One golf course means the absorption of 15 000 m^3 of water per hectar per year! Millions of m^3 of water will be spent on irrigation of the golfing facilities planned for your Wa'ab lands! The Yap water resources are **too limited** to meet the needs of the ETG proposed facilities. The runoff, laden with poisons—insecti-, herbi- and fungicides—and fertilizer chemicals **will** reach the water table, and eventually, the surrounding reefs. I urge y'all to **carefully** consider this! — **Henry Norman**

Contents

Developers typically view resort projects as having a 25 year "life cycle," meaning the original investors plan to be totally out of the project within that time frame and the project itself may not be projected to stand for more than 25 years. **Daniel Barrien**, tourism planner with Canopy Development, says: *"This lack of long term focus in the resort industry is a big problem. Areas can be chewed up and spit out, and the developer moves on. We need to be thinking 100 years or more."* (***Source Here***)

Golf Tourism: Economic Benefits vs. Environmental Impacts

By Tricia Barnett (***Tourism Concern***)

> *"In this age of increasing environmental awareness, there is no more room on Earth to destroy nature for the sake of a mere game."* — **The Global Anti-Golf Movement (GAM)**

Tourism Concern first took issues with golf nearly twenty years ago—an unwinnable campaign—one we could not ignore. The phenomenal growth of golf tourism had even the driest countries competing for tourists by prioritising golf course development.

The situation still shocks: Cyprus, seriously short of water, is developing 14 new courses to save its troubled tourism industry. Any movement towards more environmentally-friendly course management is undermined by more traditional thinking.

There are now 32 000 courses around the world—up from 25 000 in the mid-1990s—which at that time would have covered an area of the size of Belgium. The UK has the highest density in the world: about 0.6% of the land is covered by 2 600 courses, a 40% increase in the past thirty years. In Japan there are over 20 million players. And they pay a high price to travel the world for their golfing holidays.

The analysis of golf tourism requires an examination of its environmental, social, economic aspects plus human rights issues—particularly those of land ownership.

Chemicals

Water and chemicals are prerequisites for any golf course. The chemical run-off from a golf course in Japan destroyed crops and created not only deformed fish but also GAM and its World No Golf Day. It is unlikely that this stopped anyone playing golf, but it was consciousness raising and leading UK media in the UK devoted considerable attention.

The pesticides, herbicides, fungicides and artificial colouring agents poison not only the soil and fauna but also human health. **George Monbiot**, an environmental activist, reveals: *"An 18-hole course requires, on average, 22 tonnes of chemical treatments, mostly pesticides, every year: seven times the rate per hectare for industrial farming. A study shows higher rates of some cancers, such as non-Hodgkin's lymphoma (which has been associated with certain pesticides), among golf course superintendents."*

Water

Golf courses are no longer developed as adjuncts to luxury hotels, but rather as a necessity—as they are for villa developments. In Spain the coastline from Murcia

to Almeria is nicknamed the "Costa del Golf." Estimates vary but in 2005 El Pais reported that 130 golf courses were in development within the Valencia and Murcia regions alone, adding to the dozens there already.

UNESCO estimates that tourists visiting Granada in Spain use seven times more water than local people, with daily usage as high as 440 litres. Golf courses in the area need between 10 000 and 15 000 m^3 water/Ha/year, which is the same as a rice paddy. Thus the annual water consumption of a course could reach one million m^3—the same as a town with a population of 12 000 inhabitants. It is even more worrying in Thailand where a course typically uses as much water as 60 000 rural villagers (UNESCO Water Portal Weekly, 2006).

Land Abuse

Local and foreign business people, politicians and military leaders tend to form powerful alliances to support lucrative development projects. The worldwide construction of golf courses is married to dispossession and environmental destruction.

The problem is particularly acute in south-east and east Asia, where golf is big business, and land rights and the environment are often ignored by governments. Tourism Concern knows of very many accounts of battles between peasant farmers or indigenous people and golf course developers, e.g. in Hacienda La'oc in the Philippines, the year 2000 saw two farmers resist a course planned for their lands, mutilated and shot dead.

Poverty vs. Wealth

Resorts, hotels and golf courses often divert land, water, energy and access to biodiversity away from poor communities, and so make it harder for rural women and young girls to obtain water and fuel for household use. Fulfilling such basic needs competes with schooling in many poor communities. In theory, the construction of tourism infrastructure should benefit local residents by way of new and expanded services. Such benefits are often beyond the reach of the very poor, who may actually be worse off if tourism and its train of golf courses deny them access to productive land, water, biodiversity and other resources upon which their livelihoods depend.

An average golf course in a tropical country such as Thailand needs 1 500 kg of chemical fertilizers, pesticides and herbicides per year, and uses as much water as 60 000 rural villagers. Source: ***Tourism Concern***

On the minus side of golf course development:

- Loss of biodiversity
- Eutrophication of river or seawater through use of fertilisers
- Heavy use of water for irrigation
- Biocides/fungicides use to maintain the greenness of the greens, control insects and weeds, contaminate both air and water
- Most modern 18-hole courses occupy ~ 60 Ha (150 acres) of land, the average course has ~ 30 Ha (75 acres) of maintained turf.

Sources include the ***National Golf Foundation*** and the Golf Course Superintendents Association of America ***GCSAA***.

Golf, Pesticides and Organic Practices

Jay Feldman, Beyond Pesticides

For the typical golfer, a day playing golf is a day to enjoy the beautiful outdoors. Unfortunately, golf courses typically are among the areas most heavily treated with toxic pesticides. Why is that a concern?

A medical school professor at the University of Iowa in the 1990's, under contract with the Golf Course Superintendents Association (GCSAA), found that golf course superintendents have a higher mortality from certain cancers, including lung, brain, non-Hodgkin's lymphoma, large intestine and prostate. The statistical mortality study reviewed the death certificates of 618 form GCSAA members between 1970 and 1992 and compared those rates to the general population. The researchers were cautious, urging that *"a prudent strategy for golf course superintendents and their workers is to minimize their exposure to pesticides"* and reminding people that *"these results cannot be interpreted to mean that golfers are at risk."* Unfortunately, golfers as a group have not been studied. Previous studies of farmers, pesticide applicators, and agricultural workers have suggested that an elevated risk for non-Hodgkin's lymphoma and leukemia among farmers are associated with exposure to pesticides and other agricultural chemicals.

