cut short, fertilized frequently and used in wet weather conditions.

- **Medium Profile Display - High to Moderate level of service.** Action thresholds should be higher, depending on aesthetic impact and potential for disease spread.

- **Open green space - Moderate to low level of service.** Rarely prone to serious disease infection and may have a high action threshold.
Summary of minimum actions necessary:

a. Develop written treatment thresholds for each major class of site. These thresholds should be quantitative where possible.

b. Determine the criteria used to establish thresholds for each major site, such as plant damage, duration of weather favourable to disease development, risk of spread to adjacent sites, etc.

Selection of Treatment Techniques

One or several treatments may be coordinated into a management program for a target pest or for the entire complex of pests in a site or facility. Substituting biological, physical or cultural controls for chemicals is promoted wherever feasible to conserve native beneficial species and reduce impacts on the environment. When pesticides are used, they should be applied as efficiently as possible, through careful timing and high quality equipment.

Active healthy turf is the first line of defense against most disease organisms. It is important to know the cultural conditions that favour disease development so that sound management practices may be properly adjusted to favour healthy turf development and prevent turf disease from developing. It is also important to be aware that one disease control practice may stimulate another disease organism (e.g., applying nitrogen to reduce the impact of anthracnose may promote brown patch infections).

1. Preventative/Cultural Measures:

IPM programs emphasize making changes in the management of plants and habitats to prevent pest problems from developing. When a disease infection occurs that must be treated, the manager should re-evaluate the management program for the site to determine how to improve turf health and how to prevent the disease in the future.

a. Plant turf cultivars with the highest degree of disease resistance that grow well in your local climatic conditions and that exhibit other desirable qualities such as wear tolerance, drought tolerance, vigour.

b. Irrigate carefully. Most disease fungi need free water or very high relative humidity to germinate and infect grasses. Infrequent, but deep, watering is ideal for most turf types. Time irrigation cycles for early morning whenever possible to allow rapid drying of leaf blades.

c. Select and apply fertilizers based on regular soil and leaf tissue tests (especially for High Profile sites). Slow release fertilizers are generally preferred because they provide a more balanced release of nutrients. Adjust application rates to ensure that nutrient imbalances do not occur. Avoid excessive nitrogen and ensure that calcium and other micronutrients are not deficient or out of balance in the soil relative to other nutrients. Rapid bursts of vegetative growth weaken plants by removing carbohydrates from the root zone to support leaf growth, resulting in poor root systems and leaf die-back.
d. When low mower cutting heights are necessary, as required for golf and bowling greens, turf is continually stressed. Schedule mowing to provide the grass with days off from mowing, when weather conditions and degree of use permit. Keep all mower blades sharp to reduce bruising and tearing of leaf and stem tissue.

e. Aerate as required to reduce compaction.

f. Scheduled maintenance procedures to avoid working in climatic and turf conditions that favour the spread of diseases you are trying to control.

g. Golf greens benefit from removal of dew and guttation water, which contains high amount of nutritious plant sugars attractive to some fungi i.e., Rhizoctonia. Where staff levels allow remove dew by polling, whipping with bamboo poles or dragging with a rope, fishing net, or wide nylon brush. Syringing with a short irrigation period in the early morning (i.e., for 2-3 minutes, 2 hours after sunrise) may also be used, but is not as thorough as manual removal methods.

h. Control access and manage play on playing fields and sports turf to reduce damage and excessive wear, especially during wet, cool weather.

i. Keep thatch levels at a depth of 1/2-1 cm as thicker thatch creates conditions suitable for disease development.

2. Biological Controls:

   Improve the soil whenever possible through introduction and encouragement of native beneficial soil micro-organisms, which compete with and suppress disease organisms. Top dress with microbial soil amendments to increase populations of soil microbes. Promote root zone conditions that favour soil micro-organisms including correct pH and nutrient levels. Examples of commercial products under development include biological dethatchers and a form of composted turkey litter.

3. Chemical Controls:

   Spray only those areas where disease symptoms are present and/or where conditions are conducive to disease development. Synthetic fungicides have varying impacts on different turf fungi (e.g., the use of benomyl may increase Pythium infection levels). It is thus important to normally target specific fungicides against particular diseases. Broad spectrum systemic compounds which are effective in controlling multiple disease organisms should be used in situations where extended control is required. Where possible, control products should be alternated to reduce the probability of disease resistance to a particular compound. Protectants may be required when vulnerable turf is under extreme disease pressure. All fungicides must be applied with target-specific application techniques whenever practical.

Summary of minimum actions necessary:

a. Develop a written plan for the integrated control of diseases for each major class of site. The primary disease management program should be based on preventative and cultural controls.
b. Provide a written rationale for each fungicide or other pesticide to be used, based on specific monitoring and impact assessment data for each major site category.

c. Pesticides selected for use must be compatible with Calgary’s IPM programs

**Evaluation of Disease Control Strategies**

Follow-up monitoring or inspections are necessary to find out how successful an IPM strategy has been. It is essential to review records to determine what worked, where improvements should be made and what preventative steps may be possible in future.

Follow-up inspections include checking for:

1. Reduction or elimination of disease symptoms.
2. Restoration of turf to normal vigour.

In specific problem sites, the evaluation may include resampling and testing by laboratory extension office to confirm that pathogens are no longer present in the soil or turf.

Summary of minimum actions necessary:

a. Develop a written plan for follow up inspections, describing the monitoring methods and plant health criteria that will be used for determining treatment effectiveness on annual and perennial plants.

b. Specify when these inspections will be conducted and maintain written records of results, including assessments of treatment effectiveness.
Calgary Parks & Recreation - General Golf Course Maintenance Standards

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>GREENS</th>
<th>TEES</th>
<th>FAIRWAYS</th>
<th>SAND TRAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting Height</td>
<td>5/32”-1/4” daily</td>
<td>1/2”-3/4” every second day</td>
<td>1/2”-1” x every third day</td>
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<tr>
<td>Cups/Markers</td>
<td>change location daily</td>
<td>change location daily</td>
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<tr>
<td>Irrigation</td>
<td>1.25” week daily (if required)</td>
<td>.75-1.25” week daily (if required)</td>
<td>.75-1” week daily (if required)</td>
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<td>Fertilizing</td>
<td>1.5lbs “N”/1000 ft² yearly</td>
<td>.75 lbs “N”/1000 ft² monthly</td>
<td>1-2 lb “N”/ 1000 ft² monthly</td>
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<tr>
<td>Verticutting</td>
<td>monthly or every third week</td>
<td>2-3 times per season</td>
<td>once per season</td>
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<tr>
<td>Power Sweeping</td>
<td>—</td>
<td>—</td>
<td>daily</td>
<td>—</td>
</tr>
<tr>
<td>Top Dressing Mixture</td>
<td>McCall - sand</td>
<td>sand</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Power Raking</td>
<td>—</td>
<td>—</td>
<td>daily</td>
<td>—</td>
</tr>
<tr>
<td>Aeraing</td>
<td>varies with course and use 2 x per season minimum</td>
<td>in conjunction with top dressing, 2 x per season</td>
<td>twice per season</td>
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</table>

