Final Report of Environmental Audit of Gibson Hall
ENST 481, "Ecological Design"

Introduction
Peter O'Farrell

To introduce the presentation, we display our mission statement and a brief history of environmentalism at Tulane. Our mission statement reads:

> As we approach the next millenium, Tulane has the opportunity to initiate a 'renaissance of thought and action' that positively influences the future of the global community. Our analysis of Gibson Hall provides the university with a template for educational, economical, and ecological stewardship to emerge as a leader in academia, New Orleans, and the South.

Our mission was to use the Gibson Hall audit as an example of what can be done to improve the environment at Tulane and in the South. The hope is that Tulane will become environmentally conscience in every aspect, from daily activities to grand projects. As Tulane improves itself environmentally, other southern schools and businesses will look to Tulane as an example on how an institution can function while reducing their effect on the environment.

Since 1971, Tulane has had an up and down history on campus environmental issues. In 1971, Recycle Tulane was established as a group under the CATUS organization. The next year the first students design an environmental studies degree. It remained a self-designed major only until 1978. The Environmental Studies Program has grown to approximately fifty students in the program in 1998-99.

The 1984-85 school year saw the building of the A.B. Freeman School of Business on the land where Recycle Tulane's facility occupied. Recycling was re-introduced to the Tulane campus in 1987. The new center resided on Ben Weiner Drive. The facility handled not only all of recycling for Tulane's uptown campus, but it also was designated a neighborhood drop-off site before New Orleans had curbside recycling. In 1990 the Tulane Environmental Project (TEP) was created. The TEP was a committee of students, faculty, staff, and administrators. They discussed campus environmental concerns and suggested programs. In 1991 they succeeded in institutionalizing recycling at Tulane, hiring a full time director and procuring a budget. In the 1997-98 school year, residence halls began recycling. The Green Club and RHA placed recycle bins on each floor of every dorm. In the 1997-98 school year the Ben Weiner site was removed to accommodate twenty additional parking places. Tulane has placed more recycling bins around campus to try and compensate for the loss of the Ben Weiner site. Despite this, since the site was removed, overall recycling volume has decreased.

The Tulane Green Club was established during the 1988-89 academic year. They lead in service and action in dealing with campus environmental issues. They do this by sponsoring environmental speakers, publishing the "Environmental Forum" and the "Enviro Counter Culture Catalog," and holding various other events.

In 1989, both the Center for Bioenvironmental Research (CBR) and the Tulane Environmental Law Clinic were created. The CBR conducts research in interdisciplinary fields such as toxicology, medicine, and engineering, among others. The Tulane Environmental Law Clinic is the largest such clinic in the nation. It has come under heavy criticism in the past year because of their challenge to the Shintech Corporation's effort to build a PVC plant in Convent, Louisiana, mainly because the clinic has been extremely effective. It was one of the most publicized environmental justice cases in history. Tulane Law School has seen a jump in their national rankings in the past few years; much of the jump can be attributed to the Environmental Law clinic.

In 1997, the Environmental Sociology course at Tulane performed an environmental audit of the University. As a follow up to that audit, Aaron Allen wrote his honors thesis on campus greening at Tulane, and he designed the Ecological Design course (ENST 481) that has completed an environmental audit on Gibson Hall. The students gained a wealth of "hands-on" experience, helping us understand all that encompasses environmental sustainability. We learned that we must look at the building, in the building, around the building and at all the procedures and habits of the building to truly understand the effect a place have on the environment.

Policy

Jini Koh (lead), Stuart Carlton, Danielle McCarthy, Peter O'Farrell

Tulane University has no formal environmental policy. The policy that employees follow is de facto, created through memos and individual initiatives. The absence of a formalized policy results in misconceptions, inconsistencies, and failures to realize efficiencies and cost savings. In obtaining data for our poster, we surveyed the occupants of Gibson Hall. In this survey, employees were asked eleven questions relevant to policy; these questions were part of a larger survey. Overall, 92 of 129 distributed surveys were completed and returned. The results are as follows,

When asked "Do you know of an environmental policy at Tulane?", 44.6% replied "yes," 51.1% people said "no," and 4% of those surveyed did not respond to this question. The remarkable point in this question is that many employees of Gibson believe that an environmental policy exists, even though one does not.