Even before the medical school study, the New York State Attorney General's office published a report entitled **Toxic Fairways**, a widely cited study of pesticide use on 52 Long Island, New York golf courses. The report, which was particularly concerned with the potential for groundwater contamination, concluded that these golf courses applied about 50 000 pounds of pesticides in one year, or four to seven times the average amount of pesticides used in agriculture, on a pound per acre basis. The report says, *"In order to maintain the greens and fairways, many golf course managers apply huge amounts of pesticides following a pre-determined recipe of repeated applications, rather than customized treatments addressing actual problems."* The report continues, *"Many pesticides are used preventively, not in response to specific problems. Ironically, this can eventually turn into a pesticide addition, which many require increasing amounts of different types of pesticides to produce the same results."* The report recommended reducing golf course pesticide hazards by limiting or ending the use of known carcinogens, minimizing the use of other pesticides, and fully informing golf course users and the public about pesticides dangers and the times of application.

Of the 30 most commonly used turf pesticides, 19 can cause **cancer**, 13 are linked to **birth defects**, 21 can affect **reproduction** and 15 are **nervous system toxicants**. The most popular and widely used lawn chemical, 2,4-D, which kills broad leaf weeds like dandelions, is an endocrine disruptor with predicted human health hazards ranging from changes in estrogen and testosterone levels, thyroid problems, prostate cancer and reproductive abnormalities. 2,4-D has also been linked to non-Hodgkin's lymphoma. Other turf chemicals, like ***glyphosate*** (Roundup), have also been linked to serious adverse chronic effects in humans.

At the same time, public understanding of the deficiencies in the U.S. Environmental Protection Agency (EPA) process of evaluating and regulating pesticides was coming to light with reports from the U.S. General Accountability Office (GAO) and the National Academy of Sciences. Harmful pesticides are allowed to be used in the marketplace and acceptable risks at set by EPA based on effects to the average population and their average exposure to pesticides. However, exposed individuals may have the same health conditions that are caused or exacerbated by many pesticides. EPA's calculation of acceptable risk to the general population does not take into account the higher exposure associated with the game of golf. In 2003, EPA negotiated a cancellation of the residential uses of a highly neurotoxic insecticide, ***chlorpyrifos*** (dursban) but allowed its continued use on golf courses. In the 1980's, EPA banned a commonly used pesticide, ***diazinon***, on golf courses because of bird deaths. It was not until 2004 that EPA negotiated an end to residential uses of diazinon because of health and environmental effects.

As awareness about pesticide hazards improves, more golfers and greens committees are looking for alternative approaches to turf management that are not reliant on pesticides. Some are trying organic practices that rely on building soil health as a way of maintaining healthy plants or turf grass.

Efforts to change practices on managing large sites like golf courses requires information that informs people about the hazards of pesticides and the availability of alternative methods. Understanding how a beautiful turf could somehow be hurting players and the environment requires an educational campaign that explains the effectiveness of organic methods. The hazards of pesticides can be avoided with good turf management, protecting the health of golfers and the environment. Turf can be maintained using the following steps, which will eliminate the conditions that promote weeds and fungal diseases.

Compaction

Compaction is an invitation for weeds. If the turf is hard, compacted, and full of weeds, aerate to help air, water and fertilizer to enter. If you can't stick a screw-

driver easily into your soil, it is too compacted. Use an aerator. Once a healthy soil and turf are established,worms and birds pecking at your soil will aerate it for free!

Mowing Height

Bad mowing practices cause many lawn problems. Mowing lower than 1½ to 1¾" can kill the root system by preventing photosynthesis, and mowing with a dull blade makes the turf susceptible to disease. A low mowing height also invites sunlight in for weeds to sprout. Greens are particularly vulnerable and must be carefully monitored. Fairways provide opportunities to use native grasses that are more resistant to disease. While grass species vary across the country, mowing high (approximately 3") allows the grass to develop deeper, drought-resistant roots systems. Mower blades must be sharp to prevent the development and spread of fungal disease, or ask your service provider to sharpen their blades frequently.

Soil pH and Soil Testing

Low pH means acidic conditions and high pH indicates alkaline conditions. If the pH is too high, turf cannot properly absorb nutrients. Ideal pH should be between 6.5-7.0, slightly acidic. Generally, lime is added to raise the pH and sulfur is added to lower the pH, and adding compost can naturally correct your pH. A soil test is highly recommended to determine the soil pH and specific nutrient needs. In addition to nutrients and pH analysis, organic content analysis should be 5% or higher.

Fertility- Soil testing is the best way to determine the soil's specific nutrient needs. Fertilizing in early fall ensures good growth and root development for grass. Nitrogen, the most abundant nutrient in lawn fertilizers promotes color and growth. Adding too much nitrogen, or quick-release synthetic fertilizers, can weaken the grass, alter the pH, promote disease, insect, and thatch build-up. Grass clippings contain 58% of the nitrogen added from fertilizers, improve soil conditions, suppress disease, and reduce thatch and crabgrass. So, leaving clippings on the turf where possible is a positive. A mulching mower is helpful.

Compost is an ideal soil conditioner, adding the much-needed organic content to the soil, and suppressing many turf pathogens. In the fall and spring, preferably after aerating, a ¼" layer of organic or naturally-based compost should be spread over the turf. Compost tea and worm castings are also great additions.

Thatch is a dense layer of grass stems and roots on the surface of the soil. Thatch is a symptom of shallow watering and chemical fertilizer usage. When thatch layers become ½" or more, the roots will grow up within the thatch instead of in the soil, making grass susceptible to insects, disease, and weather stress. Thatch is reduced by aeration, topdressing with organic matter, or power raking. In healthy turf, earthworms and soil microorganisms break down the thatch.

Watering and Poor Drainage

Drought conditions, excessive watering or poor drainage due to soil type are all invitations for weeds. Watering needs are very site specific, but generally speaking, a deep watering of about one-inch once a week in the early morning is best. The type of soil effects drainage and is also site specific. Once established, a deep root system requires less water.

Grass Seed and Seeding

Grass varieties differ enormously in their quality, resistance to certain pests, tolerance to climatic conditions, growth habit and appearance. Some weeds are the result of using poor quality grass seed. Overseed with the proper grass seed for the region to promote a dense turf that out-competes weeds.