Calgary Parks & Recreation - General Sports Field Maintenance Standards

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>CLASS A SPORTS FIELD</th>
<th>CLASS B SPORTS FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting Height</td>
<td>1/2”-2” every five days</td>
<td>1/2”-2” weekly</td>
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<tr>
<td>Irrigation</td>
<td>1 - 1 1/2” per week daily (if required)</td>
<td>1” per week daily (if required)</td>
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<tr>
<td>Verticutting</td>
<td>once per season</td>
<td>none</td>
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<tr>
<td>Power Sweeping</td>
<td>once per season</td>
<td>once per season</td>
</tr>
<tr>
<td>Top Dressing Mixture</td>
<td>sand or sand/loam mixture</td>
<td>sand/loam</td>
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<tr>
<td>Aerating</td>
<td>2 - 3 per season additional if compacted</td>
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<td>3-4 lbs N/1000 ft²</td>
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<tr>
<td>Application Rate</td>
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<td>1 lb K/1000 ft²</td>
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<tr>
<td>Line Marking</td>
<td>weekly</td>
<td>monthly</td>
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GREENHOUSE & NURSERY: INSECT CONTROL PRESCRIPTIONS AND STRATEGIES

This category includes all conservatories, botanical gardens and other interior displays, propagation and outdoor plant propagation and nursery sites.

CATEGORIZATION OF FACILITIES

- **High Profile Display** - Premium level of service. e.g. conservatories, botanical gardens, interior display gardens, hanging baskets
- **Medium Profile Display** - High to Moderate level of service. e.g. propagation benches in greenhouses, outdoor nurseries for planting stock

**Identification**

Identification is essential because most treatments must be tailored to a particular species. Once a species causing a problem or potential problem is identified, information about its life cycle can be used to identify when suppressive measures will have the greatest effect and what preventative measures would be most effective.

Categories of insects that damage ornamentals:

1. Sucking arthropods: aphids, whitefly, scale, mealybug, thrips, spidermite
2. Root/crown feeding insects: fungus gnats, root weevils
3. Leaf feeding insects: leaf miners, various caterpillars

Take insect samples and preserve for expert identification:

1. Capture medium to large size adult insects and put in freezer to kill and preserve.
2. Collect small and soft bodied specimens (aphids, whitefly, scale, mealybug, thrips, caterpillars, grubs and other larvae) with a fine brush and preserve in alcohol. Alcohol causes the colours to fade, therefore it is useful to note the natural colour of the live insect to aid in identification.
3. Label all specimens in pencil with location, date, host plant and your name.

The complex of sucking arthropods can be difficult to diagnose due to similarity in the appearance of damage to other arthropods and to diseases. These insects are very small and some, such as thrips, move quickly, making it hard to catch them. Mites are minute and are best seen under magnification.
Summary of minimum actions necessary:

a. Insects and other arthropods targeted for treatment must be accurately identified before treatments are planned.

b. Identify the life stages when specific treatment or suppressive measures will be most effective.

c. Determine the most effective identification procedures that will be used.

**Monitoring Techniques**

Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Most monitoring programs are based on regular inspection for pests, pest damage or signs of their presence and may include monitoring for beneficial species.

Examples of specific monitoring methods:

1. Visual inspections - Regularly, usually weekly, inspect a representative sample of plants. Inspect the part of the plant where the pest is most likely to be found. Use a 10X hand lens for small arthropods. Examples for specific pests include:

   a. For aphids, inspect new growth and undersides of oldest leaves.

   b. For scale, inspect stems, petioles and along leaf veins. (i.e., lower leaves of 10% of plants checked for aphids).

   c. For root weevils, inspect for adult damage on leaves and check root crown of plants.

   Monitor during periods of the year when the pest is likely to be present or to reproduce most quickly. Most sucking arthropods listed above may be present throughout the whole year in conservatories, though will reproduce more slowly under the low temperatures and short day-lengths of winter. Outdoors, most insects (except winter moth) will be in dormant or overwintering stages from September to late March or early April.

2. Sticky traps - Yellow traps are used to monitor whitefly, fungus gnats, leaf miners, thrips; blue traps may also be used for thrips.

   a. Traps are usually hung at canopy level among plants. For greenhouse whiteflies, traps should be hung at tops of plants; for other pests, lower in canopy may be more effective.

   b. Enough traps should be used to give a representative sample from the area [e.g., 1 trap per 40-75 m² (400 to 700 square feet) of bench is usually recommended].

   c. Hang traps as soon as seedlings, plugs or transplants are put on benches. They should be placed among nursery stock outdoors as soon as weather warms in early spring.

   d. Traps should be inspected weekly or more frequently and all insects caught should be counted.
e. Replace traps after 6-8 weeks (indoors) or 2 weeks (outdoors) to ensure surface is sticky enough to catch small insects; replace more frequently if they become loaded with many insects.

3. Other trapping devices - Wooden traps (e.g., constructed of plywood and lath), are used to detect adult root weevils and other nocturnal insects. These devices are commonly placed at or near in high risk sites and inspected during daylight hours to detect insects harboring under them. Use of the traps can provide an early warning of building pest populations and signal the need for early applications of biological control agents.

Summary of minimum actions necessary:

a. Inspections for pests and/or damage must be conducted regularly; frequency will depend on the class of site and nature of the pests.

b. Determine the frequency of inspections, sampling procedures and the use of traps and other monitoring methods

Establishing Impact Assessment & Action Levels

How much damage is tolerable depends on what part of the plant is affected, the cost of treatments and the value of the plant or the aesthetic values that would be lost if not treated. In conservatories and other public facilities, the need for treatment often depends on how much damage the public will tolerate, rather than on the harm a pest might be causing to a plant or to a site. In propagating and nursery areas, the damage tolerable depends on whether the pest may spread to other stock, what effect it has on the future health of the plant.

The action level is when a particular treatment should be applied to deter pest populations from rising above the predetermined injury level.

The terms ‘severe’, ‘moderate’, ‘light’ and ‘trace’ defoliation are used to describe the impact of pests on urban forests. The terms are best interpreted as follows:

- **trace** • up to 5% defoliation
- **light** • 6-29% defoliation
- **moderate** • 30%-69% defoliation
- **severe** • 70-100% defoliation

The impact of insects on forest ecosystems is described as the area of forest within which there is moderate to severe defoliation or areas within which trees are killed by bark beetles. It is around the level of 30% defoliation that growth becomes affected. Different levels of defoliation over various periods of time result in certain losses of growth and may cause mortality. The degree of impact varies with forest type and the patterns of insect damage (Hall, 1994).
1. Examples of action thresholds that have been established for some insects in greenhouse benches:

   a. Greenhouse whitefly on poinsettia - 5 per trap per week is the acceptable limit; a suggested action level for introducing Encarsia parasitic wasps is when there is an average of 1 whiteflies per 10 traps or lower. The presence of one whitefly on any trap may also be used as an action level for release of Encarsia.

   b. Thrips - Three to four per card per week; presence of one thrips on any trap may be used as an action level for lowest release rate of predatory mite A. cucumeris.

2. Examples of differing action thresholds for aphids:

   a. If biological controls are used, the action threshold for release may be when one or more colonies is discovered to be present during systematic monitoring.

   b. When chemicals are to be used, action levels for aphids may be relatively high in bedding plants and nursery stock being planted outdoors because the high number of native aphid predators usually present will provide substantial control.