The next question asked was "have you ever encountered visual reminders of certain policies at Tulane such as the copying policy?" In response to this 23.9% said that they had, 73.9% replied that they had not, and 2% did not answer this question. Overall, this lack of visual reminders could be the reason for so many people not being aware of the few ad hoc environmental policies that do exist (such as materials recycled or two-sided copying).

To the question "are you aware of Tulane's copying policy?", 14.1% said "yes," 83.7% said "no," and 2% did not reply to this question. The double-sided copying policy, although de facto, is almost unheard of by Gibson employees. Perhaps visual and vocal reminders would aid in awareness of this, and other, Gibson Hall procedures.

When asked "what does Tulane recycle?" 89.0% could identify at least 1 item, 80.4% identified two items, and 15.2% identified 3 or more items, while 3% did not answer. While it is good that the majority of people could identify one or more items, it is possible to recycle many items at Tulane, and save money and resources in the process. Once again, visual and oral reminders are in order.

In response to the question "who do you call when you need something fixed in your office?" 73.9% contact physical plant, 13.0% contact their secretaries or office manager who then in turn usually call physical plant, and 13.0% call "other." This question was followed up with "how long does it take, on average, to receive a response from physical plant if you have a certain concern such as getting a light repaired?" To this question, 3% claimed that it "depends," 38% of the respondents said either immediately or within 1-2 hours, 38% said within 24-48 hours, 7% said that it took longer than 48 hours for their requests to be processed, and 24.0% did not answer.

When asked "is there a specific procedure for making suggestions to improve the work place environment?", 17.4% replied that there was, while 71.7% replied that there was not, and 11% did not answer. A detailed procedure for making workplace suggestions can improve morale in the workplace, as well as lead to good suggestions to increase productivity. The 17.4% (16 employees) that responded "yes" to the above question were asked "do you feel as if your suggestions are being implemented?" In response to this question, 37.5% (6 people) said they felt their suggestions were implemented or said yes and 63.5% (10 people) said no. Implementing employee suggestions, where feasible, is an excellent way to improve workplace happiness.

The next question on the survey asked "if you save Tulane University a significant amount of money by implementing an operational change, do you receive a percentage of that money?" To this question 85.9% (79 people) answered correctly that Tulane does not reward its employees for initiatives in developing cost saving techniques; 1% answered yes and 13% did not answer. However, when asked "do you feel this incentive would have a positive, negative, or no impact on the optimization of employee productivity?", 78.3% responded "positive", 1% responded "negative," and 17.4% responded that it would have no impact.

In addition to this survey, we researched past environmental policy at Tulane. To do this, we consulted with several of the research librarians as well as University Archivist Robert Sherer. Despite the immense help of these people, our search yielded little specific information, as there is little on Tulane's past policies available, and none pertaining specifically to environmental information. What we did find was a memo signed in 1993 by Alan Davis, Associate VP for Campus Services addressed to deans,

directors, and department heads announcing that copy paper purchased through university purchasing would be 50% virgin and 50% recycled content. As per correspondence with Tom Latusa, the present paper contract with Office Depot specifies 20% post consumer amount in standard office paper.

The copying policy about recommending double-sided use when possible is a memo from Dr. Eamon Kelly via the Tulane Environmental Project in 1993. The main problem is (1) that the policy is de facto in that no one really is aware of the policy because it is not stated in employee handbooks while explicit policies about hiring/ firing/ sexual harassment/ sick leave/ where to park are, and (2) there is no procedure or enforcement capacity of the policy.

Our suggestion is that environmental policy be formulated and written in handbooks for employees, staff, and students. This would give a baseline understanding of the policy, which would lead to compliance. Actual, written policies would have more teeth than simple memos, and would therefore immediately spark additional compliance. Visual reminders, perhaps in the form of signs above copy machines, recycling bins, and so forth, would also go a long way towards compliance with policy, de facto or otherwise. Overall, the employees in Gibson Hall seem willing to take basic steps towards more efficiency, they are just not fully aware of what these steps are, and how to take them at Tulane University. Once these basic suggestions are in place, Tulane University will be further down the road to sustainability.

