



**International Water Ski & Wakeboard
Federation**

Environmental Handbook for Towed Water Sports

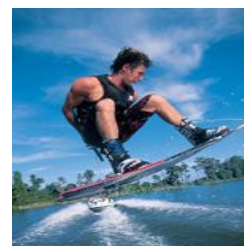
**A Guide to Understanding and
Addressing Environmental Issues**

2013 REVISION



The Spirit of Water Skiing

Water Ski



Wakeboard

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PART I

INTRODUCTION



The International Water Ski & Wakeboard Federation (IWWF) and its member organizations recognize the importance of taking care of the environment; our future, as individuals and as a sport, depends on it. Water skiers have a vested interest in protecting the environment, as the ability to enjoy our sport, and good health, depends on clean, safe and non-polluted waterways.

A. Why this Handbook?

The IWWF recognizes that environmental management is an important component of responsible sports management. It acknowledges that the sport of water skiing creates some environmental impacts that must be addressed. As a result, one of the priorities of the IWWF for the new millennium is to embrace and implement environmentally responsible management practices. The IWWF encourages its members, the water ski community, and the boating industry as a whole to do likewise.

It is the intention of this Handbook to inspire all members of the water sports community to implement a positive, practical and proactive approach to environmental management.

B. Objectives of this Handbook

The objectives of this handbook are to:

- (1) *Highlight the types of environmental impacts associated with boating and water skiing***
- (2) *Offer water skiers, riders, boaters, and club/marina operators recommended best practices and wise boating tips to reduce or prevent these impacts.***

C. What is Inside:

This handbook is based on an extensive literature review on the impact of water skiing, wakeboarding, and boating on the environment. Most of this handbook's facts and findings are based on conclusions drawn from numerous papers, reports, books, and studies and can be found in the bibliography. The recommended best practices and practical steps were developed primarily by the IWWF, with contributions made by various individuals and respected water ski and boating organizations from around the world. The handbook is divided into four parts.

Part I – Introduction – to the IWWF handbook and its objectives

Part II – Water Skiing, Wakeboarding, Boating and the Environment – Issues and Impacts

Part III – Practical Steps to Environmentally Responsible Water Skiing, Wakeboarding, and Boating

Part IV – Recommended Best Environmental Practices for Club/Marina Operators

D. The Sports of Water Skiing and Wake Boarding

Water skiing and wake boarding are sports with many social, economic and health benefits to society. They are unique in that they are sports where able and disabled persons, and people as young as 5 years and as old as 80 years of age can participate alongside each other. They are sports that involve more than one person, and are a wonderful family activity that gathers members together for a day of fun at a favorite waterway.

Anyone who has put on water skis or rode a wakeboard can attest to its health benefits. They are sports that demand and develop strength, agility and endurance. Towed water sports include several disciplines including slalom, tricks, cable, jump, ski racing, kneeboard, wakeboard, and barefoot, with each of these practiced for either recreational or competitive enjoyment.

Economically, water skiing can be credited with generating capital and employment opportunities worldwide from both direct economic activity and spin-off products and services. The sport plays an important role in the economy, tourism, and culture of many countries around the globe.

E. Towed Water Sports Into the Future

The sport of water skiing and its varied disciplines have already begun taking action towards reducing environmental impacts, as demonstrated by the creation of this Handbook and through numerous other activities. The most significant step forward for the sport has come from the technological advancements made by the marine industry. Almost all major marine engine manufacturers are today producing engines that emit significantly less hydrocarbons and less noise, with reductions in emissions in the order of up to 80% recorded by some two-stroke engine manufacturers. Also, there has been a shift away from the more polluting and less efficient older two-stroke engines towards both more efficient and less harmful four-stroke V-8 engines, and most recently toward cleaner more efficient two-stroke models. This trend toward cleaner, quieter, more efficient engines is sure to continue as pollution abatement technology becomes more sophisticated for the marine engine and as pressure from pollution regulators grows. (More on marine engines can be found in Appendix B.)

However, despite the anticipated benefits from technological advancements, there still remains much that can be done by administrators, club/marina operators, event organizers and individual participants to prevent impacts from ever occurring. This Handbook provides numerous tips and suggested best practices to help move our sport towards pro-active environmental management for all. Not only will such practices benefit the natural ecology, they can also result in various other social and economic benefits such as cost savings and enhanced member pride.

Furthermore, a sound environmental approach will assist water sports regulatory authorities in any country to set strategies for the sport's development based on the philosophy of "sustainable development": meeting the needs of the present in a way that does not limit the ability of future generations to meet their needs or harm the integrity of the natural environment. By taking action today, the sport of water skiing will be in a strong position down the road if and when regulatory authorities pass judgement, and set laws, based on the sport's record in environmental protection. Furthermore, an environmental management approach to our sport will help ensure that boating and water skiing are safe activities for both participants and the public. And finally, by implementing sustainable development practices we will enhance the conditions under which indigenous species of flora and fauna will flourish in countries around the world.

The following are just some of the reasons why it is in the best interest of the towed water sports community to embrace sound environmental management practices.

F. Benefits of Environmental Management

Due Diligence – this is a fundamental requirement of any legal defense against an environmental prosecution. This is especially pertinent for club/marina operators with regards to major spills of fuel and oil into the water or onto the ground. Part of due diligence is the adoption of a regularly updated emergency response plan with which all staff are familiar.

Regulatory Requirements – Club/marina operators must be fully aware of all applicable environmental regulations and make sure that they are being met at all times. In some jurisdictions the government's environmental regulatory body has the authority to close down a club/marina if such regulations are not being upheld.

Reduce Operating Costs – There are many small ways a club/marina can reduce costs and improve operating efficiencies. One of the simplest of these is waste reduction; an efficient waste reduction plan will ensure minimal waste arrives at the club/marina, which in turn results in reduced clean-up and waste haulage costs.

Public Relations – A clean, well-run marina will go a long way to improving public perception and the image of boating and water skiing in general. It also has the ability to improve the marketability of special events or competitions to potential sponsors.

Property Value – Property value relies largely on its salability. Many banks and lending institutions require environmental site assessments to be undertaken before financing. Sound environmental practices will help prevent spills of toxic substances or other types of environmental mishaps, which could reduce the value of the property.

Legacy – Taking steps today to protect the environment is the right thing to do for many reasons but especially because we owe it to the generations of tomorrow. Not only do we have a responsibility to clean up past damage, but also to prevent further contamination and pollution. This approach will help ensure that the sport of water skiing will exist for years and years to come. It is not unrealistic to imagine watching our grandchildren water ski behind a boat that only leaves bubbles in its wake.

This handbook is one tool which the IWWF encourages its members to use both at the national and the club/marina levels to help bring the sport of water skiing to the highest standards of environmental performance. This endeavor will not only benefit clubs/marinas and water skiers locally, but it has the potential to bring about positive change for the global environment.

The IWWF hopes that you, as a member of the international towed water sports community, will find this handbook useful in identifying ways in which to improve your environmental management practices. By doing so, you and thousands of others at all levels will continue the sport's movement toward increasingly sustainable practices.

PART II

WATER SKIING, WAKE BOARDING, BOATING and the ENVIRONMENT ISSUES and IMPACTS



A. OVERVIEW

Like most human activities, water skiing causes a certain degree of impact to the natural environment in which it takes place. Whether that impact is negative, neutral or potentially even positive is often a matter of some debate. Studies and reports rarely come to the same conclusions concerning either the degree of impact or the relative priority of any one issue as opposed to another. Several major studies undertaken in Europe and the United States conclude that in general, and relative to other boating activities, water skiing does not significantly impact the natural environment. The following pages focus instead on the most commonly cited and studied environmental impacts associated with boating and water skiing

The objectives of this section are to provide the reader a description of **what** impacts are associated with boating and water skiing, and secondly, **how** these impacts affect the environment.

B. BENEFITS OF WATER SKIING AND BOATING ON THE AQUATIC ENVIRONMENT

In some instances, boating and water skiing can directly **benefit** the ecosystem by adding much needed oxygen to the water body. Studies have indicated that the action of the engine propeller, the boat hull, and the water skier cause an increase in the oxygen content in the water. This in turn can benefit the health and diversity of the animal and plant life living in that water. This oxygenation process is most advantageous in shallow waters, waters that have minimal fresh water exchange and a high incidence of algae growth.

Another benefit of water skiing and boating is the removal of carbon dioxide, and other pollutants, from the water body. This benefit is credited to marine engines with underwater exhausts. As the bubbles containing the exhaust gases are dispersed behind the boat they help to reduce noise and to transport emissions to the surface where they are evaporated. An underwater study done by Outboard Marine Corporation found that air bubbles moving through the water at high speeds can help to degrade certain pollutants.

In narrow waterways, especially canals, a low density of regular boat traffic discourages the overgrowth of potentially troublesome plant species, and helps maintain a diversity of native plant species. In addition, the restoration of disused canals and open pit mining quarries for water based recreation has benefited many types of wildlife and waterfowl.

Furthermore, in some cases the presence of water skiing has led to significant enhancements to the local ecosystems. In one region of the United Kingdom, a local water ski club, together with the region's conservation authority implemented a comprehensive remediation strategy to protect both plants and animals along a stretch of river. Some of the actions taken included the introduction of native plant species, the construction of natural berms and islands, the implementation of strict no-pass zones along certain shorelines, and the creation of a slalom course a safe distance from nesting areas. The enhancements would most likely not have taken place if the water ski club had not initiated them.

C. THE WATER CYCLE: HOW WATER SKIING IS GLOBALLY CONNECTED

What would water skiing be without water, moreover, without CLEAN water?

We are all globally connected through nature's ecological cycles, in particular the water cycle, also known as the hydrological cycle. Through a variety of unique natural processes all of earth's water supplies, be they from rivers, icecaps, oceans or seas, eventually evaporate into the atmosphere to become part of a continuous phenomenon called the hydrological cycle. Those raindrops that cause you to cancel a day of water skiing are actually part of a much larger and vital natural process, one that all living beings depend on for survival.

Acid rain is precipitation that contains a high level of acidic compounds such as sulfur dioxide and nitrogen oxide which come from fossil fuel emissions and some natural processes like volcanism. These compounds react in the atmosphere to produce sulfuric acid, a highly corrosive compound, and ozone, a major factor in the trapping of heat and pollutants close to ground level – the greenhouse effect. Greenhouse gases related to human activity are increasing at an unprecedented rate leading to an overall warming of the earth's surface, called the greenhouse effect or global warming. The principal gases related to human activity include:

Carbon Dioxide (CO₂) -- the major contributor to the greenhouse effect primarily from the burning of fossil fuel, coal, oil, gasoline, and natural gas

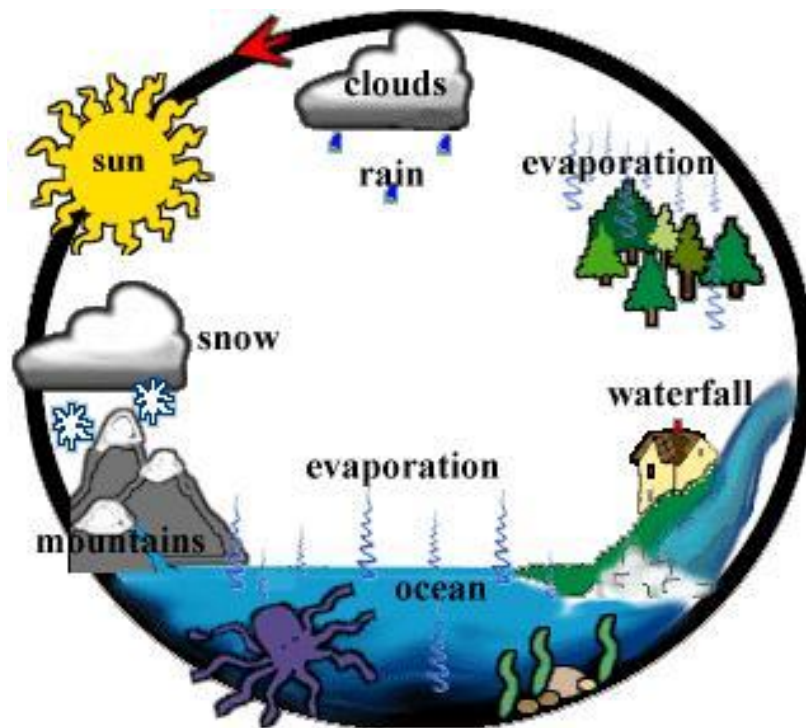
Methane – from natural decomposition process involving bacteria and the absence of oxygen -- considered to be about 20 times more powerful as a greenhouse gas than CO₂

Nitrous Oxide (NO_x) -- from burning of fossil fuels, nitrogen based fertilizers, and some man-made chemicals such as nitric acid

Ozone – main component of urban smog caused when volatile organic compounds (VOCs) and NO_x react with sunlight. VOCs are released from a wide variety of chemicals and solvents

Halocarbons – they trap heat in the atmosphere much better than CO₂ – the best known of these is chlorofluorocarbons (CFC) which is known to destroy the ozone layer. The ozone layer protects us from ultraviolet rays that can cause melanoma type cancer and cataracts.

THE HYDROLOGICAL CYCLE



D. MAIN ENVIRONMENTAL IMPACTS ASSOCIATED WITH TOWED WATER SPORTS

The main environmental impacts associated with boating water sports fall into four key categories:

- 1. Noise – engine and human noise**
- 2. Possible pollutants such as – chemicals, gases, solid wastes, and biological contamination**
- 3. Geomorphology and Hydrology – shoreline and flora degradation, and turbidity**
- 4. Birds and Wildlife – disturbance and dislocation**

Significant steps have been taken to reduce or eliminate the following:

- Noise pollution – from boat movement on the water and the club/marina grounds
- Emission of harmful gases, gaseous products and particulates from marine engines
- Emission of hydrocarbons into water body, ground water, lake sediments and atmosphere
- Release of potentially toxic heavy metals in the water
- Increased water turbidity due to the engine, boat and even water skier
- Disturbance of birds and wildlife due to boating activity and noise

1. Noise

When compared with many other types of human activities, water skiing is not particularly noisy. The typical, older two-stroke, 68 horsepower engine, operating under normal water skiing conditions produces a range between 60 to 70 dB(A)¹.

The following values help put this range into perspective relative to other types of common noise pollution:

- 120 dB(A) Discotheque – 1m in front of loudspeaker
- 100 “ Pneumatic drill at 5 m
- 70 “ Telephone ringing at 2m
- 40 “ Refrigerator humming at 2m

Unfortunately, in many parts of the world water skiing still has a reputation for being a noisy and dangerous sport, often more so than other watercraft activities. Recent studies on engine noise undertaken in different countries have shown that the typical water ski boat engine produces a level of noise well below the national standards for noise, and frequently below that of other watercraft.

Here are the results of the latest inboard competition boat test results the USA Water Ski boat tests concluded in 2008. Test parameters available from USA Water Ski.

Boat 1	36mph	67.2db	34mph	66.9db
Boat 2	36mph	72.8db	34mph	73.6db
Boat 3	36mph	67.5db	34mph	66.2db
Boat 4	36mph	70.0db	34mph	69.2db
Boat 5	36mph	72.3db	34mph	72.4db
Boat 6	36mph	67.6db	34mph	67.5db

In recent years, marine engine manufacturers have taken significant steps to reduce the level of noise created by their motors (refer to Appendix B on Marine Engines for more details). This move towards quieter technology should help to counter the image that water skiing and boating are excessively noisy.

British Water Ski Federation (BWSF) Code of Practice for Noise

The British Water Ski Federation (BWSF) has produced one of the most thorough and widely used documents on noise entitled “Code of Practice for Water Skiing & Noise” (1997).

Table 1 reveals the BWSF’s standards for noise emissions for water skiing:

¹ dB(A) – dB stands for decibel, which is a logarithmic scale used to measure sound. ‘A’ means it is a weighted decibel which is an internationally accepted unit for most noise measurement, and represents the sound pressure level weighted to correspond to the frequency response of the human ear.

Table 1

British Water Ski Federation's Standards for Noise

Maximum noise emission for one recreational boat:

- 75 dB (A) for boat traveling 22 miles per hour at a minimum of 25 metres from shore

Maximum noise emission for any boat traveling outside an environmentally sensitive area:

- 55 dB(A)

Maximum noise emission for one boat for water ski racing (other conditions stated in Code):

- 98 dB(A) with boat traveling at constant maximum design engine speed, 30m from shore
- 105 dB(A) for international and World Championship IWSF sanctioned events

It is important to remember that noise is a SUBJECTIVE, and SENSITIVE issue -- what is offensive to some may not be so to others. It is wise to approach all conflicts related to noise disturbance with sensitivity. Always respect others' right to peaceful enjoyment of their property and common waterway.

A recent trend of concern is the increase in recreational boat stereo systems with large amplifiers. As sound travels much farther on water, skiers, riders, and boaters should make sure to keep the volume low and respect other's privacy when on the water. This additional source of noise could be a detriment to the image of boating, water skiing, and wake boarding.

2. Potential Pollutants: Chemicals, Gases, Solid Waste, and Biological Contamination

a. Gasoline and Oil

Despite the best efforts of responsible boaters to prevent water contamination, gasoline and oil exhaust, namely hydrocarbons, are released every time an internal combustion engine operates.

On an individual basis the impact of your boat and skier/rider on local ecosystems is minimal.

Typical Two-Stroke Boat Engines and Their Emissions

Appendix G illustrates the minimal effects of two stroke engines on the environment as shown in the Lake X Study conducted by the University of Florida. Considering the fact that this study was performed several years ago and before many of the newest innovations in emission controls were instituted it is safe to say that the cumulative effects of today's two stroke engines is minimal.

b. Boat Engine Exhaust

Table 2
What is in Boat Engine Exhaust?

Emissions from two- and four-stroke gasoline and diesel engines includes:

Hydrocarbons: Unburnt or partially burned fuel molecules that react in the atmosphere to form ground-level ozone, a major component of smog. Some hydrocarbons, such as benzene, are toxic and may cause cancer or other health problems. Another source of hydrocarbon pollution is fuel evaporation, which occurs when gasoline vapors are forced out of the fuel tank (during refueling) or when gasoline spills and evaporates.

Particulates: An exhaust product that comes mainly from diesel-fuelled vehicles. These microscopic airborne particles can damage the respiratory system and contribute to nuisance smoke and odour associated with diesel exhaust.

Nitrogen Oxides: Nitrogen and oxygen in the air, when subjected to the high temperatures and high-pressure conditions in an internal combustion engine, form nitrogen oxides. Nitrogen oxides react in the atmosphere to form ground-level ozone and contribute to acid rain.

Carbon Monoxide: A colorless, odorless, poisonous gas that results from incomplete fuel combustion.

Carbon Dioxide: CO₂ is the ultimate product of burning carbon-based fuel. Carbon dioxide does not impair human health, but it is a "greenhouse gas" that contributes to the potential for global warming. As engine fuel economy declines, carbon dioxide emissions increase.

What Happens to Boat Exhaust?

Hydrocarbons end up in the water column, in the bottom sediments, as surface film, or released into the atmosphere. Atmospheric hydrocarbons are also a prime cause of greenhouse gases and thinning of the ozone layer.

However, there is considerable evidence to indicate that marine engine exhaust does not cause permanent damage to the aquatic environment. In particular, evidence of hydrocarbon accumulation in the sediment is inconclusive, and due to unleaded fuels lead concentration is no longer a factor. It is therefore most likely that the majority of the exhaust emissions are ending up in the atmosphere, where they are quickly dispersed.

Today there are several ways to decrease or mitigate ones carbon footprint. Some resources are listed in Appendix G.

c. Solid Wastes

All man-made materials abandoned either on land or in the water can be considered waste, or more commonly, garbage. Not only is waste unsightly, it reduces the esthetic appeal of a ski site and its grounds and waterways, and is a hazard to wildlife, birds and even children. Some wastes, even though they are biodegradable, will persist for many years. Those wastes that are not made of natural materials will either break down and leach minute toxic elements into the soil and groundwater or they will persist for decades and even centuries.

Fortunately, wastes are one of the impacts that ski site operators can address through a waste prevention plan and Codes of Conduct (addressed in Part IV). Individuals also play an important role in the success of the waste prevention plan. Part III offers several suggestions on ways individual water skiers and boaters can prevent wastes, and dispose of them properly.

d. Biological Contamination

Biological contamination is a term used to describe unwanted, non-native organisms, both plant and animal, that can invade aquatic ecosystems. Water sports enthusiasts can unwittingly play a role in spreading these species when boats and watercraft move from one water system to another without taking proper precautions to cleanse themselves of these unwanted "hitchhikers".

Plant contaminants, such as hydrilla, hyacinth and milfoil, can easily be spread in a similar manner.

These organisms also cause an increase in fuel consumption, a decrease in native plant diversity and survival rates, de-oxygenation of the water body, loss of fish life and other aquatic species. They can also prevent the safe use of a body of water for recreational activities like towed water sports as the water becomes so clogged as to be impassable. Many of these biological contaminants are difficult and costly to remove.

For additional information on the different categories of pollutants, their harmful effects, and points of control both on and off the water please refer to Appendix A.

3. Geomorphology and Hydrogeology: Shoreline Degradation and Turbidity

Shoreline erosion, degradation of shoreline flora, and turbid water (unclear or sediment-filled) are natural phenomena resulting from wind action and hydrological activities. They are also directly affected by human, water-based activities such as boating, water skiing, wake boarding and docking. See Maryland study Appendix G.

Compared to all factors, such as weather and other watercrafts, recreational boating activity has been shown to contribute **minimally** to erosion and turbidity. However, some studies have shown that if water skiing and boating are practiced too close to shore, and in environmentally sensitive areas, the impact from boat and skier wash can pose a potential for wake induced erosion.

Determining the degree of impact is complex and often involves any combination of factors from the number of boats, to the shape of the boat hull, to the speed of the boat, to the depth of the water, and the distance the boat is from shore. Therefore it is strongly recommended that a minimum of 50 meters from shore be maintained whenever possible to minimize these effects.

When considering the causes of erosion and turbidity both natural phenomena and seasonality must be taken into account. Wind action is a major contributor to both and has a greater impact during the winter season when weather conditions can be a great deal rougher. Other factors that will influence erosion and turbidity include the form and composition of the soil, the shoreline gradient, and the degree of natural or artificial protection.

One benchmark used in parts of North America and Europe is that the minimum depth in which a boat and water skier should operate is 1.5 meters.

Turbidity is caused when engine propellers and boat wash stir up bottom sediments in shallow waters and the particulates remain suspended in the water column.

The degree of turbidity is directly proportional to the depth of the water, i.e. the shallower the water the greater the turbidity levels. A minimum depth of two meters will substantially reduce or eliminate these effects.

4. Birds and Wildlife: Disturbance and Dislocation

Considerable research has been undertaken in different countries to determine if and how boating and water skiing affects birds, namely waterfowl. Considerably less work has been done on the impacts on wildlife.

In general, the majority of boating and ski activity that takes place 50 metres or more from shore usually does not cause any significant impact to birds and wildlife. However, where the disturbance and dislocation is often the most serious is:

- In narrow bodies of water
- With sensitive species
- When boaters and skiers pass repeatedly too close to shorelines inhabited by birds and wildlife.
- Shorelines with poor vegetative cover

Birds, particularly waterfowl, nest close to shorelines and are especially vulnerable when molting (losing feathers). As each water body will have different characteristics related to types of species, nesting habits, and seasonal factors, it is difficult to generalize on the impacts. However, what is known is that in areas where waterfowl disturbance has been recorded, the types of impacts can include relocation of nesting site, abandonment of nest, and loss of young. There can also be long term impacts as many species of birds that normally would return year after year to the same nesting area are forced elsewhere to perhaps less desirable bodies of water.

In general, measures to protect waterfowl are also beneficial in protecting wildlife.

Green Rule # 1

Always try to avoid disturbing birds and wildlife when boating and water skiing.

In summary, it can be said that all of us have a responsibility to ski ride and boat with care and to show respect for the environment and all the living things in it.

With that goal in mind a universal motto for the water ski community could be:

“Ski and Ride Wisely -- leave only bubbles”



PART III

PRACTICAL STEPS to ENVIRONMENTALLY RESPONSIBLE WATER SKIING WAKE BOARDING and BOATING

A. OVERVIEW

Environmentally responsible water skiing wake boarding and boating implies respect and care for the natural environment, both on and off the water. To become an environmentally responsible water skier rider, and boater means first being aware of how your actions affect the environment, and second, taking steps to prevent such impacts.

In most cases a simple change of old habits is the biggest step an individual needs to take to make a difference. Here are a few examples:

- Purchase a biodegradable boat cleaner instead of one containing toxic compounds
- Switch your engine lubricant to a biodegradable brand
- Stay as far away from the shoreline as possible when water skiing or riding.

For ski site operators there are comprehensive environmental management strategies available, if desired. One of these models is the internationally recognized ISO 14000 series of environmental management standards. Other sources include your local environmental groups or environmental consultants who specialize in Environmental Management Systems (EMS).

B. HOW CAN I MAKE A DIFFERENCE?

Water skiers, riders, and boaters play an important role in protecting the environment, both as members of their club or as individual consumers. Simple steps can be taken now and in the future to safeguard the environment.

This section provides a range of suggested steps and best practices for each of the following areas:

1. Green Practices – Members/guests
2. Fueling Practices
3. Boat and Engine Maintenance
4. Wise Boating Practices and Eco-friendly Tips
5. Waste Management
6. Consumer Power

Code of Practice

Your club may already have in place Code(s) of Conduct which specify acceptable boating behavior as well as the responsibilities that go with being a member. Some clubs may also have specific Codes of Conduct for noise control as well as a general Code of Practice to cover all other aspects.

If your club has such a Code in place you should be familiar with all its restrictions and guidelines including those pertaining to the environment. If no such Code exists, or it does not address environmental issues, then the following pages provide recommended best practices that could be part of any club individuals best practices.

Green Rule # 2

Always respect Codes of Conduct especially with regards to noise control, distance of boat and skier from shoreline, and restricted zones.

1. Green Practices for Member/Guests

The following are some of the more simple habits individuals can adopt:

- Conserve energy when and where possible:
 - > turn off lights if leaving a room
 - > use water conservatively at all times
- Minimize all wastes or garbage brought to the ski site
- Always try to Reduce, Re-Use and Recycle whenever possible (see Waste Management below)
- Seek alternative, environmentally safe cleaning products
- Minimize use of paper when possible i.e. use rags instead of paper towels, double side photocopies, canvas bags instead of paper bags, etc.

Getting There

- Carpool whenever possible for travel to your ski site or club to conserve fuel and reduce air pollution
- Ride a bicycle or take public transportation to get to the ski site or club whenever possible
- If you drive a vehicle do so with the environment in mind - make sure your car engine and tires are in proper working order, and avoid excessive trips to and from the ski site or club

2. Wise Fueling Practices

A simple spill at a re-fueling station in itself is not a serious threat to the environment. But when added to hundreds of other spills occurring over a season the effects can be detrimental to some marine and land ecosystems. By adopting some simple and safe practices this unnecessary impact can be prevented.