Summary of minimum actions necessary:

   a. Develop written treatment thresholds using monitoring data for each major class of site. These thresholds should be quantitative where possible.

   b. Determine the criteria used to establish thresholds for each major site, such as number of pests, populations of beneficial species, amount of plant damage, etc.

**Selection of Treatment Techniques**

One or several treatments may be coordinated into a management program for a target pest or for the entire complex of pests in a site or facility. Substituting biological, physical or cultural controls for chemicals is promoted wherever feasible to conserve native beneficial species and reduce impacts on the environment. When pesticides are used, they should be applied as efficiently as possible, through careful timing and improved equipment.

1. Preventative/Cultural Measures:

   IPM programs emphasize making changes in the management of plants and habitats to prevent pest problems from developing. When a pest problem occurs that must be treated, the manager should re-evaluate the management program for the pest /site/ plant to determine how to improve plant health and how to prevent the pest problem in the future.

   a. Inspect all planting stock before delivery, including roots if possible, before putting plants in greenhouse or nursery, to ensure plants are free of insects and mites.

   b. Grow bedding plants from seed to avoid plant-borne pests.

   c. Use non-soil mixes for planting nursery stock and bedding plants to avoid soil-borne insects.
2. **Biological Controls:**

Many species are now available and effective for several pests in greenhouses, though relatively high release rates may be needed on ornamentals; generally all should be released when monitoring shows the target pest is present at very low levels:

a. *Encarsia formosa* for greenhouse whitefly (usually not effective on sweet potato whitefly).

b. *Aphidoletes aphidimyza* for aphids (any species); used from early spring to fall; not effective in mid-winter.

c. *Aphidius matricariae* for aphids (green peach aphids primarily; limited host range); effective in mid-winter.

d. *Amblyseius cucumeris* for western flower thrips, onion thrips; used from early spring to fall; only effective in winter in warm (21°C during day) greenhouses; use on plants with relatively smooth leaves.

e. *Phytoseiulus persimilis* for two-spotted spider mite (only this species); useful year around.

f. *Cryptolaemus montrouzouri* for above ground mealybugs (any species); less effective in winter.

g. Several species of ladybeetle may be sold for scales including *Lindorus lophanthae* and *Chilocorus nigritus*.

h. *Hypoaspis miles* for fungus gnats and mites on small plants and plugs, *Orius tristicolor* for thrips and other small species.

Experimental species include *Deraeocorus brevis* and other species of predatory mites.

3. **Physical/Mechanical Controls:**

a. Screening to prevent entry - e.g., Visqueen screen or other fine mesh screens to for western flower thrips; larger screen mesh is adequate to prevent entry of moths, aphids and other species.

b. Drain all wet spots in benches, floor area, between nursery rows to control fungus gnats by removing breeding sites; correct irrigation system in benches and beds to eliminate pooling water and overwatered areas.

c. Yellow sticky traps may provide control of whiteflies if used at a high rate (e.g., one trap per plant).

d. A strong spray of water on plants that can withstand it is a good control for aphids, thrips, rose sawfly and other species.
4. **Chemical Controls:**

   Preferred insecticides
   
   a. Insect growth regulator, kinoprene (Enstar) effective on aphids, whitefly (Phytotoxicity may be of concern for some plant species).
   
   b. Bacillus thuringiensis var. kurstaki for use on most species of caterpillars.
   
   c. Insecticidal soaps for chewing and sucking species, especially for spot sprays.
   
   d. Botanicals, such as pyrethrins or rotenone for clean-up before release of biological controls.
   
   e. Diatomaceous earth (silicon dioxide) applied to soil for thrips and fungus gnats on pot plants.
   
   f. Supreme oils - dormant oil for scale, mites, aphids, etc. on dormant stock; summer oil for dipping rooted cuttings of poinsettias and treatment during growing season.

Routine or regular broadcast spraying is not recommended due to high likelihood of generating pesticide resistant populations. Aphids, thrips and spider mite populations in greenhouses commonly develop resistance to routinely used pesticides.

Broadcast sprays may be required when populations are too high to successfully start a biological control program or when bedding plants or stock is ready to be moved to planting sites. Least-toxic or low residual chemicals may be used as a clean-up before beginning a biological control program. Nicotine fumigants may also be used in greenhouses before beginning release of biological controls.

Clean-up chemicals (e.g. fumigants, less persistent botanicals) are also acceptable at end of growing season or before new plugs or plants are moved into greenhouse or beds.

Future products:

   a. Avermectins, derived from a soil micro-organism; for control of leaf miners and spider mites.
   
   b. Products containing azadiractin (neem) are being tested as a repellent or anti- feedant for some insects.
   
   c. Biocontrol fungus for powdery mildew control (a Plant Products’ product).

Summary of minimum actions necessary:

   a. Evaluate available options for control of each targeted pest.
   
   b. Develop a written plan for the integrated control of these pests or pest complexes, including preventative/cultural measures. Devonian Gardens has developed and implemented a successful IPM program for control of botanical pests.
   
   c. Provide a written rationale for each chemical to be used, based on specific monitoring and impact assessment data for each major site.
d. Pesticides selected for use must be compatible with Calgary’s IPM program and, except in certain circumstances, nonpersistent. These products must be applied with target specific application techniques whenever practical.

**Evaluation of Pest Control Program**

Follow-up monitoring or inspections are necessary to find out how successful an IPM program has been. It is essential to review records to determine what worked, where improvements should be made and what preventative steps may be possible in future.

Inspect for impact on pest populations within a week of treatment. Use visual inspections, sticky trap monitoring and other methods to continue pest population assessment, which may be required for a month or more to assess effectiveness of biological control agents.

Use visual inspection and counts of insects on leaves to check populations of biological control agents as well (e.g., for whitefly control using Encarsia, the ratio of un-parasitized whitefly scales [white] to parasitized scales [black] is an indicator of the progress of the biological control program).

Summary of minimum actions necessary:

a. Develop a written plan for follow up inspections, describing the monitoring methods and criteria that will used for determining treatment effectiveness;

b. Specify when these inspections will be conducted and maintain written records of results, including assessments of treatment effectiveness.

**ORNAMENTALS & TREES: INSECT CONTROL PRESCRIPTIONS AND STRATEGIES**

This category includes all gardens, horticultural displays and borders, flowering ornamentals, golf courses, city boulevards and medians, general park and playground areas and nature parks, trails and other natural areas.

**LEVEL OF THREAT TO INVENTORY**

- **Serious:** Zero tolerance to presence of insect. e.g. Native or European elm bark beetle
- **Moderate:** Will tolerate a small percentage of the inventory with the insect. e.g. Western Ash bark beetle
- **Low:** Will tolerate a majority of the inventory with the insect. e.g. Aphid
Each Level will be further sub-divided into 3 additional service levels:

High Profile Display: Premium level of service. e.g. horticultural display gardens, flowering, hanging baskets, ornamentals

Medium Profile Display: High to Moderate level of service. e.g. city boulevards, medians, general park and playground areas; specimen, shade, and boulevard trees; annual and perennial borders

Low Profile Locations: Moderate to low level of service. e.g. natural environment parks, hiking trails, beaches, native trees and other vegetation

**Identification**

Identification is essential because most treatments must be tailored to a particular species. Once a species causing a problem or potential problem is identified, information about it’s life cycle can be used to identify when suppressive measures will have the greatest effect and what preventative measures would be most effective. Insects and other arthropods can be grouped into 3 general classes:

1. Sucking arthropods; aphids, scale, mites, mealybugs etc.
2. Root/crown feeding insects; weevils etc.
3. Leaf chewing and mining insects; leaf miners, caterpillars etc.