Golf Tourism

Golf courses are fed with staggering amounts of water. They are often developed on important ecosystems, like wetlands and rainforests, and are heavily doused with toxic pesticides which leach into the surrounding area. What's more, this land is sometimes forcibly taken from more productive owners, such as farmers.

Water is to the golf course what snow is to the ski slope. If there is not enough rainfall, then water has to be supplied in other ways. This can cause serious changes in the natural water cycle and harm local flora and fauna. The World Wildlife Fund estimated that between 10 000 and 15 000 m^3/Ha/year were pumped out of freshwater supplies to keep golf courses green in south-east Spain (2004). At this rate, the water used on one golf course could supply a town of 12 000 inhabitants with enough water for a whole year.

Golf courses also require large amounts of pesticides, herbicides, fungicides and artificial colouring agents to keep them looking fresh and green. These poison the soil and wildlife, and pose a risk to human health. Journalist and environmental activist **George Monbiot** cites academic studies that found that an 18-hole course requires seven times more chemical treatments per hectare than industrial farming, and that golf course superintendents suffer higher rates of some cancers, possibly caused by exposure to pesticides

Human Rights

Around the world, land rights and the health of the environment are frequently violated in the name of golf tourism, often with the complicity or wilful ignorance of governments.

(***Source Here***).

The Impact of Golf Estates

Enviroadmin Monday, 24 May 2010

Water Demand/Supply

The amount of water golf courses use varies greatly depending on the region, but on average they use about 10 800 m^3 water/year (according to the Golf Course Superintendents Association, US golf courses use, on average, 414 500 m^3/year). In essence each golf course uses enough water to provide at least 1 200 people with their basic water needs for a year. South Africa is a dry country and many people still do not have access to running water.

Can We Afford to Waste Water on Playgrounds for the Rich?

However, using water-saving measures can cut the water use by a third, and some golf course estates are using recycled sewage effluent to water their greens and fairways. This however has other negative environmental impacts, explained in the following section.

Pollution Through Pesticides and Fertilisers

The addition of any nutrients to the system, for example through using fertilizers, impacts upon surrounding ecosystems. Increased nutrients may encourage alien species to invade and discourages indigenous vegetation, which in the Western Cape is adapted to nutrient poor soil. ***Eutrophication***[1] of water bodies may also occur. This is associated with a proliferation of plant life, especially algae, which reduces the dissolved oxygen content and often causes the local extinction of other organisms. While the use of sewage water for irrigation may solve the water problem, it adds even more nutrients to the system, compounding the negative environmental impacts of using fertilisers.

Pesticides and herbicides kill off insects and weeds within the confines of the golf course estate. However these can spread into nearby ground water or river systems. The use of pesticides may affect species higher up the food chain by either reducing the amount of food available, or through the accumulation of persistent poi-

[1] **Eutrophication** = ecosystem response to the addition of artificial substances, such as ***nitrates*** and ***phosphates***, through fertilizers/sewage, to an aquatic system. An example is the "bloom" or increase of phytoplankton in a water body as a response to increased levels of nutrients. Negative environmental effects include hypoxia (the depletion of oxygen in the water), which induces reductions in specific fish and other animal populations. Other species (such as Nomura's jellyfish in Japanese waters) may experience an increase in population that negatively affects other species.

sons in their bodies. Insects also provide important ecosystem functions such as pollination and seed dispersal. Their removal may have serious long-term implications for habitat viability.

Alien Vegetation

Golf estates may facilitate the spread of invasive alien plants through increased disturbance and nutrient levels. Furthermore, gardens are recognised as an important source of invasive species. The introduction of kikuyu grass, for example, may have devastating effects on surrounding natural habitats.

Golf course estates are essentially upmarket, residential areas located within their own private park. They are generally not located within urban areas. They usually cover large tracts of land and are frequently proposed within pristine areas, where they reduce biodiversity and destroy conservation-worthy habitats. A worrying trend in the Western Cape is that golf course estates sometimes occur on prime agricultural land. In the short-term the overall monetary value of golf course estates may be greater than that of farming. However, in the long term, these short-term monetary gains, which benefit only a few individuals, may be eclipsed by a shortage of food-producing areas, affecting all South Africans.

Urban Sprawl

Many golf estate developments are on the urban edge or in semi-rural areas. This results in urban sprawl and can create unplanned-for development nodes where infrastructure does not exist. This places an added burden on local municipalities and the community at large, for example, through increased traffic congestion and demand for services.

Supply of Services

In general these developments consist of clusters of 500 housing units, or more. In effect they are creating small towns. This has enormous impacts on water demand and sewage services, especially where such large-scale growth has not been planned for. As these are housing developments for the upper end of the market, where are the resources to be found for the lower end, disadvantaged communities development?

Socio-Political Issues, Equity and Access

This is probably the most serious weakness of golf course estates. Golf course estates are frequently elitist enclaves, isolated from surrounding communities. They have thrived on people's fear and insecurities in the face of increasing levels of crime and violence. They are populated by people who have accumulated sufficient wealth to do something about this, but rather than use their considerable resources to assist in addressing the problem, they attempt to block themselves off

from the rest of society. At its most benign, this takes the form of fencing and closing off residential areas to the public, limiting access to public open space. At its most extreme, it means guards, razor wire and electric fences. For society, this cannot be healthy, creating divides between the elite and the surrounding communities, and fostering resentment and tension between the haves and the have nots. By limiting access to natural resources such as arable land, fuel, water, food and medicinal plants, golf estates further impoverish poor communities, both economically and psychologically.

Increasingly, attempts are being made to compensate communities for these losses by making substantial financial contributions, or by offering to build facilities for the affected community. WESSA: WC does not believe that these financial contributions are equitable exchanges as they do not address the issues at hand.

Discussion

Golf course estates are not necessarily for golfers. On average, only 50% of residents are golf players, the remainder choosing to live there because of the secure environment, and because they like the idea of staying in a park. This may possibly be extended to the golfing tourist industry, as we have reason to believe that a substantial number of tourists on these golf tours do not play golf at all. This is an important factor to consider when addressing the environmental issues and, perhaps more importantly, when trying to find solutions and alternatives.