General Fueling Tips

- For outboards; carry a spare fuel tank instead of jerry cans or other containers -- this allows you to exchange tanks rather than refilling the tanks while on the water and risking a spill
- Use a gasoline container that you can handle and pour easily
- Use a funnel or spout with an automatic stop device to prevent overfilling
- Fill up your tank before a trip and NOT just before mooring at the dock -- a full tank of gas can expand and overflow in the hot sun
- Check your boat for any leaks of gasoline or oil – follow Emergency Response Protocol, for cleaning up spills safely
- Install a fuel/air separator on tank vents where appropriate
- Transport and store gasoline out of direct sunlight in a cool dry place
- Always use caution when pumping gasoline or mixing it with oil
- Follow the manufacturers recommended engine maintenance schedule
- Be a wise shopper – make a list of alternate cleaners and products, and purchase them at the start of the boating season.

✓ Before Starting to Refuel a Boat

- Ensure that emergency absorbent materials are available including lots of rags
- Do not distract the person filling the tank
- Ensure that the boat is securely moored to the dock
- Estimate the amount of fuel to be pumped
- Locate the air vent and install a special overflow container with suction pads, if available
- Ensure that there is an absorbent donut in place around the filler on deck. Always have a rag on hand. This rag should be placed in a vented container once used.
- Ask the owner to switch off all of the boat's electrical circuits
- Ask the owner to close all ports and deck hatches
- Turn off engines
- Ensure that there is no smoking or open flames in the area of the refueling dock
- Ask the owner to ensure that no persons remain on the boat

✓ While Refueling

- Use a funnel to prevent spillage if appropriate
- Do not clip the nozzle handle open but hold it during the refueling operation
- Do not walk away from the boat
- Do not overfill. If possible, feel the air vent for increasing pressure as the level nears the top of the tank
- Advise the customer against 'topping up'. Explain that fuel expands and that the tank may overflow if filled to the brim
- Keep an eye on the air vent. If there is a distinct increase in the airflow the tank is nearing full and fuelling should be stopped. A 'feel' for a full tank can be quickly developed.

✓ **After Refueling**

- Remove the overflow container from the air vent and, if necessary, pour the contents back into the fuel tank
- Replace the filler cap and tighten securely
- Return the fuel nozzle to its holder, turning the nozzle upwards to avoid dripping gas between the boat and the holder
- Avoid leaving fuel lines loose on the dock
- Clean up all small spills IMMEDIATELY and place the used absorbent material in a sealed container for proper disposal
- Politely remind the owner to turn on the blower for five minutes before starting the engine

✓ **Filling Portable Fuel Tanks**

- Do not fill a portable tank while it is onboard a boat or in the back of a vehicle. Place the tank on an impermeable pad with catchment and absorbent material ready.
- Do not fill anything other than approved portable fuel tanks
- Do not fill portable fuel tanks beyond their stated capacity. Remember that fuel expands in the heat of summer.
- Ensure that the filler cap is properly secured before the tank is replaced on board.
- Observe the practices for filling inboard fuel tanks where applicable

✓ **Fueling Personal Water Crafts and Outboard Motors with Built-in Tanks**

- Ensure the craft is tied securely before starting to refuel
- Do not fill the tank onboard a small craft that may rock around. If necessary move the craft to calmer water beside or behind the gas dock.
- If practical, before refueling, place motor/PWC ashore over an impermeable pad with catchment and absorbent material. Some club/marinas install floating drive-on PWC docks for this purpose
- Do not overfill the tank. Always leave room for the fuel to expand.
- Ensure that the filler cap is properly secured before replacing an outboard motor on the boat.
- Observe the practices for filling inboard fuel tanks where applicable.

3. Boat and Engine Maintenance

Boat maintenance can cover a range of activities including washing, painting and mechanical repairs. These activities often require the use of chemicals, cleaners or petroleum based products which can end up released into the environment.

Whoever undertakes the work assumes the responsibility to do the job in an environmentally responsible manner. When they do not it is the environment and the club/marina that suffers in the long run.

The following practices should be made known to everyone who is working on a boat on club/marina property. All boaters, skiers and club/marina staff should not only be familiar with these clean practices but make them part of his/her wise boating habits:

Hull and engine maintenance activities most often include:

- Woodworking
- Metal working
- Surface preparation
- Engine work
- Fiberglass repair
- Washing and polishing
- Painting and coating
- Work on mechanical and hydraulic systems

The type of impacts associated with these activities include the release of:

- Metals, metal-containing compounds from paint chips direct or indirectly into the water
- Acids and alkalis directly or indirectly into the water
- Solvents direct or indirectly into the water
- Soaps, cleaners and nutrients directly into the water
- Air emissions including particulates and ozone depleting substances like hydrocarbons
- Generation of hazardous and non-hazardous wastes including used oil, coolant, gasoline and grease, dead batteries, unused cleaners and solvents, and oily rags

a. Hull Maintenance Practices

The following practices should be posted in an easy to read site in your club/marina's boat work area:

- Always try to keep the hull clean to reduce friction and conserve fuel
- All exterior hull work done on site by boat owners or outside contractors should have the approval of the management
- Purchase alternate cleaners and products that do not harm the environment and purchase them at the start of the boating season (see E, Tables 1,2,3)
- All hull work should be done in the designated area
- Waste should be segregated and disposed on in accordance with the waste the club/marina's waste management guidelines
-

- Minimize waste by opening only enough product needed to complete the task at hand.
- Always ensure that dust and particles are collected and do not blow away. To achieve this members should be encouraged to:
 - place the boat over a hard non-porous surface such as a concrete pad
 - place tarpaulins beneath the boat if working over a porous surface
 - use a vacuum regularly to collect dust and particles
 - use dustless vacuum sanders
 - always wear personal protective gear
- AVOID working over water
- Use abrasive processes or heat guns to strip off old paint wherever possible
- AVOID the use of solvents for stripping paint

b. Mechanical Maintenance Practices

- Keep your engine well tuned
 - Make sure the right propeller is being used
 - Make sure that all mechanical work is done in designated area where spills can be contained
 - Always make sure to use the proper oil mix for the motor
 - DO dispose of used oils, greases and antifreeze, used oil filters, old fuel and other waste in accordance with the club/marina's waste management practices
 - DO keep your engines clean to minimize chance of discharges
 - Reuse and recycle all waste materials whenever possible
 - DO NOT work on the gas side of air-conditioning systems unless facilities are available to contain and collect the refrigerant and a certified technician performs the work.
 - Change oil before winter storage to eliminate residual acids and moisture in crankcase
 - Add a fuel stabilizer to fuel tanks before onset of winter to avoid deterioration of fuel and the needless dumping of stale fuel in the spring
 - Avoid ethylene glycol anti-freeze as it is highly toxic. Use a low toxic, propylene glycol-type antifreeze specially designed for marine engines.
 - Make sure batteries are filled with distilled water and are fully charged. Recycle old ones.
-
- ✓ **Before Starting:** Make sure suitable containment is in place including absorbent material and separate containers for all fluids, rags etc.
 - ✓ **IF Afloat:** Isolate the bilge pump from the automatic switch. Ensure that absorbent materials are in place around the work area when working on hydraulic equipment on deck.
 - ✓ **When Working:** Clean all spills immediately and follow all applicable protocols for spills. Do not wash away spills and do not mix wastes.
Use a wash tank for cleaning parts.
 - ✓ **After Completion:** Check for leaks Clean work area thoroughly and deposit wastes in designated containers

✓ End of Season

- Follow the manufacturers recommended engine maintenance schedule
- Prepare boat engines properly for winter storage. Make sure that:
 - batteries are clean, do not leak, and are stored properly
 - a low-toxic propylene glycol brand of antifreeze is used
 - used antifreeze is recycled and stored properly for reuse for the next season
 - tanks are left close to full to reduce condensation and corrosion (room must be left for expansion when temperatures warm up)
 - a fuel stabilizer is added to tank before winter arrives – this prevents deterioration of fuel quality and harmful dumping of old fuel come spring
- If you purchase a new engine make sure it at least meets the US EPA's 2006 standards for hydrocarbon emissions (see Appendix B for details)
- Plan Ahead – make a list of environmentally safe cleaners and products you need to replenish or purchase, and put the list in an easy-to-find place ready for next season's preparations

c. Cleaning, Polishing, and Painting Your Boat

There are many ways to clean a boat without harming the environment. One of the best tools at hand is 'elbow-grease' instead of harsh detergents and cleaners. Another is to make sure to purchase products that are environmentally benign and non-toxic whenever possible (see Appendix E for alternative products).

In some countries, or districts, there are government sponsored programs that identify environmentally-responsible products. Canada has its Ecologo program that has to date certified hundreds of products, including some specifically for the marine market, that in some way or another are more environmentally acceptable than their competitors. Check with your government environment office for a similar certification program.)

Here are some suggested best practices for cleaning, polishing and painting:

- Use portable high-pressure power water sprayer whenever possible
- DO NOT use high-pressure washers on the slip where paint particles can be washed back into the water
- Use only pure soaps and environmentally-acceptable cleaners for hull washing
- Use cleaners and polishes that have minimal environmental impact i.e.:

- AVOID using bleach, detergents and soaps that contain chlorine, phosphates, inorganic salts and metals
- substitute water-based cleaners in place of those that are solvent based
- use environmentally-safe alternatives whenever possible
- Reduce solvent use by first cleaning area with water, keep containers closed when not in use, reuse used solvents for the first rinse of the spray gun
- Reduce paint use by adjusting spray nozzle to minimize over spray, and use a gravity spray gun instead of a suction cup gun
- Change filters in the paint work shop ventilation system regularly as this reduces emissions and improves dust extraction

Green Rule # 3

Always try to use alternative, non-hazardous materials whenever possible.

✓ **Clean Green Reminders**

- Before launch, the boat should be given a thorough cleaning, in an area where run-off will not go into the waterway.
- Next, a good coat of boat wax should be applied and polished on as this will help prevent surface dirt from becoming engrained in the hull. Re-waxing periodically will keep the boat in excellent condition.
- Finally, when storing the boat, give it a thorough cleaning and add a final coat of wax for the season. This will protect the hull and help avoid the use of harsh chemicals for the next boating season. When covering the boat, use an all-weather tarp. They last longer and are less damaging to the environment than shrink-wrap.

(1) Anti-fouling Paints and Anti-fouling Practices

Hard anti-fouling paints are more environmentally safe than the ablative and the non-ablative (sloughing) brands. However, all commercial anti-fouling paints are made using heavy metals (tin and copper) which are toxic to certain species above natural levels.

- Instead of using an anti-fouling paint use a regular hull paint and a coat of slick non-toxic, bottom wax.
- Do not use paints containing tributyl tin (TBT) except where required and permitted for painting aluminum hulls and aluminum stern drive legs
- Always use the least toxic anti-fouling paint that is compatible with the water conditions (salt or fresh) and the required surface finish
- If anti-fouling paints are used, frequent hull scrubbing should be avoided as excessive amounts of chemicals are released
- Use water-based and high-solids paints in preference to solvent-based paints

4. Wise Boating Practices and Eco-friendly Tips

Boating smart is not only safe but it also helps the environment and all those living near the body of water. Operating a boat wisely can lead to fuel savings and in turn minimize potential air and water pollution, and it can reduce noise levels. Some eco-friendly tips are listed below.

- Always try to conserve fuel
- Limit engine operation at full throttle and minimize engine accelerations
- Distribute the boat weight evenly and do not overload
- Adopt practices to keep noise levels to a minimum
- Plane quickly at take-off, then throttle back to cruising speed immediately
- Avoid boating and skiing too close to shorelines to minimize erosion and the destruction of vegetation, and to prevent the contamination of the intake valve
- Avoid, where possible, boating and skiing close to shorelines that may have nesting areas and other wildlife
(check your club/marina's Code of Conduct or with operator)
- Make fewer turns so you can reduce motor load and conserve fuel
- Eliminate unnecessary idling
- Avoid shallow waters (less than 2 metres depth) where possible
- Clean all debris off your boat and trailer when going from one water body to another
- Always remove water from the compartment bilge and storage areas

Green Rule # 4

To prevent shoreline erosion, loss of vegetation cover, and turbidity always try to stay as far away as possible from shorelines, shallow waters, and environmentally sensitive areas.

5. Waste Management

Waste management applies to almost all activities associated with boating as most, if not all, generate waste to some degree. It is up to each and every boater water skier and rider to do their part to keep water skiing and wake boarding a clean and respected sport activity.

Waste consists of any unwanted products and materials, either hazardous or non-hazardous, and can be defined as:

By-products resulting from processing, manufacturing and/or consumptive activities which cannot, for whatever reason at the time, be recycled or reused and must be land filled, incinerated or otherwise disposed.

There are basically three classes of wastes; solid, liquid and gas. Each of these can be further categorized as either non-hazardous or hazardous. Non-hazardous solid wastes typically make up the majority of the waste stream and are often the easiest to prevent or reduce.

Taking steps to reduce waste means:

- A reduction in the use of raw resources, like paper and fuel oil.
- Cost savings from reduced waste disposal for your club/marina
- Conservation of valuable resources like trees
- Reduced pollution levels in water and air
- Improved image of boating and water skiing to public
- Less visual pollution
- Reduced risk of injury to birds, wildlife and children

a. The 4Rs

The best approach to live by to prevent all types of wastes is the "**4Rs**":

Rethink

Reduce

Reuse

Recycle

Rethink :The first R, **Rethink**, is all about doing things in a new way. It is a reminder to always think of new ways to reduce waste, to seek new, less harmful methods or products, and to continually ask ourselves how to prevent waste from being created in the first place.

Reduce: The best way to avoid waste is to **Reduce** it right at the source. Here are 9 simple rules to reduce:

1. Purchase supplies in bulk
2. Purchase materials in re-usable containers
3. Encourage retailers to use minimal packaging
4. Minimize your packaging needs when planning your day on the water
5. Use reusable containers wherever possible
6. Adopt "clean" working practices at all times
7. Avoid buying or using anything described as being "disposable"
8. Use products described as "long-life" (i.e. solar powered) whenever possible
9. Seek out alternative, environmentally friendly products where possible

Reuse: Products and materials can often have several uses and should be Reused as often as possible. This approach requires one to think of alternatives for an item such as converting old clothing into boat rags, using old food or product containers for storage bins, composting food wastes for garden fertilizer.

Recycle: Find out what types of waste materials (such as plastics or newsprint) are recycled at your club/marina.

Use reusable containers to sort the waste on your boat.

Avoid contaminating the club/marina's recycling containers by carefully placing your recyclable items in the correct container.

Green Rule # 5

Everything taken out on the boat, must come back on the boat.

TIPS to Waste-Free Boating

- DO NOT take packaging and other waste onboard
- DO NOT pour waste liquids into any solid waste containers
- DO NOT put waste directly into the dumpster without first checking with the club/marina operators to find out what type of waste should go where
- DO find out if club/marina operators have services to collect all liquid wastes from boats. This is important for preventing contamination of valuable recyclables.

b. Hazardous Waste

All persons who use a ski site or club facility should be aware that some materials are considered dangerous and/or hazardous. Such materials must be handled very carefully, kept segregated from other waste, and disposed of according to strict protocols usually dictated by the appropriate government or state regulations.

Green Rule # 6

Always know what products are hazardous and handle them with extreme caution at all times.

(1). What Qualifies as Hazardous Waste?

A hazardous waste is usually labeled as hazardous in print on the package and by universally recognized symbols, such as a skull with an 'X' or a caution sign. Hazardous wastes are often poisonous and can cause serious or fatal reactions if ingested. Some ways to determine if a material is hazardous include:

- Examine the Material Safety Data Sheet (MSDS) supplied with the material. MSDS describe the physical and chemical nature of the substance and the methods for proper handling, storage and disposal.
- Check with the club/marina staff responsible for handling hazardous materials
- Contact the retailer or manufacturer of the product
- Contact the local government office responsible for the environment and waste management issues.

(2). Wise Handling Practices for Hazardous Materials

- Confirm with club/marina operators the procedure for handling hazardous wastes i.e. location of storage containers, safe work areas for transferring liquids, lock-up areas, holding drums etc.
- Handle all hazardous waste extremely cautiously—have safety gloves, spill rags, and proper containers readily available
- Handle hazardous wastes on land and not on boat whenever possible
- Have First Aid Kit in an easy to access location
- Place materials that are contaminated with a hazardous substance in tightly closed containers of a compatible material (refer to manufacturers instructions or MSDS for guidance)
- Keep hazardous chemicals separated according to their classes
- Keep hazardous wastes in separate containers that are clearly labeled with their contents prior to being disposed of in a proper manner
- Never leave hazardous materials stored on boat – dispose of as soon as possible
- Ensure that the storage location for hazardous materials is out of high traffic areas and can be secured from children and public at all times

Green Rule # 7

All spills must be cleaned up immediately using the proper absorbent materials contained in the Emergency Spills Kit. Used absorbent materials must be placed into a sealed container and stored for proper disposal. Do not place used absorbent materials in the dumpster. Treat gasoline cautiously because of fire risk.

6. Consumer Power

As a consumer you have the power to influence and set trends by the choices you make at the cash register. Collectively, consumers wield an even greater influence over governments and in turn manufacturers.

The recent introduction of hydrocarbon emission regulations by the United States Environmental Protection Agency acts as proof in point (see Appendix B for details). After years of lobbying by the public and environmental groups demanding better air quality, the US government took action to address the pollution issues with off-road vehicles, including recreational marine engines.

These 1998 regulations have forced manufacturers to produce more efficient marine engines (as high as 40 percent less fuel consumed), reduce hydrocarbon emissions (by as much as 90 percent), and operate with less noise.

As American manufacturers account for over 50% of all marine engines sold worldwide, significant global reductions in hydrocarbon levels can be expected.

a. Positive Trends

Today, marine engine manufacturers recognize that consumers and regulators demand cleaner and quieter engines. As a result, older two-stroke engines are being gradually phased out and a much wider range of four-stroke engines are being phased in. More recently, state-of-the-art cleaner direct fuel-injected (DFI) two-stroke technology has reached the marketplace in a number of models of larger engines. Not surprisingly, more consumers are choosing cleaner four-stroke engines and moving toward the newer DFI two-strokes, and an increasing number of authorities in different parts of the world are banning the older models of two-stroke engine.

There is also an increase in the use of the much cleaner burning propane gas fuel, particularly in the United Kingdom and throughout Europe, and the use of synthetic lubricants that require a lower mixing ratio.

Inboard marine manufacturers have taken significant steps to reduce engine emissions and reduce noise. See Indmar test results in reference section.

The combined effect of these trends will mean significant reductions in hydrocarbon emissions worldwide. They also demonstrate that marine engine manufacturers are taking steps to significantly reduce emissions, and ultimately enhance the public image of towed water sports and boating.

b. What Can I Do?

Today, most major engine manufacturers are already producing engines that meet or exceed the EPA emission standards. Therefore, when purchasing a new engine, make sure you choose one that meets, or preferably exceeds, the USEPA standards. Be a wise consumer and always compare manufacturers' pollution control features -- there may be significant variances in quality or grades of efficiency.

Older engines, on the other hand, can produce less emissions through a retrofit with modern pollution control devices. To significantly reduce emission levels it is essential for owners of older marine engines to service their engines regularly, use cleaner burning reformulated fuels and bio-degradable lubricants, and use the correct gasoline-to-oil ratios.

Whether you have an old, retrofitted marine engine or a brand new one you will not only incur significant fuel savings, but you will be playing an important part in pollution prevention.

c. Eco-Wise Consumer Tips:

✓ **Do Your Homework**

When shopping for a new outboard engine or inboard ski boat ask plenty of questions. Now that the move towards cleaner and quieter engines is underway, innovations will continue to be made to pollution and noise control features. Some of the best sources of information on what is new in engines include:

- local club/marina operators and staff
- marine engine dealers
- marine engine sales representatives
- local marine engine repair shop mechanics
- boating magazines and journals
- Internet web sites for boats, engines, magazines etc.

- ✓ **Use leaner fuel** mixtures to reduce inefficient burning. This can be done on existing engines without totally redesigning the engine.
- ✓ **Use simple direct fuel injection** on existing engines. This modification simply means that the fuel is injected into the cylinder after closure of the exhaust port, thereby almost eliminating unburned fuel emissions.
- ✓ **Purchase the most advanced two-stroke design** such as the direct fuel injection systems.
- ✓ **Upgrade** the advanced two-stroke design engine with a catalytic converter once this technology is readily available to consumers.
- ✓ **Install noise reduction** devices, such as mufflers and engine box insulation, wherever possible on old engines. Make sure the operating level falls within your club/marina's Code of Practice for Noise.

Finally, remember to always live by the **4Rs—Rethink, Reduce, Reuse, and Recycle**. Support your club/marina in the implementation of its Codes of Conduct at all times. By taking small steps and actions we can all make big differences for the betterment of the environment and the towed water sports.

PART IV

RECOMMENDED BEST PRACTICES for CLUB/MARINA OPERATORS



A. OVERVIEW

If you are a club/marina operator and are looking for practical advice on environmental management strategies, this section will help you get started.

The term 'environmental management' is used broadly to describe the process of managing an activity or program that ultimately has one or more benefits for the natural environment. This can be as simple as providing a spill prevention course for club/marina staff to implementing a comprehensive top to bottom Environmental Management System (discussed below).

Regardless of the extent of the program, the important fact is that steps are being taken today to minimize the environmental impacts of tomorrow.

B. ENVIRONMENTAL MANAGEMENT GUIDELINES

1. Environmental Management System (EMS)

If a comprehensive, top to bottom management approach is what your club/marina requires, then an Environmental Management System (EMS) is an excellent tool to help you achieve a high level of environmental performance.

Today, organizations of all types and sizes are implementing EMSs. There are several options as to how to implement an EMS. They range from hiring a consultant, to doing it on your own, to being part of a government or university case study program. There are also journals, publications, and public information on EMS from environmental groups and government agencies. The challenge for you, the operator, is in the practical implementation of an EMS.

An EMS guides the user through a series of logical, interconnected steps based on well thought-out goals and objectives intended to address one or more environmental issues. While there are minor variations in different EMS models, they are all very similar in the main components and overall objectives.

The following is an outline of the main components of an **EMS** model:

- **Management Support** – ensure that all key decision-makers endorse the program.
- **Statement of the Issue** – develop clear definition of the issue and its impacts.
- **Program Leader** – point person who drives program and oversees its progress.
- **Regulations** -- list all that apply to issue and incorporate into strategy.
- **Goals and Performance Targets** – establish realistic goals and performance targets for each issue.
- **Implementation Strategy** – develop strategies to meet performance targets within a time frame.
- **Performance Measures** – establish benchmarks by which to measure progress.
- **Resource Needs** – determine resource requirements within a realistic time frame.
- **Observe and Record** – monitor progress and maintain accurate records.

- **Educate and Communicate** – *inform and educate staff, members, other stakeholders about issues, strategies, and how they can contribute to the program.*
- **Review and Improve** -- *establish regular review periods and make changes as needed.*
- **Fund Raising and Promotion** – *develop strategies to fund and/or promote the program if necessary.*

Remember, the greater the preparation, the more likely the program is to be a success

C. BEST PRACTICES for CLUB/MARINA OPERATORS

Preparatory work is important as it helps prevent misunderstandings and setbacks, and lays a foundation for long-term program success. It can also have other additional benefits such as cost savings, overall improved operating efficiencies, improved public image for club/marina, and enhanced member pride.

The following headings cover the main areas of operation for club/marina operators, and include suggested best practices for preventing or minimizing environmental impacts.

1. Codes of Practice

One of a club/marina's best security blankets is its Codes of Practice. Codes provide members and the public a clear understanding of the club/marina's guidelines, restrictions, and rules of membership for safe, responsible boating.

Why Have Codes Of Practice?

Codes of Practice are invaluable tools as they:

- Set the boundaries of acceptable behavior both on and off the water
- Demonstrate the marina's commitment to the environment
- Help reduce the marina's liability and risk
- Demonstrate the marina's commitment to safety both on and off the water
- Demonstrate to the local community that the marina upholds principles of sound management and respect for the environment
- Demonstrate sensitivity and respect for neighbors and other waterway users
- Demonstrate a level of professionalism and due diligence many potential sponsors value

All Codes of Practice should be posted in the clubhouse and dock areas, and communicated regularly through the appropriate club/marina publications. As part of a Code, some clubs/marinas have developed policy statements and agreements for members to sign that demonstrate a commitment to clean and safe boating practices. A sample of such a policy and agreement can be found in Appendix E.

For a sample outline of a Code of Practice, produced by Britain's Sports Council, and a Code of Conduct for Noise, produced by the British Water Ski Federation, refer to Appendix C.

2. Environmental Regulations

To reduce and eliminate risk and liability a club/marina must be fully aware of **all** environmental legislation and regulations related in any way to its activities, services and products. This also includes proposed or draft legislation.

Not only does this awareness help the marina address environmental liability issues, but it also provides lenders, employees, and other stakeholders evidence of sound environmental performance. Management is advised to check with local authorities and government agencies on a regular basis to make sure that they are current on proposed legislation.

Green Rule #8:

Environmental regulations should be updated regularly, and, posted for staff and members to see.

All regulations and by-laws which affect boaters, water skiers, and members should be posted, printed in marina literature, included in member contracts, and updated regularly.

3. Ecological Issues – Addressing the Impacts

Operators should at a minimum be aware of the types of ecological impacts associated with the club/marina's land and water-based activities. With some issues, and in certain bodies of water, these impacts may be well known and documented, while with others there may be no awareness or history of reporting.

It is to your advantage to be as knowledgeable as possible about the impacts – not only will it demonstrate a level of responsibility but you will also be prepared to respond publicly if the issue were to become controversial. It also provides you with a strong base of knowledge when the time comes to choose a strategy to minimize or prevent the impact.

It is helpful to put together a list of the most commonly known impacts and start a file on each. This is a great opportunity to seek input from other "stakeholders"/interested parties, such as members, the local cottage association, or conservation group, and invite them to be part of an environmental team.

If more information is required on an impact, the following sources may be helpful:

- Government bodies responsible for environment and land use –all recent biological and environmental reports undertaken on area
- Local library
- Local and/or national environmental groups
- Local and/or national conservation groups

- Local and/or national interest groups
- Private developers that have worked near shoreline or in general vicinity
- Universities or Colleges – potential source for biological or environmental studies

Maintaining files on each impact is beneficial because they:

- Provide management with a recorded history of the issues
- Reduce the marina's environmental risk through sound record keeping
- Involve stakeholders, and potential funding partners, in pursuit of common environmental goals
- Influence the type of remedial steps taken
- Can be used as educational material for teaching young and old boaters and skiers

If you are not sure where to begin, you may want to consider one or more of the following:

- Hire an environmental consultant to perform study and develop recommendations
- Undertake work on your own with professional input where necessary
- Seek assistance from affiliated organizations, such as your national water ski federation, the IWWF, or other boat or ski groups
- Partner with academic institutions to undertake study (i.e. a graduate degree project)
- Approach local government for funding or to undertake study

If your time and resources are limited, a volunteer committee could be struck to manage the program. If well organized, a volunteer program is not only cost effective but it provides people opportunities to get involved. However, as with staff, a volunteer driven program still requires guidance, direction, review and recognition on a regular basis.

4. Dock and Yard Management

Dock and yard management are an important issues for a club/marina as they are two of its most visible assets. They are also the busiest, and potentially the most hazardous areas of the club/marina. Sound dock and yard management is not only important for environmental and safety reasons, but also for attracting new business.