A chart can be made of pest and relevant beneficial insects that shows their development in relation to date, degree days, non-related flowering plants, or other seasonal indicators.

Summary of minimum actions necessary:

a. Insects and other arthropods targeted for treatment must be accurately identified before treatments are planned.

b. Identify the life stages when specific treatment or suppressive measures will be most effective.

c. Determine the most effective identification procedures that will be used.

**Monitoring**

Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Most monitoring programs are based on regular inspection for pests, pest damage or signs of their presence and may include monitoring for beneficial species. Staff carrying out the monitoring may find the chart referred to under the Identification section useful to optimize these activities.

Examples of specific monitoring methods include:

1. Visual inspections - for many small insects, mites and for characteristic damage. Indicator plants are useful to observe for pest presence or damage and can be those that are along a regularly travelled route and are easily visible from a passing vehicle.
2. Yellow sticky traps to attract aphids, whiteflies and leaf miners.
3. Pheromone traps for gypsy moth, smaller European elm bark beetle

Summary of minimum actions necessary:

a. Inspections for pests and/or damage must be conducted regularly; frequency will depend on the class of site and nature of the pests.

b. Describe frequency of inspections, sampling procedures and the use of traps and other monitoring methods on the Monitoring form.

Establishing Impact Assessment & Action Levels

How much damage is tolerable depends on what part of the plant is affected, the cost of treatments and the value of the plant, or the aesthetic values that would be lost if not treated. In parks and other public facilities, the need for treatment often depends on how much damage the public will tolerate, rather than on the harm a pest might be causing to a plant. The action level is when a particular treatment should be applied to deter pest populations from rising above the predetermined injury level.

Serious injury - Aesthetic injury threshold is low because plants are viewed at close range.

Moderate injury - Proportionately higher population range is acceptable for treatment thresholds.

Low injury - A higher level of plant injury is allowed before actions are initiated. As a general rule, suppressive action will be implemented when unacceptable plant loss or spread of pest into adjoining higher profile facility is probable.

For all sites:

1. Define when no action needs to be taken; what population density is acceptable.

2. Define when preventative intervention required; when population densities are low but are increasing as verified through monitoring.

3. Define when suppressive action is required; when population densities are high and increasing and there is the risk of major economic damage or nuisance.

Thresholds may be defined and recorded as:

1. Percentage or proportion of leaves damaged on a particular plant.

2. Percentage of plants affected on a site.

3. Number of pests or pest colonies counted.
Examples of thresholds include:

1. For biological controls - generally the action threshold is when one or more of the target pest (or colonies of the pest) is discovered to be present during monitoring. This is because it is generally necessary to have a pest presence before releases of beneficials can successfully become established.

2. For chemical controls - action levels depend on the facility and target. Action levels for aphid control may be relatively high due to the high number of native aphid predators that are usually present.

Summary of minimum actions necessary:

a. Develop written treatment thresholds using monitoring data for each major class of site. These thresholds should be quantitative where possible.

b. Determine the criteria used to establish thresholds for each major site, such as number of pests, populations of beneficial species, amount of plant damage, etc.

Selection of Treatment Techniques

One or several treatments may be coordinated into a management program for a target pest or for the entire complex of pests in a site or facility. Substituting biological, physical or cultural controls for chemicals is promoted wherever feasible to conserve native beneficial species and reduce impacts on the environment. When pesticides are used, they should be applied as efficiently as possible, through careful timing and more accurate, precise equipment. Criteria for selection of treatment technique will also include choosing the least toxic yet effective product for the application.

1. Preventative/Cultural Measures:

   IPM programs emphasize making changes in the management of plants and habitats to prevent the development of pest problems. Tree health can be improved and maintained by following recommended horticultural and arboricultural practices such as proper soil management, nutrient and watering programs, pruning and planting techniques.

   The foreman should re-evaluate the management program for the site when faced with a re-occurring pest problem. Determine how to improve plant health and prevent the pest problem in the future.

a. Plant diverse cultivars, species and families of plants and trees to prevent single species plantings which are vulnerable to serious insect problems. Continue to investigate and test new species that are adaptive to our climate.

b. Establish alternate hosts to attract and maintain natural predator/parasite populations. Try to alternate species with different flowering times to provide a more consistent nectar supply for beneficial insects.

c. Inspect planting stock and purchase only healthy plants - ensure plants are in good health and conform to ISA or LANTA standards.
d. Plant at the proper depth.

e. Maintain a mulched tree circle or bed around new plantings to retain moisture, nurture beneficial soil organisms and prevent injury from mowers and other equipment.

f. Design irrigation systems taking into account the difference in water requirements between turf, shrubs, trees at varying sites. Ensure regular and adequate water during establishment of new plantings.

g. Prune and train young trees properly so that large pruning cuts will not be needed later to correct poor tree structures; make cuts properly to promote rapid wound closure. Elm trees shall only be pruned during the months of October to March. Pruning during other times of the year increases the attractiveness of the elm to the smaller European elm bark beetle.

h. Sanitation - remove infested, dead and fallen twigs, leaves and fruit from base of trees and shrubs, especially where soil-borne or root/crown feeding insects have been a problem.

i. Avoid use of fast acting, high nitrogen fertilizers that promote succulent, insect susceptible plants.

j. Plant site selection. Find the proper tree species to be utilized in the specific situation. When tree mortality occurs, determine the cause of tree failure. Consider the following diagnostic options:

   Abiotic factors - e.g. mechanical damage, physical damage. If death is a result of these types of abiotic intervention, then replant the site with the same species;

   Biotic factors - e.g. environmental conditions including too wet, insufficient nutrients. If death is a result of these types of conditions, then replant the site with a more appropriate tree species.

   Select the best management option and tree species for each site - do not overlook eliminating the site, if necessary.

k. Investigate tree watering regime. Fertilizers that promote root growth (e.g. 10-52-10) may be applicable to new plantings for the first few years. Monitoring tree well composition may be appropriate by the third year to determine nutrient needs. Fertilizers may not be required in certain soil types.

l. Investigate whether salinity damage maybe a result of over-fertilization instead of road salt.

m. Consider a spring application of a high nutrient fertilizer (e.g. 20-20-20) to spruce trees that are under moderate to severe environmental stress. This may be particularly useful in soils that are more prone to binding up phosphorous nutrients.

n. Species Testing and Variety Selection. Internal inspection of our urban forest may yield unique healthy tree specimens that survive within our climatic and growing region. Wherever feasible, remove fruit and try to propagate new sapling trees. Propagation trials may be accommodated at the Heritage tree nursery or in cooperation with a private tree nursery.
2. Biological Controls:
   a. Aphid predators - *Aphidoletes aphidimyza*
   Lacewings - *Chrysoperla/Chrysopa ssp.*
   Lady beetles
   Parasitic wasps - *Aphidius matricariae*
   b. Insect parasitic nematodes - for black vine weevil, other root weevils, cutworms
   c. Predatory mites - native species for spider mite, European red mite control

3. Physical & Mechanical Controls:
   a. Sticky barriers on tree trunks to control:
      - ants (which remove natural enemies of aphids)
      - weevils
   b. Water sprays for aphids, thrips, mites
   c. Pruning out:
      - tent caterpillar infested branches
      - bronze birch borer infested wood
   d. Wiping plant scales from stems

4. Chemical Controls:

   Spray programs may be required when populations are too high to successfully start a biological control program. Least toxic or low residual chemicals should be used as a cleanup before beginning a biological control program.