Facilities

Danielle McCarthy (lead), Stuart Carlton, Jini Koh, William Schleizer

To measure the passive design used in Gibson Hall, the Facilities group started off with the question “To what extent does Gibson Hall operate efficiently by taking advantage of the relationship between energy use and architectural form?” This was divided into multiple subquestions, which we answered individually.

The first subquestion was “Can natural ventilation strategies be integrated to allow current climate control systems to perform at peak efficiency?” This demanded two questions which were even more specific: “are natural ventilation strategies realistic in the climate of New Orleans?”, and “is the building design appropriate for the adaptation of natural ventilation strategies?” To answer the first of these most specific questions, we consulted bioclimactic charts. Bioclimactic charts are used to determine heating and cooling strategies by plotting the temperature and relative humidity of New Orleans against the human "comfort zone" based on 0.8 clo level (like wearing winter clothes) and an activity level of 1.3 Met (office work). The charts tell us what temperatures are too high or too low to be acclimated by natural ventilation strategies or by solar heating. Although Gibson Hall has a substantial internal microclimate generated by the number of occupants and equipment, the bioclimatic chart gives us parameters within which we can work. Natural ventilation (defined as ceiling fans or an open window- anything that moves air) extends that human comfort zone up to ten degrees. After consulting the bioclimactic charts, we determined that natural ventilation strategies are a realistic solution in the New Orleans area that save money and energy.

To determine whether or not Gibson Hall’s design is appropriate for natural ventilation strategies, we physically went to Gibson and tested the windows for operability, and also checked to see where ceiling fans can be installed. The idea of ceiling fans is particularly attractive, as they have a certain “Old New Orleans” feel to them, and certainly appeal to the architectural concept of “sense of place.” Ceiling fans would be both helpful and beautiful, making Gibson Hall decidedly more pleasant. There is room in Gibson Hall to install them on both the second and third floors. To use them as a supplement to the current air conditioning units would be quite pleasant.

In short, natural ventilation strategies are not only plausible for Gibson Hall, but are actually quite simple to implement. When the building was first built in the late nineteenth century, it was designed to incorporate these strategies, as air-cooling technology was nonexistent. To reintroduce these strategies, such as ceiling fans and open windows would not only save money, but also increase Gibson Halls “sense of place.” A cool breeze and the sounds of passing streetcars on historic St. Charles Avenue provide

quite a nice ambiance, one that can easily be achieved through the implementation of these simple strategies.

The second subquestion was "Can a more efficient electric lighting system be developed by the incorporation of daylighting strategies?" This, too, was divided up into two more specific questions, "is daylight availability adequate to provide the sufficient illumination of the interior spaces of Gibson Hall?", and "can interior spaces and activities be zoned as part of a more efficient electric lighting system?"

In order to answer the first part of this subquestion, we used a Daylight Availability Curve. A Daylight Availability Curve is the percentage of exterior illumination available inside the building for a given latitude, a set of working hours (we choose 09.00-17.00), and a chosen footcandle level for illumination (we choose 50, the desired level according to Tulane's resident ecological design expert and Professor of Architecture John Klingman). The curve determined light was adequate 90% of the time. That means that in the average workweek, 36 of the 40 hours worked have potentially adequate light for natural lighting schemes.

To answer the second part of this subquestion, we went into strategic points in Gibson Hall with a light meter, and measured it concurrently with the ambient light outside. Three measurements were taken in a total of ten different rooms in Gibson Hall, with each measurement coming from a slightly different location within the room. Most of the points measured in Gibson Hall had at least the minimum day light factor (a measurement determined by dividing the interior level of daylight by the exterior level of daylight) required for natural lighting. This means that, because the levels are sufficient across the room, the current zoning in Gibson Hall is adequate, but can be optimized by placing desks closer to the windows and computers and other task-lighted equipment in the interiors. As the sky changes, the interior light levels change, so electric lighting can be designed to layer the electric lights parallel to the window plane in order that lights can be individually turned on, off, or dimmed as needed. Doing so will allow an optimization of the available light, which would improve efficiency and save money.