Typically, the dock area provides the following services to the club/marina:

- Fuel dock
- Pump-out facility
- Launching and Storage
- Grounds Maintenance
- Water body usage i.e. water skiing

Each of these services has the ability to affect the environment and therefore they are addressed individually.

a. Fuel Dock

One of the most common and severe risks that occur in the dock area is the spill of hydrocarbons (oil, gasoline, and diesel) in the water, on land, and in the atmosphere (see Appendix A for details of impacts). Another risk in the fuel dock area is fire - a potentially devastating threat intensified by poor fueling techniques.

The following are recommended best practices for dock management:

Safe Practices for Dock Managers:

- List proper re-fuelling practices including safety issues
- Comply with the requirements of relevant fuel handling codes and regulations
- Provide clear instructions for reporting spills
- Indicate location of absorbent materials and instructions for their use
- Make sure instructions are readily visible to boaters

b. General Rules for Pump-Out Facilities

The following are some basic rules for the management of pump-out facilities:

- The pump-out facility shall be available and in good operating condition at all times. If it is not, customers should be asked to inform management immediately
- Customers should be informed of what practices are and are not permitted
- Ensure that the tank is pumped out regularly – don't wait until the tank is full before calling a licensed sewage haulage contractor
- If a pump-out facility is not on site, management must indicate the nearest location
- Suction and washout hoses should be clearly marked and their storage position clearly labeled. Coil and hang the wash-water hose beside a sign which states that the water from that hose is NOT A DRINKING WATER SUPPLY
- Location of onshore toilet facilities should be clearly indicated
- Check the pipes from the dock pump-out station regularly for damage and leaks

c. Launching and Storage

Some of the impacts associated with **launching** and **retrieving** boats include the release of hydrocarbons (gas, oil, and diesel) and heavy metals into the water, atmosphere and on the ground. Also, the transfer of unwanted marine organisms, or biological contaminants, can be prevented before boats are put onto the trailers.

The following are some best practice tips for safe launching and retrieving:

- Keep fuel, oil, grease and heavy metals out of the water
- Help members reduce their launching time whenever possible. Explain that oil, grease and other contaminants may drip from the hull into the water
- Remove boats from the ramp as quickly as possible to minimize oil and grease spills

- Avoid leaving the travel hoist parked over the haul-out dock when not in use to minimize the chance of hydraulic oil and grease dripping into the water. The hoist must be well maintained to prevent leaks.
- Boats should be removed from the haul-out slip area to a designated wash area before hulls are power washed. Only light hosing or hand washing should be done in the ramp and haul-out areas
- Encourage members to keep trailers well maintained and free of excessive oil and grease
- Encourage members to use vegetable-based greases for trailer wheel bearings

Similarly, storage of boats and liquids can also lead to release of hydrocarbons and heavy metals due to leaks. And, the storing of boats can be done without the creation of unnecessary solid wastes.

The following are some best practice tips for boat storage:

- Ensure stern drive units and outboard engines are not leaking
- Place drip trays under grease-filled stern tubes
- Place drip trays under stern drives and outboards
- Add inhibitors to the gas tank before long term storage to stabilize the fuel
- Ensure that fuel tank suction line valves are closed where appropriate
- Encourage boat owners to use tarpaulins or invest in a canvas boat cover that can be reused over and over
- If possible, restrict the use of shrink-wrap in the absence of a recycling contract with the supplier as part of the standard service
- If shrink-wrap is being used, be sure to tape over all fuel vents before igniting heat gun

As an added incentive members could be offered free storage of tarpaulins as part of their storage of cradles contract.

For the storage of liquids make sure to:

- Check the condition of fuel lines to the gas dock
- Check the condition of above ground tanks and secondary containment walls for damage and/or corrosion
- Check that the drain valves to the secondary containment are kept closed
- Verify that the fuel pumped at the gas dock corresponds to changes in tank levels. This should be done on a daily basis during the season and once a month out of season. When dipping, look for water in the tank as well as checking the fuel level
- Always have someone standing by when fuel tanks are being refilled

5 Grounds Maintenance

The grounds of a club/marina include everything from roads, parking, and outdoor storage to drainage, grass, buildings and utilities.

The following are some suggested best practices for grounds maintenance:

- Allow the grounds to grow as naturally as possible and explain this to the members
- Avoid or at least minimize the use of toxic herbicides and pesticides for weed and insect control – use biological means of control whenever possible
- Do not cut grass more often than necessary and leave all grass at least 5cm long
- Cut grass only where necessary for recreational purposes
- Do not water more often than absolutely necessary
- Maintain a natural buffer area wherever possible between marina and the shoreline. This will help to restrict storm-water runoff and will improve visual impact of club/marina
- Keep storm-water gullies clear of debris and grass well groomed
- Encourage members to enjoy the wildlife that will be attracted
- Ask members to avoid throwing food and fish scraps that may attract unwanted wildlife pests. Also, discarded fish parts can lead to a reduction in the oxygen content of the water and foul smells
- Provide members with baggies for cleaning up after pets and encourage them to take pets far from recreational and work areas
- Collect and properly dispose of garbage regularly
- Maintain granular surfaces to maximize storm water absorption and minimize runoff
- Use only vegetable-based liquids (such as black liquor from the pulp and paper industry) or calcium for dust suppression.
- Use only environmentally acceptable cleaners and disinfectants for buildings and washrooms – avoid flushing any chemicals as they may be toxic to the bacteria that keep a septic system functional.
- Avoid using any air conditioning units that produce chlorofluorocarbons (CFCs)
- Do not let refrigerant gases be released during maintenance of air conditioning units
- Maintain all machinery in good working condition and repair all leaks immediately
- Provide drip trays or other containment wherever leaks occur in machinery
- Use vegetable-based greases where possible

Check with local gardening shops or agricultural depts. of universities or governments for alternative methods of weed and pest control.

6. Waste Management

Implementing a waste prevention program is usually simple and, if done correctly, cost effective. The 4R philosophy should be promoted and members encouraged to reduce wastes in every way possible.

A waste prevention program can provide the following benefits:

- Reduction in use of raw materials
- Cost savings from reduced waste disposal fees
- Conservation of valuable resources
- Reduced pollution and enhanced visual impact
- Improved public image and employee pride
- Compliance with regulations and reduced liability

a. The Waste Audit

One of the best steps to take before implementing a waste management program is to conduct a waste audit at your club/marina. This is a simple procedure that will tell you what categories of waste are being generated and in what volumes. The findings become the benchmarks upon which realistic waste reduction targets can be set and measured against.

For an outline of a waste audit please refer to Appendix D.

b. Waste Collection For Marinas and Clubs

Once management has determined what the waste categories will be, separate containers for garbage, recyclable materials, and reusable items should be set up side by side, at convenient locations around the marina.

Members and other club users should be encouraged to participate in the recycling program. This requires plenty of easy to read informative signs and containers placed in convenient locations. This program also demands that the containers be emptied on a regular and/or as needed basis.

➤ Waste Management Practices for Operators

- Ensure that containers have lids that are in place
- Ensure that containers for recyclables are clearly labeled
- Ensure that containers are emptied into the dumpster regularly
- Keep collection areas neat and tidy
- Ensure that lids on dumpsters are kept closed
- Ensure that dumpsters drains are kept closed
- Call the waste hauler for pick-up before the container is completely full
- Always set a good example by picking up waste and keeping the marina premises tidy.

➤ Waste Management Practices for Members and Customers

- Members should be discouraged from taking packaging and other waste onboard.
- Members should be offered onboard containers for their recyclables
- Do not allow members to pour waste liquids into any solid waste containers
- Do not allow members to put waste directly into the dumpster. Management should know and control what goes into the dumpster.
- Management can offer a service to collect all liquid wastes from the boats. This will prevent contamination of valuable recyclables and of dumpster

➤ **What Qualifies as Hazardous Waste?**

A hazardous waste can be either liquid or solid and is usually labeled as hazardous in print, by universally recognized symbols. The other ways to properly identify a hazardous waste include:

- Examine the Material Safety Data Sheet (MSDS) supplied with the material. MSDS describe the physical and chemical nature of the substance and the methods for proper handling, storage and disposal.
- Contact the manufacturer of the product
- Contact the local government office responsible for the environment and waste management
- Obtain a copy of a registration guidance manual for generators of liquid industrial waste and hazardous waste usually available from government offices.

➤ **Safe Hazardous Waste Handling Practices**

- Register as a generator of hazardous waste (depending on local government regulations)
- Ensure that the hazardous wastes are collected regularly by a registered hauler
- Ensure that each shipment is properly manifested.

➤ **Wise Storage Practices for Hazardous Materials**

- Place materials that are contaminated with a hazardous substance in tightly closed containers of a compatible material (refer to MSDS for guidance)
- Keep hazardous chemicals separated according to their classes
- Keep hazardous wastes in separate containers that are clearly labeled with their contents prior to being disposed of in a proper manner
- Minimize the amount of materials stored on site
- Ensure that the storage location for hazardous materials is out of high traffic areas and can be secured from public at all times

The contracted waste hauler should be asked to assist in the preparation of both the waste generator registration report and the manifests. This co-operation will be of benefit to both parties in ensuring that the documentation correctly identifies the waste to be transported.

➤ **Waste Collection – Hazardous Waste**

All persons who use a marina should be aware that some materials are considered to be hazardous wastes and are regulated accordingly. Such materials must be segregated and collected separately.

Management would also be wise to check periodically with local environmental organizations for suggestions on alternative products, and where applicable, with government departments that have a labeling program for environmentally approved products or services.

7. Energy Conservation and Efficiency Practices

One of the best ways to determine if a club/marina could be more energy efficient is to undertake an energy audit. The audit should be carried out by someone with an understanding of the various energy systems of the club/marina, or by an energy consultant. In many countries there are private companies who will undertake an audit, retrofit a facility, and arrange for financing based on the savings accrued over time from the retrofit.

To find such an energy consultant check with your local government agency, hydroelectric commission, or energy association. A search of the internet may also prove worthwhile.

Management should have a good understanding of what operations consume energy, how much energy is used, and at what times during a 24-hour period. An energy audit is the best way to reveal this, while simple things, like monthly hydroelectric bills, can help pinpoint general energy consumption practices.

The following are some energy saving tips for a club/marina and its facilities:

✓ **Dock Area**

- Provide a metered electrical supply to individual docks to encourage energy savings
- Provide customers with magnetic identity cards to use the toilet facilities where possible
- Turn off unnecessary lights--operate area lighting on automatic timers or motion sensors

✓ **Office**

- Turn off unnecessary lights--operate area lighting on automatic timers or motion sensors
- Use only enough wattage per bulb as necessary
- Turn off all computers and other office machines when not in use
- Use high quality, energy efficient lighting throughout offices – compact fluorescent bulbs use 70% to 80% less energy than regular light bulbs
- Plant deciduous shade trees near windows to reduce demand for air conditioning in summer, and heat in the winter months by allowing sun through windows
- Attach awnings outside and curtains (or blinds) inside to reduce demand for air conditioning and heat in summer and winter months
- Use fans instead of air conditioning if possible – fans use less energy and do not contain the ozone depleting coolants that many air conditioners require (like chlorofluorocarbons)

✓ Yards and Grounds

- Where possible, use hand operated equipment over power tools or vehicles
- Let grass areas grow longer and cut less frequently to reduce use of electric mowers

8. Water Body Usage

We all have a responsibility to keep the water body in as natural, and clean a state as possible. While the majority of the evidence finds that boating and water skiing has a minimal impact on aquatic ecosystems, there are also studies that find that boating activity can have a significant impact on certain aquatic environments.

The following are suggested best practice tips to prevent damage to the water body:

- Do not allow members to operate boats, or water ski at high speeds in shallow waters (a minimum level in some areas is 1.5 metres) – not only does it cause turbidity and destroy fish habitats, but it is very dangerous where there are swimmers in the water
- Put in place no-pass zones to prevent shoreline erosion from wash especially if shorelines do not have natural or artificial reinforcement or protection barriers. It can also damage boats moored on outer docks of some club/marinas
- Put in place controls to prevent excessive noise (as in Code of Conduct for Noise)
- Inform customers that they are responsible for their own waste management and request that they use the club/marina facilities and containers for appropriate wastes
- Introduce a Safety Education Program for water skiers and boaters
- Create an Awards Program to recognize members for excellence in boat and ski safety and environmental responsibility.

To control **aquatic plant growth** around dock and the shoreline certain precautions can be taken including:

- Obtain appropriate permits for weed removal from government, if necessary.
- Keep plant removal to a minimum—in some areas the removal of a small amount can have a detrimental effect on a marine environment
- Be aware of periods when fish spawn in order to protect spawning habitats
- Avoid use of herbicides and pesticides – some jurisdictions ban such chemicals
- Use mechanical methods, such as boat-mounted cutters, to cut back excess plant growth where possible and practical. The plant debris should then be collected and composted at a suitable composting site away from recreational areas.
- Dredging should be avoided as much as possible – it destroys habitats and breeding areas for fish, amphibians and other organisms. It can also disturb harmful contaminants that may have settled in the sediments and affect water quality
- All dredged material must be disposed of on land and suitably contained to prevent it from washing back into the water

Green Rule # 9

Always strive to keep the water body in a clean, natural state and prevent damage to shorelines and all types of natural habitats.

Weeds that have been removed can be composted, used as mulch or given away to local gardeners for fertilizer.

9. Other Key Success Factors

a. Education and Communication Programs

Effective education and communication strategies can be critical to the success of an environmental program. They inform members and in turn encourage them to participate. They can also ensure a minimum level of compliance by all, and make the enforcement of Codes of Conduct by management and staff much easier.

Water skiers and boaters need to know what the environmental issues are, and how their activities contribute to the impacts. And importantly, they need to be informed in a constructive way as to what steps they can take to prevent further impacts.

A Communications Committee made up of volunteer members is one way to develop a communications strategy. This committee would be responsible for making sure that the correct messages are getting out and in a timely manner.

Some of the information sources at their disposal may include:

- Provide regular updates to members through club/marina newsletter
- Ensure a staff member is on the Committee to ensure all staff are informed
- Create an environmental section on club/marina notice board
- Use posters and flyers
- Make announcements over public service system
- Place inserts into regular club/marina mail outs
- Use member internet e-mailings and a club/marina web site
- Annual reports

The Communications Committee can oversee a staff awareness program and make sure that required protocols, like Emergency Spill Plans, First Aid, or Hazardous Waste Management Procedures are updated, well communicated, and visible to all affected.

Management and its Committee members may also want an external communication plan to inform sponsors, the boating/water ski public, and other stakeholders about the environmental programs. A separate mailing may be the way to communicate with some of these audiences, or any of the above listed vehicles could also be used.

b. Monitor and Review

In order to assess a club/marina's environmental performance, regular record keeping should be maintained. This will provide results, allow managers to spot weak areas, and provide the benchmark for setting new goals.

Furthermore, a regular review period of all environmental programs is wise as it will help club/marina operators measure performance, control spending, and ensure that performance targets are being met.

c. Recognition and Awards

Last, but certainly not least, is a reminder to recognize all those who contribute to the environmental management program. Some organizations create awards to recognize staff and volunteers who made a valuable contribution to an environmental goal. Some possible awards include:

Best Boat Driver

Lowest Marine Engine Emission

Quietest Marine Engine

d. Green Volunteer Award

An environmental management program is an excellent way for a club/marina to introduce a range of stakeholders to the world of water skiing and boating and strengthen bonds within the community. Their assistance can sometimes make an environmental program truly successful. Expressing gratitude to these persons is not only the right thing to do, but good public relations for the club/marina and the sport of water skiing.

WATERSKI AND WAKEBOARD CABLEWAY IMPROVEMENT OF WATER QUALITY

BY A RIXEN CABLEWAY

WATER QUALITY

The positive impact of the wakeboard / waterski cableway on the quality of the water is well known for decades. The reason is the spluttering of the water by wake boarders and water skiers causing a high insertion of oxygen into the water. The oxygen is needed by micro organisms that clean the water, and it eliminates impurities by way of oxidation. The clean and quiet electric engine, on the other hand, does not cause any kind of pollution. As a result, lakes with a waterski cableway have exceptionally good measurement results and fishers observe that fish grow particularly well.

INTAKE OF OXYGEN BY A CABLEWAY – SAMPLE CALCULATION

Pumps are used to increase oxygen and thus water quality of polluted waters since the 70ies. The association of German engineers (VDI) has reported about this method in its magazine, VDI-Nachrichten, in articles published in January 1975 and in November 1976. The amount of oxygen absorbed by the water is 1 kg O₂ per kWh. A modern wakeboard / waterski cableway loses less than 20 % of the energy to friction, so at least 80 % of the energy is used for spluttering the water. Each rider uses an average amount of 4 kW of energy. As the concentration of oxygen is generally higher near the water surface than in deeper levels, a discount factor of 75 % is applied. With 10 riders on the cableway, 10 hours of operation per day, 180 days of operation per year, and a long-term use of this capacity of only 35 % the intake of oxygen into the water is up to 5 tons per year.

SUMMARY OF CALCULATION PARAMETERS:

Oxygen absorbed per energy used: 1 kg O₂ / kWh
Portion of energy used for spluttering the water: 80 %
Factor due to higher oxygen concentration at the surface: 25 %
Energy used by one rider: 4 kW / rider
Number of riders at the same time: 10 riders
Average utilization of capacity: 35 %
Hours of operation per day: 10 hours / day
Days of operation per year: 180 days / year

CALCULATION:

$1 * 80 \% * 4 * 25 \% * 10 * 35 \% * 10 * 180 = 5.040 \text{ kg Oxygen per year}$

SIGNIFICANT IMPROVEMENT OF WATER QUALITY

EXAMPLE SALZGITTER LAKE

The installation of a Rixen cableway at Salzgitter lake in 2004 has substantially improved

the cleanliness of the water of the lake. The measured indicator, the amount of coliform bacteria per 100 ml water, was reduced from an average 1,324 in 2003

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Biological Cleaning for Wakeboard- and Water ski Lakes

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Uwe Goldstein

Biological cleaning for Water ski and Wakeboard

Since many years wakeboard and water ski lakes have been build.

At the beginning it was usual to use only ground water lakes but later on the market spread into direction to build artificial lakes that are sealed with liner.

The questions all investors have:

- how to operate to build a lake?

Second question after this:

- how to operate this lakes and how to hold good water quality?

Biological cleaning for Waterski and Wakeboard

We have over 30 years experience in developing ground water or artificial lakes and take care in the water quality.

The goal of the team is always to take care on environment and therefore they developed a system to clean water with a biological system, and not using chemicals.



Wetland filter – without chemicals

In the following we want to give a brief introduction, how to develop such a project so that cable from Rixen Cableways can be build and run.

To find out the best solution for such a project and give you support we need following basics:

1. Survey plan
2. Soil surveys
3. Position of ground water
4. Analyse of water



How to build a water ski lake / wakeboard lake?

1. Wakeboard sealed with liner

This system will be used if ground water is lower then 3 m (9,8 feet) under basic building level or ground water level is changing to much. The building soil must be compacted. The slopes must be filled with fine material so that there will be a slope 1:5 at the first part and after this 1:3 in the deeper part. This will be in accordance with drawing section prepared by us.

On the smooth compacted layer will be installed a geotextile min. 8 oz. – quality 270 g/m². An additional quote should be solicited for 16 oz. – 500 g/m²

The liner will be installed above that. Material HDPE, min.40 mill. - 1,50 mm. Color of the liner black or green smooth. Depth of the lake minimum 2,00 m.

The slopes at the 1:5 part must be covered with gravel to protect against the sun and against getting destroyed.

Pro:

- Constant water level
- Seems easier to build

Contra:

- Building costs are higher
- Liner can get destroyed
- Problem with water quality possible Algae
- Large extra filter (biological or chemical) is necessary



How to build a water ski lake / wakeboard lake?

2. Wakeboard as a ground water lake

For this type of lake must be excavated under the ground water level. This seems at the first moment very difficult, but can be managed.

At first it is necessary to bring the edge of the lake all around on the correct level. From there should be excavated minimum 1,0 m under the water level.

The next step will be to install a ground water management to lower the ground water.

The lake should be made in smaller sections. Between the sections there should be installed clay that is excavated on other parts of the lake. Install ground water pump and pump up the water.

After finish excavating the lake, there will be installed a layer of gravel (15 cm – 0/32 / 6 inch - 0/ 12 inch) on the floor and the slopes of the lake and be compacted.

How to build a water ski lake / wakeboard lake?

Pro:

- Less expensive then sealed lake
- Better water quality
- Looks more natural
- Smaller biological cleaning system

Contra:

- To excavate seems to be more difficult, but is to handle
- Water level is flexible
- Water quality can change regarding ground water influence

Wetland for a biological cleaning

A wetland is a system consisting of a constructed body of water, where the water is contained by an isolating membrane or membranes, in which no chemicals or devices that disinfect or sterilize the water are used, and all clarifying and cleaning of the water is achieved purely with the motion of the water through biological filters and plants rooted hydroponically in the system.

For that will be excavated a pond minimum 1,0 m (3 feet) and then sealed with liner. In that liner will be filled gravel, substrates and a distribution system with perforated pipes. In that way water can circulate.

The size of wetland depends on size of lake, climate type and water quality. In average such a wetland will get a size between 2.000 m² and 5.000 m² (21.500 sqft and 54.000 sqft).

Between lake and wetland will be a pump to circulate the water between that system.

They idea on that system could also be to use wetland as a part of landscape. There could be build islands in wetland, that can reached by bridge. This parts could be an additional recreation area for users.

Biological filtration for wakeboard lake inside lake

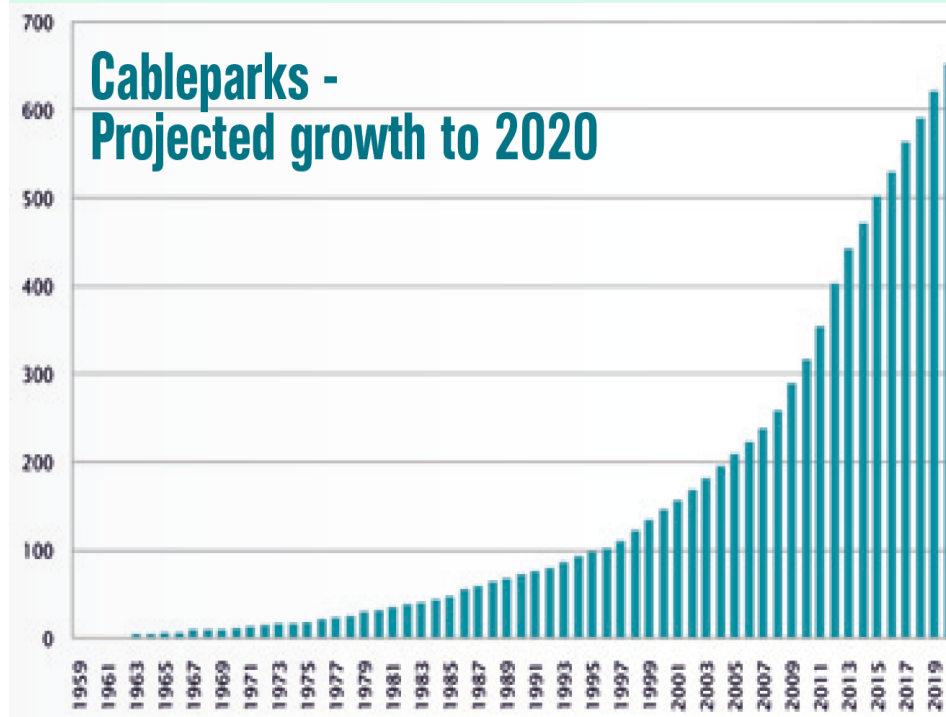
What to do for install a biological cleaning system inside artificial lakes?

1. The slopes can be made steeper because they were filled up on the liner with gravel (1:2)
2. After sealing with liner there must be installed perforated pipes DN 100 (10 cm diameter or 4")
3. After this will be filled with gravel and stones that can used from material on place
4. The last layer will be fine material
5. In this layer will be planted water plants
6. There will be two different sectors: Under water plant area and filtration area. The specification will be worked out by our office
7. There will be installed air compressor and pumps for circulation.

Portable 2-mast tower Waterski & Wakeboard Cable



- Easy to learn
- Easy to install with minimum equipment everywhere in each region worldwide.
- No water pollution
- Improve the water quality.
- No noise by using electro motor.
- Double use for summer and winter activities



APPENDIX A

TYPES OF POLLUTANTS AND THEIR IMPACTS

1. Hydrocarbons -- Gasoline and Oil Emissions

What are Hydrocarbons? Hydrocarbons are products derived from crude oil and include gasoline, diesel fuel and most oils and greases.

Why are they harmful? They are toxic to humans and some species. Being less dense than water, they float on the surface and smother marine larvae that need to breathe at the surface. This loss can impact the water body's food chain of species. In their gaseous state, they contribute to ground level ozone that is a major component of smog. Smog, or air pollution, is known to cause asthma and cancer in humans.

Points of Control: Boat engine operation (through Codes of Practice), Gas docks, pumping bilges, machinery service, engine tuning, and transfer of fuel tanks.

2. Air Emissions

What are they? There are five main classes of atmospheric pollutants, namely particulates, ground level ozone, carbon monoxide, hydrocarbons, nitrogen oxides and sulfur oxides. They originate from three processes: combustion, vaporization and mechanical abrasion and wear.

Why are they harmful? As contaminants in the atmosphere these air emissions are highly toxic to plants and animals; consequently, they directly disrupt the ecosystem. These contaminants cause local problems, including summer smog. They are also responsible for acid rain, global warming, ozone depletion and the 'green-house' effect.

Points of control: The operation of engines and furnaces, fuel filling and storage, mechanical service and maintenance work, engine tuning, and use of some aerosol products.

3. Bacteria and Viruses

What are they? Microbial organisms contained in human and animal sewage.

Why are they harmful? They include bacteria and viruses that are directly harmful to human health. Illnesses resulting from ingestion of polluted water include diarrhea, dysentery, hepatitis and salmonella.

Points of control: Pump-out station, black water holding tanks and overboard discharges (especially the "Y" valve release system); septic systems, grounds maintenance.

4. Sediments

What are they? Suspended particulate matter from bottom of water body that causes water turbidity.

Particulate matter washed off the land into the water column.

Why are they harmful?

They contain organic material that uses up the water's dissolved oxygen in their decomposition process. An increase in the turbidity of the water reduces the amount of light getting into the water column and in turn reduces the growth of submerged aquatic vegetation. They also cause an increase in phosphorous concentrations that can lead to increase in algae, chlorophyll concentrations, and gross oxygen production.

Points of control: Boat engine operation (especially in waters less than 2 metres); storm water management system; dock and shore area where boats and other vehicles may be washed; garage and repair shop areas.

5. Metals, including Anti-fouling Paints

What are they? Metals and metal-containing compounds have many marine applications including use as fuel additives (lead), paint pigments (arsenic), wood preservatives (arsenic), corrosion protection (zinc), anti-fouling (tin and copper), construction materials (iron, aluminum and chrome).

Anti-fouling paints – these are used widely by all boaters as they protect the hull and improve fuel efficiency. They are made using metals which can be carcinogenic and toxic to both marine and land animals, and humans. Tributyltin (TBT) was the major biocide used before being banned in the late eighties in most developed countries because of its toxicity, specifically to shellfish.