   Preferred Insecticides:
   a. Insect growth regulators (e.g. kinoprene) for aphids and whitefly.
   b. *Bacillus thuringiensis var. kurstaki* (Btk) for caterpillars.
   c. Insecticidal soaps for chewing and sucking insects and mites, especially for spot sprays.
   d. Pyrethrins, low in toxicity but to mammals but post-treatment delays in introducing some beneficial arthropods may be required because of the compound's potential impact on them.
   e. Rotenone, especially for cleanup before release of biological controls.
   f. Mineral oils (dormant and supreme horticultural oils) for scales, mites, aphid eggs, moth eggs, etc. on dormant stock.
   g. Primor and Vendex for mites, compatible with some biological controls.
Other pesticides should be considered if there is a strong rationale for their use.

**Preferred application methods:**

a. Spot sprays targeted to the specific location for the appropriate pests.
b. Placing systemic pesticides in bands or Maugetre.g. injectors on tree trunks (e.g. for sucking insects such as aphids).

**Future products:**

a. Bacillus thuringiensis var. San Diego for beetles such as elm leaf beetle.
b. Biocontrol fungus for powdery mildew control.
c. Products containing neem (azadiractin) are being tested as a repellent or anti-feedant for some insects.
d. Avermectins derived from soil micro-organisms, effective on leaf miners and spider mites; they have some systemic effects.

**Summary of minimum actions necessary:**

a. Evaluate available options for control of each targeted pest.
b. Develop a written plan for the integrated control of these pests or pest complexes, including preventative/cultural measures,
c. Provide a written rationale for each chemical to be used, based on specific monitoring and impact assessment data for each major category.
d. Pesticides selected for use must be compatible with Calgary's IPM program and, except in certain circumstances, nonpersistent. These products must be applied with target specific application techniques whenever practical.

**Evaluation of Insect Control Strategies**

Follow-up monitoring or inspections are necessary to find out how successful a strategy has been. It is essential to review records to determine what worked, where improvements should be made and what preventative steps may be possible in future.

Use visual inspections, sticky trap monitoring to continue pest population assessment. Keep records of inspections and insect counts, both desirable and undesirable. Look for dead or parasitized insects and signs of fresh or continuing damage.
Summary of minimum actions necessary:

a. Develop a written plan for follow up inspections, describing the monitoring methods and criteria that will used for determining treatment effectiveness;

b. Specify when these inspections will be conducted and maintain written records of results, including assessments of treatment effectiveness.

**ORNAMENTALS, TREES, AND NURSERIES: DISEASE CONTROL PRESCRIPTIONS AND STRATEGIES**

This category includes all botanical gardens, horticultural displays and borders, flowering ornamentals, nursery stock, golf courses, city boulevards and medians, general park and playground areas, natural environment parks and pathways.

**LEVEL OF THREAT TO INVENTORY**

- **Serious**: Zero tolerance to presence of pathogen (biotic) or environmental factors (abiotic). e.g. Dutch elm disease
- **Moderate**: Will tolerate a small percentage of the inventory with the pathogen (biotic) or environmental factors (abiotic). e.g. Fire blight, cytospora, sun scald
- **Low**: Will tolerate a majority of the inventory with the pathogen (biotic) or environmental factors (abiotic). e.g. Nectria, reduced plant tolerance as a result of salt injury

Each level will be further sub-divided into 3 additional service levels for the following locations:

- **High Profile**: Premium level of service. e.g. botanical gardens, horticultural display gardens, flowering ornamentals, hanging baskets, greenhouses and nurseries
- **Medium Profile**: High to Moderate level of service. e.g. city boulevards, medians, general park and playground areas; specimen, shade, and boulevard trees; annual and perennial borders
- **Low Profile**: Moderate to low level of service. e.g. natural environment parks, hiking trails, beaches, native trees and other vegetation

**Identification**

Identification is essential because most treatments must be tailored to a particular species. Once a species causing a problem or potential problem is identified, information about its life cycle can be used to identify when suppressive measures will have the greatest effect and what preventative measures would be most effective. Categories of disease organisms include:

1. Fungi
2. Bacteria
3. Viruses and Viroids
4. Mycoplasmas
Identification can be carried out by:

1. Signs of the disease including spores, conks, mushrooms and other actual parts of the disease causing organisms

2. Symptoms expressed by the plant-wilting, leaf spots and blights, root rots, and cankers.

3. Identification of the causal organism by sending a sample to a diagnostics laboratory or by direct isolation and culturing for identification, where lab facilities are available (e.g. University of Calgary, Brooks Diagnostic Clinic)

Given the turn-around time for diagnoses from professional laboratories, the recommended approach is to periodically follow up any diagnosis that has been done on the basis of symptoms with a laboratory identification of the causal organism.

Keep photographs and descriptions of disease symptoms that occur on various sites to assist in future identification.

Summary of minimum actions necessary:

a. Diseases that require treatment must be identified through plant symptoms and evidence of the disease on affected plants.

b. Determine how diseases will be identified, how disease symptoms will be distinguished from nutritional problems or other factors, and when samples will be sent to a disease identification laboratory.

**Monitoring**

Monitoring provides the information needed to decide whether treatments are necessary, the best timing of treatments, and how the treatments are working. Most monitoring programs are based on regular inspection for pests, pest damage or signs of their presence and may include monitoring for beneficial species.

Visual inspections can be done weekly in conjunction with monitoring for insects; diseased plants are usually first noticed via symptoms.

The following characteristics should be noted on monitoring forms:

1. Severity and extent of the problem
2. Position on plant
3. Number of plants affected
4. Whether plants appear to be in the early or advances stages of the disease
5. Proximity of alternate hosts (e.g. for rusts-pear trellis on pear and juniper)
Scoring systems may be used to help establish disease severity (e.g. hawthorn leaf blight: 0=healthy, no spots on leaves; 1=slight, the occasional spot observed but less than 10% of crown involved; scores may range up to 10=severe, total necrosis or premature leaf drop).

Factors to check for when assessing plant damage include:

1. Prior history of plant
2. Recent weather influences
3. Signs and locations of disease
4. Evidence of nearby fertilizer or herbicide use
5. Whether there has been construction in the area
6. Use of de-icing salt in the root zone
7. Other types of disturbances

Inspections of indicator plants (i.e., varieties known to be susceptible to diseases known to occur in the area) should be monitored at the times of the year that symptoms would be expressed.

