

# Waste Management at UW

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# Waste Management Systems

- **Auditing**

- **1992 Visual and Weight Audits Results**
- **Annual audits**
- **Lessons learned**

- **Solid Waste Systems**

- **Garbage**
- **Hazardous waste**
- **Paper**
- **Corrugated Cardboard and Boxboard**
- **Cans, Glass, Newsprint**
- **Books**
- **Printer Ribbon Cartridges**
- **Styrofoam Packaging**
- **Daycare Reuse Program**

- **Waste Management Opportunities**

- **Contract Negotiations**
- **Internal Operations**
- **Building relationships with suppliers to reduce waste**

# Programs Implemented

## **Reduction:**

- **Energy-saving copiers ONLY purchased**
- **UW Calendar on-line**
- **Gazette production decreased**
- **Water saving devices all through campus**
- **Efficient lighting and HVAC programme**

## **Reuse:**

- **Chemical Reuse Centre**
- **Book Reuse**
- **Daycare Reuse Centre**
- **Vermicomposting in Offices**
- **"Backyard" Composting in various locations**
- **Surplus Stores**

## **Recycling:**

- **Cans, glass, newsprint, plastics (PET and Styrofoam packaging), cardboard, boxboard, metal, kitchen grease, motor oil, tires**
- **Laser and ribbon cartridge reuse and recycling**
- **Contact Lens Bottles**
- **Recycling in both libraries and in copy centres.**

# WATgreen A Project Sampler

## Students:

- **Reducing the use of disposable products in food outlets.**  
Styrofoam cups have been reduced from 1,000,000 to 200,000 in the period 89-97, largely through the Lug-A-Mug programme.
- **The Debit Card System for Village I and II Cafeterias**  
40% reduction in waste per meal served.
- **Waste Audit of the Gazette**  
As a result of examining the distribution of the Gazette, the number printed was reduced by 30% (3.75 tonnes/year).
- **Feasibility Study of a Campus Cyclical Water System**  
Through the use of closed loop re-circulation system and other changes water consumption has been reduced by 35%/ m<sup>2</sup>.
- **Waste Reduction at Source: University of Waterloo's Food Services as a case study**  
Reusable containers introduced for bagel delivery - impact to UW and to company.
- **Alternative Turf Grass Maintenance Strategies**

## Staff:

- **Water Reduction**  
Replaced once through (tap to drain) equipment cooling systems with re-circulating chilled water systems
  - lower water/sewer load
  - treated water
    - eliminated pipe and equipment corrosion
    - eliminated biological fouling of equipment
  - heat is available for energy recovery projectsBuildings converted
  - physics
  - engineering iii
  - chemistry ii
  - esc (current project)
  - biology I & ii (future project)

- **Lighting Improvements**  
 Delamped 12,000 fluorescent fixtures
  - reduced number of tubes from 4 to 2 and 2 to 1
  - less glare - more comfortable light levels
  - resulted in largest of all energy savings
  
- **Heating, Ventilation and Air Conditioning Improvements**  
 Thermal storage using mass of the buildings
  - the mass of the building is pre-cooled early in the morning
    - energy is less expensive
    - free cooling with fresh air
  - building temperature ramps up during the day
  - temperature difference inside/outside more constant
    - healthier - less temperature shock
    - building purged with fresh air
  - large reduction in air conditioner load
    - went from 100% capacity to 70%
    - provides additional capacity for 2+ buildings
  
- **Landscaping Practices**  
 Reduced pesticide use towards 0 in the year 2000.

## Committee:

- **The WATgreen Task Force on Turf Grass Maintenance**  
 Established to investigate the options and alternatives to turf grass maintenance. The result was the Turf Grass Maintenance Action Plan, held in Plant Operations, which includes a target of 0 pesticide use by the year 2000.
  
- **Bicycle Use Planned Management**  
 Bicycle transportation to and from campus, bicycle safety, secure bicycle storage and safety on campus.
  
- **Laurel Creek Symposium**  
 Held to facilitate relevant discussions and ideas about the biology and health of Laurel Creek. Speakers ranged from University of Waterloo and Wilfrid Laurier University Biology and Chemistry Departments, the City of Waterloo, the Grand River Conservation Authority and the Ministry of Natural Resources.