Daylighting is possible. When we were taking measurements from office to office, we discovered that many of the employees in Gibson Hall usually kept their lights off, anyway. Even if it isn't practical for the entire workday, the pleasing effects of natural sunlight can be used to enhance Gibson Hall, creating a more satisfying workplace.

These two steps towards a more ecologically sound Gibson Hall -- daylighting and natural ventilation strategies -- are easy and can be taken almost immediately. There is very little money to be spent, and a fair amount to be saved. In addition to the added efficiency and saved money, they both have the potential to greatly enhance the Gibson Hall experience, and make it a more beautiful place to work.

Utilities

Dan Au (lead), Brian Fink, Peter O'Farrell

Improvements in energy and water consumption can add up to substantial reductions in utility bills. For this report our team compiled data from answers to questionnaires filled out by building occupants, met with physical plant staff, and conducted our own survey of all four floors of Gibson Hall, making notes on over 1300 lights, 167 computers, six common restrooms, refrigerators, copiers, and other equipment. Overall, we found three areas in electricity and water use that could benefit from technological and behavioral improvements.

The first area of electrical use we examined was lighting. All of the lights we inspected in Gibson Hall were efficient fluorescent lights with the exception of desk lamps and track lighting. Physical Plant confirmed that they retrofitted Gibson, like many but not all of the campus' buildings, with T-8 diameter fluorescent lamps and ballasts. These retrofits increase luminaire efficiency 73-85% while delivering higher quality light than their older T-12 cousins. T-8s not only last longer, but are inexpensive.

T-8 retrofits are an area where the university has seized cost-savings opportunities, yet many more exist. Innovations in lighting have led to the development of compact fluorescent bulbs. These bulbs emit little heat, use 70-85% less energy, and last up to 13 times longer than conventional

incandescents. While surveying the overhead fluorescent lights we counted over 44 desk lamps and track lighting fixtures still outfitted with outdated incandescents.

In our floor by floor survey of Gibson we also noticed another inefficiency: many rooms were lighted but empty. Two ways to minimize lighting inefficiencies are to install room occupancy sensors and to encourage conservation practices, such as turning off lights when not in use or when there is sufficient natural illumination. Intelligent room occupancy sensors are now available which automatically turn off lights through sound and motion detection. Ambient daylight sensors can also adjust for daylight contributions. In our survey we found sensors could save the most energy in places only periodically occupied, such as classrooms, lounges, and restrooms.

A second area of inefficiency in electrical use was the heating/cooling system. According to the questionnaires filled out by building occupants, 78% reported that Gibson Hall was over-air-conditioned. Over-cooling and over-heating wastes energy and can reduce occupants' comfort and productivity levels. In addition, building occupants can not easily adjust for individual preferences. According to physical plant there are 42 thermostats in Gibson. Each of these thermostats, except one or two, require a physical plant worker to adjust. This is done to prevent high fluctuations in energy demand. This problem is compounded by the fact that rooms in the same zones may vary widely in temperature. Part of the reason for this is that Gibson's air handling system dates back to 1951. Unlike current systems, it can not vary air flow or motor speed to suit demand. This means that even at almost zero occupancy Gibson must run its heating/cooling to meet near full occupancy for those late night or weekend users. This severely reduces the effectiveness of the university's modern Energy Management System, which is a computerized control system centrally located in physical plant which can adjust the heating, cooling, and electrical inputs of a building according to its occupancy schedule. The lack of individual or variable control also prevents full realization of the benefits of natural ventilation strategies.

The third and final area in electrical use we examined was computer equipment. Our inspection for energy saving sleep mode functions on the computers we counted was somewhat flawed because many computers did not have any sort of EPA energy star type identifying sticker. So, for this we relied on the questionnaire data: 27% of respondents noted that they always left their computer on and 54% of these lacked an auto sleep mode. Most modern monitors have this feature, but some do not. Additionally we counted almost one printer for every computer; consolidating and networking printers for shared use cuts back on purchasing and operating expenses.