Why are they harmful? Above certain concentrations metals are toxic to humans and aquatic organisms. They are bio-accumulative and may eventually reach concentrations in the food chain where they are toxic to larger species, like humans. New anti-fouling paints are being made using copper. Copper ingestion above natural levels can prove toxic to certain marine organisms.

Points of control: Boat engine operation, fuel dock, engine and hull maintenance area, retail store, water and wash areas.

6. Solvents

What are they? Chemicals used as cleaners, degreasers, thinners for paints and lacquers, including substances such as trichloroethylene and methylene chloride.

Why are they harmful? Many are known carcinogens. Being relatively stable, they are insoluble in water and tend to accumulate in the ecosystem.

Points of control: Machinery and hull maintenance areas, retail store

7. Antifreeze

What is it? Ethylene glycol or propylene glycol used in engine cooling systems to prevent freezing during winter storage

Why is it harmful? Both types can be harmful to humans and aquatic organisms.

Points of control: Machinery service, boat storage areas, and retail store.

8. Acids and Alkalis

What are they? Acids are used as the electrolyte in batteries and occasionally as straight cleaners. Both strong acids and alkalis are often the main constituents of cleaning compounds and detergents.

Why are they harmful? They are toxic if ingested. Acids in particular will dissolve other contaminants such as heavy metals, resulting in indirect toxicity to humans and aquatic organisms.

Points of control: Machinery and hull maintenance areas, dock area, and retail store.

9. Surfactants

What are they? Chemicals added to detergents to reduce surface tension.

Why are they harmful? Some, such as alkyl benzene sulfonate (ABS), are chronically toxic to aquatic organisms. Surfactants can form a film on the surface of water and reduce oxygen transfer at the air/water interface.

Points of control: Any process that generates grey water

10. Nutrients

What are they? Chemical elements, primarily nitrogen and phosphorous, that are essential for aquatic plants and algae to grow and reproduce. They are found in many soaps and detergents and are the main working ingredients of fertilizers.

Why are they harmful? In excessive concentrations they may stimulate nuisance growths of some plants and algae. Excessive growth and decay of plants lowers dissolved oxygen concentrations and reduces water clarity.

Points of control: All processes that generate grey water containing soaps and detergents; ground maintenance (especially fertilizers).

11. Solid Wastes

What are they? All man-made solid debris that finds its way into the natural environment.

Why are they harmful? Plastics, in particular, remain intact for decades. They attract wildlife that then tries to eat them or gets caught in them. Nylon fishing line and the plastic ring holders for beverage six-packs are especially dangerous to birds and water fowl. All debris is visually unacceptable. Concentrations of food waste can affect dissolved oxygen levels as they decompose in the water.

Points of control: The marina's waste management system, boaters (Code of Practice), dock area, and retail store.

APPENDIX B

MARINE ENGINES

The following section provides an overview of:

- The different types of marine engines used for water skiing and how they impact the environment.
- The various types of fuels used in boating
- The most recent technological advancements in marine engines
- The United States Environmental Protection Agency's (and California's) recent regulations for marine engines

TYPES OF MARINE ENGINES SUITABLE FOR WATER SKIING

The engines used for water skiing are either inboard or outboard, with the former most likely a four-stroke gasoline or diesel engine. Boat engines used for water ski racing are often turbo or supercharged. Outboard engines are attached to the stern of the boat and are invariably two-stroke, operating on a gasoline/oil mix.

Two-Stroke and Four-Stroke Marine Engines

The four-stroke engine is considerably cleaner as there is no mixing of gas and oil and it typically gets about twice the mileage of the common older model two-stroke engine. A four-stroke fires its spark plug to make power every *other* time the piston has climbed to the top of the cylinder versus the two-stroke engine firing every time. The other major difference between these two engines is that the lubricating oil for the two-stroke engine is mixed with the fuel and is emitted on each stroke whereas the oil for the four-stroke sits in the crankcase or sump. Only if the piston rings that seal the gap between the piston and the cylinder wall become badly worn does this heavy fluid find its way into the cylinder head.

The two-stroke engines built after 1997 use new technologies to significantly reduce hydrocarbon emissions. However it has been shown that even engines built before do not significantly contribute to environmental degradation. See Lake X study in Appendix G.

FUELS – OLD AND NEW

Gasoline

Gasoline, as a fuel, has been in use since around 1910 and its early forms were relatively simple and burned clean. The gasoline used today is a complex blend that varies from producer to producer, from grade to grade, and even by location and season.

This fuel is so widely used because it is inexpensive to produce and contains 50 times more energy by weight than lead-acid batteries. The advent of a range of sophisticated engine refinements have resulted in emission levels dropping to single-digit percentages as compared to the double-digit levels of only twenty years ago.

The new 'reformulated' gasolines are the result of certain compounds being removed and others added to produce a fuel that is intended to be higher in octane, keep engines cleaner, and produce less emissions. However, engine manufacturers and boaters have complained that this reformulated gasoline clogs and damages outboard motors due to high carbon deposits.

Check with your supplier, and or mechanic, to make sure that you are using the best form of gasoline for your marine engine.

Ethanol and Methanol

Over the years, millions of dollars have been spent on research into alternative fuels, namely ethanol and methane. Emission tests support the claim that alcohols burn cleaner, reduce hydrocarbon emissions by half in uncatalyzed engines, and less so in a variety of catalyzed engines. Ethanol is made from corn, wheat, rice, oats, rye, beets, sugarcane and other common crops. Methanol is made primarily from coal, natural gas, and a variety of woods and wood by-products or effluent. While both have higher octane ratings than gasoline, they are less energy-dense than gasoline: a gallon of ethanol contains only as much energy as two-thirds of a gallon of gasoline. Most alcohol fuels are being used as additives in around 10 percent solution with gasoline, sold as super unleaded. These biomass fuels emit fewer greenhouse gases. Some concerns exist for the use of high percentage ethanol mixtures in marine engines. See Ethanol Fuel Attacks....Page 73

Diesel

Diesel fuel is a better source of energy than gasoline. In fact, it produces more foot-pounds of torque per gallon and per mile/km than gasoline, and at a lower cost. It operates with an oxygen surplus (a lean exhaust condition) and produces much less carbon dioxide emissions.

The problem with diesel fuel is primarily its emission of sulfates due to its high sulfur content, as well as the emission of particulates, unburned hydrocarbons, polycyclic aromatics, aldehydes, and a high degree of nitrogen oxides. These compounds are associated with smog and its many negative effects on the environment and human health. However the new, reformulated diesel fuels have a reduced sulfur and aromatics content, and contain cetane-enhancing additives (a hydrocarbon of the methane family that assists ignition).

Natural Gas

This naturally occurring petroleum product is found in abundance worldwide. It is a very pure fuel, requiring almost nothing in the way of refinement. The emissions from the combustion of natural gas are much lower than gasoline, diesel fuel, and even the alcohol fuels. There are no particulates, and almost no engine residue deposits. It is also one of the least expensive fuels on the market.

The downside for boaters is that to retrofit an existing fuel system to natural gas is not practical as it requires large storage space for the holding tanks. Also, its availability is limited in certain countries and regions as distribution networks are not well established.

Alternatives

There are other types of fuels being proposed for boating, but none are yet widely available or affordable. Some of these include fuel hydrogen, solar, and electric powered. You can check with your local marine dealer, or engine manufacturer, to find out if such soft energy options will be available in the near future. It is not unrealistic to imagine boaters one day using zero emission fuel systems, or a combination of very low emission systems such as ethanol fuel and electric motors.

US EPA HYDROCARBON EMISSION CONTROL REGULATIONS

In 1998 the United States Environmental Protection Agency introduced regulations to reduce hydrocarbon emissions from marine engines by 70 to 80 percent over a phase in period ending in 2006. In the state of California even more stringent regulations have been introduced called California Air Resources Board (CARB). CARB requires all gasoline engine manufacturers to meet the USEPA 2006 standards by 2002 and continue the gradual reduction of exhaust emissions through 2008. This long-term target will mean an additional 2/3 reduction in hydrocarbon emissions of engines that meet the USEPA 2006 standard.

To satisfy these standards, marine engine manufacturers are producing new engines that meet, and often exceed these regulatory standards for outboards, personal watercraft, and jet boats. And because American manufactured motors account for over fifty percent of worldwide sales of marine engines, these regulations will translate into significant reduction in global hydrocarbon emissions.

MODERN ENGINES – NEW TECHNOLOGIES IN POLLUTION CONTROL

To meet the USEPA regulatory requirements engine manufacturers have been relying on three basic technologies; direct injection for two-stroke engines, catalytic converters, and high performance four-stroke technology for outboard motors.

Direct fuel injection (DFI), two-stroke technology is designed to significantly reduce HC emissions from engines used in outboard boats and personal watercraft. This process injects the fuel charge directly into the cylinder above the piston, after the exhaust port is closed. Since the exhaust port is closed at time of injection, unburned fuel cannot escape through the exhaust port, as it used to in earlier two-stroke models. The outcome of this new technology is an engine that produces 80 percent less hydrocarbon emissions and consumes between 35 to 45 percent less fuel.

Direct-injection technology is currently available from a variety of manufacturers of outboards and range in power from 90 to more than 300 horsepower. Some of the most recent PWCs go as high as 135 horsepower.

Catalytic converters present a greater challenge despite their proven success in automotive applications. The two main challenges to the engineers involve temperature control. Many marine engines require water to help cool the engine and quiet the

exhaust. If the water used is saltwater, as is often the case, it will corrode engine parts and reduce the longevity of the catalyst. The second challenge is that marine engines often operate at higher temperatures for extended periods of time. This type of operation can lead to significant loss of conversion efficiency of the catalyst over time. Engines equipped with catalysts and closed-loop, electronic-fuel-injection systems, like automotive engines, often can achieve more than 90 percent HC conversion efficiency. However, these engines do not operate at higher temperatures for extended periods, which keeps the catalyst from reaching the high temperatures that can result in deactivation of the catalyst.

For marine applications, catalyst conversion efficiency may be restricted to lower conversion efficiency levels (below 80 percent) due to these temperature concerns. The outboard engine manufacturers are working hard to address these challenges and predictions are that a catalytic conversion system for the marine industry will be perfected by the millennium. One PWC manufacturer has introduced a 1999 model that is equipped with a catalyst.

Four-stroke engine designs have traditionally made up a smaller percent of the engines used to pull water skiers because they have generally been more expensive, not as quick at the start, and are usually heavier motors. However, in recent years manufacturers have made some significant changes to make the four-stroke engines lighter, quicker to start, and smoother to operate. They have also been able to build engines that exceed 100 horsepower due to the lighter components.

Just about every marine engine manufacturer offers a range of four-stroke power options for nearly any marine application.

Competition type Inboard and inboard/outboard (IO) engines are typically the cleanest of water ski boat engine applications. Newer technologies which include catalytic converters, electronically controlled fuel injection for fuel burning efficiency, and new technologies in sound abatement have contributed these advancements.

APPENDIX C

CODES OF PRACTICE

Codes of Practice, namely ones for Conduct and Noise, help ensure that all towed water sport participants are more environmentally responsible and practice safe boating

Some Codes include separate sections for each major area of concern such as safety regulations, boating, and water skiing. However it is divided, the Code should be targeted to the marina operators, the water ski boat driver, and the water skier.

Every member should be given a copy of the Code and asked to read it in its entirety.

The following are examples of the type of ingredients found in a Code of Conduct and a Code of Practice for Water skiing and Noise:

SAMPLE

Table of Contents of a Code of Conduct for Towed Water Sports and Boat Drivers

All boat drivers and water skiers agree to:

- Comply with all local laws and regulations at all times as they apply to the operation of a motorized vessel
- Respect speed limits on the water at all times
- Take care not to disturb wildlife and waterfowl, particularly during nesting and molting and in sensitive areas
- Use appropriate fuel for you engine
- Do not idle engines unnecessarily
- Drive the motorboat in a manner which produces least fuel emissions
- Reduce wash as much as possible
- Stay out of shallow water and well away from shorelines
- Meet requirements for boat registration and display certificate on boat
- Meet requirements for certificate of insurance and display certificate on boat
- Reduce noise emissions
- Follow accepted standards of boating etiquette including acting with due consideration for swimmers, fishermen and all other water or shore side users
- Abide by By-Law which specifies the distance from shore water skiing is permitted
- Abide by By-Law which specifies the hours of operation permitted for water skiing and power-boating
- Respect all restrictions placed on sensitive areas and areas that are seasonally constrained.
- Only refuel or use the bilge pump far from any sensitive wildlife areas.
- Follow all laws which state that no person shall drive a vessel, observe in a vessel or water ski behind a vessel whilst under the influence of alcohol.
- Follow all applicable Safety Codes
- Remember as the driver of a vessel that anything towed behind the vessel is considered on board the vessel and sole responsibility of the captain.

RECOMMENDED ECOFLAG EVENT GUIDELINES FROM THE GLOBAL SPORTS ALLIANCE

The Global Sports Alliance (GSA) is a coalition of sports and outdoor recreation enthusiasts working together for environmental awareness and action. Flying the GSA's Ecoflag at an event represents the organizer's commitment to "consider the environment" and signifies that the event strives to adhere to the principles of "Ecoplay". These principles are outlined below along with some ways that they might be incorporated.

PROTECT AND ENRICH NATURE

Natural areas are diligently protected from event damage.

The Ecoflag is prominently displayed to remind participants to "Think environment!" Efforts are made to educate participants and spectators about stewardship.

Anti-litter outreach in effect.

Event is recognized as a celebration of a clean and healthy environment.

Leave areas in better condition than we found them.

REDUCE ENERGY

Reduce energy use with energy efficient equipment, lighting, etc.

Event is accessible by mass transportation.

Encourage carpooling, biking, walking to the event.

Use high-efficiency or alternative-fuel support vehicles.

Power needs supplied from some renewable sources.

REDUCE MATERIAL CONSUMPTION

Provide progressive recycling arrangements.

Discourage disposable bottles. Promote reusable sport bottles.

Print literature on recycled paper with non-toxic ink.

Registration not paper-based.

Supplies, gear, etc. made from recycled materials.

Renting or borrowing preferred over purchase for items infrequently used.

PROMOTE A SUSTAINABLE ECONOMY

Promote the event's environmental attributes.

Event apparel of natural or recycled fabrics.

Promote the use of high quality, durable gear.

Invest in local environmental charities.

Encourage youth involvement.

Involve local artists / artisans.

Source locally produced foods.

GSA's mission is to mobilize the sports community to lessen our environmental impact and to leave a healthy environment for our future generations.



ECOFLAG PLEDGE

Global Sports Alliance (GSA) is a coalition of sports and outdoor recreation enthusiasts working together to lessen our environmental impact and to leave a healthy environment for our future generations.

Flying GSA's Ecoflag at an event represents the organizer's commitment to "consider the environment" and signifies that the event strives to adhere to the principles of "Ecoplay". These principles are outlined below along with some ways that they might be incorporated. Please indicate which items your organization or event already does, and those you pledge to include in your event(s).

Protect and Enrich Nature

- ☐ Natural areas are diligently protected from event damage.
- ☐ Efforts are made to educate participants and spectators about stewardship.
- ☐ The Ecoflag is prominently displayed to remind participants to "Think environment!"
- ☐ Anti-litter outreach in effect.
- ☐ Event is recognized as a celebration of a clean and healthy environment.
- ☐ Leave areas in better condition than we found them.

Reduce energy and resource use

- ☐ Reduce energy use with energy efficient equipment, lighting, etc.
- ☐ Event is accessible by mass transportation.
- ☐ Encourage carpooling, biking, walking to the event.
- ☐ Use high-efficiency or alternative-fuel support vehicles.
- ☐ Power needs supplied from some renewable sources.

Reduce material consumption

- ☐ Provide progressive recycling arrangements.
- ☐ Discourage disposable bottles. Promote reusable sport bottles.
- ☐ Print literature on recycled paper with non-toxic ink.
- ☐ Registration not paper-based.
- ☐ Supplies, gear, etc. made from recycled materials.
- ☐ Renting or borrowing preferred over purchase for items infrequently used.

Promote a sustainable economy

- ☐ Promote the event's environmental attributes.
- ☐ Event apparel of natural or recycled fabrics.
- ☐ Promote the use of high quality, durable gear.
- ☐ Invest in local environmental charities.
- ☐ Encourage youth involvement.
- ☐ Involve local artists / artisans.
- ☐ Source locally produced foods.

Other

Organization/Event _____ URL _____

Signature _____ Date _____

APPENDIX D

WASTE MANAGEMENT PROGRAMS

The Waste Audit:

A first step of a waste management plan is to conduct a waste audit to determine what items are going into the waste stream at the marina. While a waste audit is not critical to a sound waste management program it is a very good barometer for determining its success, particularly over the long term.

Waste audits are simple and usually not unreasonable in cost. They often pay for themselves over a short time due to accrued savings from reduced waste haulage costs.

The following are the steps involved in a standard solid waste audit:

1. Review and inventory all marina operations and activities
2. Identify waste categories (i.e. plastics, cardboard, newsprint, aluminum, glass, yard waste etc.)
3. Plan audit (when, where, tools needed, waste collection, how much, number of audits etc)
4. Conduct audit
5. Prepare waste audit report

Typically, a club/marina will examine the types of wastes and how much of each type is being generated over a given time period, usually not less than one week's operation.

At the end of each day during that period, the waste materials are separated into preset categories such as glass, plastic, paper and hazardous waste.

After all categories have been weighed and weights recorded management will have a fairly accurate picture of what wastes are being generated.

All audit findings are projected over time (usually a year) making it all the more important that the waste audit reflect normal operating practices. If special events are scheduled, then projections for these events can be made and added as separate line items in the report.

Waste auditing can be a messy business and it may be best to let a professional consulting company perform the audit. The findings will play an important role in the waste reduction targets you set for your club/marina.

Another place to look for support is your local government office that deals with waste issues. Often, these departments have advisors and useful guide documents to take you through an audit and help you set up a waste diversion program.

Based on the audit findings, management can then develop a comprehensive 4Rs waste management strategy and set objectives figuring in how many categories of items can be diverted from landfill or incineration, recycled, reused or avoided altogether.

Performance indicators, like waste diversion goals, can then be set.

Your next step is to contract with a local waste hauler for removal of recyclables and other wastes. By shopping around you may find one more reasonable in price than another.

Waste Diversion Program:

Once you have decided what materials you intend to divert from the waste stream through a recycling or reuse program, and have contracted with your local waste hauler, you are ready to set up your containers.

What you will Need:

- Waste containers for recyclables, reusable items, and other garbage wastes—all with strong ,secure lids.
Color code and label systems for the different material containers to prevent contamination (i.e. recyclables being placed in garbage containers)
- Well thought out placement for each of the containers
- Very easy to read signage indicating what item goes where
- Storage space for each category of wastes
- Regular emptying of containers
- Response system to questions about waste program from staff and customers
- Staff trained to look for contamination problems with recyclables and encouraged to come up with solutions to problems
- Another waste audit to measure effectiveness of program
- Improvements made where necessary keeping principles of 4Rs in mind

Communication and Education:

Key components of a successful waste diversion program are communication and education. All staff, members, and guests coming on to the property should be aware that such a program is in place. They can be encouraged to participate through well placed, easy to understand signage and club/marina posters and literature.

If records are being well kept and waste diversion successes evident, the program manager may want to post these results for all to see. By letting people know that the club/marina has diverted x number of tons of waste, and saved x number of dollars, they may feel a greater sense of program ownership and desire to see it to succeed even further.

APPENDIX E

A SAMPLE "CLEAN BOATING POLICY"

I have read and agree with the intent of the Clean Boating Policy. I am aware that the marina is adopting Clean Boating Practices throughout the facility. I will make every effort to comply with those practices where possible and help the marina to protect our natural environment.

As the owner of _____ (boat name) _____, and as the tenant of _____ (Marina name) _____, I, _____ (Name) _____, confirm that I have read, that I am familiar with and I fully agree with the intent of the Clean Boating Policy and the following guidelines.

In becoming a tenant, I commit myself, by guests, and my crew:

- 1) To keep all refuse and garbage of any kind on board the boat until we are able to place it in the waste containers on shore.
- 2) To separate all recyclables and place them in the appropriate containers
- 3) To separate hazardous wastes, including used oils and antifreeze, unwanted paints, solvents and cleaners, batteries, old unusable fuel, and used oil filters and dispose of them in accordance with marina guidelines or else take such waste to the licensed household hazardous waste collection site.
- 1) To take all necessary steps to avoid spilling fuel, oil or any chemicals or cleaners whatsoever into the water, to refrain from pumping oil-contaminated bilge water overboard and to be guided by instructions from the attendant when at the gasoline and/or pump-out dock..
- 2) To carry out any repair work on the boat in designated areas only, taking all precautions required by the marina to avoid leaving any debris, litter or liquid contaminants on the ground.
- 1) To use the onshore washroom facilities whenever practical, as long as the boat is at the dock and to avoid pumping grey water overboard when in the marina.
- 1) To never discharge raw sewage from the black-water holding tanks to anywhere other than an approved pump-out facility.
- 2) To use environmentally-safe products whenever and wherever possible
- 3) To operate my boat in a safe and considerate manner at all times, to operate the engines only when necessary, to avoid creating a wake when entering and leaving the dock, and to avoid causing a nuisance to all others using the marina's facilities.
- 1) To always show respect for the environment and for the fish, birds, and animals and all other creatures that share it with us.
- 2) To abide by all of the marina's Codes, including the Code of Conduct and Code of Practice for Noise.

APPENDIX F REFERENCES and RESOURCES

INTERNATIONAL WATER SKI & WAKEBOARD FEDERATION President Mr. Kuno Ritchard

Email: IWWF@IWWF.com

IWWF Environment Committee

Chairperson:

Mr. Leon Larson United States of America E-mail llarsonusaws@aol.com	Region: PANAM
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Members:

Mr. Colin Ellison Australia	Region: AA
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Ivar Fosse Norway ifosse@online.no	Region: EAME
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Mr. Vern Oberg Canada	Region: PANAM
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Mrs. Gillian Hill Great Britain	Region: EAME
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NATIONAL ORGANIZATIONS AND ASSOCIATIONS

Every country and/or region has its own national and provincial/state organizations and associations that may be of interest. The following lists offer some of the possible titles to search for, keeping in mind that there may be variations in titles from country to country, and language to language.

Most of the listings can be located on the internet through a search by name and jurisdiction. Other sources are the library, your local phone book, and trade magazines or journals.

Water Ski and Boating

National Water Ski Federation or Association
USA Water Ski
Marina Operators Association
National Marine Manufacturers Association
Marine Industries Association/Federation
Marine Boatbuilders Association/Federation
Water sports Industry Association

Government

Government Agency – Ministry of Natural Resources or Environment,
Environmental Protection Agency, Department of Marine
Management etc.
Conservation Authority

Educational Institutions

University – Departments of: Aquatic Sciences, Biology,
Environmental Sciences,
Ecology, Resource Management, Mechanical
Engineering etc.
Library – local and university

ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)

For consultants and general information on EMS search the internet
under key words such as:

ISO and 14000
EMS Consultants
EMS and Marina

International Standards Organization Homepage --

<http://www.ndt.net>

ISO 14000 series on EMS -- <http://www.iso.ch/9000e/14kbusy.htm>

Both the Canadian Standards Association and the British Standards Institution have produced extensive materials on EMS. These can be obtained by contacting either organization on the internet or directly

Canadian Standards Association

<http://rts.ceogroup.com/csa/pg1.htm>

CSA

178 Rexdale Boulevard

Etobicoke, ON

M9W 1R3

Other Locations – CSA Edmonton, CSA Montreal, CSA Vancouver,
CSA Hong Kong, CSA Japan, CSA California

British Standards Institution – <http://www.bsi.org.uk>

British Standards House

389 Chiswick High Road

London, United Kingdom

W4 4AL

Tel: +44 (0) 181 996 9000

Fax: +44 (0) 181 996 7400

Email: info@bsi.org.uk

Customer Services:

Tel: +44 (0) 181 996 9001

Fax: +44 (0) 181 996 7001

INTERNET -- WEB SITES of INTEREST

USA Water Ski Water Ski Association – www.usawaterski.org

British Columbia Marine Awareness Society– wbs@pacificcoast.net

Center for Marine Conservation – <http://www.cmc-ocean.org>

Conservation and Land Management (Australia) –

<http://www.wa.gov.au/>

Department of Transport Marine Section (Australia) (Rob Kay) –

rkay@dot.wa.gov.au

Environment Canada

Marine Environmental Data Service – www.cbesc.org and
www.oag-bvg.gc.ca

Leif Stephanson, Transportation Systems Branch –
leifstephanson@ec.gc.ca

The Canadian Pollution Prevention Information Clearinghouse:

<http://www.ec.gc.ca/water/index.htm>

International Council of Marine Industry Associations (ICOMIA) –
<http://www.tecc.co.uk/marine/>

International Water Ski & Wakeboard Federation –
<http://www.IWWF.com>

Mining Company – <http://powerboat.miningco.com>

National Boat Network – <http://www.boatnetwork.com>

Boating Industry International Online: <http://www.boatbiz.com>

North American Lake Management Society – <http://www.nalms.org>
Canadian Office – Canada@nalms.org

Ontario Environmental Network – oen@web.apc.org

Recreational Boat Building Industry – <http://www.rbbi.com>

Swan River Trust (Perth, Australia) – www.whitepages.com.au

United States Environmental Protection Agency – Office of Mobile
Sources: www.epa.gov/OMS

USEPA – Boat Operation Management Measure:

USEPA -- Final rule on emission regulations:

USEPA – Management Measures for Marinas and Recreational
Boating:

USEPA – Petroleum Control Management Measure:

Water Ski Canada – <http://wsc@waterski.ca>

Worldwatch Institute – <http://www.worldwatch.org>

Global Sports Alliance - <http://www.gsa-world.org>

Water Sports Industry Association <http://www.wsia.net/>

Members user name: 2012active and password funinthesun!

ADDITIONAL RESOURCES;

The 2008 American Kneeboard National Championships Offsets its Carbon Emissions with Carbonfund.org

Fort Lauderdale, FL, August 11, 2008 - The American Kneeboard Association National Championship announced today that it is offsetting its carbon emissions with Carbonfund.org, one of the country's leading carbon offset organizations. The AKA National Championships organizers have offset competitors', officials', and families' travel to and from the Championships, their hotel stays, meals, and all local travel and towboat pollution emitted while pulling events. The organizers have scheduled all events within a 2.5-mile radius to reduce travel and will take several additional measures to reduce the use of non-renewable resources during the Championships. The commitment establishes The American Kneeboard Association as an environmental leader in the USA Waterski community and demonstrates the proactive steps the AKA is taking in the fight against global climate change.

The American Kneeboard Association members are very concerned about global warming. With the grave implications of climate change in mind, carbon offsets through Carbonfund.org reflect a natural extension of the socially-minded work the AKA does on behalf of its members. "Protecting the environment in our daily lives, also known as 'going green,' has become something that is on everyone's radar these days, even when it comes to kneeboarding," said George Rohner, National Kneeboard Championships Tournament Coordinator. "After checking out the credentials of Carbonfund.org and their verification/certification process, and finding out how easy it is to reduce our climate impact, it was a no brainer. I encourage individuals and all other sport disciplines to consider doing the same," said Rohner.