## The Benefits of **WATgreen**

- **an opportunity for students to learn more about environmental issues while receiving a course credit.**
- **a forum for all members of the University community to make a positive contribution to the resolution of environmental issues facing UW.**
- **mobilization of campus resources to discover cost-effective solutions for dealing with environmental concerns and new environmental regulations.**
- **making all of us aware of the UW infrastructure that supports our activities, and giving students the experience of working within an institutional infrastructure.**
- **graduates, who will carry with them into the broader society, the knowledge and skills necessary to work toward an environmentally sustainable future.**

**We are reducing our ecological footprint, and our costs, complying with the law, and changing our relationship with the environment.**

# Accomplishments

## **Solid Waste Management**

- reduced waste by 48% since 1987
  - recycle 900 tonnes/year
  - pay 30% less than we did 5 years ago.
  - reduced Styrofoam cup usage from 1 Million to 200,000
  - Styrofoam eliminated from student villages
  - standardized on post consumer recycled paper towels
  - commenced custodial participation in recycling of aluminum, glass, newsprint inside buildings
  - implemented Styrofoam packaging program
- Book Reuse Program
  - Daycare Reuse Centre
  - Vermicomposting, windrow and backyard composting
  - Recycling of cans, glass, newsprint, plastics (PET and Styrofoam packaging), cardboard, boxboard, metal, kitchen grease, motor oil, tires, wood, laser cartridges, and contact lens bottles.

### **Hazardous Materials:**

- 100% of PCBs containing equipment removed from service.
- Online chemical inventory of reusable chemicals.
- Collaboration with WLU to provide WLU with services
- 24 hour campus spill response team established.
- Underground storage tanks either removed or upgraded.
- Regularly scheduled pickup of hazardous wastes.
- Spill procedures revised and made available electronically.
- Facilitated application of bioremediation technology to campus projects.
- Improved procedures for removal of hazardous materials from decommissioned labs.

## Solid Waste Mgmt. - Con't.

- 95% of PCBs disposed of by destruction.
- Donation from Natural Resources Canada of solvent recycler.
- Revised purchasing practices of lecture bottles (small compressed gas cylinders) from single use to reusable.
- Cleaned up 12,000 litres of contaminated water in the 1997-98 fiscal year
- Recycled 4,000 litres of photographic wastes and 2,400 litres of oil in 1997-98 fiscal year
- 50% of all materials received at the Environmental Safety Facility are removed from the hazardous materials waste stream.

### **Waste Audits**

A number of substantial waste audits have been carried out by over 100 students and this has helped UW meet its obligations under Bill 143, The Waste Management Act. Since 1987 48% reduction in waste generated by weight. Each year, approximately \$100,000 is saved in income generation from recycling and cost avoidance from the landfill.

### **Surplus stores as a Reuse Center on campus.**

As a result of a survey of the UW community, Surplus Stores now maintains a WWW site and has well advertised monthly sales.

### **Waste Management Study of the Davis Center Library**

This study resulted in recycling containers being placed in appropriate locations in the library for the first time.

### **Recycling at Columbia Lake Townhouses and Athletic Events**

Audits revealed methods of implementing and improving recycling at these locations

### **Reducing the use of disposable products in food outlets.**

Styrofoam cups have been reduced from 1,000,000 to 200,000/year in the period 89-97, largely through the Lug-A-Mug programme.

### **The Debit Card System for Village I and II Cafeterias**

40% reduction in waste per meal served.

### **Waste Audit of the Gazette**

As a result of examining the distribution of the Gazette, the number printed was reduced by 30% (3.75 tonnes)/year.

# Landscaping & Ecological Management

The landscape practices at UW have changed. Instead of 350 acres being sprayed with chemicals at least twice a year and often four times, there has been a gradual reduction of pesticide spraying. For general turf areas, the target is 0% pesticide use (exceptions for infestations and hard surface maintenance). For sports turf, spot spraying is done only as required to maintain safe playing conditions. Also 10% of the campus is now naturalized landscape instead of grass.

The WATgreen Task Force on Turf Grass Maintenance was established to investigate the options and alternatives to turf grass maintenance. The result was the Turf Grass Maintenance Action Plan, held in Plant Operations, which includes a target of 0 pesticides by the year 2000.