In the area of water use, we inspected faucets and commodes. Except for one new restroom on the ground floor, all of the common restrooms were inefficient users of water. None of the faucets have simple aerators, which reduce water flow rates. All of the commodes were 3.5 gallons/flush. According to physical plant, all newly manufactured commodes are government mandated to be at most 1.6 gallons/flush. Physical plant informed us that water costs $0.40 per 100 gallons and that these commodes cost $130 each, including parts and labor. At an average rate of 15 flushes per day, it would only take about 3.1 years for new toilets to pay for themselves.

Our findings indicate that large sources of inefficiencies in Gibson can be reduced through technological upgrades and modifications in habits. In lighting, compact fluorescents and room occupancy sensors can be combined with employee mindfulness. Heating and cooling suffers from an outdated system. Computers could be turned off when not in use and new purchases should have energy efficient criteria. Lastly, water use can be reduced cost effectively through commode upgrades. The measures we've highlighted are just some of the opportunities for cost-effective and efficient management of utilities.

Utilities Appendix

So how is Gibson Hall cooled? Basically a chilled water system pipes water to the building. Water is piped to the ground floor where a large pump sends it to the different floors. Each floor has two to four air handling units. Each air handling unit then uses the water to cool air and sends it through vents to different zones. There are 42 zones in Gibson total and each has a thermostat. Thermostats regulate temperature using a damper. Air from this thermostat-regulated zone is heads through ducts to diffusers, the vents in the ceilings. In colder months the air handling units also manage heated air.

There are numerous problems with this system. The first pertains to the thermostats, which only physical plant can adjust so that too many people do not set their thermostats too low. This would lead to more energy used to cool down the returned water from buildings (chilled water is continually cycled). Second, rooms in the same zone may have very different temperatures. Part of the reason may be poor air duct layout. Finally the system itself is old. Some air handling units are barely running.

Newer and more efficient systems, while expensive to install, may be worth the costs. Variable air volume systems (VAS) will adjust fan motor speed according to user demands. This leads to greater control of temperatures, especially in zones served by the same air handling unit. Decreased fan motor speeds leads to decreased utility bills. Demand control systems can works with VAS. Demand control monitors rooms for occupancy, usually by CO2 concentration and can adjust amount of air accordingly. With these systems, building occupants can have greater control over their work area climate. Such systems also work better with energy saving natural ventilation strategies. Demand control and VAS are appropriate for Gibson. As occupancy changes, the amount of energy used should change also.

Tulane has a computerized Energy Management System (EMS). From the physical plant building this system centrally monitors and controls various electrical inputs into buildings. For example, it can turn off power to lights or to the heating/cooling system. Gibson's shutoff times are from 10pm to 5am. This should work well except that there are usually a few late night or weekend users, reducing efficiency. For example to accommodate a few users, the whole building's heating/cooling system may have to be turned on. With VAS and Demand control the EMS would be able to manage buildings more efficiently.

How can cost-savings in utilities be measured? Finnin Associates has laid out a system of 56 electrical meters and monitors across the campus. These meters are used to give various utility readings for a building across time. Physical plant checks monthly readings for such things as abnormal increases. Gibson Hall averages about 58,000 kwh, costing about $2,900 a month. The kwh does not vary much over the summer or winter, because occupancy is near constant and air handling units are used for both heating and cooling. Also this figure does not include gas, steam, or chilled water costs. These figures are available as university wide statistics.

For more information, contact Physical Plant: Greg Chlup, Terry Langston, or Michael Crago; www.honeywell.com is also a good site with info on VAS and demand control air systems.

Procurement of Chemicals

Seth Willey (lead), Brian Fink, Jessica Lunsford, Naomi Worth

This portion of the audit focuses on the procurement of chemicals by *Jani-K*ing, *Redd Pest Control*, and *Tulane Physical Plant.* All conclusions are based on analysis of the Material Safety Data Sheets (MSDS) and personal interviews. The audit examines chemicals for carcinogens, Superfund and other regulated ingredients, and ecologically hazardous compounds. The remainder of the study focuses on product selection criteria, necessity of use, and willingness to consider impact-reducing alternatives. Where appropriate we provide recommendations to diminish ecologically detrimental affects of Tulane's checmical use.