"It's very encouraging to see a sporting events like the National Kneeboard Championships Tournament commit to showing this kind of leadership in going green," said Eric Carlson, Executive Director of Carbonfund.org. "We're truly excited about this partnership."

The American Kneeboard Association is known as the leading authority of competitive kneeboarding in the United States. The AKA is a water ski discipline of USA Water Ski, the national governing body of all water skiing in the United States.

About Carbonfund.org Carbonfund.org is one the country's leading carbon reduction and offset organizations, making it easy and affordable for individuals, businesses, and organizations to reduce their climate impact. Carbon offsets enable individuals and businesses to reduce carbon dioxide emissions they are responsible for in their everyday lives by investing in renewable energy, energy efficiency, and reforestation projects where they are most cost effective. Carbonfund.org works with over 300 corporate and non-profit partners.

APPENDIX G STUDIES

Summaries of Environmental Studies

1a) “Analysis of Pollution from Marine Engines and Effects on the Environment - Southern Lakes (The Lake X Study)”

The Lake X Study, as it is most often referred to, can be extremely useful in instances where pollution or potential pollution of an enclosed body of water is the issue. The study was done some twenty years ago but is still valuable and useful today, perhaps even more so due to the technological advances in fuels, fuel handling, engines, and engine exhaust systems.

Kiekhäfer Marine sponsored the study and acquired the services of Environmental Sciences and Engineering of Gainesville, Florida to carry it out. The two lakes that were chosen were side-by-side and represented closed systems; one lake provided the control and the other the test site. The 1400 acre lake was subjected to continuous use by the operation of a series of six cylinder outboard engines 24 hours per day for a ten year period of time. Some three million gallons of fuel, both leaded and unleaded, were burned. This amounts to approximately 68,100 outboard engine hours per year. More than 681 boats would have to operate for 100 hours each to equal that exposure.

The bottom line here is that no detectable pollution was found that could be attributed to the engine operation. This even includes hydro-carbons.

2a) “A Partial Checklist of Florida Fresh Water Algae and Protozoa, with Reference to McCloud and Cue Lakes”

The significance of this study is to indicate in the variety of lakes studied, some with and some without boating activity, that no apparent differences in algae or protozoa production was noted.

3a) “Effect of Water Skiing on Fish Populations at Green Valley Lake”

A study was completed by the Iowa Conservation Commission at Green Valley Lake, Iowa. A baseline study was done on this lake in 1971. This made it ideally suited to this work.

A water skiing zone was designated on the lake shortly thereafter. Later, the fish population was checked again. The results indicated no adverse effects from water skiing activity on either turbidity, fish, or the production of invertebrates.

4a) “Eutrophication Factors in North Central Florida Lakes”

This study goes into depth on the various factors that contribute to the eutrophication process. It is of interest more for what it does not say rather than for what it does.

Of all the factors discussed, boating was not mentioned as contributing in any way.

In some lakes boating may even be beneficial in contributing to the dissolved oxygen process through aeration. This process is generally most helpful in shallow closed system bodies of water.

5a) “Marine Sanitation Devices and Pollution from Small Boats”

This publication is in the form of a bibliography and covers the following topics:

- Nature of the pollution threat.
- Background pollution measurements, 1960-1980.

- Role of marinas in the potential problem.
- Marine sanitation devices.
- Current status of the most recent research.
- The public reaction.

This is a problem which has more to do with the recreational skier who is more likely to use a watercraft with this type of equipment on board. Most boats designed specifically for water skiing do not carry on-board sanitation devices.

6a) “Mixing Effects Due to Boating Activities in Shallow Lakes”

This study, which was conducted in Maryland, is most useful for those who ski on small shallow or man-made lakes.

There is no argument that boating activity will stir-up or even scour the bottom in very shallow areas. The study does, however, show diminishing effects with depth. Some scouring will take place at the two-to-three foot depths, but you cannot operate a ski boat safely in water that shallow. At the five foot level, which is the USA WATER SKI Safety Committee’s recommended minimum safe depth, very little, if any, scouring or mixing takes place. At the eight foot level there is no effect at all. Most courses are at least at that depth.

For man-made lakes this study is useful in determining sediment settling characteristics when designing a lake specifically for tournament skiing. For those already in operation, it can supply a reference for calculating settling rates. It can also answer such questions as how long will it take for my lake to clear, or will it ever clear?

This study was done using boats of different lengths, drafts, and with horsepower ratings from 28 to 150.

7a) “Recreation in a Marine Environment”

In the article, a committee of the International Marine Environmental Commission (IMEC), (after looking at air and water pollution in general, and how recreational marine activities impact on it), made the following conclusions:

“We have seen that the environmental issue entails more than just pollution control. What we need is proper management of our resources for maximum benefit in health and happiness. The marine industry is willing to accept this responsibility and supports any action to provide a high quality marine environment in which people may find the freedom required for recreation.”

A commitment of shared responsibility by all sectors, (industry, government, and the user public), will then provide the recreational facilities so urgently needed by people of all social levels, now and still more in the future.

This article is also available from the Waterways Committee and makes for some interesting reading.

8a) “The Role of Boat Wakes in Shoreline Erosion”

This is an important study in as much as this question often arises in complaints against ski boats. Skiers tend to seek out areas either close to shore or in small lakes in an effort to avoid wind chop and other boat wakes. This tendency puts us at risk of incurring this type of complaint.

The study, carried out by the Maryland Department of Natural Resources, attempts to answer three basic questions. How do boat wakes compare with normal wind generated waves as a source of energy for erosion and transport of shoreline sediments? How do rates of erosion during the boating season compare to other times of the year? Can different types of boating patterns change the level of energy in boat wakes and to what degree?

The answer to question 1 is that at all but one site no increase in erosion levels could be attributed to boating. The site that did show some minimal erosion was in a narrow creek where the following characteristics were noted:

- Exposed point of land in a narrow creek.
- Easily erodible shoreline material (sand and gravel).
- Steep shoreline gradient.
- Susceptible to a high rate of boating.
- Boats passing relatively close to shore.

This is not the type of area where water skiing generally takes place.

The answer to question 2 was that for the exception of that one area no significant differences were noted between seasons.

The answer to question 3 is yes. For instance, boats traveling at what we generally perceive as trick speeds will generate more wave energy than boats traveling at slalom, jump, or barefoot speeds. The recommendation here is to take these factors into consideration when choosing a ski site. If you follow the general 300 foot rule you should experience no problems even at trick speeds.

An additional study was performed by the Department of Conservation of the state of Illinois. Their final statement in summary was: "We cannot attribute any appreciable shoreline erosion to the wakes of passing watercraft. Wind and other acts of nature basically are at fault in instances of bank erosion."

A Decision Support Tool for Assessing the Impact of Boat Wake Waves on Inland Waterways

William C. Glamore

Senior Research Engineer, Water Research Laboratory, School of Civil and Environmental Engineering, University of New South Wales, Australia

Abstract

The generation, propagation, attenuation and forces related to boat generated wake waves are currently being investigated due to increasing concerns regarding their impact on coastal and inland waterways. To ensure that these concerns are objectively addressed, a Decision Support Tool (DST) to assist in waterway management has been developed. The DST is based on standardized field measurements of boat wake waves, which have been specifically developed for this field of study, local wind wave energy calculations, and an assessment of the waterway's erosion potential. Importantly, the tool incorporates both individual and cumulative wave energy calculations and a field methodology for assessing the erosion potential of a selected site. An interactive spreadsheet has been developed to assist in applying the DST at selected sites. Field testing of the DST has assisted in refining and validating the assessment methods. The DST can be easily adapted to assess the impact of boat wake waves in a variety of waterways and can be expanded to include additional vessels. While there is currently a large demand for this type of decision support tool in coastal and inland waterways, no alternative comprehensive method currently exist.

Link: http://www.pianc.org/downloads/dwa/Wglamore_DPWApaper.pdf

9a) "The Effect of Water Skiing on Fish Populations at San Justo Reservoir, Hollister, California"

(Cited in a letter of 31 December 1991 to USA WATER SKI member and ski school operator Geneva marine Brett of Hollister, California)

Dear Ms. Brett: In response to your letter of November 19, 1991, I can simplistically state that it is my opinion that water skiing will not have any adverse impact on the fish populations at San Justo Reservoir. In general, as both currently exist at many Reservoirs in the State of California, water skiing and fishing are compatible recreation activities. >>To answer your specific questions:

- 1) I am the Fisheries Biologist for San Justo Reservoir, and as such I am responsible for stocking the fish and ascertaining the general well-being of the reservoir, insofar as the fish populations are concerned;
- 2) the trout are stocked in the reservoir for human consumption, not propagation;
- 3) Our intent is to stock the reservoir every year with trout, depending on the availability;
- 4) Water skiing will not be a causative factor in the fish placement at San Justo, we will stock if the fish are available;
- 5) Water skiing should not affect the patterns and feeding habits of this fish populations (including the rainbow trout for which you expressed specific concern);

6) Yes, plant life does take oxygen from the water, and yes the fast-spinning propeller from a ski boat will put oxygen back into the water, which does aid the fish population;

7) There is somewhat less algae with agitation of the water;

8) We have stocked both trout and warm-water game fish species (such as bluegill and largemouth black bass) at San Justo, which coexist because of the varying depths of the pond;

9) Yes, the fish will have a tendency to move away from the vibrations of your propeller, which may result in better fishing outside your designated ski zone.

In my opinion, one boat will not have an adverse impact on the turbidity of the reservoir; however, I direct you to the reports/studies you possess for technical information regarding turbidity.

Due to time, personnel, and money constraints, we have been unable to conduct in-depth studies of the fish populations at San Justo; it is our intent to commence such studies in the future, when the time, personnel and money are available.

In conclusion, as the Fisheries Biologist for San Justo Reservoir, I would have no objection to the implementation of your proposed water ski concessions operation at that site. In my opinion, the use of one ski boat will not harm the fish population, the fish will continue to exist, without detriment.

Dean Marston, Fisheries Biologist
California Department of Fish and Game

4. Some Additional Conclusions of Environmental Studies

Executive Summary of Scientific Literature on Outboard-Powered Boats

NOTE: The following references are for literature citing the effects of outboard motors on water quality. The literature search and following summaries were done by Dr. S. Bradford Cook, Biological Scientist IV, Florida Game and Fresh Water Fish Commission. The Executive Summary he wrote after reviewing the studies is presented first.)

Executive Summary — Twenty-four references were reviewed in order to evaluate the effects of gasoline-powered outboard motors on the aquatic environment. These effects included the introduction of volatile substances through outboard motor exhausts, re-suspension of sediments due to boating activity, erosion of shorelines due to wave-wash, and direct disturbance of aquatic biota.

Although boating activity can influence the concentration of volatile substances such as lead and hydrocarbons in the aquatic environment changes in the construction of the two-stroke gasoline-powered outboard engines since 1972 have drastically improved this problem. Newer engines do not emit the concentrations of these substances like the older models did. Also, with the advent of unleaded fuels, lead concentrations are not a problem as they once were. Results of studies on volatile compounds have shown that their effects are more pronounced in areas of very little mixing (marinas and boat docks) and also in areas where boat fueling occurs with chances of fuel spillage. These areas were found to have high concentrations of lead and hydrocarbons and also had little to no diversity of benthic invertebrates.

Sediment re-suspension was found by many authors to be a major problem influenced by boating activity. This was especially evident in shallow water bodies with sediments characterized as being primarily organic or silt in nature. This re-suspension can cause problems due to increased turbidity levels and also by reactivating phosphorus bound up in sediments. Turbidity can cause loss of aquatic macrophytes due to shading, and reactivation of phosphorus makes these compounds available as nutrients for plant growth. This plant growth can either be found in macrophyte growth or in the excessive growth of algae. Algae, if abundant, can also cause the same shading conditions that results from turbidity.

Sediment re-suspension was found to be greatest with large [commercial] tow boats. These large boats are associated with barge traffic. Although this type of traffic is not found in many of Florida's lakes. Due to the shallowness and sediment composition of our lakes, heavy boat traffic by boats powered by large engines may cause significant sediment re-suspension. This aspect needs to be further researched in order to more definitively determine if this does occur.

Bank erosion was cited as a potential problem caused by boat traffic. This problem was most evident in areas with unstable, un-vegetated shorelines. Vegetation along shorelines stabilizes

sediments and dissipates wave energy prior to its effecting shoreline sediments. If shorelines are maintained such that a vegetated buffer is present, the problem of shoreline erosion will be reduced. Also, keeping boating activity away from these important areas will reduce damage.

The direct effects of boating activity on the aquatic biota are less well documented in the scientific literature. Evidence has been found that boating activity disturbs spawning fish. However, these findings were based solely on observations and it was found that boat speed and proximity of the activity to the spawning fish were important determinants. Physical damage to aquatic vegetation communities was cited as a problem. This damage resulted in the actual elimination of vegetation and also changes the character of the sediment in once-vegetated areas. Problems of this nature also need to be further researched to determine if these are actual problems or only effects resulting from boating activity.

In summary, moderate boating activity does not appear to definitively cause direct deleterious effects to the aquatic environment. It is true that there are environmental effects caused by boating activities. If precautions are taken such as maintaining vegetated shorelines, preventing excessive boating activity on a single body of water, and keeping boat traffic away from critical habitats, until further research questions are answered, boating activity should not be looked upon as an environmental hazard.

— S. Bradford Cook, Ph.D.

Biological Scientist IV

Florida Game and Fresh Water Fish Commission

1b) Anderson, F.E. - 1974. The effect of boat waves on the sedimentary processes of a new england tidal flat (Technical Report No. 1, June - August 1972), Durham: New Hampshire University., Jackson Estuarine Lab., 1 Feb., 1974. 44 p.

The intent of this study was to estimate the effect of increased boat traffic on channel bank and tidal flat erosion. Six different boats, ranging from 13 to 34 feet in length, with different sized motors were used to establish waves. Water samples were taken at 30 and 15 cm off the bottom during and after boat waves passed. These samples were filtered to determine total suspended load.

The amounts of sediment resuspension were seen to vary among the different boat types. The largest boat (34 ft.) has a displacement type hull and was found to cause considerable sediment resuspension at slow speeds. Tri-hulled boats, which planed on top of the water, caused relatively minor resuspension of sediments. These same boats were found to only cause sediment resuspension when operated at speeds less than planeing.

With given wave heights, water depths, and boat types, more sediment was resuspended on the flood tide than the ebb tide. This was suggested to possibly be due to changes in the internal temperature structure of the mudflat. Boat waves were found to resuspend one-third to one-half more sediments under the same wave conditions on the flood tide than on the ebb tide. During the flood tide, the resuspended sediments were transported seaward in a tidal current.

2b) Anderson, F.E. - 1975. The short term variation in suspended sediment concentration caused by the passage of a boat wave over a tidal flat environment (Technical Report No. 2), Durham; New Hampshire University, Jackson Estuarine Lab., 1 Feb. 1975. 45 p.

A series of boat waves were directed across a New England tidal flat at varying depths to examine the post-boat wave effects on sediment resuspension and deposition. Boat waves were described as a possible man-made erosion or non-depositional agent in estuarine waters due to the fact that in some areas, boat wave wash leads to severe shoreline erosion.

The outer part of the tidal flat appeared to be the most effected with alternating periods of sediment resuspension and deposition. However, the inner part was described as being an area for deposition. At the low tide mark, sediments were easily resuspended and just as easily deposited. The affected sediment particles behaved more like low-density aggregates of material rather than individual grains of silt or clay.

2b) Byrd, J.E. and M.J. Perona. 1980. The temporal variations of lead concentrations in a freshwater lake. *Water, Air and Soil Pollution* 13: 207-220.

Variations in the lead concentration of a freshwater recreational lake were determined in this study. The lake studied was Turlock Lake in California. A daily record of the number of boats launched was kept by the California Department of Parks and Recreation, and this data was used to compare with the lead concentrations found in order to determine the lead contribution from boating activity. Boating was found to be important in controlling the lead concentration in the boat dock area. The highest observed levels of lead were obtained in this area. Thus, boating activity was considered as a potential contributor of lead to the water.

Maximum boat concentrations were noted to occur during the week of 4 July. These concentrations were found to correlate with the maximum lead concentrations at the boat dock. The boat dock area was the area of the greatest boating activity because all boats launched must pass this area, and fueling facilities area also located in a cove which was somewhat isolated from the main body of the lake.

A mathematical model was used to evaluate the lead concentrations in the main body of the lake. Boating was not the sole contributor to the lead concentration in this part of the lake. Sediment-water interactions were felt to be more significant. This was due to the facts that the sediment in contact with the water was capable of either absorbing or desorbing lead and that the influence of complex reactions on the equilibrium lead concentration was minimal.

3b) Chmura, G.L. and N.W. Ross. 1978. The environmental impacts of marinas and their boats: a literature review with management considerations. NOAA Grant No. 04-6-158-44002, Marine Memorandum 45. 36 p.

The purpose of this review was to summarize all aspects of marina and boat-related environmental effects. Review of this information was limited to those effects resulting from boating activity and boat motors.

One study reviewed brought out the point that in freshwater ponds with mud bottoms, although a considerable amount of bottom material was moved by outboard boats in shallow water, turbidity was not measurably increased. However, beds of aquatic vegetation helped to minimize the created turbulence. Aquatic vegetation was not found to grow in areas frequently utilized by boats, especially where motors were within 12 inches of the bottom. Benthic organisms were also noted to be substantially reduced in a number of these same areas. Another study found that regular boat use destroyed established beds of aquatic vegetation in shallow water. In these areas, there was less fine sediment, a reduced Ph, and a reduced oxidation-reduction potential in the bottom sediments.

The effects of boat motors on the chemical composition of water were discussed in reference to outboard motor exhausts. Two-cycle engines were noted to release unburned fuel in the exhausts. Outboard motors manufactured prior to 1972 were found to discharge oil directly into the water. This was significantly reduced after 1972. Other emissions mentioned included high carbon monoxide levels. Hydrocarbon emissions were noted to be approximately ten times higher than those of a typical four-cycle gasoline engine. Once released into the water, some hydrocarbons were found to be suspended in the water at propeller depth where they would be mixed by propeller activity. Lead emissions were found to be dependent upon the speed of boat operation. Almost all the lead discharged was noted to eventually reach the bottom sediments. Overall, this paper concluded that little could be done to reduce the impact of boat motor emissions other than reducing boating pressure.

5b) Clark, R.C. Jr., J.S. Fineley, and G.C. Gibson. 1974. Acute effects of outboard motor effluents on two marine shellfish. Environmental Science and Technology 8(12): 1009-1014.

The effects of the diluted effluent from a two-cycle outboard motor on mussels and oysters were analyzed in this paper. Both types of shellfish were found to display physiological stress, degenerated of gill tissue, and uptake of paraffin hydrocarbons from the effluent. Two-cycle outboard motors were noted to perhaps be a significant source of petroleum pollutant in the aquatic environment. Oysters were less effected by these pollutants than were the mussels. After 10 days in the effluent water, 66% of the mussels died while only 14% of the oysters died. Oysters were found to be capable of closing their shells for long periods of time and thus were able to exclude the pollutants. The high sensitivity of the mussels to the diluted effluent suggested that small amounts of petroleum from outboard motor exhaust may adversely effect these organisms.

6b) Cole, B.J. 1974. Planning for Shoreline and water Uses; A report on the Third Marine Recreation Conference. University of Rhode Island, Kingston.

The effects of outboard motors on the environment were briefly discussed in this report. An organization of the major outboard manufacturers, the Marine Exhaust Research Council (MERC), was formed to determine if outboards are compatible with the aquatic environment. This organization coordinated with the Environmental Protection Agency (EPA) to look at lakes in both Michigan and Florida. Lakes were selected which had never had outboard motors stressed with exhaust from outboard motors exhibited no signs of environmental problems when compared with control lakes. The following year, the stressing rate was increased as was the number of monitoring samples taken. Again, no adverse environmental impacts were detected. Overall, even with stresses being almost four times that of normal boat usage, the EPA still had no proof that any environmental damage was caused by outboard exhausts.

KEUKA LAKE WATER QUALITY TESTING PROGRAM, 2000

PETER LANDRE AND AMY BARKLEY

KEUKA LAKE ASSOCIATION, HAMMONDSPORT, NY

HYDROCARBON TESTING

Background

In 2000, the KLA Board instructed the water testing committee to study the levels of motorboat fuels (hydrocarbons) in the lake. The study was initiated because of potential water quality concerns from proposed jetski event(s) slated for Keuka Lake during the spring/summer. The study was intended to answer the following questions: 1) What are the background levels (midweek, May) of motorboat fuel contaminants (Benzene, toluene, ethylbenzene, xylenes and MTBE) in Keuka Lake? Do jetski events contribute significantly more motorboat fuel contaminants in the lake than background levels or holiday weekends (July 4th). Are levels found during these periods a potential health or ecological risk?

Methods

Since this type of research is considered relatively new nationwide and to the KLA testing team, determining a suitable and cost-effective testing method was the first step. Fortunately, Canandaigua Lake had conducted some preliminary research the previous year. Two testing methods and laboratories were chosen to answer the above questions, allow comparison with the Canandaigua Lake results, and determine if a simpler and cheaper method was reasonable to use as a screening tool. Brockport University Department of Biology Laboratory (who we also use for our other lake testing analyses) was chosen to perform a BTEX (Benzene, toluene, ethyl benzene, xylenes) immunoassay colorimetric screening analysis. These tests are considered accurate at low detection limits (10 parts per billion). The screening test is relatively inexpensive, however, the method is not EPA approved and reports the combined total of the four BTEX analytes. The second method used was the EPA 8020 using a GC/MS. This method is considered very accurate and the analysis reports results for each analyte. This also is the method used by the Canandaigua Lake testing group.

Four to six individual samples were taken on four separate days during the spring and summer including: a) mid-week, during May; b) before, during and after May jetski event; c) July 4th weekend, early, mid and late day; and, d) mid-week, summer day, and e) labor day.

Results

The hydrocarbon testing before, during and after the PWC event in May, July 4th, Labor Day and several other weekday events showed low to non-detectable levels of BTEX (benzene, toluene, ethylbenzene, and xylene) and MTBE (see table below). The immunoassay scan results showed low levels not exceeding 0.24 ppm. Using the GC/MS 8020 method, most of the samples (100) were below detection limits and drinking water standards. There were 8 "hits", all below 2 ppb and below the 5 ppb standard for toluene and xylene. Curiously, one of the hits on 7/5 was tap water from the CCE office, which the lab reported a 1 ppb concentration of o-xylene. While the immunoassay scan yielded detectable concentrations in 10 out of 21 samples, these results were contrary to samples collected at the same location and analyzed using the EPA approved 8020 method. One conclusion is that the immunoassay method is not as reliable a method.

Conclusion

Even in the most crowded boating areas during the holiday weekends, non-detectable levels of hydrocarbons were found. While these results seem to indicate that motorboating does not negatively pollute the lake with hydrocarbons, one should be cautious to make any concrete conclusions from one year of testing data. These results are also not consistent with Canandaigua Lake where consistently much higher levels of hydrocarbons were reported.

Indmar's ETX/CAT Catalyst Technology Wins 2006 IBEX Environmental Innovation Award

ETX/CAT (Extreme Tuned Exhaust with Catalyst) by marine engine manufacturer Indmar Products Company, Inc. has won the 2006 IBEX Environmental Innovation Award at the recent International Boatbuilders Exhibition & Conference (IBEX) held November 1-3, 2006 in Miami Beach, FL.

ETX/CAT BY Indmar, patent pending, is the marine industry's first and only catalytic converter system for gasoline inboard/sterndrive marine engines. Its innovative "green" technology reduces exhaust emissions to less than half of the hydrocarbons (HC) and oxides of nitrogen (NOx) over engines of previous years. ETX/CAT's most dramatic achievement for boater safety is its ability to reduce poisonous carbon monoxide (CO) gases by up to 98% in all part-throttle operating modes. And thanks to the system's non-restricting "header" style exhaust, there is no engine power loss.

Indmar engines fitted with ETX/CAT meet all federal Environmental Protection Agency (EPA) emission requirements for 2008. And these are the only inboard marine engines to achieve a Four-Star, Super-Ultra-Low Emission rating by the California Air Resources Board (CARB) for 2007.

"This Environmental Innovation Award for Indmar's ETX/CAT is really a win/win for everyone; the industry, our OEM builders, boaters and the environment we all share", said Richard C. "Dick" Rowe, Indmar founder.

The 2006 IBEX Environmental Innovation Award is organized by the National Marine Manufacturer's Association (NMMA). Selection is made by a panel of seven Boating Writers International (BWI) members representing editors and writers who are experts in a variety of recreational marine technologies.

Earlier this year Indmar's ETX/CAT was recognized by both the Environmental Protection Agency (EPA) and the US Coast Guard for developing the first clean catalytic marine engine, hailing it as a groundbreaking step that will take the boating industry into a new era of engine safety and offer substantial air quality benefits.

All 2007 model Indmar 5.7L Premium EFI V-8 engines feature ETX/CAT as standard equipment.

Ethanol Fuel Attacks Outboard Engines, Inboard Engines and Fuel Tanks

Blended fuels present new, and potentially costly, problems for gasoline engines.

Who wouldn't accept with open arms a renewable product that is produced right here in the United States, reduces our dependency on foreign oil, and reduces pollution? You've probably already heard of biodiesel, a fuel made from, among other things, soybeans and used deep-fryer oils. Similarly, ethanol or ethyl alcohol is made from various agricultural products such as sugar cane and corn. (It's what moonshiners used to make in rural stills in the early part of the last century.) Here in the U.S., where huge quantities of corn are grown, this seems like a natural fit. When mixed with gasoline, usually at a 10-percent ratio, it's referred to as either E10 or gasohol. The resulting product, an oxygenate, allows fuel to burn more efficiently and thus produces less pollution.

The main impetus for using or switching to E10 stems from the problems that the previous pollution-reducing additive, MTBE (an acronym for a type of ether and known carcinogen), was causing when it leaked from underground storage tanks into ground water.

The switch to E10 created almost immediate noticeable effects in one of the largest recreational boating regions in the U.S., the Northeast and Long Island Sound. Initially, mixing fuel that contained MTBE and ethanol created a sludgy material that quickly clogged fuel filters, carburetors, and fuel injection systems. Anecdotal evidence suggests that fuel system repairs in this region increased noticeably during the 2005 boating season.

That problem paled in comparison, however, to the effect that E10 appears to be having on the luckless owners of gasoline-powered vessels equipped with fiberglass fuel tanks.

Fiberglass is acknowledged by many boat builders and professionals in the marine industry as the material to use for a "forever tank." It doesn't rust, corrode, or otherwise suffer like other materials. (It fades and needs wax, but that's not an issue for fuel tanks.) Fiberglass fuel tanks are more expensive than other materials such as steel, aluminum, and plastic, and as a result, they often found their way into high-end power cruisers and sport fishing boats such as those made by Hatterass, Bertram, and Chris Craft in the '60s and '70s, along with some later-model small boats like Boston Whalers.

When used to store E10, these fiberglass tanks dissolve, literally. The alcohol, which is a solvent, begins to molecularly disassemble the fiberglass resin matrix. Eventually, the tank may become structurally unstable as it softens, and fuel may begin to leak. A number of cases have already been reported.