- reduced pesticide use towards 0 in the year 2000.
- more naturalized areas on campus
- implemented a Native Species planting list
- hosted Laurel Creek Symposium
- increased each year amount of naturalized areas previously maintained at regular turf level
- purchased several new pieces of equipment that has allowed improvement of cultural practices (Trackless mower, Tycrop topdresser, aerator)
- started wildflower test area
- installed below grade irrigation system on north campus to better irrigate fields and reduce pesticide use
- mulched pathway in wood lot to maintain narrow intrusion
- experimenting with new equipment (steamer, propane burner) to eliminate use of Roundup.
- replaced all tractor salt/sand spreaders with drop style to reduce over spray and consumption

# Energy

Since 1973, Plant Operations has done much to reduce energy consumption on campus. **Energy consumption** (fuel and electricity combined) **per square meter has been reduced by 42% since 1973.** Even though the campus has grown substantially in this period, the electricity bill in constant dollars is less now than in 1973. **(From 73 to 52 GW-hr/year.)** This has largely been accomplished by the Department of Plant Operations and predates the WATgreen initiative. In fact they have done such a good job that not much has been left for students to do!

- Energy-saving copiers ONLY purchased

## Lighting Improvements

- Delamped 12,000 fluorescent fixtures
  - reduced number of tubes from 4 to 2 and 2 to 1
  - less glare - more comfortable light levels
  - resulted in largest of all energy savings
- Adoption of high efficiency 34 watt fluorescent tubes versus 40 watt
  - completed during relamping (no incremental labour cost)
- Adoption of high efficiency ballasts
  - during renovation projects
- Replacement of incandescent lighting (pot & entrance) with
  - : compact fluorescent (pl)
  - : standard fluorescent
  - : high pressure sodium (gold colour)
  - energy reduction
  - improved light levels
  - longer lamp life 20,000 vs. 1,000 hrs.
    - reduction in relamping labour
    - fewer burned out lights (dark areas)
  - changes to lighting resulted in reduced air conditioning costs

- Replacement of standard flood and spot lamps with halogen lights
  - energy reduction
  - longer lamp life
- Replacement of mercury street lighting with high pressure sodium:
  - Increased light levels (x3)
- replacing standard fluorescent lamps with electronic ballasts “t8” lamps
- evaluating - electronic ballasts
  - motion sensor light switches
  - scheduling
- Received hydro rebates for energy saving (approx. \$35,000)
- Maintenance crew initiatives reduce an additional 700,000 kwh each year

### **Air Conditioning Chiller Plant Improvements**

- Converted constant chilled water systems to variable flow
  - less pumping horsepower
  - greater chiller efficiency
- Connected four separate plants into a single loop system
  - previous minimum of 4 chillers now a minimum of one
  - can stage the chillers to match load
  - greater chiller efficiency
- Reduced chilled water operating pressures
  - Less pumping energy (decreased by 450 h.p.)
- replaced two cfc chillers (phy & b1 ) with high efficiency units
  - use almost 50% less power
- Renovated cooling towers
  - replaced towers on phy and b1 with more efficient ones.
  - environmental improvement (less water spray carry over)
  - more efficient - less energy

- Converted to building automation system computer control
  - four plants work as one
  - remote start/stop from power house
  - interacts with building controls
  - variable flow control at chillers
    - less pumping energy
  - mass thermal storage using chilled water main's volume (560 tonnes of water)
    - water cooled at night when power is less expensive (tod rate)
    - temperature ramps up during day to absorb heat (4°c)
  
- "free" cooling in winter
  - cooling towers run just above freezing
  - cool chilled water in a heat exchanger rather than mechanical chiller
    - large energy savings (decreased by 200 h.p.)
  
- Thermal storage using mass of the buildings
  - the mass of the building is pre-cooled early in the morning
    - energy is less expensive
    - free cooling with fresh air
  - building temperature ramps up during the day
  - temperature difference inside/outside more constant
    - healthier - less temperature shock
      - building purged with fresh air
  - large reduction in air conditioner load
    - went from 100% capacity to 70%
    - provides additional capacity for 2+ building

### **Steam System Improvements**

- Renovation to steam line insulation
  - insulated fittings
  - doubled thickness
  
- Blanked off redundant and unused lines

- Reduced operating pressure (1200 kpa to 860 kpa)
  - reduces
    - operating temperature
    - heat loss
    - pumping power
- Computer controls on boiler
  - increased efficiency
- Mothballed surplus boiler
  - less heat loss
  - lower maintenance costs
- Computer building automation system
  - elimination of heating while cooling
  - mass thermal storage
  - unoccupied hours temperature setback (i.e. Christmas break)
  - accurate control