The enthusiastic drive for golf course estates amongst local authorities appears to be linked to perceived economic growth, and job creation, through golf tourism. Local authorities also seem to think that the rates created by the exclusive golf course estate can then subsidise the development of disadvantaged areas.

However, these conclusions rely on certain assumptions:

- That all economic growth will lead to job creation and skills development, particularly at the lower-skilled end of the labour force. This is not necessarily true. There are generally fewer jobs than initially promised, and the jobs are often menial with little prospect for training or capacity building. Skilled staff are generally drawn from the ranks of those who already have jobs, thereby depleting the skills base in other areas. Even at construction phase, construction firms often prefer to bring in their own labour.
- That foreigners spend large sums of money in the country. Golf tourism necessarily relies on overseas tourists who pay for their tours in their country of origin. The money actually remaining in South Africa is therefore somewhat limited, with the vast amounts of money being recycled back to the country of origin.

- That the value of the land is signified by the amount of income it generates (generally through rates) and that any development which increases this is positive.

The loss of agricultural land means loss of potential food production in the future. Although it is increasingly recognised that pristine habitats have economic value of their own, through *inter alia* the services and resources they provide and the tourists that flock to appreciate our scenic and endemic landscapes, these values are not generally considered in conventional economic systems.

WESSA:WC believes that the current proliferation of golf course estates is not sustainable. In order to ensure that all the above issues and concerns are addressed, we request that a strategic environmental assessment be required for any major golf estate development.

On a more positive note, if golf estates are appropriately located and planned for, they could play a valuable role in rehabilitating derelict areas and transforming them into green belt areas. However, where a golf course estate development is proposed for an ecologically degraded environment WESSA:WC believes that such a development could only be supported if;

- The results of an objective, independent Environmental Impact Report show that there would be no significant negative environmental impacts.
- An environmental monitoring committee is formed to ensure that the development follows an environmental management plan.
- The environmental management plan follows international best practice.

AND if such a development will:

- ensure public access to the communal green space,
- rehabilitate degraded habitats,
- enhance the overall economic, social and environmental benefits to the surrounding communities,
- result in pockets of protected conservation-worthy land, and
- provide a buffer between the urban area and the non-urban land.

In summary, it would appear that golfing estates are less about golf and more about the widening and increasingly prevalent gap between the rich and the poor. Golfing estates are an aggressive, and environmentally and socially destructive method used by the rich to insulate themselves from what they regard as uncomfortable realities.

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A Place to Help Save the Earth

A Greener Golf Course

In recent years, many Americans have asked questions about the safety of pesticides not only in our foods, but also in and around our homes and workplaces. Although pesticides permeate our everyday lives, we don't know enough about the dangers of pesticide exposure. The U. S. Environmental Protection Agency (EPA), which regulates pesticides, is currently reviewing the data on the health and environmental effects of some pesticides to decide whether these products should be continued to be used. In the meantime, thousands of pesticides still under review are freely marketed—unless the EPA decides to restrict or eliminate their use. So far, only one of the 34 most commonly used pesticides for turf and lawn care has completed this review.

The bottom line is that consumers do not know all the questions associated with pesticide use. Most important, no one has all the answers—not the manufacturers, not the EPA.

In fact, when the EPA permits a pesticide to be sold in the United States, the Agency does not decide that the product poses no environmental or health threats. The federal pesticide law, known as the ***Federal Insecticide, Fungicide and Rodenticide Act*** (FIFRA) which gives the EPA authority over pesticides, requires the EPA only to decide that the pesticide poses "no unreasonable risk" (emphasis added) to public health or the environment, based on its perceived economic, social and environmental costs and benefits. Before the EPA may register a pesticide and allow it onto the market, the agency must first determine that the risks are worth the benefits. But as more and more is learned about the extent of these risks—including the groundwater threat—this balancing act may tilt in the opposite direction, against the use of certain pesticides.

Unfortunately, it may be quite a while before the EPA restricts or bans certain pesticides that do pose an "unreasonable" risk. The EPA is requiring pesticide companies to supply additional data on potential risks of their products. The Agency will review the adequacy of this data as part of the pesticide re-registration process and this will most likely continue into the next century. An example of the new data requirement came in response to a 1987 petition submitted jointly by several environmental groups, the New York State Attorney General's Office and others, requesting EPA to perform tests for the neurotoxic effects (effects on the nervous system) of some pesticides. The EPA is now planning to require that pesticide

manufacturers conduct such tests but it may be years before the public knows the full neurotoxic potential of pesticides now in use.

Several pesticides on the market have been identified as probable human carcinogens and some have been linked to birth defects, nervous system disorders and reproductive problems. In addition, as this report will discuss, pesticide use has the potential to threaten wildlife and contaminate natural resources. People can be exposed to pesticides in the water they drink, or through direct skin contact, inhalation or in the food they consume.

Although the risks of using pesticides to grow food crops may be worthwhile to ensure a continuing food supply, most people would agree that the benefits of pesticides used merely to produce green lawns and turf are far less. Despite the relatively limited benefits of turf and lawn care pesticides, three to six times as much pesticides are used per acre on home lawns than to grow the food we eat. As shown later in this report, golf courses on Long Island use almost four to seven times the average amount of pesticides used in agriculture, on a pound/acre basis.

In order to maintain the greens and fairways, many golf course managers apply huge amounts of pesticides following a pre-determined "recipe" of repeated applications, rather than customized treatments addressing actual problems. Many pesticides are used preventively, not in response to specific problems. Ironically, this can eventually turn into a pesticide addiction, which may require increasing amounts or different types of pesticides to produce the same results. Increased application rates further contribute to the potential threats to public health and the environment.

Who can be exposed to pesticides used on golf courses? Anyone on the golf course or nearby is at risk. Pesticide applicators, either professional contractors or golf course workers, can be exposed to these poisons during storage, mixing and application. Golfers, often playing shortly after pesticides have been applied, can be exposed directly to the pesticides on the turf, as well as to pesticide vapors and mists. People living near a golf course may be affected by sprays and dusts blown from the golf course onto their property and into their homes. Finally, pesticides applied to the turf may run off into surface waters or leach down to groundwater, which can then expose people to contaminated drinking water. These people may live far from the place where pesticides were used.

Unfortunately, neither the state or federal government require advance notification to the public of all pesticide applications, so that people can be exposed to pesticides without their knowledge.