As if this isn't bad enough, the dissolved components, styrene and polyester, make their way along with the fuel to the engine. The result is a black, gooey substance that can be found beneath the carburetor and on valves and valve guides. This often leads to valve seizure, poor running, and eventually engine failure. In some cases, repairs are not economically feasible. Ethanol may also damage plastic and rubber components such as fuel lines and filters. Fuel hose that is alcohol-resistant, such as type A1, is usually so labeled.

If you suspect you have fuel in your tank that contains MTBE, try to use it up before refilling with new fuel that may contain ethanol. If you have fiberglass tanks, you will probably be facing the unpleasant task of replacing your fuel tanks with aluminum, upgraded fiberglass, polyethylene, or stainless steel (ABYC now approves stainless steel as long as it's 316L and at least .075 inches thick.)

The final nail in the E10 coffin is ethanol's affinity for water it absorbs it and holds it in suspension, to a point. In some cases, this may be desirable. Some water-absorbing "dry gas" products allow water to be suspended and then burned with the fuel. But too much water can present a problem. If the water content of the tank rises much above 0.5 percent that's half a gallon in a 100-gallon tank the ethanol's water-supporting capacity will be overwhelmed. This is called phase separation. The ethanol/water mix will drop out of the fuel and sink to the bottom of the tank where your engine will suck it up. Engines don't run well, if at all, on this gelatinous mixture. Plus, the remaining fuel in the tank, now devoid of the ethanol, will be of a significantly lower octane rating, as low as 83, which will also lead to running problems.

E10 fuel is apparently less stable than ordinary gasoline, on the order of 60 to 90 days. So some experts are now suggesting, contrary to previously held wisdom, that tanks be stored empty rather than full. A tank full of E10 may spoil, and it will tend to absorb water through fuel vents, leading to more trouble for the tank and the engine. Fuel stabilizers will help and should be used even for short-term fuel storage; however, seasonal lay-up is probably too long to rely on additives.

Evidence indicates that 40 percent of all service stations will be selling E10 by the time you read this, and that number is likely to grow. What's next? E20, and some locations are offering

Alcohol & Boat Engines, Is There Another Way?

By Ryck Lydecker

Federal law says the nation must increase its "biofuel" capacity dramatically in the next decade, but does it have to be ethanol?

It's zero-dark-hundred at an undisclosed marina somewhere on the western shore of the Chesapeake Bay. Two men noiselessly transfer gear from the covered bed of a pickup truck to the cockpit of the non-descript center-console outboard at dockside. Quickly they stow hoses, canisters, and meters, plus vinyl pouches that sprout tubing with stainless-steel fittings. Two others silently remove unmarked barrels from a storage shed, wheeling them toward the boat.

Finally the men whisk a secret weapon known only as "MPSS" aboard, a white metal cabinet the size of a large ice chest. Laid flat on the cockpit sole, it's below sight from curious eyes that may pass in another boat, or attempt to spy from shore.



A veteran Mako 19 powered by a conventional two-stroke outboard, one of three boats used for isobutanol fuel testing. Photo by Emily McKnight

Once loaded, two of the team begins rigging the MPSS to its attendant vinyl bag, the hoses tracing umbilicals to the exhaust system of the 175-hp Evinrude E-Tec engine on the transom. It takes more time to rig a battery of sensors — from water temperature and barometric pressure, to fuel flow and boat speed — but eventually and with little fanfare, the boat heads for a quiet creek that shall remain nameless. Once on the unmarked, one-mile-course track, the boat begins a repetitious navigation routine — up and back, up and back — as team members monitor the MPSS, now sucking samples of engine exhaust into the pouch.

This being mid-week, such boring, back-and-forth operation at various speeds apparently goes unnoticed from shore. Two minutes at 5,000 RPM, five more at 4,000 and so on, through a five-stage protocol from wide-open throttle to idle speed in neutral. After several laps, one crewmember switches out the portable fuel tank while another screws tubes from a fresh pouch into the MPSS. The routine repeats, lap after measured lap, until the technical appetites of both pouches are satiated and the boat heads back to the dock.

There, while two men unload equipment and reconfigure the boat to its inconspicuous, every-day appearance, the other two whisk the pouches into the truck. They head south where a late-night rendezvous with a gas-mass spectrometer awaits at an undisclosed lab three hours away. Anticipation in the truck is electric. The secrets the two pouches hold could do no less than revolutionize recreational boating.

Team Biobutanol

All melodrama, intrigue, and clandestine-op allusions aside, the description above is a slightly embellished version of how three marine-industry engineers put together their equipment and expertise in an effort to solve the problem an ethanol increase in gasoline poses for boat-engine manufacturers and boat owners. After a series of on-the-water evaluations and laboratory tests conducted over the summer with, not ethanol, but another alcohol derivative called isobutanol, it turns out they may be on to something.



Evinrude engineer Jeff Wasil loads a fresh emissions-trapping pouch into the Marine Portable Sampling System (MPSS) that he designed.

"We know that increasing ethanol content in gasoline to 15 percent wouldn't be good for modern marine engines, which today are designed to run on 10-percent ethanol," reported John McKnight, environmental and safety compliance director for the National Marine Manufacturers Association, who helped organize the on-the-water evaluations. "Ethanol adds oxygen, making engines run hotter, so if they increase the amount to 15 percent in the gasoline, that could lead to mechanical failures." McKnight is referring to the ethanol industry pressing to raise the content to 15 percent, and the partial approval for that given last year by the U.S. Environmental Protection Agency.

"The National Renewable Energy lab sanctioned a series of performance and durability tests on both two- and four-stroke outboards (see sidebar) and we know that E15 can seriously damage those engines," McKnight added. "Right now in the U.S. we use 14 billion gallons of corn-based ethanol in gasoline, but the nation is under a federal mandate to increase biofuel consumption to 36 billion gallons by 2022. So we thought it was time to look for an alternative to ethanol, and after analyzing our tests of last summer, we may have found just that in isobutanol."

Although discovery of isobutanol as a byproduct of plant fermentation goes back to 1861, it's only due to innovations in biology over the past 20 years that it's become a viable and potentially cost-effective fuel source, according to chemical engineer Dave Munz. As a member of the team that conducted the June boat trials, Munz and his company, Gevo, a Colorado-based isobutanol producer, supplied the fuel. Isobutanol, Munz said, is everything ethanol isn't; it's non-hygroscopic, meaning it absorbs little water, and its use would avoid the fuel phase-separation problems in boat engines that aren't run regularly. In addition, isobutanol is not as potent a solvent as ethanol, so it might be the panacea for older boats with fiberglass fuel tanks.

From a distribution-cost perspective, Munz explains that because isobutanol is less corrosive than ethanol, it can be shipped by pipeline as opposed to the more expensive truck and rail transportation that ethanol demands. "We think it can solve a lot of problems for the fuel industry, as well as for the consumer," he adds.

The EPA has ruled that isobutanol, even at a higher percentage, is a "substantially similar" fuel, meaning that small retailers like rural convenience stores and marinas should not have to retrofit or replace their gas pumps, which can help keep prices down. That "higher percentage" is one of isobutanol's chief advantages: It's got 30 percent more energy than ethanol.

Fuel Of The Future?

Gevo, in fact, supplied isobutanol fuel for an entire summer of testing, according to John Adey, technical director for the American Boat and Yacht Council and a member of our BoatUS Magazine tech team writing "Ask The Experts." Adey handled logistics for the four-month project and designed test protocols that put three boats through their paces on isobutanol.

"By the time we were done in September, we'd gone through about 800 gallons of isobutanol-enhanced fuel," Adey reported. "We wanted to conduct the scientific emissions tests, but also just to operate the boats on this fuel the same way regular boaters would during a summer." Adey's work actually started in March, prepping the boats: a Mako 19 with a 175-hp Evinrude E-Tec, two-stroke outboard; an 18-foot Sea Ray with 135-hp Mercruiser inboard/outboard power; and a 23-foot Sea Doo with twin 215-hp Rotax engines driving its jet pump. In addition to the calibrated and controlled emissions testing in June, Adey, McKnight, and others (including a few BoatUS staff who were asked to help) logged 40 hours, what EPA determines the average "seasonal life" for recreational boat engines, on each boat.



Volvo Penta engineer Rich Kolb (standing) operated the Mako during June exercises to capture engine emissions for later testing at the firm's laboratory in Virginia.

The June emissions testing with the Mako provided a baseline for the entire summer suite of evaluations. According to Jeff Wasil, engineering technical expert for Evinrude Marine Engines, and inventor of the MPSS, which stands for Marine Portable Sampling System, the first "bag run" captured exhaust with the engine burning a pure, EPA-approved, test gasoline called Indolene.

"Two years ago we investigated how isobutanol would work in one of our outboards and its properties seemed much better suited for marine engines," Wasil said. "We found no appreciable changes in emissions and because you get more energy without more pollution, and with a fuel

that appears to be more compatible with marine engines, isobutanol looks more promising than ever as a replacement for ethanol."

Coming To A Pump Near You?

Wasil notes that the U.S. Department of Energy has designated isobutanol a "drop-in fuel," meaning that it can be used to displace petroleum under the Energy Independence and Security Act of 2007, and increasing its use could help reduce greenhouse-gas emissions faster as well. It can be produced from agricultural waste products like corn stalks, or from switch grass and wood chips. At last count at least 10 companies worldwide, including a BP-Dupont joint venture called Butamax were working toward commercializing isobutanol in the next few years, according to chemical-industry reports.

"There is no need to rush E15 into the marketplace," Wasil told the House Subcommittee on Energy and Environment in testimony for NMMA last July 7. He appeared before the panel to address the risks of the EPA's "partial wavier" allowing 15-percent ethanol fuel, or E15, to be used in some engines and not others. He told lawmakers, "Let's have a strategic pause while more testing is done to determine the effects of E15 on various kinds of engines and to see whether there might be alternatives to ethanol, such as isobutanol."

With the baseline emissions tests quite literally in the bag and a full summer of routine operation logged on all three boats, at press time Team Isobutanol planned to conduct the emissions test sequence again and look for anomalies. "We want to find out if, after 40 hours of running time, the engines still comply, or if there were any ill-effects," Adey explained in late summer. "So far, the engines are running better than ever. Power is excellent and fuel economy seems improved; in fact, I'm amazed at how great this fuel seems to be."

But if one of the engines doesn't pass the next "bag test," scheduled for the fall, after boating season, Adey said technicians would tear it down and determine how any failures may relate to the fuel. As Wasil put it, "It's important for the marine industry to secure a fuel that we know is going to work in our products and that consumers can depend upon." McKnight said a full report on the project would be ready for presentation at the Miami International Boat Show in February. 🚤

The above article courtesy Boat US

Testimony of David Hilbert
Mercury Marine
Fond du Lac, Wisconsin
before the
Subcommittee on Energy and Environment
Committee on Science, Space, and Technology
United States House of Representatives
November 2, 2011

Good afternoon, Chairman Harris, Ranking Member Miller, other members of the subcommittee.

It is a pleasure to be here this afternoon. My name is David Hilbert and I am a thermodynamic development engineer for Mercury Marine, a division of the Brunswick Corporation, located in Fond du Lac, Wisconsin. Mercury Marine has been a manufacturer of recreational marine engines continuously since 1939, and currently makes and sells more marine engines than any other manufacturer in the world. I am here today to testify on behalf of the National Marine Manufacturers Association, which represents over 1500 boat builders, marine engine, and marine accessory manufacturers.

I was the technical leader of a test of E15 blend fuel in three different Mercury outboard engines. These tests were conducted at the Mercury Marine test facility in Fond du Lac in 2010-2011 by Mercury personnel under contract to the US Department of Energy and coordinated by the National Renewable Energy Lab (NREL). The final report was released by the Department of Energy in October 2011.

The objective of these tests was to understand the effects of running a 15% ethanol blend on outboard marine engines during 300 hours of wide open throttle (WOT) endurance testing—a typical marine engine durability test. Three separate engine families were evaluated. A 9.9 HP carbureted four-stroke engine and a 300 HP supercharged electronic fuel injected (EFI) four-stroke engine represented current products. A 200 HP electronic fuel injected (EFI) two-stroke engine was chosen to represent the legacy products still in widespread use today. Two engines of each family were evaluated. One test engine was endurance tested on E15 fuel, while a second control engine was endurance tested on ethanol-free gasoline.

The primary point to remember when considering this test is that ethanol, in any blend, is an oxygenator. E10 fuel has 3% oxygen while E15 fuel has 5%-6% oxygen. On a typical marine engine, this

additional oxygen makes the fuel burn hotter, and the higher temperatures can reduce the strength of the metallic components. In addition, ethanol can cause compatibility issues with the other materials in the fuel systems because of the chemical interaction.

I would like to show you some photos of the engine components after the endurance testing to illustrate the results of the testing.

We were able to complete the entire 300 hour test running E15 in the 9.9 HP engine. Test results indicated poor running quality, including misfires at the end of the test. The poor run quality caused an increase in exhaust emissions. In addition, there were increased carbon deposits in the engine on the underside of the pistons and on the ends of the rods indicating higher engine temperatures. You can see the difference in the carbon deposits in this photo. Additionally, deterioration of the fuel pump gasket was evident, likely due to material compatibility issues with the fuel blend. This deterioration of the gasket could lead to fuel pump failure, disabling the engine. The effect on the gasket is shown here.

The 300 HP four-stroke supercharged engine did not complete the endurance test on E15 fuel. The engine encountered a valve failure after 285 hours of endurance testing. As you can see from the photos, one valve broke apart, which ended the test, and two others developed cracks. I should mention that these are high-quality valves constructed of inconel, a high-temperature resistant alloy. Even so, when we did metallurgical analysis on this engine, we found that the cause of these fractures was deteriorated mechanical strength due to high metal temperature. The next photos show a comparison of the pistons and connecting rods from the Verado engine, also indicating that the E15 test engine operated at elevated temperatures.

The 200 HP two-stroke engine using E15 fuel also failed to complete the endurance test. It failed a rod bearing at 256 hours of testing, resulting in catastrophic destruction of the engine. You can

see the remains of the bearings in the photos. There was so much damage to the engine that we could not determine the exact cause of failure. It is important to note that two-stroke engines of this architecture mix the fuel and the oil and use that mixture to distribute the oil to the critical interfaces such as the bearings and cylinder walls. Ethanol may have an effect on the dispersion or lubricity of the oil as it is mixed with the fuel. More testing of such engines is necessary to understand the ramifications of an E15 blend fuel on this type of lubrication system, as it is not well understood at this time.

Despite the limited nature of this testing, several significant issues were identified. The testing was done on a small sample of engines running one operating point, wide open throttle. In addition to the need for more 2-stroke lubrication system testing, more testing is needed to understand how E15 fuel affects marine engines during other operating conditions. Examples would include starting, acceleration/deceleration, part-throttle operation, and the effect of E15 fuel on marine engines that are stored with fuel in the system over long periods of time, which occurs regularly with our engines.

What I have presented to you in brief today—and what is available at the NREL website in full—are the results of the limited testing conducted on three of Mercury’s outboard engine families. Changes in fuel formulations and the resulting effects on marine engine operability are of high importance. This study showed how misfueling marine engines currently in use with E15 may cause a variety of issues for owners and can lead to premature engine failure.

Thank you for allowing me the opportunity to testify today.

To see the full report from the testing performed by Mercury Marine on outboard marine engines, please visit the following website:

<http://www.nrel.gov/docs/fy12osti/52577.pdf>

E15 Outboard Marine High Ethanol Fuel Endurance

A study of the effects of running gasoline with 15% ethanol concentration in current production outboard four-stroke marine engines and conventional two-stroke outboard marine engines.

Prepared By:
David Hilbert



Overview

- Test Objective: Run 300 hours of wide-open throttle (WOT) endurance on 3 engine families.
 - Two engines from each family: One on E15 (15% ethanol blend fuel) and the other on pure gasoline.
 - 9.9HP 4-stroke carbureted,
 - 300HP Supercharged 4-stroke "Verado",
 - 200HP 2.5L 2-stroke EFI (represents "legacy" product)
- Engine selection was reviewed and approved by NREL Technical Monitor
- Test standards used were common qualification tests.
- Test regimen was reviewed and approved by NREL Technical Monitor

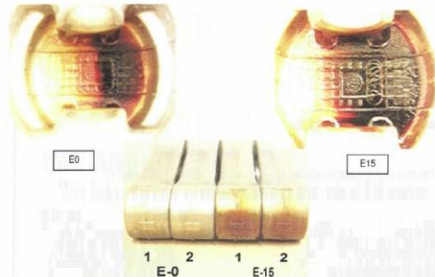


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4/16/2012

9.9HP Carbureted 4-Stroke

- More carbon deposits on piston underside and rods of E15 engine.

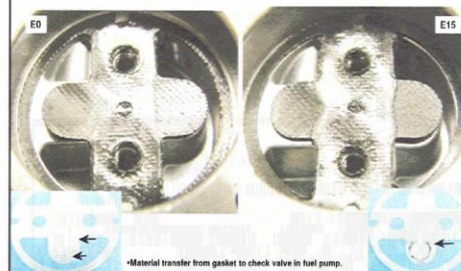


3

4/16/2012

9.9HP Carbureted 4-Stroke

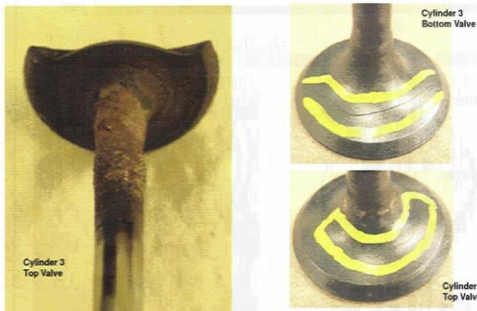
- The fuel pump gasket showed signs of deterioration on the E15 engine compared with the E0 (pure gasoline) engine.



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4/16/2012

300HP Supercharged 4-Stroke "Verado"



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4/16/2012

300HP Supercharged 4-Stroke "Verado"

- Carbon deposits may indicate that the E15 engine's pistons and connecting rods were hotter during operation than those in the E0 engine.



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200HP EFI 2.5L 2-Stroke



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Conclusions and Recommendations Summary

- Despite the limited scope of the project several significant issues were discovered.
- More testing is necessary to understand effects on:
 - Lubrication system in 2-stroke engines
 - "Driveability"- Examples: cold and hot start, acceleration, deceleration, etc.
 - Similar testing by Volvo Penta indicated difficulty starting the E15 engine.¹
 - Storage (phase separation, corrosion, etc.)

Source 1: M. Cahoon, R. Kolb, and G. Zoubul, Volvo Penta 4.3 LG E15 Emissions and Durability Test, NREL SR-5400-32577, October 2011

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<http://www.nrel.gov/docs/fy12osti/52577.pdf>

(1) Register of Environment Literature

Information pertaining to the resources listed below may be obtained by
contacting IWWF@IWWF.com

Country	Date/year issued	Title	
Australia	1989	Safe Boating Handbook	MSB
		Keep Soundwaves Down	
		Preventing WaterWays Pollution-Boaters Guide	MSB
		Preventing WaterWays Pollution	MSB
		Water Skisafety	
	9/1996 1996 11/1997 8/1993 10/1992 4/1994	Waterways - Report on Noise Control	New South Wales
		Water Ski Safety	
		Waterways - report on Noise Control	New South Wales
		Hawkesbury Nepean Management Control	Protocol
		" " "	Draft report
		Analysis of Pollution from Marine Engines & effects on the Environment	
		River Murray Boating Management	
		Greenburg River Estuary Management	
Canada	1998	The Environment Boater Guide	
Belgium/ Netherlands	6/1993	Technical Research re Literature Studies Greenwich Research *	Letters Article
	7/1994	Positive Environmental Effect of Pleasure Boating Study on Exhaust regulations for Pleasure Boats	Pieter van Donkelaar Greentech
	12/1991	Propulsion Engines -TNO Road Vehicles Research	
	7/1980	Cable ski and Water Ecology	Council of Europe
	2/1989	Access to Aquatic Nature	
	8/1989	Maasmechelen and Frogs	
	8/1992	Sport Information on Germany *	
	9/1996	CableSki	Lakens Douwes
France	2/1989	Water Skiing and the Environment	Howard Pearce
	6/1996	Gendarmerie et Environment Ecologie	Ministry of defense Ski Naurique
Germany	2/1992	Report on WaterSkiing to Ministry	

	4-5/1993	Bodensee and Ecology	Articles
	4/1993	Bodensee- Business boating Report	
	Feb-00	Agenda	Magazine
Greece	7/1993	Environment Impact Assessment	
	6/1993	Update - General	
Italy	6/1998	Sport for the Environment	FISN for Euro Conference
	10/1991	Report translated into Italian	Keith Rose
	5/1995	Resume of Reports for FISN	?
New Zealand	Summer 1987	Recreation & Water Appearance	W N Vant
	1/1998	Water Appearance and Recreational Use on 10 Lakes of North Island	Vant and Davies Culley
South Africa	Post 1997	Zoning on Buffelspoort dam	
	12/1993	Working Group Investigation on Draft Legislation for small vessels on Inland Waters	
United Kingdom	1991	Sport & Recreation in the Countryside	Central Council of Physical recreation
	.4/1994	Club Survey on Lake Windemere	BWSF
	1995	British Waterways	CCPR
	.1/1996	Special Areas of Conservation	Dept. of Environment
	1991	Heritage Coasts Policies	Countryside Commission
	.2/1995	Environment Impact of Leisure Activities	Evidence for BWSF
	.1/1991	Outdoor Areas of Special Importance for Sport	Loughborough University
	.12/1988	Sport recreation and Nature Conservation	UK Sports Council Study
	.12/1993	Club of the Year	Article
		Environmental Practice - What does it do	
	.4/1989	Code of Practice	BWSF
	.4/1998	Environmental Noise Impact Assessment	Holmpierreport
	.4/1995	Guidance to the Environmental Agency on Sustainable Development	DoE
	.9/1995	Broads Authority Water Ski Project	Survey
	post 1997	Agenda for Sport & the Environment	UK Sports Council
	.7/1995	Environmental Impact of Leisure Activities	House of Commons
			4th Report
	.6/1991	Sport & Recreation in the Countryside	CCPR Conference
	.5/1993	International Boat Industry	Magazine
	1991	Estuaries Wildlife & Man	Nature Conservancy Council
		Sport, Recreation and Nature Conservation	UK Sports Council Leaflet
			Water Space Amenity Commission
	1978	Water Skiing - Trials & Guidelines	Howard Pearce
	1989	Water Skiing & the Environment	Keith Rose
	10/1971	Pollution and Sound Level Tests	Keith Rose
	6/1973	" " "	Keith Rose

	1992	the Countryside Resource	UK Sports Council
	6/1993	Lake Windemere - Second Discussion	Environment Council
	3/1998	The Broads - Report by Management Team	Environment Council
	6/1991	Special Scientific Interest	CCPR
	10/1995	Regional Environment Protection	CCPR
	11/1995	Regional Environment Protection	CCPR
	6/1992	Waterskiing and its Impact on the Environment - Scope of Study	UK CEED
	8/1999	Water Skiing on the Broads - Survey of Boat owners	Sport England
	7/1997	Impact of water Skiing on the Broads	Broads Authority
	7/1994	Windemere Public Enquiry - Management Plan	Sports Council
	6/1999	Water, Environment & Health	Conference
	2/1995	Noise - Nuisance/Disturbance/Annoyance	Berriman
	2/2000	Water, Leisure & Landscapes	ILAM
	7/1991	Blue green Algae	National Rivers Assoc
	1/1994	Safety & Code of Practice	BWSF
	10&11 1995	Noise Correspondence GB & Belgium	
	11/1996	Noise	Broads Authority
	3/1992	Provision for Powered Water Sport in Environmentally Sensitive Areas	Sports Council
	4/1989	Waterskiing and Wildlife - article	WaterSki International
	1/1996	Toxic Blooms	British water Skier
		Ski Boat Driver Award - BWSF	
		Candidates Manual -3rd	
		Lake District leads the way	LARA News
	May-79	Noise & Emission Tests - Holmepierrepont	
	Jun-82	_ Kielder Reservoir	
	Oct-82	- Thorpe on the Hill	
		- Pentney	
	08/84	Lakes	
	07/85	- Bottoms Reservoir	
	05/87	- Toun Loch, Dunfermline	
	5/4/1995	Noise Code of Practice	Correspondence
	Apr-92	Waterskiing & the Environment	
		Literature Search	UK Sports Council
	Apr-91	S S I - Planning Control	
	1992	Future of Waterskiing in National Parks	
	Mar-95	House of Commons -Environment Committee	Minutes
	Oct-91	The Environment Agency	Dept of the Environment
	Feb-97	Windemere Speed Limit	Judicial review
	Nov-96	Noise Code of practice	NS Clear Air
	Jun-92	Windemere - Whatever happens	Water ski International
	Sep-94	Denham green - Proposal for waterskiing & Nature Conservation	
USA	May-94	Why Outboards are in dispute	
	To April 1991	Waterways Education -Series of Articles	AWSA
	Apr-92	" "	The Water Skier

	Mar-81	Environment Literature List- AWSA	Bob Corson
	Jun-91	Ski Laws - The Good, Bad & Ugly	Boating Industry
	?1993	Polluting for Pleasure	Andre Mele
	? 2002	Waterways Education Manual	USAWS
	Post 4/1971	Analysis of Pollution from Marine Engines	US Environment Protection Agency
	1969	Effect on Power Boat Fuel Exhaust on Florida Lakes	Marine Exhaust Research Council
	1988/9	The Battle of the Banks	AWSA Water Skier
	Nov 1971	The Mercury Project	1971 State Conference
		Our Concern	Boat Law Administrations
		Ficht ram Fuel Injection	OMC
	1991	Legal Source Document	AWSA
	May-94	Recreational Boating, Disturbances of Natural Communities & Wildlife	
	Jul-98	Available Resources 6 part series	AWSA
		Four Stroke v Ficht	Trailer Boats
		Water pollution & Marine Life - Lake X	?
	May-94	Complexity of Noise	HS Larsen - US
			Boating Industry Assn
	Jan-99	Dockside Comparison	Marine Business Academy
	1998	Dirty Deeds - Will California kill the 2 stroke	
	1982/1995	Articles	Waterskier -AWSA
	?	Two Strokes - various Bibliography	
IOC	Jun-96	WFSG1 - Article - IOC Establishes Environment Commission	
	Mar-93	L'Environnement - Olympic message Sport for Sustainable Development IOC Agenda 21	
	1997	Sport & the Environment	
	Jul-98	Sport Europe	
	1995	World Conference on Sport & the Environment	Report
	1997	2nd World Conference on Sport & the Environment	Report
	1994/95/96	WFSG1 - News Bulletins x 3	
ICOMIA-BMIF	Jun-93	Recreational Motorboat - Sound Test	Report
	1992	Guide to Boating & the Environment	
	Apr-94	Introduction	Van den Eyden (Bel)
		*	
		*	
		*	
		Recreation in a Marine Environment- with literature list to March 1996	
	Post 1976	Towards a Sound Marine Environment	

	Aug-94	Boating Industry & the Marine Environment	
Various			
USSR	Post 1994	Ecological Effects on Creation of Sports Facilities Net	Kiezmichova
Switzerland	May-94	Ecowave Newsletter articles	
EAME	Jan-89	Seminar in Greece	
Norway	Jun-84	Report	
IWWF	Oct-93	Questionnaire to Boat engine Manufacturers	Replies
Portugal	Jun-05	The Water Manifesto - Right to Life	Soares
Kuwait	Jun-05	Establishing Environment Public Authority and Policies and Objectives	
UN	1997	Our Planet- UN Environment Programme	
EU	Jul-91	The European Community & Sport	
IWWF	Set/Nov 1992	Letters leading to Questionnaire	
Norway	Jan-97	Site Situation	
Norway	Oct-80		

APPENDIX H

GRONLUND CASE STUDY

STATE OF FLORIDA
DIVISION OF ADMINISTRATIVE HEARINGS
PHILLIP BUCHNER, STAN KRUPSKI,)
and JACK K. AUSTIN,)

)
Petitioners,)

)
vs.) Case Nos. 02-2940
) 02-2941

MARK GRONLUND and DEPARTMENT OF)
ENVIRONMENTAL PROTECTION,)

)
Respondents.)