### **Ventilation Improvements**

- Renovation to variable air volume (vav) systems @ hh, lib
  - fan energy saving
  - steam energy savings
- Use of variable speed fan drives (vsd)
  - fan energy savings (over damper control)
- Fan scheduling
  - shutdown during low occupancy hours
  - energy savings
    - fan horsepower
    - heat
    - air conditioning

### **Other Improvements**

- Recaulking
- Upgraded roof insulation

# Water

- Air conditioning cooling towers
  - electronic blow-down controls
  - renovated : spray mist eliminators
    - reduced water loss
  - : water sumps
    - less water leakage
- Replaced once through (tap to drain) equipment cooling systems with re-circulating chilled water systems
  - lower water/sewer load
  - treated water
    - eliminated pipe and equipment corrosion
    - eliminated biological fouling of equipment
  - heat is available for energy recovery projects
- Buildings converted
  - physics
  - engineering iii
  - chemistry ii
  - esc (current project)
  - biology I & ii (future project)
- Retrofitted low flow shower heads
- Adjusted toilet flush rates
- Renovated leak prone sections of water mains
  - add anti-corrosion anodes
  - replaced cast iron with plastic pipe
- Drilled wells for chiller plant cooling towers

## **Feasibility Study of a Campus Cyclical Water System**

Through the use of closed loop re-circulation system and other changes water consumption has been reduced by 35%/ m<sup>2</sup>.

# Transportation

- Bike parking available year round
- Purchasing secure bike lockers for pilot project.
- Reduced UW fleet - increased services
- Clean Air Plan for UW.
- Converted selected vehicles to propane

## **University Transportation System**

Over 70 UW vehicles are driven around the campus. Some were left running for long periods of time, a practice which has now been stopped.

## **Transportation to and From Campus**

On a typical day, 7000 cars are driven to campus. 41% of students walk, 32% drive, 17% bike, and 8% use buses. Of the drivers, 35% live within 2.5 km. of the university. 70% of the cars contained one person.

## **Studies into the Micro-commuting on Campus**

On a typical day 140 cars are driven from residence to another parking location on campus (i.e. students commute from residence to class.)

## **Waste Reduction at Source: University of Waterloo's Food Services as a case study**

Reusable containers introduced for bagel delivery - impact to UW and to company.

# Environmental Policy & Planning

- **A Native Species Planting List:** initiated by the WATgreen Committee, has been approved for university operations.
- **Bicycle Use Planned Management:** bicycle transport to and from campus, bicycle transport on campus, secure bicycle storage and safety on campus.

# Environmental Literacy

- Education is an integral part of the 'greening' process. Discovering what people know, how they learn, and what the best educational tools are, and providing the tools, is an important step in monitoring and improving our progress towards a sustainable campus.

# Waste Reduction; Not Just Garbage

- **Solid Waste**
- **Energy**
- **Water**
- **Food**
- **Air**
- **Transportation**
- **Landscaping**
- **Time**
- **Money**

**Waste Management supports reduction, reuse and recycling of ALL resources. By working towards reduction of energy consumption, packaging and pesticide use, water conservation, the purchase of reused and recycled products, the reusing and recycling of products, and alternate transportation methods, environmental impacts and operating costs are reduced.**

## **The Future...**

- **Waste Reduction**
- **Green Procurement/Design for the Environment**
- **Environmental Management Systems**
- **Environmental Literacy**
- **Ecological Footprinting**
- **Sustainable Lifestyles and Living**
- **Environmental Investing**
- **Environmental Accounting & Taxation**
- **Environmental Ethics & Law**
- **Environmental Building Design**

# Design for the Environment

Design for the Environment considers the full range of environmental impacts of a product - raw materials, extraction, transportation, production, energy, water, distribution, waste, product-use, and final disposal - into account and attempts to minimize these impacts. A growing number of companies are seeking ways to design and deliver products while minimizing their environmental impacts.