Chemical Cleansers. Tulane Physical Plant and Jani-King divide janitorial services for the Tulane University uptown campus. Physical Plant is responsible for four buildings and limited ordering. H & F Inc., an independent franchise of the Jani-King Corporation, is subcontracted to clean the remaining fifty-two buildings. Jani-King is responsible for its own staffing, training, insurance, supervision, and purchasing. They are responsible for procuring their own equipment, supplies, and chemicals. Tulane Physical Plant orders paper products (toilet paper and paper towels), soap, and trash bags for all janitorial work (including Jani-King). Due to limited time and resources, this audit focuses primarily on chemical cleansers.

In interviews regarding chemical use, Jani-King expressed significant concern for employee safety. Jani-King's precautions include intensive training periods, color-coded training and safety sheets, audio tapes, videos, and many other types of equipment. Unfortunately, this concern has not transferred

into environmental considerations. Jani-King does not currently consider environmental impact in any procurement decisions.

Our findings illustrate a strong need to consider environmental impact. Of the sixty-nine chemical cleansers Jani-King uses:

Thirty-two percent of cleaners contain Superfund regulated compounds.
An additional thirty-two percent of cleaners contain compounds commonly known to be hazardous to the environment.
At least one cleanser contains a known carcinogen.
Nearly half of all cleansers reporting pH, listed an extreme pH.
Six products are aerosol propelled.

While Jani-King has not considered environmental impact in any procurement decisions in the past, they have expressed a willingness work with the University take such considerations into account in the future.

Indoor Pest Control. Redd Pest Control Inc. is contracted by Tulane University to provide all pest control services within Tulane Campus buildings, including Gibson Hall. The service includes all insect and rodent control within these buildings. In addition, a bait treatment is used around the perimeter of the buildings to prevent the entrance of outside pests. Redd Pest Control works under a standard contract with Tulane University. The pesticides used come from a list provided by the Redd Pest Control corporate office. The individual operators have limited choice within the standard product list. Much of this choice is in the application of the chemical not its ingredients. Because the operator cannot currently make procurement decisions, it is our recommendation that pesticide chemical composition should be factored into future contract negotiations.

Pesticides within the occupied parts of the building are restricted to the bathrooms and the brake rooms. Unoccupied areas treated include walls, attics, and basements. Problems in other areas of the building are dealt with by request only to reduce pesticide use. Spray pesticides were phase out in Gibson Hall because of employee concern. Spray pesticides are still in use in other buildings.

Grounds: Lawn and Garden Care. Tulane Physical Plant cares for all of the Tulane Campus grounds. This includes all of the lawns and gardens. The Physical Plant's uses chemical fertilizers and pesticides to care for the grounds. All chemicals used biodegrade in the soil. In an interview, Tulane Physical Plant said environmental health and safety of the products is the top priority in procurement decisions. There is some reuse of grass clipping on the laws but this does not consistently occur. There is no written policy for environmental consideration in lawn and garden care. Ten products were analyzed for their chemical content and use:

Three of ten are lawn and garden fertilizers
Seven of ten are pesticides
Five of ten contain phosphates
Two of ten contain hazardous chemicals

Conclusion. Our analysis of fertilizers, pesticides, and chemical cleansers procurement and use revealed the need for additional environmental considerations in policy and contracting. Although employee health and safety is a top priority of purchasers, this concern does not transfer over to environmental considerations. In fact, neither of the subcontracted firms considered environmental impact at all. Other U.S. universities have promoted environmental consideration among subcontractors by writing such concerns into contracts. While Tulane Physical Plant currently considers environmental impact, no formal policy exists to ensure these practices continue into the future. The changes proposed in this audit are merely a first but necessary step towards the environmentally conscientious use chemicals on Tulane University campus.

Paper Procurement

Brian Fink (lead), Jessica Lunsford, Seth Willey, Naomi Worth

In evaluating Tulane's paper procurement policy, we looked at the extent to which the use and procurement of paper at Tulane maximizes efficiency and minimizes environmental impact. We had

many conversations and meetings with buyers in Tulane's procurement department, used information from the survey administered to Tulane employees in Gibson Hall, and independently gathered additional information on our own. This independent gathering included locating Tulane's double-sided copying policy at the Zemurray Copy Center and examining the labels of copy paper boxes found in Gibson Hall.