_____)

RECOMMENDED ORDER

On September 27, 2002, final administrative hearing was held in this case in Leesburg, Florida, before J. Lawrence Johnston, Administrative Law Judge, Division of Administrative Hearings.

APPEARANCES

For Petitioners: Stan Krupski, pro se
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Umatilla, Florida 32784

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For Respondent Department of Environmental Protection:
Craig D. Varn, Esquire
Department of Environmental Protection
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Mail Station 35
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For Respondent Mark Gronlund:
Mark Gronlund, pro se
Post Office Box 1476
Umatilla, Florida 32784

STATEMENT OF THE ISSUE

The issue in this case is whether Respondent, the Department of Environmental Protection (DEP), should grant the application of Respondent, Mark Gronlund, to modify his Standard General Environmental Resource Permit for water ski jump and slalom courses on Lake Blanchester in Lake County, Florida, to increase the size of the jump course and combine it with a new slalom course, so that buoys are shared by the two courses, and to add gate alignment buoys to the existing slalom course.

PRELIMINARY STATEMENT

DEP gave notice of intent to issue the requested modification, and two timely requests for an administrative hearing contesting both the existing permit and the proposed modification were filed by neighbors of Gronlund who reside on Lake Blanchester--one by Phillip Buchner, and a second by Stan Krupski and Jack K. Austin. On July 23, 2002, DEP referred the requests to the Division of Administrative Hearings (DOAH) for assignment of an administrative law judge. Buchner's request was given DOAH Case No. 02-2940; the request by Krupski and Austin was given DOAH Case No. 02-2941. The cases

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were consolidated and scheduled for final hearing on September 27, 2002. A Joint Prehearing Statement was filed on September 11, 2002.

On September 25, 2002, Krupski filed a Request for Continuance on behalf of all Petitioners, and Gronlund filed an objection, a telephone hearing was held, and the Request for Continuance was denied.

At final hearing, Gronlund called six witnesses and had Applicant Exhibits 1-7 admitted in evidence. DEP called one witness (DEP Environmental Manager, Tammy Dabu) and had DEP Exhibits 1-4 admitted in evidence. Krupski called one witness (Bobby Grinstead, a fisheries biologist), had Krupski Exhibits 1-5 admitted in evidence, and testified in his own behalf, as did Buchner.

No transcript of the final hearing was requested, and the parties were given until October 7, 2002, to file proposed recommended orders (PROs). DEP timely filed a PRO; Krupski and Buchner filed written argument. The post-hearing submissions have been fully considered, along with the oral argument and evidence presented at final hearing.

FINDINGS OF FACT

1. Mark Gronlund owns property which includes some lake bottom and shoreline at the southeast corner of Lake

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Blanchester in Lake County, Florida. His property also

includes a residence on the uplands.

2. Lake Blanchester is a small, Class III waterbody located in Section 20, Township 18S, Range 27E in Lake County. It is not classified as an Outstanding Florida Water. It is roughly triangular in shape, with angles roughly in the west, southeast, and northeast. The eastern shoreline of the lake appears to be approximately 2400 feet in length; the southern shoreline is longer, about 3200 feet; the northern shoreline is in between, approximately 2800 feet long. The lake bottom is not owned by the State of Florida; instead, it appears to be owned by individual riparian owners around the lake.

3. Other than Gronlund's courses and proposed courses, there are no other water ski courses on Lake Blanchester. There also are no others under construction, and there was no evidence of any reason to expect other courses in the future.

Existing Permit

4. On June 21, 2000, DEP issued Gronlund a Standard General Environmental Resource Permit, No. 35-167439-001, to construct a private, single-family use only dock, a boat ramp, and skiing facilities in Lake Blanchester. The permitted skiing facilities consisted of "a 850 feet long by 75 feet 5 1/2 inches wide slalom course and 623 feet long by 74 feet 10 inches wide ski jump course that is equipped with a 24 feet 5

long by 25 feet wide ski jump ramp. The slalom course will comprise 22 buoys and the ski jump course will comprise 7 buoys. All buoys are 8 inches in diameter and anchored to the bottom of Lake Blanchester with galvanized screws."

5. The permitted ski slalom course was oriented approximately parallel to the southern shoreline of the lake, at least 350 feet from the shoreline, apparently over and on lake bottom owned by riparian owners along the southern shoreline of the lake. The ski jump course was oriented approximately south-southeast to north-northwest. One end of the jump course was near the southeast corner of the lake, near Gronlund's property, approximately 350 feet from the shoreline; from there, the course angled slightly away from the eastern shoreline of the lake towards the north-northwest, so that the other end of the course was well over 350 feet from the eastern shoreline of the lake. Despite the proximity of the jump course to Gronlund's property, because Gronlund appears to own so little lake bottom, the entire jump course also appears to be located on and over lake bottom owned by his neighbors.

6. Among other general conditions, the permit limited Gronlund to implementation of the plans, specifications, and

performance criteria approved by the permit; deviations would constitute a violation of the permit. General and special

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conditions also required permitted activities to be conducted in a manner so as not to cause violations of state water quality standards. Gronlund also was advised by a general condition of the permit: "This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrances upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and chapter 40C-4 or chapter 40C-40, F.A.C."

Permit Violations

7. After issuance of the permit, DEP received complaints about Gronlund's activities. First, and most significant, it was alleged that Gronlund was clearing most of his shoreline (approximately 500 linear feet) and was placing sand on it without a permit. It also was alleged that his dock structure was larger than permitted and that he added unauthorized buoys to his ski jump and slalom courses.

8. DEP's investigation of the first complaint confirmed a violation. It appears from the evidence that Gronlund began to take corrective action to restore his disturbed shoreline while DEP was investigating. It also appears from the evidence that DEP's enforcement section ultimately required Gronlund to restore at least part of his shoreline. The

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details of DEP's requirements for restoration and Gronlund's performance of restoration requirements are not clear. The testimony presented by Petitioners was that the restoration does not yet match conditions before Gronlund cleared the shoreline. But DEP's witness testified that, according to DEP's enforcement section, Gronlund was in compliance with the terms of the consent agreement entered into to resolve that complaint as of September 19, 2002.¹

9. It does not appear from the evidence that Gronlund's dock itself was oversized. However, it appears that Gronlund included a pole and swing structure that was not included on the permit drawings and might constitute a violation. DEP's witness characterized the issue as a possible enforcement matter.

10. It is not clear from the evidence when Gronlund began adding buoys to those originally permitted. The first additions probably were for alignment gates for the two existing permitted courses. It appears from the evidence that

Gronlund eventually also put in a new slalom course without authorization; it was not clear from the evidence whether this occurred before or after Gronlund applied for permission to do so. It appears that Gronlund subsequently removed most if not all of the unauthorized surface buoys but that the anchors, polypropylene rope, and sub-buoys remain in place.

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Permit Modification

11. On April 2, 2002, Gronlund applied to modify his ski courses, listing himself and his wife as "Owner(s) of Land." First, he applied to add four buoys and 360 feet of length to the east-west slalom course and to modify the angle of the jump course, bringing it closer to the eastern shoreline. Second, he applied to add a slalom course to the northnorthwest end of the jump course, for a combined jump/slalom course 1615 feet long by 124 feet wide.

12. In response to a request for additional information (RAI), Gronlund explained that the change to the east-west slalom course added two gate alignment buoys and 180 feet in length to either end of that course. He also explained that the new slalom course would have the same number of buoys and length but would share some buoys with the combined jump course, reducing the number of additional buoys and length otherwise required for separate jump and slalom courses.

13. In Gronlund's modification application, the combined jump/slalom course appeared to be less than 250 feet from Gronlund's shoreline and less than 300 feet from some of the shoreline of the riparian owner to Gronlund's immediate north. Petitioner, Buchner, testified that some of the sub-buoys in place at this time actually are only approximately 200 feet from the nearest shoreline. Farther away from Gronlund's

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property, the course's angle to the north-northwest and the eastern shoreline's angle to towards the north-northeast combine to separate the course from the shoreline by more than 300 feet. In his response to DEP's RAI, Gronlund gave assurances that both courses would be least 300 feet from all shorelines, except "at the south end of the [proposed combined] ski course and ski jump ramp [which are] located closer to the shoreline, directly adjacent to the applicant's shoreline . . . to avoid placing the ski jump where it could interfere with other boating traffic."

14. DEP's RAI also asked Gronlund to "provide documentation from other properties [sic] owners with riparian rights to Lake Blanchester, stating no objections to your proposed project." Gronlund's response stated only: "The

other property owners with riparian rights to Lake Blanchester that do not object to my proposed project are the same ones that have not issued any complaints in the two years I have been skiing on the lake."

15. Based on Gronlund's response to DEP's RAI, DEP gave notice of intent to modify Gronlund's permit to allow "62 buoys in Lake Blanchester (26 buoys for the slalom course and 36 buoys in the combined ski/slalom course). These buoys will range in size from 7-9 inches in diameter and will be made of soft, lightweight, plastic. The buoys will be anchored into 10

Lake Blanchester using galvanized screw attached to polypropylene rope, sub-buoys, and rubber strips. This modification will increase the size of the slalom course from 850 feet long by 75 feet and 5.5 inches wide to 1210 feet long by 75 feet and 5.5 inches wide. This modification would increase the size of the ski-course from 623 feet long by 74 feet and 10 inches wide to accommodate the combined ski/slalom course at 1615 feet long by 124 feet wide."

Permit Challenges

16. Petitioners not only seek to have DEP deny Gronlund's application for modification, they also want DEP to revoke Gronlund's existing permit for the ski slalom and jump courses. Except for general testimony from Buchner that he was not aware of Gronlund's original permit application and DEP's notice of intent to issue a permit, Petitioners introduced no evidence as to why any challenge to Gronlund's existing permit should not be considered untimely.

17. Petitioners contended that Gronlund's existing and proposed ski courses themselves interfere with navigation, infringe riparian rights, and are unsightly. There is no contention or evidence that the installation and maintenance of the ski courses themselves cause any significant environmental impacts. However, Petitioners presented evidence in support of their contention that the use of the 11

ski courses will adversely impact water quality, aquatic vegetation, and fish populations. They also contended that use of the ski courses interferes with navigation and other uses of the lake, causes unsafe conditions, infringes riparian rights, and constitutes a trespass on others' property, including the property of Petitioner, Austin.

18. The evidence was that the buoys and ski jump ramp themselves are not navigation hazards. The buoys are tethered in position so that they are half in and half out of the water and easily visible to boaters. If a boat were to approach

close to one, the bow of the boat would likely push the buoy out of the way. Even if a boat made contact with a buoy, the "collision" probably would not even be noticed by the boater since the buoys are made of soft, lightweight plastic. While the jump ramp could cause damage in a collision with a boat, it is easily visible and should not pose a navigation or safety hazard to other boats.

19. The ski courses themselves do not impair access to the lake and do not infringe any riparian rights. While they change the view, the buoys are fairly unobtrusive visually, and the ski jump is comparable to a large dock or boat house.

20. As to Petitioners' contentions regarding the use of the ski courses, it is first noted that all of the alleged impacts are similar to the impacts from skiing on the lake

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without a course (or, for that matter, any other similar operation of a similar boat on the lake). One primary difference is that impacts from use of a course would tend to be repetitive and confined to one part of the lake. Another difference is that, at least for the slalom courses, the tow boat usually accelerates from a stop and decelerates to a stop at the beginning and end of run down the length of the course. (It was not clear from the evidence whether the jump course is used in the same manner.)

21. Petitioners accused Gronlund of dominating Lake Blanchester, causing a hazard to navigation, and infringing riparian rights by his use of the existing and proposed ski courses. Petitioners also accused Gronlund of exacerbating these problems by operating his ski boat in a reckless manner, often illegally without a spotter.

22. Gronlund put on ample evidence that he operates his boat in a safe and considerate manner. When there is no spotter in the boat, the driver utilizes a wide-view mirror to maintain eye contact with the skier, as allowed by law. When possible, Gronlund alerts other boaters on the lake of his intention to use the course and attempts to obtain the other boaters' agreement that Gronlund's skiing will not endanger or interfere with the other boat. Sometimes, Gronlund will

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choose a course he thinks will not conflict with the other boaters.

23. It appears that most of the boating conflicts on the lake to date have been the result of misunderstandings. First, it appears that some other boaters view all slalom skiing and ski jumping as inherently reckless regardless whether standard safety protocols are being used. Secondly,

it appears that boaters sometimes miscommunicate or misinterpret intentions. This type of problem once led Petitioner, Buchner, to erroneously believe that Gronlund's boat was intentionally moving into the way of Buchner's small boat, while the operator of Gronlund's boat thought Buchner was intentionally moving into the way of Gronlund's boat. Third, it appears that Gronlund sometimes thinks other boaters are far enough away not to be disturbed by skiing when the other boater thinks the skiing is still too close. Finally, Gronlund has allowed a neighbor to use Gronlund's boat ramp on occasion, and it is possible that boaters on the lake have mistaken the other boat for Gronlund.

24. Obviously, as a practical matter, when Gronlund's ski courses are in use, no one else can use the part of the lake being used for skiing. But this kind of preemption of part of the lake, which is inherent in any ski course and

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boating in general, does not constitute a navigation hazard or an infringement of riparian rights to access to the lake.

25. Petitioners complained of the noise level generated by Gronlund's use of his ski courses. Gronlund responded with evidence that his boat, a 1997 Ski Nautique, is well-muffled. The decibel level generated when this type of boat passes by at a distance of 25 feet is between the decibel level of normal conversation and the decibel level next to a busy street; when this type of ski boat accelerates away from a location, by the time it is 100 feet away, the decibel level at the starting location already would be lower than normal conversation.

26. Turbulence created by a boat's propeller can cause prop scouring and turbidity, which can adversely impact water quality and fish populations, if the water is shallow enough. But the evidence was that these problems would not be expected in water four or more feet deep. Gronlund reported to DEP that the water in the vicinity of his existing and proposed ski courses ranges from approximately 16-22 feet deep. While Petitioners questioned the accuracy of those reported depths, it appears from the evidence that the water in the vicinity of the ski courses is at least nine feet deep. No prop scouring or turbidity should result from use of the courses.

27. Usually, the impact of waves from a boat's wake would not be expected to create much environmental impact,

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even when the waves reach shallow water. Their impact would not differ much from naturally wind-driven waves. But wind-driven waves depend on wind strength and direction, and the possibility of significant additional turbidity and even

erosion from constant waves generated by a ski boat going back and forth on a ski course cannot be completely disregarded, especially if the course is used a lot.

28. In addition to how often a ski course is used, the impact of wake-generated waves would depend on several other factors as well, including: the size of the wake-generated waves; the proximity of the shallow water; slope of the bottom; the composition of the bottom substrate; and the amount of vegetation present to absorb and attenuate wave energy.

29. Addressing the first factor, a well-designed ski boat such as Gronlund's minimizes the size of the wake. At competition-level slalom speed--approximately 34 miles per hour--the wake directed back towards the skier from Gronlund's boat would be only approximately 3-4 1/2 inches high. (Exact measurement is difficult, but tests of an open-bowed 1995 model Ski Nautique indicated wakes of 4.7 inches at slalom speed. The wake from Gronlund's newer 1997 model, which appears to be closed-bow, would be expected to be lower than that.) A relatively small wake also would be expected at high 16

ski-jumping speed. A larger wake would be generated at the lower speeds skied by younger and less-skilled skiers. Trick skiing also is done at lower speeds, but trick skiing does not occur on a marked course and is not relevant to a permit for a slalom or jump course. But even at lower speeds, the wake directed back towards the skier still would not be extremely high--certainly not as high as 2 1/2 to 3 feet.

30. Petitioners contend that the bow of Gronlund's ski boat throws a larger wake off to the side which is higher than the wake measured behind the boat where the skiing takes place. But the videotape placed in evidence by Gronlund does not support this contention. There does not appear to be any additional wake forward of the wake involved in slalom skiing.

31. The largest wakes are generated during acceleration (before the boat planes off) and deceleration (after it comes off its plane). In slalom skiing at least, the course normally is used repeatedly in alternating directions, with a stop between runs.² As a result, the ski boat accelerates at the beginning and decelerates at the end of each run down the length of the course. But even then, it does not appear from the videotape that the wake generated at those times is very large or that it remain larger for very long.

32. Addressing the other factors, the closest shallow water to the existing and proposed ski courses would be the

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nearest shoreline of Lake Blanchester. Based on the evidence, much of the lake bottom near the shoreline is relatively silty (except where Gronlund placed sand on his property), which increases the likelihood of erosion and turbidity. But the slope of the shoreline bottom is relatively gentle; and there is considerable vegetation (including maiden cane, native rushes, and spatterdock) along the eastern shore of Lake Blanchester (again, except where Gronlund cleared his shoreline), and the vegetation along the southern shoreline of the lake is even denser, reducing the likelihood of erosion and turbidity.

33. Krupski's witness, Bobby Grinstead, who is a fisheries biologist, testified that Lake Blanchester is a "perched lake" which is high in acidity and low in nutrients, making its shoreline relatively fragile. It was his opinion that adverse impacts on aquatic flora and fauna (primarily, fish) can be expected from use of Gronlund's ski courses. But DEP's witness, who has had considerable experience reviewing similar applications, disagreed; instead, she supported the testimony of Gronlund's witness, based on a literature review, that no adverse environmental impacts should be expected from use of Gronlund's course. Based on all of the evidence, it is found that Gronlund gave reasonable assurances that his existing and proposed ski courses will not result in

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significant adverse impacts to water quality, aquatic vegetation, or fish populations.

34. As found, Gronlund gave reasonable assurance that his proposed ski courses will not adversely impact navigation, public safety, or riparian rights of neighbors. However, as noted, the courses are placed on and over lake bottom owned by persons other than Gronlund. It is not clear that Gronlund has the permission of these owners to put his courses on their property. At least one of these owners--namely, Petitioner, Austin--clearly objects.

Need for Additional Condition

35. To address some of Petitioners' concerns, Gronlund presented evidence that he actually has spent relatively little time skiing on the lake--approximately 300 engine hours, including engine warm-up time, time to the course, time picking up skiers (after each trip down the course), and time returning to the dock), in two and one-half years. Gronlund's evidence also refuted Petitioners' contention that Gronlund is operating a ski school out of his house--to date, Gronlund has used the facilities by himself, with a ski partner, and with his immediate family. Gronlund's purpose in presenting this

evidence was to assure Petitioners and DEP that he plans to continue to use his courses in a similar manner.

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36. Gronlund also devoted a great deal of his presentation to evidence of how important it is to the continued success of competitive skiing, as well as the ski industry as a whole, in this country, for his application (and others like his) to be granted. His evidence emphasized the world water skiing championships being held in Lake County in 2003, and their expected contribution to the local economy. Those aspects of Gronlund's presentation raised some question as to the reliability of Gronlund's assurances that his relatively elaborate proposed ski facilities will only be for personal use in the future. To allay these concerns, and to assure that the ski courses are operated as represented by Gronlund, an additional permit condition to that effect would be appropriate.

CONCLUSIONS OF LAW

37. The evidence was that Petitioners' challenges to Gronlund's existing permit were untimely. In addition, Petitioners do not have standing to initiate a proceeding to revoke an existing permit. Only DEP has such standing. See *Friends of the Robert Crown Wilderness Area, Inc., v. Dept. of Environmental Reg.*, OGC Case No. 89-0068, 1989 WL 197902 (DER 1989), *aff'd*, 558 So. 2d 20 (Fla. 1st DCA 1990). As a result, Petitioners' challenges must be limited to the modification application.

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38. Sections 403.087(1) and 373.413, Florida Statutes, and the pertinent administrative rules, required Gronlund to obtain a permit for his water ski jump and slalom courses. Florida Administrative Code Rule 62-312.815 grants a general permit for ski jumps and slalom courses, but Gronlund does not seek to use this general permit. For one thing, the general permit cannot be used under Rule 62-312.815(1)(c) because part of the proposed combined jump/slalom course is not "placed at least three hundred (300) feet from any shoreline that is not under the ownership or control of the permittee" For another, the general permit also was not utilized for the existing permit (although the existing ski courses appear to have been placed arguably at least 300 feet from "any shoreline" not owned or controlled by Gronlund). Instead, the existing ski jump and slalom courses were included in Gronlund's Standard General Environmental Resource Permit, No. 35-167439-001, which also included Gronlund's private, singlefamily use dock and boat ramp, and his proposed ski courses

were processed as a modification of the existing Standard General Environmental Resource Permit--apparently as a major modification under Florida Administrative Code Rule 62-343.100(1)(b).

39. DEP only cited two statutes and one rule in its PRO. (Krupski cited one in post-hearing argument, and no other
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party cited any.) But it actually appears necessary to follow a complicated maze of administrative rules to ascertain the applicable law in this case.

40. Since Gronlund's Standard General Permit was required in part by Section 373.413, Florida Statutes, most of Parts I and III of DEP's Florida Administrative Code Rule Chapter 62-4 do not apply. See Florida Administrative Code Rules 62-4.001 and 62-4.510. Instead, certain rules of the St. Johns River Water Management District, including those cited *infra*, are adopted by reference for use in this case in conjunction with applicable DEP rules.

41. Since Gronlund was issued a standard general permit, Florida Administrative Code Rule 40C-40.302 might apply.³ This rule states: "To qualify for a standard permit under this chapter, the permittee must give reasonable assurances that the surface water management system meets subsection (1) and all of the threshold conditions of subsection (2)." But Gronlund's proposed ski courses is not a surface water management system. In addition, by its terms, Section (1) of the Rule applies to surface water management systems; and the threshold conditions in subsection (2) do not seem at all applicable to ski jump and slalom courses. However, while referring to conditions that must be met by a surface water management system, subsection (1) references the conditions
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for issuance specified in Florida Administrative Code Rules 40C-4.301 and 40C-4.302, some of which appear to be applicable to a ski jump and slalom course.

42. Pertinent to this case, Rule 40C-4.301 requires applicants for "a standard individual, or conceptual approval permit under this chapter or Chapter 40C-40" to provide reasonable assurance that a surface water management system:

- (d) Will not adversely impact the value of functions provided to fish and wildlife and listed species by wetlands and other surface waters;
- (e) Will not adversely affect the quality of receiving waters such that the water qualify standards set for the in Chapters

62-3, 62-4, 62-302, 62-520, 62-522, and 62-550, F.A.C., including any antidegradation provisions of paragraphs 62-4.242(1)(a) and (b), subsections 62-4.242(2) and (3), and Rule 62-302.300, F.A.C., and any special standards for Outstanding Florida Waters and Outstanding National Resource Waters set forth in subsections 62-4.242(2) and (3), F.A.C., will be violated;

(f) Will not cause adverse secondary impacts to the water resources;

Since Gronlund's proposed ski courses do not appear to constitute a "surface water management system," these rules may not apply. If they do, it is clear from the evidence that there will be no adverse impacts under Subsections (1)(d)-(e) from the installation and maintenance of the ski courses in Class III waters; the only possible consideration would be secondary impacts under Subsection (1)(f).

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43. "Secondary impacts are impacts caused not by the construction of the project itself but by 'other relevant activities very closely linked or causally related to the construction of the project.' See *Conservancy, Inc. v. A. Vernon Allen Builder, Inc.*, 580 So. 2d 772, 777 (Fla. 1st DCA 1991); *Florida Power Corp., Inc. v. Department of Environmental Regulation*, 605 So. 2d 149, 152 (Fla. 1st DCA 1992)." *Deep Lagoon Boat Club, Ltd. v. Sheridan*, 784 So. 2d 1140, 1142 fn.3 (Fla. 2d DCA 1998).

44. The possible secondary impacts from Gronlund's proposed ski courses include impacts on water quality and fish populations from waves generated by boat wakes, impacts on navigation, impacts on safety, noise impacts, and the impact of preemption of part of the lake when the course is in use. But, as found, most of these possible impacts differ little from impacts from skiing on the lake without a course (or, for that matter, any other similar operation of a similar boat on the lake). In addition, Gronlund gave reasonable assurances that there will be no adverse secondary impacts from his use of the proposed ski courses.

45. Rule 40C-4.302 states in pertinent part:

(1) In addition to the conditions set forth in Rule 40C-4.301, F.A.C., in order to obtain a standard individual, or conceptual approval permit under this chapter or Chapter 40C-40, F.A.C., an applicant must provide reasonable assurance

that the construction, alteration, operation, maintenance, removal, and abandonment of a system:

(a) located in, on, or over wetlands or other surface waters will not be contrary to the public interest, or if such an activity significantly degrades or is within an Outstanding Florida Water, that the activity will be clearly in the public interest, as determined by balancing the following criteria as set forth in subsections 12.2.3 through 12.2.3.7 of the Applicant's Handbook: Management and Storage of Surface Waters:

1. Whether the activity will adversely affect the public health, safety, or welfare or the property of others;
 2. Whether the activity will adversely affect the conservation of fish and wildlife, including endangered or threatened species, or their habitats;
 3. Whether the activity will adversely affect navigation or the flow of water or cause harmful erosion or shoaling;
 4. Whether the activity will adversely affect the fishing or recreational values or marine productivity in the vicinity of the activity;
 5. Whether the activity will be of a temporary or permanent nature;
 6. Whether the activity will adversely affect or will enhance significant historical and archaeological resources under the provisions of Section 267.061, FRS.; and
 7. The current condition and relative value of functions being performed by areas affected by the proposed activity.
- (b) Will not cause unacceptable cumulative impacts upon wetlands and other surface waters as set forth in subsections 12.2.8 through 12.2.8.2 of the Applicant's Handbook: Management and Storage of Surface Waters adopted by reference in Rule 40C-4.091, F.A.C.

There is no language in this rule that would limit its application to surface water management systems, and it presumably would apply to Gronlund's proposed ski courses. In addition, the assurance required under Subsection (1)(a) of this rule essentially mirrors the assurance required under Section 373.414(1)(a), Florida Statutes--namely, in this case, reasonable assurance that the "activity regulated" is not contrary to the public interest.