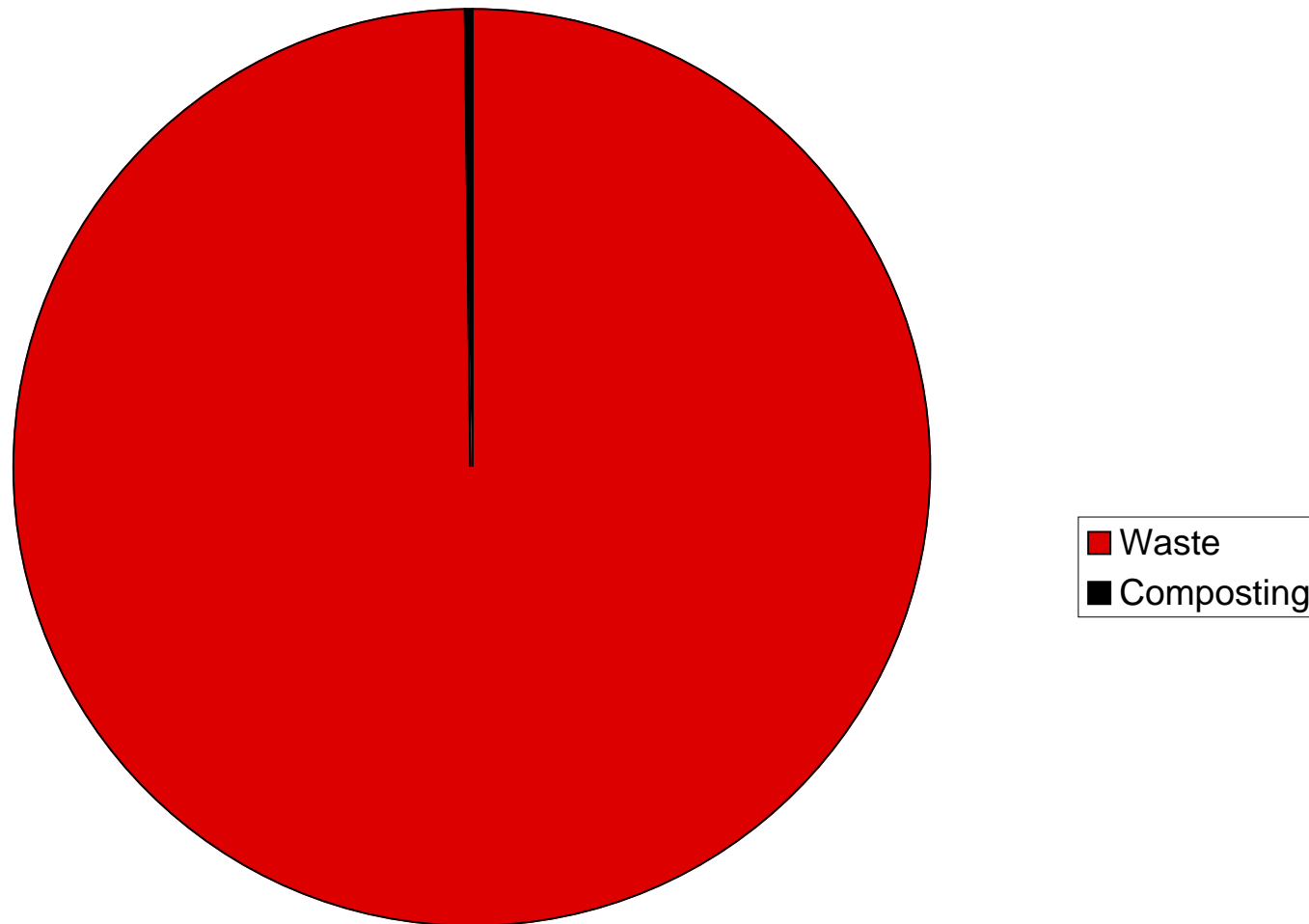
**Consider the following questions:**

- **What is the environmental impact of the product? (Recyclable? Packaging?)  
How can it be minimized?**
- **Is it energy efficient? Water-efficient?**
- **What are the primary raw materials used?**
- **Is the product life appropriate to its task and features?**
- **Are hazardous materials controlled in a closed loop?**
- **Are wastes minimized throughout the life cycle?**
- **Does the design minimize use of nonrenewable resources?**
- **What happens at the end of the product's life? Are the constituent materials and components reused, recycled, or recovered?**
- **Purchase durable products: for example, look for products designed for long life, warranties and extended service contracts for repair of products should be provided.**