Summary of minimum actions necessary:

a. Regular inspection and sampling programs should be established for each class of facility; frequency will depend on the pathogens, weather conditions and affected plants.

b. Determine the frequency of inspections, sampling procedures and monitoring methods

**Establishing Impact Assessment and Action Levels**

How much damage is tolerable depends on what part of the plant is affected, the cost of treatments and the value of the plant or the aesthetic values that would be lost if not treated. In parks, conservatories and other public facilities, the need for treatment often depends on how much damage the public will tolerate, rather than on the harm a pest might be causing to a plant or to a site. The action level is when a particular treatment should be applied to deter pest populations from rising above the predetermined injury level.

For the most part these will have to be developed for the site as action levels for disease control on ornamentals are generally not yet available. The site class and category can be used to help set tolerance levels.

- **Serious injury:** Aesthetic injury threshold is low because plants are viewed at close range.
- **Moderate injury:** Proportionately higher population range for no action/preventative or action/suppressive actions.
- **Low injury:** These allow for higher level of plant injury before actions are initiated. As a general rule suppressive action will be implemented when unacceptable plant loss or spread of pest into adjoining higher profile facility is probable.
For all sites:

1. Define when no action needs to be taken; what population density is acceptable.

2. Define when preventative intervention required; when population densities are low but are increasing as verified through monitoring.

3. Define when suppressive action is required; when population densities are high and increasing and there is the risk of major economic damage or nuisance.

Thresholds may be defined and recorded as:

a. Percentage or proportion of leaves damaged on a particular plant.

b. Percentage of plants affected on a site.

c. Scores or indices over a predetermined level.

Example of an adjustable threshold:

a. A decision not to control black spot on wild roses in a natural setting may be appropriate for instance, while a preventative program consisting of weekly applications of sulphur, fungicidal soap, or other product may be applicable to rose beds in display gardens that have expressed a past history of the problem.

Summary of minimum actions necessary:

a. Develop written treatment thresholds for each major class of site. These thresholds should be quantitative where possible.

b. Determine the criteria used to establish thresholds for each major site, such as plant damage, duration of weather favourable to disease development, risk of spread to adjacent sites, etc.

Selection of Treatment Techniques

One or several treatments should be coordinated into a management program for a target pest or for the entire complex of pests in a site or facility. Substituting biological, physical or cultural controls for chemicals is promoted wherever feasible to conserve native beneficial species and reduce impacts on the environment. When pesticides are used, they should be applied as efficiently as possible, through careful timing and improved equipment.

1. Preventative/Cultural Measures:

   IPM programs emphasize making changes in the management of plants and habitats to prevent pest problems from developing. Ensure proper horticultural and arboricultural practices are adhered to; these include proper soil management, nutrient and watering programs, and optimal pruning/planting techniques. When a disease occurs that must be treated, the manager should re-evaluate the management program for the disease/site/plant to determine how to improve plant health and how to prevent the problem in the future.
a. Plant diverse cultivars, species and families of plants and trees to prevent single species plantings which are vulnerable to serious disease problems. Continue to investigate and test new species that are adaptive to our climate.

b. Ensure new planting sites are properly prepared; plant into friable, uncompacted soil. Avoid planting in heavy soils in the fall. Plant in the spring in these situations.

c. Inspect planting stock and purchase only healthy plants - check tree root collars for circling, kinked roots, basal cankers, check condition of main roots and for girdling ropes or wires; ensure plants are in good health and conform to Landscape Alberta Nursery Trades Association (LANTA) standards.

d. Plant at the proper depth.

e. Maintain a mulched tree circle or bed around new plantings to retain moisture, nurture beneficial soil organisms and prevent injury from mowers and other equipment.

f. Design irrigation system taking into account the difference in water requirements between turf, shrubs, trees at varying sites. Ensure irrigation water is not directed to root crowns of mature trees or that new beds become water logged. Ensure regular and adequate water during establishment of new plantings.

g. Provide good drainage. Dig a drainage trench on the downhill side of the hole and backfill with coarse material when planting on a hillside where water is likely to collect in the hole.

h. Prune and train young trees properly so that large pruning cuts will not be needed later to correct poor tree structures; make cuts properly to promote rapid wound closure.

i. Sanitation - remove infested, dead and fallen twigs, leaves and fruit from the base of trees and shrubs, especially where soil-borne or root/crown feeding insects have been a problem.

j. Quarantines and inspections - conduct routine inspection of incoming plant material; grow or start your own plant material.

k. Evasion of the pathogen - use vigorous seed, maintain proper planting dates and sites. Keep proper distance between disease susceptible plants by interplanting with non-susceptible stock. Control insect and weeds that are agents of disease or harbour disease pathogens.

l. Use pathogen-free propagating material; it is often possible to grow plants free of pathogens for their entire lives if you start clean, especially woody plants affected by non-vectored viruses.

m. Eradicate or reduce disease inoculum levels through removal of alternate hosts (e.g. pines or Ribes where white pine blister rust is a problem), rotating plants in beds - avoid planting a susceptible plant in the same site where a plant has been taken out due to the same disease (e.g. alternate plantings of tulips with other spring flowers to avoid buildup of tulip fire - Botrytis tulipae) and remove/destroy infected leaves, prune infected branches and other plant debris that may harbour the pathogen.
n. Create conditions unfavourable to the pathogen (e.g., use of non-soil mixes for containerized nursery stock.

o. Use resistant or tolerant varieties; select native species that possess resistance factors to local disease.

p. Plant site selection. Find the proper tree species to be utilized in the specific situation. When tree mortality occurs, determine the cause of tree failure. Consider the following diagnostic options:

Abiotic factors - e.g. mechanical damage, physical damage. If death is a result of these types of abiotic intervention, then replant the site with the same species;

Biotic factors - e.g. environmental conditions including too wet, insufficient nutrients. If death is a result of these types of conditions, then replant the site with a more appropriate tree species.

Select the best management option and tree species for each site - do not overlook eliminating the site, if necessary.

q. Investigate tree watering regime. Fertilizers that promote root growth (e.g. 10-52-10) may be applicable to new plantings for the first few years. Monitoring tree well composition may be appropriate by the third year to determine nutrient needs. Fertilizers may not be required in certain soil types.

r. Investigate whether salinity damage maybe a result of over-fertilization instead of road salt.

s. Consider a spring application of a high nutrient fertilizer (e.g. 20-20-20) to spruce trees that are under moderate to severe environmental stress. This may be particularly useful in soils that are more prone to binding up phosphorous nutrients.

t. Species Testing and Variety Selection. Internal inspection of our urban forest may yield unique healthy tree specimens that survive within our climatic and growing region. Wherever feasible, remove fruit and try to propagate new sapling trees. Propagation trials may be accommodated at the Heritage tree nursery or in cooperation with a private tree nursery

2. Biological Controls:

a. Crown gall treatment - Agrobacterium radiobacter

b. Numerous antagonistic microorganisms, such as fungi and bacteria have been found occurring in nature. While many are available for research purposes, it will be a few years before registration and approval for sale.

c. Preserve naturally occurring biological controls.
3. **Physical & Mechanical Controls:**
   a. Remove and destroy diseased tissue and overwintering stages of the disease organisms; isolate or remove diseased stock to avoid spreading diseases such as Pseudomonas, Verticillium, Armillaria, etc.
   b. Regular syringing leaves with water in the morning to wash off dew and dislodge spores before they germinate (e.g. black spot and powdery mildew on roses).