In 1979, high levels of the pesticide ***aldicarb*** (Temik) were found in public and private drinking water wells in Suffolk County. The manufacturer provided well-

head treatment to remove the pollution. After a persistent degradation product of an herbicide called ***Dacthal*** (chlorthaldimethyl or DCPA) was recently applied on Long Island, the chemical was detected in drinking water wells at levels 20 times above the State safe drinking water standards. In addition to Dacthal and Temik contamination, by 1988, 9 other pesticides or their degradation products had been detected in Long Island's groundwater. Two of these pesticides (chlorothalonil and Dacthal) are frequently used in turf care. Another 13 have been detected intermittently and more testing is necessary to verify their continuing presence in groundwater. Temik can no longer be used in Suffolk County. In 1988, one Dacthal manufacturer (ISK Biotech) voluntarily restricted its Dacthal products from use in Suffolk County; however, other companies have not. This restriction should be extended to all products containing Dacthal.

Why Long Island?

The Attorney General's office decided to examine pesticide use on Long Island golf courses because pesticides pose special risks on the Island. Long Island's nearly three million people depend on groundwater as their only source of drinking water. This irreplaceable resource is vulnerable to contamination by surface-applied pesticides. Large areas of the island's groundwater lie beneath a sandy, porous surface soil layer with little organic matter to adsorb pesticides. This type of soil provides little if any barrier against contaminants reaching the groundwater.

Currently, groundwater monitoring for pesticides in Suffolk County is limited primarily to those pesticides used in agriculture. In Nassau County however, which has very little agricultural acreage, there is no comparable monitoring program for agricultural pesticides. All public drinking water supplies in New York State (including those in Long Island) must be tested regularly for the pesticides ***endrin***, ***lindane***, ***toxaphene***, 2,4,5-TP, 2,4-D and ***methoxychlor***. In Nassau and Suffolk counties, public drinking water supplies are also routinely tested for ***aldrin***, ***dieldrin***, DDT, ***chlordane***, ***heptachlor***, and ***heptachlor epoxide***. In addition, Suffolk tests regularly for ***alachlor, aldicarb*** and several other related pesticides, ***EDB***, ***endosulfan*** and ***1,2-dichloropropane***. Most of these pesticides are either no longer in use or have severely restricted uses. Apart from 2,4-D, they are not used in turf care. The EPA has recently conducted a ***"National Survey of Agricultural Pesticides in Groundwater"*** but only eight water samples were taken from Nassau County and none from Suffolk. Two of the eight samples contained residues of chlorthaldimethyl (Dacthal).

However, there is no comprehensive and targeted program for monitoring Long Island's groundwater for the vast majority of turf care pesticides used on Long Is-

land. As a result, there is no way to determine whether contamination may have reached the aquifer in some locations.

This survey provides the first report on the extent of pesticide use in one specific area, golf courses, and also offers the first estimates of the potential for harm to the groundwater from golf course pesticides. No conclusions are drawn concerning any present danger to consumers of the groundwater. There is no reason to believe that any water now supplied to Long Island exceeds safe drinking water guidelines for any pesticides. The purpose here is to show the potential for damage to the groundwater resource due to long-term use of pesticides in sensitive areas, which may at some time affect the drinking water of Long Island's nearly three million people.

Although Long Island's geology and the dependence of such a large population on a single source of drinking water is unusual, groundwater quality in other areas of the state may also be jeopardized by pesticide use. Thus, the concerns raised in this report could apply to several other parts of the state where turf care pesticides are heavily used over aquifers.

Survey Methods

The Attorney General's survey of pesticides used on Long Island golf courses provides the basis for an initial evaluation of potential impacts on groundwater. In 1990, the Attorney General's office surveyed 107 private and public golf courses in Nassau and Suffolk counties to determine the identity, amounts and patterns of use of pesticides on golf courses. After the initial mailing, follow-up mail and telephone inquiries were made to increase responses. A total of 58 surveys were returned but six responses were incomplete and unusable.

The Attorney General's office determined the identities and concentrations of "active" ingredients in each of the products used. The "active" ingredients are the chemicals in the product intended to kill pests. Pesticide manufacturers must identify the chemicals used as active ingredients on the product label, as well as their concentration. Since other ingredients, known as "inert" ingredients, are generally not identified, our calculations of pesticide use refer only to the active ingredient portion of the pesticides applied to the golf courses. "Inert" components are not necessarily non-toxic, nor can they be assumed to pose no threat to groundwater quality. Because their identity is treated as confidential business information by the EPA, their potential to contaminate groundwater cannot be evaluated.

Sumary of Survey Results

The 52 golf courses reported using a total of approximately 200 000 pounds of bulk dry products and close to 9 000 gallons of bulk liquid formulations in one

year. This included 192 different pesticide products containing 50 different active ingredients which totalled more than 50 000 pounds.

If these 50 000 pounds were applied evenly across the total area of the 52 golf courses, it would amount to an average of 7 pounds of pesticides per acre annually. By comparison, a national average of 1.5 pounds of pesticides per acre are applied in agriculture annually. The actual rate of golf course pesticide use may be much higher than seven pounds per acre, since the playing surfaces that are treated make up only a portion of the golf courses' total acreage. A comparison of pesticide usage in agriculture and golf course maintenance which is based on the acreage actually treated with pesticides is even more alarming. Based on responses to our survey, pesticides were applied to only about 50 % of the total acreage of Long Island golf courses. By contrast, pesticides are applied to about 62 % of all agricultural land. Using these figures, the average golf course application rate increases to 18 pounds of pesticides per treated acre per year, about seven times the agricultural rate of 2.7 pounds per treated acre per year. Thus, between four and seven times as much pesticides are used on Long Island golf courses than are applied on food crops. (On the average, public golf courses used far less pesticides than private golf courses and fungicidal pesticides were far more heavily used than either herbicides or insecticides.)

By comparison, when homeowners follow the directions for various annual do-it-yourself lawn care programs, they may apply from 3.2 to 9.8 pounds of pesticide per acre annually. Thus, homeowners may apply up to 3.6 times as much pesticides as is typically used in agriculture. Even at that level, they apply less pesticides than golf courses.