## Annual Weights Comparison

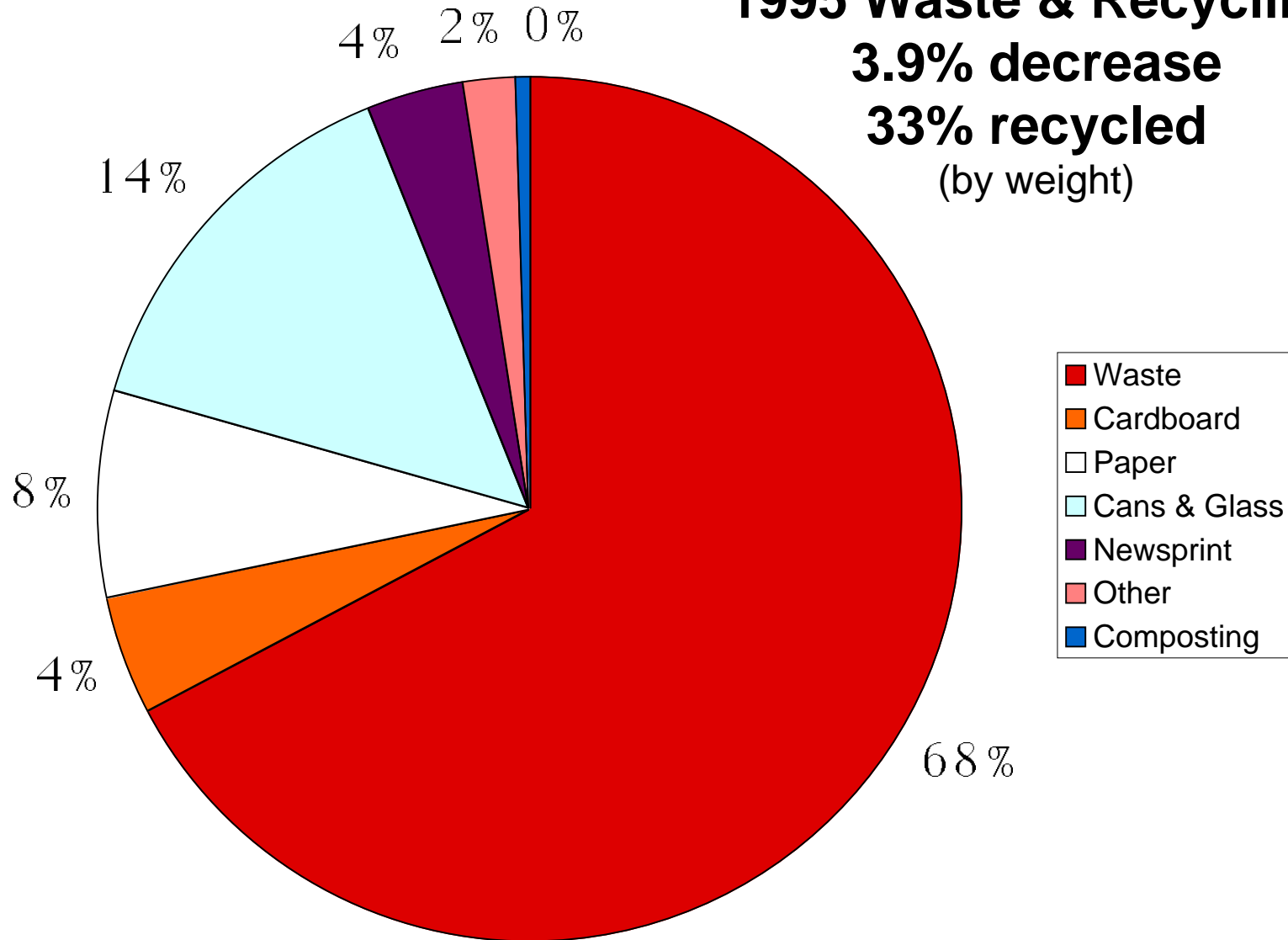
<b>Material</b>	<b>Weight in Tonnes</b>		
	<b>1987</b>	<b>1995</b>	<b>1999</b>
Waste	2963.60	1916.182	1678.74
Cardboard	0	125.81	193.31
Paper	0	228.82	244.25
Cans & Glass	0	405.23	205.01
Newsprint	0	108.52	91.40
Other	0	57.6	135.45
Composting	6	12	16
<b>TOTAL</b>	<b>2969.60</b>	<b>2854.16</b>	<b>2564.15</b>
% Reduction		3.9	13.7
Total Recycled	6	937.98	885.41
% recycled	0.2	33	35

## 1988 Waste and Recycling



# 1995 Waste & Recycling

**3.9% decrease**  
**33% recycled**  
(by weight)



# 1999 Waste & Recycling

**13.7% decrease**

**35% recycled**

(by weight)