4. **Chemical Controls:**
   Preferred fungicides
   a. Chose fungicides that are both reasonably effective and the least disruptive to the beneficial organisms protecting the plant from insect and disease.
   b. Powders are generally more disruptive as they are more residual and can impede respiration in beneficial insects.
   c. Spreader/stickers can cause mortality to beneficials; even oils and anti-transpirants are a concern.
   d. Flowable sulphur is generally pretty safe.
   e. Chemical families should be alternated, preferably between systemic and contact products to help avoid inducing resistance.

Use spot treatments whenever practical instead of general broadcast sprays. Other related options/techniques involve applications of compounds such as fixed copper in the fall and spring (e.g. on ornamental pears to prevent infections of Pseudomonas syringae) as a protectant. This is appropriate prior to signs or symptoms of disease if:
- the plant material is known to be susceptible and;
- the disease occurs in the area, and;
- the value of the plant material warrants maintaining such a yearly program.

**Summary of minimum actions necessary:**
   a. Develop a written plan for the integrated control of diseases for each major class of site and summarize it on the monitoring form. The primary disease management program should be based on preventative and cultural controls.
   b. Provide a written rationale for use of each fungicide or other pesticide for each facility/site category (i.e., High medium and if relevant, low that is based on specific monitoring and impact assessment data).
   c. Pesticides selected for use must be compatible with Calgary's IPM program and must be applied with target specific application techniques whenever practical.
**Evaluation of Disease Control Strategies**

Follow-up monitoring or inspections are necessary to find out how successful an IPM strategy has been. It is essential to review records to determine what worked, where improvements should be made and what preventative steps may be possible in future.

For annuals, evaluation often means quickly determining whether the plant recovered or not. For perennials and long-lived plants it may involve using pre- and post- treatment monitoring involving a scoring system and/or photographs to track the disease progression.

Summary of minimum actions necessary:

a. Develop a written plan for follow up inspections, describing the monitoring methods and plant health criteria that will be used for determining treatment effectiveness on annual and perennial plants; summarize on the Monitoring form.

b. Specify when these inspections will be conducted and maintain written records of results, including assessments of treatment effectiveness.
The Pesticide Advisory Task Force (PATF), a sub-committee of the Environmental Advisory Committee (EAC), facilitated the public participation throughout the development of the Integrated Pest Management (IPM) Plan. During their two year mandate, 22 meetings and 3 open houses were held to clarify public issues and perception on pest management and pesticide use. The PATF, upon review information from oral / written public submissions and internal reports, submitted 27 recommendations to the EAC for consideration by the S.P.C. on Operations and Environment and City of Calgary Administration.