Several of the pesticides (or their degradation products) applied on golf courses on Long Island in 1989 were then classified as probable or possible carcinogens:

Six pesticides (propoxur, DDVP, oryzalin, trifluralin, fosetyl-Al and chlorothalonil), totalling 9 932 pounds or 19.8 % of the total active ingredients applied, were classified by the EPA as possible or probable human carcinogens. (Chlorothalonil is the most heavily used fungicide on Long Island golf courses and has also been detected in Long Island's groundwater.)

Another three (***trichlorfon***, ***mancozeb***, ***maneb***), totalling 6 350 pounds or 12.7 % of the total active ingredients applied, naturally break down in the environment into various compounds including substances the EPA classifies as probable human carcinogens.

One active ingredient, Dacthal, with 1 789 pounds used or 3.6 % of the total active ingredients applied, has been found by the EPA to be contaminated with traces of dioxin, a probable human carcinogen. (Dacthal was the second most heavily used

herbicide on Long Island golf courses responding to the survey and its persistent degradation product has also been detected in Long Island's groundwater.)

Five more (oxadiazon, benomyl, metalaxyl, pentachloronitrobenzene, captan) totalling 4 685 pounds or 9.4 % of the total active ingredients applied, were being reviewed by the EPA for carcinogenicity.

Long-term, low-level exposure to many of the pesticides used by Long Island golf courses is associated with a variety of other health problems. This is the type of exposure generally resulting from drinking contaminated groundwater. According to the EPA, some of these chemicals can impair the nervous system, while others may damage the kidneys, liver, thyroid and adrenal glands, and the blood. Some cause degeneration of the testes, decreased sperm counts, reduction in weight of the uterus, and decreased birth weight.[2]

Since the health risks of chronic, long-term exposure to many pesticides are not fully understood, any discussion of these effects will be incomplete. It may take many more years of research before the full range of these effects is known.

The potential for these health effects depend on whether, and how, people are exposed to these pesticides. Many of the pesticides used can contaminate the groundwater which in turn may end up as drinking water.

According to a 1991 report on pesticides in groundwater by the U.S. General Accounting Office, the investigative arm of Congress, at least six of the pesticides used by Long Island golf courses are already known to be capable of contaminating groundwater after normal applications following label directions. These six pesticides are: chlorothalonil, Dacthal, dicamba, 2,4-D, prometon and trifluralin. They accounted for 11 349 pounds or 22.6 % of the pesticides used by the 52 golf courses in the survey. By 1988, the degradation products of two of these (chlorothalonil and Dacthal) had been detected in Long Island groundwater at the highest levels anywhere in the country.

Long Island's groundwater aquifers are replenished in the deep flow recharge areas. It is in these areas that precipitation infiltrates and trickles down through the soil and replenishes the Magothy and Lloyd aquifers, upon which the residents of Long Island depend for their drinking water supplies. An estimated 53 golf courses covering 7 294 acres are located within these deep flow recharge areas. Another 54 golf courses are estimated to cover 6 286 acres outside the deep flow recharge areas. Although pesticide use by golf courses outside the recharge areas are less

[2] These are some health effects identified by the EPA that can result from sufficient oral exposure to the pesticides listed, including exposure from drinking water. Exposure to these pesticides by inhalation or direct contact and/or at higher concentrations could cause more severe health problems. (Source: ***Oral Reference Doses, Integrated Risk Information System***, U. S. Environmental Protection Agency, 1991)

likely to affect the two deeper drinking water aquifers, it may contaminate the Upper Glacial aquifer which is used for both shallow private wells and even a few public supply wells.

Pesticides, like other chemicals, may vary in their potential to leach, or to migrate through soils. In the absence of groundwater monitoring studies, this potential can still be estimated. Table 4 presents estimates of this potential, based on a leachability rating system adopted by the U.S. Soil Conservation Service. The "leachability" ratings in this table consider pesticide persistence and mobility, and represent different probabilities for groundwater contamination. Pesticide applicators can use Table 4 as a guide for selecting pesticides that pose the least risk of groundwater contamination. This information can also be used to decide which pesticides should be monitored in groundwater.

The actual impact of the pesticide on groundwater is influenced by several additional factors including the type and thickness of the surface soil in the area where the pesticide is applied. As noted earlier, Long Island's soils are generally a poor barrier to contaminant migration. Long Island's vulnerability to groundwater contamination by pesticides is perhaps best illustrated by the fact that degradation products two of the pesticides (chlorothalonil and Dacthal) that are rated in Table 4 as having a "small" leaching potential have nevertheless already reached Long Island's groundwater.

Other Potential Dangers of Golf Course Pesticides

Unfortunately, the potential adverse impacts of pesticides heavily applied on golf courses are not limited to the possibility that they may contaminate underground water supplies. People and the environment are not immune to many effects of pesticides. Millions of Americans may be sensitive to pesticides. Some of those afflicted with such reactions go to extraordinary lengths—greatly disrupting their lives—to avoid even the slightest chance of unwitting exposure. And still people continue to be poisoned by pesticides at work, at play and in the comfort of their own homes.

In addition to long-term health effects of pesticides like cancer, recently there have been various reports of people suffering immediate health problems after exposure to pesticides. In one extremely unusual case in 1982, Navy Lieutenant George Prior died two weeks after he spent three consecutive days playing golf at the Army Navy Country Club in Arlington, Virginia. His doctor, an expert forensic pathologist, reported that Prior suffered a severe reaction to chlorothalonil, a pesticide used weekly on the golf course.

In 1990, workers at Cornell University suffered attacks of vomiting, blurred vision, and headaches after the building where they were working was sprayed with an

insecticide. Because of the growing number of these reports, last year New York State instituted a toll-free pesticide poisonings registry to keep track of these incidents. Pesticide poisonings must now be reported to the Department of Health's Pesticide Poisoning Registry at 1-800-322-6850.

Pesticides have also hurt the environment. Several years ago, more than 700 Brant geese were killed after absorbing diazinon from a Long Island golf course. Shortly after, New York State forbade the use of diazinon on golf courses.

Recommendations

If there is any doubt that Long Island's groundwater needs special protection, the fate of groundwater in Brooklyn and Queens is an unfortunate reminder of the consequences of inaction and neglect. All of Long Island (Brooklyn, Queens, Nassau, Suffolk) shares the same regional groundwater aquifer system. Groundwater in Brooklyn and Queens was a source of drinking water from colonial times until well into this century. Yet because the vulnerability of this resource was not understood, it was not protected from the ravages of commercial and industrial development and burgeoning population growth. For example, an underground pool of about 10 million gallons of oil and gasoline under the Greenpoint section of Brooklyn has contaminated the Upper Glacial aquifer. Today, except for the groundwater under a small section of southeastern Queens, the groundwater in Brooklyn and Queens is not used for drinking water.