From our conversations with the procurement department, we discovered that Tulane has a fairly strong policy for purchasing recycled paper. According to a 2/24/93 memo provided by the department (from - Alan B. Davis, Associate Vice-President for Campus Services), the procurement policy is the following: "Please be advised that copy paper purchased through the University Purchasing Department will be recycled paper. The paper will be 50% virgin fiber and 50% recycled. This policy is effective immediately."

By increasing the demand for recycled paper, Tulane is helping to decrease the cost of buying recycled paper products for the general public.

Through our examination of the labels on boxes of copy paper found in offices in Gibson Hall, we found that 11% of the paper was virgin, 22% had 20% post-consumer-recycled content and 67% had 30% post-consumer recycled-content.

The procurement department explained that each on campus department would receive 20% post-consumer content copy-paper, unless they specifically requested virgin paper (e.g., for laser printers). Departments that had been receiving the 30% paper did not necessarily request it, and was not paying extra for it. Our contact at the procurement department was not aware that 30% paper was being ordered.

According to the procurement department, virgin copy paper from Office Depot costs $1.66/ream and 20% post-consumer recycled copy paper costs $2.22/ream.

Potential benefits of using recycled paper include:

For every ton of paper that is recycled, we save 17 trees, 7,000 gallons of water and 4,100 kilowatt hours of electricity.

Replacing virgin paper with recycled paper reduces water use by 58 percent.

Logging has serious consequences for the environment, including increased soil erosion, destruction of wildlife habitats, and increased CO2 levels due to the loss of CO2 absorbing trees.

Recycling reduces the amount of dioxin, a hazardous chemical by-product that results from industrial air emissions, wastewater discharges, and disposal activities.

Recycling reduces the need for municipal waste incineration - the source of 30% of all dioxin air emissions

In water, the largest source of dioxin comes from wastewater discharged from virgin pulp and paper mills through the bleaching paper process - discharging 110 grams of toxic equivalents per year

In paper mills that use recycled paper, dioxin is only found at trace levels because recycled paper does not need to be re-bleached, but instead, uses non-chlorine processes, such as hydrogen peroxide, ozone, or hot water to clean the fibers.

Recycling reduces the amount of garbage in our landfills. Every ton of paper recycled leaves 3.3 cubic yards of free space in our landfills.

When paper products are recycled, fewer carbon-absorbing trees are cut down. By using recycled paper instead of virgin pulp, less carbon is released through the paper manufacturing process.

From the survey that was administered to Gibson employees, we found that of the people with the power to make purchasing decisions, cost was very important for 78%, somewhat important for 14% and not an important criteria for 7%; quality was an important criteria for 83%, somewhat important for 17% and not important for 0%; and environmental impact was an important criteria for 13%, somewhat important for 47%, and not important for 40%.

We also examined the extent to which double-sided copies are made. In the Zemurray Copy Center, Tulane's double-sided copy policy, which President Eamon Kelly promulgated on 10/29/92, is posted. It reads in part: "I am requesting all Deans, Directors and Department heads to implement two-sided copying for all memoranda, classroom and printed materials of more than one page, to the fullest extent possible. Two-sided copying is not only ecologically sound but will also result in identifiable savings to the university."

In concordance with that policy, from the survey, we discovered that 91% of Tulane employees believe that they have the option of making double-sided copies. However only 7% of employees make double-sided copies all of the time; 22% make them most of the time; 40% make them sometimes; 19% make them once in a while; and 12% never make them.

Overall, we concluded that Tulane generally has strong environmentally-friendly paper procurement and use policies. The Tulane community, however, is not aware of them and therefore does not follow them, all of which results in an economically and ecologically wasteful use of paper at Tulane.