<table>
<thead>
<tr>
<th>No.</th>
<th>Issue</th>
<th>PATF Recommendation</th>
<th>Response From Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>City of Calgary's Weeds and Tall Grass Bylaw #30M80 be reviewed and the weed designations be made consistent with Alberta's The Weed Control Act's Weed Designation Regulation. This would lower the status of all nuisance weeds, including the dandelion, from noxious weed to nuisance weed status.</td>
<td>The Weeds, Plants and Tall Grass Bylaw #30M80 will be reviewed and the Calgary Parks &amp; Recreation will report back to the S.P.C. on Operations and Environment.</td>
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<tr>
<td>2</td>
<td>Notification of Pesticide Applications</td>
<td>The City develop clear operational guidelines on public notification of pesticide applications. The guidelines must include a clear statement on the purpose of the signs (i.e. is it to inform the public about treated areas or is it to warn the public to stay off treated areas) and the placement (where and how) of signs to maximize visibility to persons approaching the pesticide treated area.</td>
<td>The IPM Plan has guidelines on public notification of pesticides. Pg. 32-33.</td>
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<tr>
<td>3</td>
<td>Notification of Pesticide Applications</td>
<td>Each spring the City shall inform the public what their pesticide spraying strategy will be for the next growing season. This should include predicted problem areas (infestations, routine maintenance areas) and ongoing IPM strategy. Method of dissemination of information could include one or more of the following: print media and/or voice media, flyer in utility bills, open houses.</td>
<td>Funds for a public information program are included in the IPM program budget. Public information is an integral component of the IPM implementation plan.</td>
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<td>4</td>
<td>Notification of Pesticide Applications</td>
<td>There should be adequate prior notification of pesticide applications. Pre-notification signage should be placed at least 48 hours prior to the proposed application. These signs will be a size and format similar to the street cleaning signs. Prior notification will allow care givers, teachers and others using the area sufficient time to obtain more detailed information and plan accordingly.</td>
<td>The IPM Policy identifies that The City will notify the public prior to herbicide applications in park areas. Calgary Parks &amp; Recreation is prepared to provide 4 day prior notification through community signage related to scheduled applications to parks within the community. Emergency applications on all lands (such as may be required to control spruce sawfly) will be signed at time of treatment. Recommendation 9. Pg. 34.</td>
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| 5         | Notification of Pesticide Applications | The current NOTICE sign used by the City to identify pesticide treated areas needs to be improved to clarify that an area has been treated with pesticides. As per current practice, these site warning signs should be posted at the time of pesticide application and remain a minimum of 48 hours post application. The notice sign should:  
• be larger (suggested size approx. 16" by 22")  
• contain a true graphic indication of warning which is clearly visible and recognizable by small children, parents and pet owners. A symbol of an adult, child and dog in a circle with a line through it indicating “do not enter” is recommended.  
• use the word “WARNING” in bolded letters to replace the word “NOTICE”.  
• contain the same information and colour format as on the notice sign presently in use. | These suggestions will be implemented in the next series of printed signs. The new signs will be replaced as soon as current inventory is exhausted. |
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<td>6 Notification of Pesticide Applications</td>
<td>A registry for environmentally/chemically sensitive people should be established so that these individuals can be informed of pesticide applications on civic land in their area (similar to the PACT system). The City should consult with the appropriate organizations in developing this system.</td>
<td>Calgary Parks &amp; Recreation staff will meet with representatives from the appropriate organizations to establish a registry. Registered individuals will be contacted through Calgary Police Services PACT system.</td>
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| 7 No Spray Areas | The City specify areas where no pesticide will be used to manage the site or facility. It is recommended that the following areas be considered as “no spray areas”:  
• Tot lots, play grounds  
• Outdoor pools when open to the public  
• Within a 10 metre perimeter of the above areas | Pesticide-free areas have been defined within the IPM policy. Pg. 23.                                                                                                                                                                                                                                    |
<p>| 8 Training | The City maintain a high level of professionalism for pesticide applicators. The City will use provincially certified applicators (civic employees or contractors) who ensure receive regular training in the proper use and handling of pesticides. The City will develop protocols to assist applicators in dealing with citizen inquiries and concerns (e.g. wallet size info card with contact names and telephone numbers). | The Pesticide Use Section of the IPM Plan provides the framework to civic compliance. Calgary Parks &amp; Recreation will work to develop an information card to be carried by operational staff.                                                                 |
| 9 Training | City staff will keep current with new vegetation and pest management strategies and, where appropriate, assess suitability of these new strategies under local conditions, and implement where feasible. | The IPM Policy proposes an IPM Technical Group to be established within the Department. Pg. 25, Training Section.                                                                                                                                 |
| 10 Training | The City use pesticide formulations and methods of application which will minimize pesticide drift.                                                                                                                                                                                                                                                                                                         | The City presently uses and will continue to use products and methods of application which will minimize pesticide drift. Pg. 28, Corporate Goals.                                                                                                                                                          |
| 11 Training | The City shall ensure that a certified applicator is present when applying products under an Alberta Environmental Protection Special Use Approval (e.g. application within 30 horizontal metres of open bodies of water) | The Pesticide Use Section of the IPM Policy provides the framework to ensure civic compliance. Pgs. 31-34.                                                                                                                                 |</p>
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<td>12</td>
<td>Education</td>
<td>The City make copies of the IPM policy and program available to any interested parties</td>
<td>Calgary Parks &amp; Recreation will ensure that copies of the IPM Policy and Plan will be available to any interested individual or group through the office of Central Parks Services.</td>
</tr>
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<td>13</td>
<td>Education</td>
<td>The City encourage land owners and managers to adopt similar IPM policies and programs.</td>
<td>The City will encourage land owners and managers to adopt similar IPM policies through its public education campaign, through the Horticultural Information Line, and cooperatively with involved organizations. Pg. 23, Principles; pg. 24, Implementation.</td>
</tr>
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</table>
| 14  | Education | The City develop and disseminate educational information to inform the general public about the City's IPM Program and urban landscape management. Where possible, this information should be developed in co-operation with other municipalities and agencies. This information could be distributed in form of brochures or information sheets and cover topics such as:  
- turf maintenance  
- tree and shrub selection and maintenance  
- information and alternative methods for dealing with weed and pest problems  
- a graphic depiction of the fate of pesticides and fertilizers applied in the urban environment (persistence, breakdown, movement from application site, and uptake by target and non-target organisms)  
- City's IPM Plan and departmental programs  
- pesticide application signs and interpretation  
- advertising no-spray e.g. signage, no-spray areas  
- new management initiatives undertaken by Calgary Parks & Recreation  
- maintaining Calgary Parks & Recreation's Horticultural Information Line  
- involving the public in developing tolerance/action level for pests. | Within budget allowances, funds will be dedicated to develop and implement IPM educational programs. Pg. 23, Principles; pg. 24, Implementation. |
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<td>15</td>
<td>Audits of the IPM Program</td>
<td>At the end of each year the City of Calgary should summarize all pest infestations, cost to control problem, method of control, how much product was used, did they meet or exceed their objectives. This report will be accessible to the public.</td>
<td>Annual summaries will be prepared and made available upon request for public review. Pg. 27, Roles &amp; Responsibilities.</td>
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<td>16</td>
<td>Public Involvement in IPM Programs</td>
<td>The City involve the public in the periodic review of the IPM Program.</td>
<td>It is recommended that the process for periodic review be established through the Office of the Environment and the Environmental Advisory Committee. Pg. 27, Roles &amp; Responsibilities.</td>
</tr>
<tr>
<td>17</td>
<td>Public Involvement in IPM Programs</td>
<td>Calgary Parks and Recreation develop opportunities for partnerships with communities and other group - similar to the program implemented in other municipalities.</td>
<td>New opportunities will be investigated on an individual basis. Pg. 23, Principles; pg. 28, Corporate Goals.</td>
</tr>
<tr>
<td>18</td>
<td>Other</td>
<td>Calgary Parks &amp; Recreation review their beaver control plan and co-ordinate plans with other local authorities in the Bow River Basin.</td>
<td>Calgary Parks &amp; Recreation continues to consider alternative measures for beaver control. These initiatives will be discussed with the local authorities to establish a coordinated approach.</td>
</tr>
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<td>19</td>
<td>Other</td>
<td>The City monitor contracted commercial applicators to ensure pesticides are being applied in accordance with the service agreement, IPM policy and guidelines, and provincial/federal legislation</td>
<td>The equipment tender developed in conjunction with Supply Management Services, requires private contractors to comply with all provincial and federal legislation, and local civic policies. The City will continue to monitor the activities of private contractors to ensure compliance. Pg. 23, Principles, pg. 34, Pesticide Use.</td>
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<td>20</td>
<td>Other</td>
<td>The City shall use IPM practices in managing pests in civic facilities and structures.</td>
<td>Presently, IPM principles are being used in Devonian Gardens, additional investigation on IPM practices in other civic facilities ties will be undertaken through responsible departments. Pg. 23, Principles; pg. 28, Corporate Goals.</td>
</tr>
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<td>21</td>
<td>Other</td>
<td>The City review the issue of pesticide use by private land owners</td>
<td>Although, this issue lies outside the scope of the IPM policy, continued education can encourage home owners to investigate alternative pest management measures. Pg. 23, Principles; pg. 28, Corporate Goals.</td>
</tr>
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<td>22</td>
<td>Other</td>
<td>The City will consider target reductions in the use of pesticides.</td>
<td>The IPM policy provides a sound rationale for pesticide use and negates the need for target pesticide reduction. OE96-78 recommended to eliminate an annual pesticide reduction.</td>
</tr>
<tr>
<td>23</td>
<td>Other</td>
<td>The City include Public Education and Participation in the IPM budget</td>
<td>These items are included in the proposed IPM Program budget.</td>
</tr>
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<td>24</td>
<td>Other</td>
<td>An Ombudsman be appointed to represent members of the public who have come forth with specific concerns. This person would also, be accountable for resolution of the issues.</td>
<td>The Public Information Line operates in a similar manner to an ombudsman. Inquires and requests are forwarded to the appropriate department. The Information Line follows up on each inquiry.</td>
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<td>25</td>
<td>Other</td>
<td>The City will restrict the use of herbicides within 30 horizontal metres or in an open body of water for the control of restricted and noxious weeds in accordance with the Weed Control Act and where such a use is part of an IPM program.</td>
<td>The City will continue to adhere to the conditions outlined within the City's Special Use Approvals as issued by Alberta Environmental Protection. Pg. 30, Federal &amp; Provincial Legislation.</td>
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<td>26</td>
<td>Other</td>
<td>The City approach the Province to ensure that all stakeholders, in particular landlords and tenants are aware of the new Alberta Environmental Protection regulations and Environmental Codes of Practice with respect to pesticide use.</td>
<td>This item lies outside the scope of the IPM policy but could be investigated upon request from Council.</td>
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<td>27</td>
<td>Other</td>
<td>The City consider creating a bylaw which adopts the existing Alberta Environmental Protection, Environmental Codes of Practice, but increases the pre-notification period from 24 to 72 hours.</td>
<td>This item lies outside the scope of the IPM policy but could be investigated upon request from Council.</td>
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Appendix III: Acknowledgements

The City of Calgary would like to thank all staff, groups, organizations and individuals who participated in the development and creation of the IPM Plan.

The overall project was coordinated by Todd Reichardt, Parks Entomologist. The IPM Plan document was designed, edited, and formatted by Judith Sparkes and Sandy Deren, respectively.

The following groups were consulted and participated in the creation of the Integrated Pest Management Plan. Their participation is sincerely appreciated.

• Environmental Advisory Committee (EAC)
• Pesticide Advisory Task Force (PATF)
• Calgary Parks & Recreation Ad-Hoc Committee