Despite this sobering lesson, government has yet to address groundwater contamination by pesticides before it happens. Instead, pesticide contamination has been responded to—after the fact—with band-aid measures that only address the immediate problem, not its source. Contaminated water has been replaced with bottled or tank-truck water or individual households have received drinking water filters that require ongoing maintenance. Affected public supply wells have been closed or fitted with expensive filters. Temik and Dacthal were banned for use in Suffolk County only after widespread contamination had occurred. However, such measures are no substitute for keeping groundwater clean by preventing future pesticide contamination. Yet the federal EPA, the agency with primary regulatory authority over pesticides, has made only limited prevention efforts. It has recognized that pesticide applications can jeopardize water quality and recently announced that it will take action to reduce the threat. However, the Agency has reviewed only about one-third of the studies submitted on the leaching characteristics of 16 pesticides known to contaminate groundwater. The EPA has determined that 40 % of the studies are inadequate and must be supplemented or repeated. It will be years before the EPA has the full data requested in order to evaluate the threat of groundwater contamination. Until the data is complete and fully evaluat-

ed, the EPA should take interim action to prevent further groundwater contamination.

The State Legislature has already acted to protect Long Island's groundwater from some threats by ordering all landfills to close because of the danger they posed by leaking contaminants. The Legislature also enacted legislation banning certain septic tank cleaners on Long Island. But further action is needed.

To protect the public health and natural resources like Long Island's groundwater from the risks of pesticide contamination, the following measures should be taken in several areas.

Reducing Pesticide Hazards

The use of pesticides containing known or probable carcinogens for aesthetic purposes such as golf courses or lawn care should be eliminated. The risks posed by these carcinogens are not outweighed by the benefits of an aesthetically pleasing green lawn.

Pesticide users, particularly golf course management, both public and private, should consider the leachability and toxicity of pesticides they apply and avoid those with significant potential toxic effects.

Efficacy should not be the only reason for choosing a pesticide.

Groundwater quality should be monitored for pesticide contamination, particularly in groundwater recharge areas where pesticides are known to be applied in large quantities, such as Long Island golf courses.

As suggested by the GAO, the EPA should require groundwater advisories on the labels of pesticides known to cause widespread groundwater contamination.

The GAO also suggests that the EPA prohibit the use of pesticides known to leach into groundwater wherever groundwater is particularly vulnerable to pesticide contamination.

The GAO further suggests that the EPA permit only certified pesticide applicators to use those pesticides that leach into groundwater.

Minimizing Pesticide Use

All pesticide applicators, including golf course managers and homeowners, should use less toxic alternatives and "Integrated Pest Management" (IPM) practices to minimize the amounts of toxic chemicals applied.

Pesticide applicators should advise consumers that reduced or non-chemical alternatives to pesticides are available, so that consumers may choose to use such alternatives.

Full Disclosure

Pesticide labels should inform users that any pesticide use may pose potential health and environmental risks.

Pesticide labels should state clearly that registration is not a guarantee that pesticide use is free from risk.

The public should receive advance notice of pesticide applications in public buildings and places such as golf courses. Then people can make their own, informed choices about whether they want to risk exposure.

Implementing these recommendations cannot reverse past pesticide contamination. However, protection of our drinking water resources today will help ensure a continuing and safe water supply for future generations.

Written by: Environmental Scientist **Patricia Primi**, Chief Sientist **Michael H. Surgan**, Ph.D., Assistant Attorneys General Deborah I. Volberg and **James A. Sevinsky** and other staff of the Environmental Protection Bureau. ***Office of New York State Attorney General***

Estimated Pesticide Use on Hawai'i Golf Courses

by Barry M. Brennan, Alan K. Higashi, and Charles L. Murdoch

Source: *http://pesticides.hawaii.edu/epp/reportglf.html*

Pesticide Category	Quantities (pounds per year)		%age of total
	Surveyed Areas	Statewide (estimate)	
Herbicides	53 876	94 025	76.5
Fungicides	12 614	19 051	17.9
Insecticides	2 719	4 463	3.9
Algicides[3]	1 232	2 328	1.7
Total (Pounds)	**70 441**	**119 867**	100
Total (Metric Tons)	**31.95**	**54.37**	

Table 1: *Annual pesticide use on Hawaiian golf courses*

Herbicides	Quantities (pounds per year)		%age of total
	Surveyed Areas	Statewide (estimate)	
MSMA	36 445	63 578	67.65
Glyphosate[4]	3 798	7 000	7.05
Oryzalin	3 399	6 254	6.31
Oxadiazon	3 201	5 171	5.94
Metribuzin	1 710	3 109	3.17
Dicamba	1 269	2 335	2.36
2,4-D	1 029	1 893	1.91
MCPP	802	1 476	1.49
CAMA	790	946	1.47
Simazine	563	1 036	1.04
Pronamide	515	573	0.96
Pendimethalin	288	530	0.53
Imazaquin	59	109	0.11
Bensulide	8	15	0.01
Total (Pounds)	**53 876**	**94 025**	**100**
Total (Metric Tons)	**24.44**	**42.65**	

Table 2: *Annual herbicide use on Hawaiian golf courses*

[3] Mostly ***copper sulfate***, a compound used in controlling algal blooms in ponds, small drainage catchments, and other water elements of golf courses. ***Cupric hydroxide***, a fungicide, is used as an algicide primarily on greens and tees.

[4] Also known as ***Roundup***, manufactured by ***Monsanto, Inc***.