Waste

Naomi Worth (lead), Dan Au, Betsy Franke, William Schleizer

To what extent are resources used efficiently-- and needless waste avoided-- in the management of Gibson Hall? Data collected from Gibson show that some employees and students in Gibson make an effort, but everyone in Gibson could make a more comprehensive effort. Such an effort would result in benefits for Tulane University as a whole. Not only would costs be avoided and revenues gained in certain areas, but everyone who participates in recycling becomes educated to incorporate recycling into their everyday lives, and will bring this knowledge to their future work environments and homes. Increased recycling and waste reduction for Tulane are attainable, but require a sustained and coordinated commitment. The focus of the commitment should be education and environmental stewardship.

In assessing the efficiency of material use in Gibson, we performed a waste analysis on three occasions. Random trash from receptacles was collected from every area in the building. The trash that we did not collect was from mostly empty receptacles. The trash was transported to another building and weighed aggregately. Then the trash was sorted into materials that Tulane could recycle. Tulane currently recycles paper, cardboard, glass, aluminum, and plastic numbers one and two. If Tulane had a more extensive recycling program, more materials would have been recyclable than are represented in this audit. The audit shows that 45% of the items people threw away could have been recycled. The most represented recyclable item in the trash was paper; next was aluminum, which is an item that creates revenue for the university (about $500 per ton).

The first priority in waste reduction is to reduce the source of wastes. Educating people to make double-sided copies, use reusable mugs, and use a scratch paper box are all realistic techniques in reducing the source. Tulane's "moveable property management" program currently has an internal waste exchange program; they will take any materials and try to reallocate them on campus before disposing of them. Materials included are mostly office supplies and appliances. The program is not well known on campus because it is not advertised. More principles of internal waste exchange could be applied to the university, possibly by an end-of-the-semester drive for all materials that are unwanted by departments and students. These materials could be reallocated at the beginning of the next semester when students are purchasing most of their supplies, greatly reducing the influx of trash that comes about during times when a lot of materials are thrown out, and avoiding costs for recipients of reused materials.

Costs could be avoided for the university if recycling were increased. Current tipping fees to landfill wastes for Tulane are $32.29 per ton. When you factor in the costs for labor (people have to pick up the trash and escort it to a landfill) and hauling fees (the cost of transportation, including vehicles and gas) the cost to landfill wastes is approximately $100 per ton. Tipping fees are rising, as illustrated by the following chart.

Year	Tipping Fee (per ton)
93-94	$25.80
94-95	$29.04
95-96	$29.62
96-97	$31.24
current	$32.29

From Gibson Hall alone, approximately 1610 pounds of garbage are removed each month. This is a low estimate based on the data we collected, which did not include all of the trash in Gibson. It costs

$80.50 per month to remove trash from Gibson, and $966 per year. If recycling practices were efficient, it would cost $44 per month to landfill wastes, or $528 per year. Such a waste reduction would result in a savings per year for the university of $438. This number may seem negligible, but when applied to the many buildings on campus, savings could be much greater.

Recycling at Tulane is creating significant cost avoidance and revenues. Paper and glass do not generate any income, but the cost avoidance in recycling these materials is significant. In one week, 449 pounds of paper were recycled at Gibson. At this rate, one month of paper recycling avoids $89.80 in tipping fees. A year of paper recycling could avoid $1077.60 in tipping fees. No data could be collected on the amount of glass, plastic and aluminum that was recycled from Gibson Hall. (Tulane, as a whole, has averaged a revenue of $121.55 per month from recycling used beverage cans, which include glass, plastic and aluminum.) Tulane has potential for much more efficient recycling that would generate a significant income.

Tulane is missing out on the benefits of recycling. Resources already exist at the university that could handle an increase in recycling. The problem is that recycling has not been made a priority; many of the employees at Gibson do not know of Tulane's recycling policy, and none of them know where their wastes go after they throw them in the garbage. The wastes travel 76 miles to a landfill in Pecan Grove, Mississippi. In the Gibson Hall survey, only 20% of respondents knew that their wastes even go to a landfill but not that they go out of state to a landfill.

The Tulane community could receive many benefits from recycling, but first need to be educated on how to recycle and why it is important. A coordinated waste management hierarchy of reduce, reuse, repair and recycle before disposal is needed.