Fungicides	Quantities (pounds per year)		%age of total
	Surveyed Areas	Statewide (estimate)	
Chlorothalonil[5]	6 808	8 969	53.97
Mancozeb	3 345	6 155	26.52
Iprodione	944	1 154	7.48
Cupric hydroxide	891	1 639	7.06
Metalaxyl	390	700	3.09
Fosetyl-Al	112	206	0.89
Anilazine	100	184	0.79
Benomyl[6]	19	35	0.15
PCNB	5	9	0.04
Total (Pounds)	12 614	19 051	100
Total (Metric Tons)	5.7	8.6	

Table 3: *Annual fungicide use on Hawaiian golf courses*

Insecticides	Quantities (pounds per year)		%age of total
	Surveyed Areas	Statewide (estimate)	
Chlorpyrifos[7]	2 022	3 181	74.37
Carbaryl[8]	400	736	14.71
Ethoprop[9]	126	232	4.63
Bendiocarb[10]	122	224	4.49
Fluvalinate[8]	41	75	1.51
Hydramethylnon[11]	8	15	0.29
Total (Pounds)	2 719	4 463	100
Total (Metric Tons)	1.233	2.024	

Table 4: *Annual insecticide use on Hawaiian golf courses*

[5] Main breakdown product is the **30 times more toxic** *4-hydroxy-2,5,6-trichloroisophthalonitrile* (also **more persistent in the environment**).

[6] Possible link with exposure of pregnant mothers: Children **born without eyes** *(anophthalmia)* or related syndromes, including **reduced eyes** and **blindness** due to severe optic stem damage.

[7] Potential for acute toxicity (at larger amounts) and neurological effects in fetuses and children (even at very small amounts).

[8] Kills targets (e.g. **malaria mosquitos**), beneficial insects (e.g. **honeybees**), and **crustaceans** (e.g. **crabs**). Yap courses are going to need **a lot** of this ***very*** nasty stuff…

[9] If reaching the reefs, kills fish, crustaceans, mollusks, phytoplankton, and zooplankton.

[10] Acutely toxic (inhibiting ***acetylcholinesterase*** (enzyme required for transmission of nerve impulses)).

[11] Especially toxic to fish.

Pesticide Category	%age of		Statewide Acreage[12]	Application/Acre (estimates)		
	Courses Using[13]	Acres Treated[14]		Pounds/ Application[15]	Times Yearly	Pounds/ Year[16]
Herbicides						
MSMA	97	55	5 065	4	3	11.67
Metribuzin	70	48	3 265	1	1	0.95
Dicamba	54	48	2 475	0.4	2	0.94
2,4-D	54	48	2 430	0.75	1	0.78
MCPP	43	48	2 030	0.75	1	0.73
Oryzalin	40	41	1 330	4	1	4.71
Fungicides						
Metalaxyl	84	3	230	1.4	2	2.95
Chlorothalonil	76	3	200	7.3	3	23.8
Mancozeb	71	3	200	8.7	4	31.26
Iprodione	38	3	105	5.5	1	4.82
Cupric hydroxide	34	3	45	16.8	1	19.37
Insecticides						
Chlorpyrifos	76	N/A[17]	1 012	1	3	3.02
Carbaryl	37	3	110	4	2	6.67

Table 5: *Usage characteristics of the 13 most common pesticides*

The ***source document*** was last updated on March 16, 1999

For detailed toxicological information, see ***www.pesticideinfo.org***

[12] Fairways (including tees), treated roughs, and greens assumed to constitute 55% of total course acreage, fairways (including tees) 41%, and greens 3%. Estimated total of surveyed acreage was multiplied by 68:37 (1.84) for an estimated statewide total, rounded to the nearest 5 acres.

[13] %age of 37 courses reporting use. Assumed constant for the 68 courses statewide.

[14] MSMA applied to fairways (including tees), roughs, and greens: *metribuzin*, *dicamba*, *2,4-D*, and *MCPP* applied to fairways (and ~ half frequency to roughs); *oryzalin* is applied to fairways. Fungicides and insecticides are applied primarily to greens.

[15] Pounds per acre per application

[16] Pounds per acre per year. Application rates from the two courses using anomalously high amounts of pesticides not included in the calculation of mean statewide rates or application.

[17] Varied considerably from course to course.

Extrapolating Hawai'i Pesticide Statistics to Wa'ab

by Henry Norman, MicroTech Consulting

Using the ***Hawaii pesticide statistics***, I did some simple Excel number crunching, producing the following four tables. The numbers are striking *(for verification, my Excel workbook is accompanying this document)*. Keep in mind also that the one fundamental assumption—***that the Chinese greenkeepers will adhere to U.S. EPA guidelines***—may not necessarily be true…

Total Land Area		
	Miles^2	**Km^2**
Hawai'i	6 425	16 641
Yap	39	102
Ratio Hawai'i:Yap Land		**163:1**

Table 6: *Island Size Comparison*

Golf Course Density (Yap: ETG Proposal)				
	Courses	**Per Mile^2**	**Per Km^2**	**Km^2/Course**
Hawai'i	104	0.02	0.01	160
Yap	15	0.38	0.15	7

Table 7: *Golf Course Density Comparison*

Estimated Average Pesticide use (Pounds), Assuming U.S. EPA Rules				
	Total	**Per Course**	**Per Mile^2**	**Per Km^2**
Hawai'i	119 867	1 153	19	7
Yap	17 289		443	169

Table 8: *Pesticide Usage Comparison (equal per course usage assumed)*

Ratio Hawai'i:Yap Pesticide Usage		
Number of Yap Courses	15	**1:23**
	5	1:7
	2	1:3
	1	1:1

Table 9: *Pesticide Usage, varied number of Yap courses*

Grim numbers: Hawai'i, with a land area **163 times** that of Yap, would receive less than **0.05 times** as much pesticides, over all (if 15 Yap golf courses were to be developed). This appears to be a ***strong indication that the number of proposed courses may be on the high side***. One single Yap golf course, on the much smaller Yap land area, would be enough to dump as much pesticides into the environment as Hawai'i gets, with its 104 courses!

Granted, large areas of Hawai'i land are not well suited for golf courses, but this is equally true for Yap, so that should cancel out. What is **worse** is that Yap has an extensive and very sensitive **fringe reef** to worry about (not so on Hawai'i): the poison-laden golf course runoff **will** reach the water table, and eventually, ***seep out to the surrounding reefs, with possibly disastrous long term consequences***.

Related Internet Links

www.pesticideinfo.org

www.beyondpesticides.org/golf/materials

cals.arizona.edu/pubs/insects/az9524

snobear.colorado.edu/Markw/WatershedBio/Nitrogen/Rocknitrogen/golfcourse

grounds-mag.com/golf_courses/grounds_maintenance_sick_golf