46. If the "activity regulated" was considered to be just the construction and maintenance of the ski facilities, it would be relatively easy to decide that Gronlund's modification application would not be contrary to the public interest. Actual construction and maintenance has very little environmental impact. But DEP's predecessor agency has held: applicant must also show that secondary impacts of the project, and cumulative impacts of reasonably foreseeable similar projects in the same geographical location will not result in violations of water quality standards, and will not result in the project being not clearly in the public interest. *Conservancy, Inc. v. A. Vernon Allen Builder, Inc.*, No. 90-520 (Fla. 1st DCA, March 29, 1991); *Caloosa Property Owners' Ass'n v. Department of Environmental Regulation*, 462 So. 2d 523 (Fla. 1st DCA 1985); Section 403.919, Florida Statutes. The analysis of secondary and cumulative impacts is not a third test; rather, it is a factor to be considered in determining whether reasonable assurance has been provided that the project will not result in violations of water quality standards, and that the

project meets the applicable public interest test. *Conservancy, Inc.*, supra; *Peebles v. Department of Environmental Regulation*, 12 FALR 1961 (DER, April 11, 1990); *Concerned Citizens League of America v. Department of Environmental Regulation*, 11 FALR 4237, 4246 (DER, March 29, 1989). *Sarasota County, et al. v. Dept. of Environmental Reg.*, et al., DOAH Case No. 90-3533, OGC File No. 90-0857, 1991 WL 161053, at *10 (DER Final Order 1991). See also Florida Power

Corporation v. Dept. of Environmental Reg., et al., DOAH Case No. 91-2148, OGC File No. 90-1520, 1992 WL 279020, at *15 (DER Final Order 1992). For this reason, secondary and cumulative impacts must be considered as part of the regulated activity in applying the public interest test.

47. Secondary impacts already have been addressed in Conclusions 43-44, *supra*. "Cumulative impacts analysis involves consideration of 'the cumulative impacts of projects which are existing, under construction or reasonably expected in the future' upon surface waters and wetlands. See, e.g., *Florida Power Corp. v. Dep't of Env'tl. Regulation*, 638 So. 2d 545 (Fla. 1st DCA 1994), *rev. denied*, 650 So. 2d 989 (Fla. 1994)." *Sierra Club v. St. Johns River Water Management District*, 816 So. 2d 687 (Fla. 5th DCA 2002). In this case, there are no other ski jump or slalom courses existing on Lake Blanchester, under construction, or reasonably expected in the

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future. Petitioners' cumulative impact arguments are speculative.

48. Based on the facts of this case, and balancing the factors listed in Section 373.414(1)(a), Florida Statutes, and in Florida Administrative Code Rule 40C-4.302(1), Gronlund's evidence was sufficient to provide reasonable assurance that his proposed ski courses will not be contrary to the public interest.

49. As mentioned, this is not a proceeding to determine whether Gronlund should be allowed to use the general permit for ski jumps and slalom courses granted by Florida Administrative Code Rule 62-312.815. But the requirements for use of the general permit are instructive as to what kind of ski jump and slalom courses would be likely to meet the criteria for issuance of a standard general environmental resource permit for these facilities. As already noted in Conclusion 38, *supra*, Gronlund would not meet the criterion set out in Rule 62-312.815(1)(c). But his proposed ski courses would meet the other criteria for use of the general permit. Otherwise, as found, the proposed modification would not create a navigational hazard or interfere with public use of waters of the state (other than the obvious preemptive use of the waters of the courses while being skied). Also, as

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found, no riparian rights (as opposed to other property rights) would be infringed.

50. As to other property rights, no applicable statute or rule explicitly requires Gronlund to demonstrate ownership or control of the lake bottom on and over which he intends to

place his proposed ski courses. Instead, as found, Gronlund's permit conditions are explicit that the permit does not convey or create any property right, or any interest in real property, or authorize any entrances upon or activities on property which is not owned or controlled by Gronlund. See Finding 6, *supra*. See also Florida Administrative Code Rule 62-343.020(5). Contrast, e.g., Florida Administrative Code Rules 40D-4.101(2) and 40D-1.6105(1). Contrast also *Brown v. Winter Haven Ski Club and Dept. of Environmental Reg.*, DOAH Case No. 82-988, OGC Case 82-0228, 1983 WL 36417, at *2 (DER Final Order 1983)(where Rule 17-1.122(15) required an applicant to execute an "affidavit of ownership or control," which was not done, and DER adopted a Recommended Order to deny a permit for a ski jump and slalom course, stating it "will not knowingly issue a permit for dredging and filling or other activities which would constitute a trespass on private property"). For these reasons, it appears that Gronlund's permit modification can be granted without a showing of ownership or control, leaving those issues to a state circuit

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court in an action in trespass or some other action involving title and boundaries of real property under Section 26.012(2), Florida Statutes.

51. Rule 40C-4.302 states in pertinent part:

(2) When determining whether a permit applicant has provided reasonable assurances that District permitting standards will be met, the District shall take into consideration the applicant's violation of any Department rules adopted pursuant to sections 403.91 -- 403.929, F.S. (1984 Supp.), as amended, which the District had the responsibility to enforce pursuant to delegation, or any District rules adopted pursuant to Part IV, Chapter 373, F.S., relating to any other project or activity and efforts taken by the applicant to resolve these violations. . . .

As found, Gronlund was found to have provided the necessary reasonable assurances after consideration of the pertinent enforcement matters and Gronlund's efforts to resolve them.

RECOMMENDATION

Based upon the foregoing Findings of Fact and Conclusions of Law, it is

RECOMMENDED that the Respondent, the Department of Environmental Protection, enter a final order granting the

application for modification of Standard General Environmental Resource Permit, No. 35-167439-001, with the additional condition that the permitted ski jump and slalom courses will be for personal use only, and will not be used for a ski school or for organized ski tournaments.

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DONE AND ENTERED this 13th day of November, 2002, in Tallahassee, Leon County, Florida.

J. LAWRENCE JOHNSTON
Administrative Law Judge
Division of Administrative Hearings
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Filed with the Clerk of the
Division of Administrative Hearings
this 13th day of November, 2002.

ENDNOTES

1/ Petitioner, Buchner, testified that approximately 92 feet of Gronlund's shoreline remained sandy beach at the time of final hearing. It is not clear from the evidence whether the consent agreement complied with Section 369.20, Florida Statutes, which requires a permit to remove "herbaceous aquatic plants and semiwoody herbaceous plants, such as shrub species and willow" except "within an area delimited by up to 50 percent of the property owner's frontage or 50 feet, whichever is less, and by a sufficient length waterward from, and perpendicular to, the riparian owner's shoreline to create a corridor to allow access for a boat or swimmer to reach open water."

2/ See Endnote 1, *supra*.

3/ According to Rule 40C-40.011, these rules apply to systems which have been determined to be not harmful to the water resources of the water management district and not inconsistent with its objectives.

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NOTICE OF RIGHT TO SUBMIT EXCEPTIONS

All parties have the right to submit written exceptions within 15 days from the date of this Recommended Order. Any exceptions to this Recommended Order should be filed with the agency that will issue the final order in this case.

APPENDIX I



Overview of the Recreational Boating Industry's Aquatic Stewardship through technology, Innovation and Education

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Abstract

This study will provide an overview of the recreational boating industry's contributions to aquatic stewardship and environmental responsibility. It provides a thorough analysis of the boating industry's efforts to promote responsible recreation through the promotion of education and outreach programs, the development and marketing of new, environmentally friendly products and the cooperative efforts of the industry to work in conjunction with state and federal government to institute policies that protect the environment.

I. Introduction

The U.S. recreational marine industry, along with other outdoor recreation interests, has long been faced with the challenge of balancing the need to protect and preserve the environment with the desire to keep outdoor aquatic recreation open and accessible to the American public. Often, these two demands are seen to compete, and are sometimes even viewed as mutually exclusive. The National Marine Manufacturers Association (NMMA), however, takes a different view: environmental protection and open access for boating are mutually reinforcing—two goals which can be achieved by similar means and at the same time. It is the goal of NMMA, the nation's leading recreational marine industry association, to make boating the number one choice in outdoor recreation. With that endeavor comes the responsibility to promote proper, environmentally-sustainable uses of America's aquatic resources.

The National Marine Manufacturers Association (NMMA) is the nation's largest recreational marine industry association, representing more than 1,600 boat builders, engine manufacturers, and marine accessory manufacturers, as well as more than 800 marina operators and owners through its affiliated Association of Marina Industries (AMI). NMMA members collectively produce more than 80 percent of all recreational marine products made in the United States, including boats, engines, and marine accessories and components.

NMMA and its member companies are well aware of the need to promote responsible boating. It has long been the aim of NMMA and the companies, large and small, comprising it to attain this outcome through a variety of mechanisms which at once

serve the environment, the industry and those who depend on it for their economic wellbeing, and the boating enthusiasts who are closest to the resource. To that end, they have been actively involved in advancing the cause of aquatic stewardship through the development and marketing of new, innovative products and through the support of environmental initiatives and outreach.

Environmentally-friendly products are often pursued by companies because there is consumer demand and when companies offer pioneering, state-of-the-art products, they are helping shape consumer preferences. Boaters are increasingly concerned about things like water quality and the protection of important aquatic habitats and ecosystems.¹ Although innovative products initially come with a higher price tag, boaters are demonstrating their commitment to the environment by electing to purchase them. This is consistent with polling which indicates that consumers are increasingly drawn to green marketing campaigns and, given the choice, will opt for environmentally-friendly products and companies most of the time.

The need for these product offerings is abundantly clear. The corporate role in—indeed responsibility for—advancing aquatic stewardship is based centrally on the notion that the making and marketing of advanced, environmentally-safe products constitutes an articulation of the need for responsible recreation and offers consumers the widest possible opportunities to do so. Though central, the corporate role in aquatic stewardship is far greater than simply offering environmentally-sensitive products. Therefore, we outline the marine industry's larger role in aquatic stewardship by discussing a sampling of past and present environmental initiatives as well as attempting to chart a course for future corporate participation in the important task of preserving the beauty and bounty of the world's oceans, lakes, rivers, and coasts—all of which are essential to a thriving recreational marine industry.

Although 70 percent of boating occurs in the nation's lakes, NMMA has taken note of the warnings regarding ocean environmental health issued by the United States Commission on Ocean Policy (USCOP) in its 2004 Final Report to the President and the United States Congress. In that report, which rightly acknowledges that "oceans affect and sustain all life on Earth," the commissioners conclude soberly, and simply, that "our oceans and marine resources are in serious trouble." NMMA has expressed its broad support for nearly all of the Commission's more than 200 recommendations directly to the Bush administration and to key Members of Congress, as well as to the Commission itself. Like our oceans, many of our lakes and rivers are experiencing similar environmental stresses, and users of these resources, federal, state and local agencies, and the public at large must be aggressive in attempting to improve the conditions of all America's aquatic resources. In America's nearly 1,800 federal lakes, which host more than 900 million visits each year and generate over \$44 billion in economic impact,⁷ almost 40 percent are said to suffer from some source of pollution or habitat degradation, while nearly half of America's 2,000 watersheds are "seriously or moderately deficient" in water quality.

II. Boating, A Growth Industry

From the thrills of wakeboarding and waterskiing, to fishing, to simply enjoying the sunshine and fresh air of cruising along the coast, millions of Americans enjoy boats and related recreation every year. In 2005, recreational boating contributed approximately \$37 billion to the nation's economy. The more than 33,000 marine businesses in the United States support some 500,000 well-paying American jobs.¹⁰ The number of boats in use in 2004 was 17.6 million, an increase of 210,000 over 2003 and a more than 12.5 percent increase from 1989.¹¹ There are approximately 71.3 million boaters in the United States.¹² Despite a modest drop in overall boating participation during the past 15 years, it is clear that interest in boating is once again gaining traction among the American public. Certainly, the demographics are ripe for a significant increase in participation, with the baby boomer generation now reaching the age where time and financial resources for boating are no longer constraints but opportunities. NMMA is dedicated to growing boating further and expanding the industry in order to sustain a strong and socially-rewarding American enterprise. But as the popularity of recreational boating grows, so too does the responsibility to effectively foster a national ethic of sound environmental stewardship. To be sure, the boating industry takes this responsibility seriously. The efforts of the boating industry to help foster environmentally-appropriate behaviors among recreational boaters provide the focus for this paper.

The marine industry depends on its users to protect the environment, a behavior that comes naturally to most boaters. On water, especially, every action or sound a boater makes has a potential impact on air and water quality, near-shore and shoreline ecosystems, and the marine life which inhabit them. A responsible, common sense approach to boating will help protect aquatic ecosystems. Clearly, clean water is the foundation for enjoyable boating. At a basic level, it is up to those who appreciate and recognize the privilege of using America's aquatic environments to protect those resources now and for future generations. It is also incumbent upon manufacturers of boats and related products, however, to promote responsible boating practices and manufacture products that help safeguard the environment.

Industry is in a position to be a very positive force in promoting environmental stewardship through the "pursuit of new business opportunities and markets, reduction of operation footprints, development and deployment of new technology, and establishment of effective partnerships. In addition, business can demonstrate leadership in support for and reform of public policy that seeks to raise industry environmental performance standards in order to gain first-mover advantages while improving the reputation of their industry as a whole with important customers and constituencies." In the marine industry, through research and development, testing and employing technology of related industries, propulsion systems are gaining efficiency, waste treatment systems are becoming more effective, and maintenance products are getting greener. Industry workers understand that their livelihood depends on clean water, and that they play a critical role in helping to keep waters clean.

Indeed, it has long been the position of the association that a healthy and clean marine environment makes solid business sense. Not only does careful attention to environmental issues stave off cumbersome government regulations which slow business growth, but without clean and healthy waterways, the desire to boat will

diminish. This outcome would have a direct and negative impact on the boating industry, shrinking the demand for boats, reducing interest in coastal tourism, and slowing the local economies that depend on these industries. Moreover, the marine industry recognizes that it is in the interest of everyone, from boat, engine and accessory manufacturers to boaters themselves, to promote sound environmental policies, enhance environmental awareness, and develop innovative marine technologies which ensure the long-term sustainability of America's aquatic treasures for current and future generations to enjoy. The efforts of the industry to promote sound environmental policies will be explained in further detail in a subsequent section.

Demand for marine products is inextricably tied to the health of marine environments. This linkage affirms the view that businesses in the marine industry are enhanced rather than hindered by adhering to environmental standards and advancing products which protect aquatic resources. This explains why the recreational boating industry has historically been well ahead of the curve in advancing new technologies, meeting new government regulations, and never shying from the apparent challenges associated with maintaining a healthy corporate bottom line as well as a healthy environment. As the entire marine industry embarks on a coordinated, multi-year, multi-million dollar venture to increase interest in boating and create an entirely new crop of boating consumers through the Grow Boating Initiative, it is clear that environmental awareness and corporate environmental responsibility will play a key role in locating new market opportunities, attracting new boaters, and enhancing the overall boating experience.

III. Environmental Challenges for the Boating Industry

In April 2003, *Environmental Health Perspectives*, a journal on environmental and human health, published an article discussing some of the environmental concerns associated with recreational boating. The article, "The Environmental Pain of Pleasure Boating," overly dramatizes and substantially mischaracterizes boating's impact on the environment as "death by a thousand cuts," in which recreational watercrafts "put petroleum products, human and pet waste, trash, and potentially toxic metals into coastal waters, lakes, and rivers," as well as "slice swaths through slow-to-heal marine vegetation" and produce noise that "disturb[s] sea life." The article also impugns marinas, which it says "provide a treasure trove of potential ecological disruptors, including slips, mooring pins, launch ramps, gas docks, sewage pumpout stations (if used improperly), boating supply stores, and boatyards where vessels are repaired and maintained." But the article also notes the considerable progress made by the marine industry and others to mitigate boating's footprint on the environment, and it concludes optimistically with a quote from Andre Mele, an environmentalist who wrote a now hard-to-find book called *Polluting for Pleasure*. Says Mele: "Boaters can be the best conservationists on the water." And increasingly, the recreational marine industry and its manufacturers are providing boaters new products that tap into the innate conservation ethic common to most boaters.

Boating can impact the environment in numerous ways, including air and water pollution, habitat disturbance, fuel and oil spills, trash and other marine debris, and sewage disposal and waste treatment. Recreational boat engines have been identified as a source of air pollution, and older marine engines have an impact on water quality, although that impact is difficult to determine with any precision. While the environmental impacts of petroleum discharges from boats have in many cases been greatly exaggerated, the marine industry has recognized the need to mitigate the risk of fuel spillage, increase the fuel economy of marine engines, and reduce water and air emissions. Manufacturers are promoting new technologies and products to address these challenges in addition to limiting engine pollution; bilge waste, which contains wastewater mixed with oil and fuel; and refueling spills, which leak volatile organic compounds (VOCs) directly into aquatic ecosystems.

The industry is working proactively to promote more effective disposal of maritime trash and sewage; cleaner waste treatments; and the elimination of marine debris, including discarded fishing gear, which can entangle marine wildlife. Marine manufacturers are also developing new products to mitigate the environmental impact of boat cleaners, hull stripping, painting and repair products and antifouling and bottom paints, which can introduce toxins and heavy metals into ecosystems.

IV. The Revolution in Marine Engines & the Selling of Cleaner Boating

In the mid-1990s, the U.S. Environmental Protection Agency (EPA) initiated a rulemaking which had profound implications for boat engine manufacturers. Because, as some studies allege, conventional carbureted two-stroke outboard marine engines release as much as 20-30 percent of fuel directly into the air or water, and consequently emit hydrocarbons (HC) and nitrogen oxide (NOx) into the environment, EPA began consultations with the marine industry to begin a process to address this concern. Working closely with NMMA and marine engine manufacturers, EPA developed regulations in 1996 that should result in an unprecedented 75 percent reduction of hydrocarbon emissions by 2025 from outboard engines, personal watercraft (PWC) engines, and jet boat engines. From 1998 to 2006, the corporate average exhaust emission standards for outboard and PWC marine engine manufacturers become increasingly more stringent, with EPA expecting to achieve the following projected hydrocarbon and NOx reductions nationally: 4 percent in 2000; 26 percent in 2005; 52 percent in 2010; 68 percent in 2015; 73 percent in 2020; and 75 percent in 2025, with the model showing a constant 75 percent reduction in HC and NOx emissions through 2050.

At the time of the rulemaking, the technology to meet EPA standards did not, on the whole, exist—EPA acknowledged then that its emission standard would “require revolutionary technology that does not currently exist across the product line, the lead time for implementation is short, and the targeted reductions across the phase-in are large.” Engine manufacturers responded to the rulemaking by pursuing two key technology advancements: direct fuel injected (DFI) two-stroke engine technology and four-stroke engines. In two-stroke DFI engines, fuel is injected directly into the combustion chamber and burned while the exhaust port is blocked by the piston at the top of its stroke, effectively reducing emissions by preventing unburned fuel from escaping through the exhaust port. Four-stroke engines, like those in a car, are

lubricated by circulating multi-viscosity oil in the engine. These engines require oil changes after a certain period of time, and easily meet EPA's emissions standards. Although four-stroke engines are heavier, more complex, and more expensive than traditional two-stroke engines, they are far quieter, improving the quality of the boating experience and minimizing environmental impacts on sensitive habitats. They are also 40 percent more fuel efficient, lowering fuel costs and significantly limiting pollution impacts. Despite not having technology at the ready when the EPA regulation was finalized, the marine industry's aggressive pursuit of new technology means the four-stroke and DFI two-stroke marine engines available today already meet the EPA emissions standards for 2006.

The EPA rulemaking is so important because of its reach. According to EPA, over ten million marine engines are operated in the United States, contributing to "hydrocarbons (HC) and oxides of nitrogen (NOx) emissions in many areas of the country." Accelerating the retirement of old-technology two-stroke engines is one environmental challenge that remains. Clearly, it is in the business interests of the marine industry to sell the new engine technologies which it has spent so much time and money developing. In this instance, maintaining a healthy corporate bottom line converges with that which is best for the environment. The boating industry is pursuing rapid fleet turnover—that is, the accelerated transition from traditional two-strokes to four-stroke and DFI two-stroke technology—through a variety of channels, including broad-based public relations and marketing efforts, incentive programs, warranty deals, and others. This change in engine technology and the accompanying educational and marketing efforts to prompt consumers to switch from two-stroke to four-stroke engines demonstrates how industry interests and stewardship interests go hand-in-hand. The two-stroke marine engine population, as a result of the EPA rulemaking as well as innovative product development and aggressive marketing by engine manufacturers, is rapidly declining. But the accelerated decline in the two-stroke population also is due in large measure to government-industry voluntary, cooperative partnerships in several critical areas of the country.

Although the California Air Resources Board (CARB)²⁴ elected to pursue a command-and-control approach which placed more stringent regulations²⁵ on the marine industry than had EPA in 1996, several state environmental agencies chose a different tack and implemented cooperative programs with industry that have proved immensely successful. For example, the New Hampshire Department of Environmental Services (DES) in 2000 approached the New Hampshire Marine Trades Association (NHMTA), a local marine trade group which includes marine engine dealers, to form a partnership designed to encourage boating consumers to purchase and use low-pollution two- and four-stroke marine engines through a statewide education and outreach campaign.

The New Hampshire boating industry responded enthusiastically—NHMTA signed a Memorandum of Understanding (MOU) with the state environmental agency in February of 2000 and nearly 40 marine retailers in the state had signed onto the agreement by 2002. Through the program, New Hampshire marine dealers agreed to immediately encourage customers to buy low-pollution engines and report sales totals back to DES in order to evaluate the success of the program. As a result of the program, participating dealers "met the New Hampshire program's goal for 2001 of having clean engines comprise 75 percent of all new engine sales, well ahead of the schedule required by EPA regulations. The program has set a goal of 90 percent for 2002 through 2005," and

is well on track.

The program in New Hampshire turned out to have a lasting impact beyond the state's borders. In early 2002, NMMA joined EPA and other national partners in celebrating the success of the New Hampshire program and with that backdrop embarked on a program to expand the initiative to the entire New England region. Out of the New Hampshire program was born the New England Clean Marine Engine Initiative. This cooperative effort, also known as the "Get on Board Initiative," was designed "to accelerate the sale of low-pollution two- and four-stroke marine engines which emit substantially less pollution than conventional marine engines." The New England agreement, formalized in a Memorandum of Understanding (MOU) among NMMA and other parties, includes Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, and ten Tribal Nations. NMMA signed a similar accord with the state of Wisconsin in 2001, an important development since that state is home to both Mercury Marine and Bombardier Recreational Products (BRP), two major engine manufacturers. In addition, NMMA signed clean engine MOUs with appropriate state agencies in Oregon and Florida in 2002 and with New Jersey in 2003. In 2000, NMMA's Canadian affiliate, the Canadian Marine Manufacturers Association (CMMA), signed an MOU with Environment Canada, the federal environmental agency, designed to "fast track the early introduction of cleaner engines" in that nation.

There is no question that these efforts have hastened the introduction of these new-technology, low emissions engines into these markets and had a demonstrable impact on consumer purchasing. Indeed, statistics released in July of 2005 by the New England Office of the EPA, which runs the Get on Board Initiative, verify the success of that program. "About four-fifths of the outboard motors and watercraft engines sold in New England in the last three years by participating retailers were low pollution models," according to EPA. These cleaner engines "help meet EPA low-pollution requirements by reducing air pollution by 75 percent or more, lowering gasoline discharges to the water, improving fuel efficiency by 35 to 50 percent, and using up to 50 percent less oil."

Boat builders are also doing their part to increase fuel efficiency through the design and development of lighter, more technologically advanced hulls. MJM Yachts, a Boston-based company, is manufacturing a 34 foot vessel using pieces of fiberglass cloth injected with a resin to reduce the weight from fiberglass without compromising any additional strength. The 34Z requires only 11 gallons of diesel fuel per hour to run at 25 knots, which is up to three to four times less fuel than its comparable counterparts. Duroboats, a fishing boat manufacturer, uses a unique hull contouring system to offer several high performing models that operate with minimum fuel use including a 16 foot craft that can achieve speeds up to 30 mph when combined with a new 40 HP 4 stroke engine or 2 stroke DFI engine. One such product used in making lighter, more fuel-efficient hulls and decks is BALTEK Balsa cores. In addition to conserving fuel, the cores are a renewable resource that is produced without depleting hydrocarbons.

When confronted with the prospect of increased government regulation, the industry engaged rather than obstructed the process. Instead of hiring a team of corporate attorneys and systematically attempting to delay or derail new government mandates on marine engine technology, NMMA and its member companies embraced reform, offering technical expertise, testing data and facilities, and industry-wide cooperation.

The boating industry, from manufacturer to dealer, in essence acknowledged its inherent responsibility as an environmental steward. The Get on Board Initiative and similar efforts in other states in effect amount to a specific aquatic stewardship education campaign. In the participating states, boating consumers were educated about the environmental benefits associated with the new generation of marine engines, made aware of the environmental concerns associated with older technology, and directed to retailers offering the cleaner option. These programs have been demonstrably successful in raising awareness as sales data indicate that consumers, in large numbers and well ahead of regulatory deadlines, are actively choosing the environmentally safer product, even though these products come with a higher price tag. Independently, this provides compelling evidence about the efficacy of education and outreach in general, and it validates the view that most boaters have an innate sense of personal responsibility to the environment—a sense which can be further cultivated through targeted and purposeful education campaigns, government-industry cooperation, and dedicated resources.

Nautique Announces Industry's First High Performance 100% Electric Boat



Nautique, a Premier Sponsor of USA Water Ski, has announced the industry's first high performance 100% electric boat, the Ski Nautique E. To explore future propulsion technology, Nautique has partnered with LTS Marine, a Canadian company that specializes in electric motors.

LTS Marine began teaming up with Nautique in 2010 to test its electric system in a Ski Nautique. The Ski Nautique E contains two automotive electric motors, which connect through a transfer case to the propeller shaft of the boat producing tournament worthy performance.

The Ski Nautique E is equipped with state-of-the-art lithium ion batteries that are located to keep the center of gravity according to the boat performance; when fully charged this is equivalent to eight gallons of gas accommodating up to four slalom skiers during a session and achieving speeds of nearly 40mph. This new emissions free technology is extremely eco-friendly and requires minimal maintenance.

For more information, visit www.nautique.com.

V. Boat Sewage: A Three-Pronged Approach

The release of untreated sewage into the water by recreational boaters is an important environmental and human health concern. In lakes, waters surrounding marinas, and other waters with low hydrologic flushing rates, the impact of improper waste disposal can be particularly significant. Untreated sewage discharges result in the increased concentration of fecal coliform bacteria and consequent human health risks. Such discharges contaminate and degrade water quality by introducing microbial pathogens and hazardous compounds into the marine environment and reducing dissolved oxygen levels (biological oxygen demand) required to decompose organic matter, therefore negatively impacting local aquatic habitats and fish species. The marine industry has approached the boat sewage issue in three central ways: (1) supporting a federal grant program for the construction and maintenance of pumpout facilities under the Clean Vessel Act, and the legislation which authorizes it; (2) participating in and supporting educational outreach on boat waste; and (3) developing innovative products which effectively treat and/or safely contain waste while mitigating or eliminating pollution concerns.

To address the issue of boat sewage, Congress enacted two central pieces of legislation. The Federal Water Pollution Control Act of 1972 required recreational boats with installed boat toilets to be equipped with marine sanitation devices (MSDs) to treat sewage. Amended in 1977, the Federal Water Pollution Control Act became commonly known as the Clean Water Act (CWA). Under the Clean Water Act, the discharge of untreated sewage from vessels within all navigable waters of the U.S., including coastal waters within three miles of shore, is prohibited. The Clean Water Act also provides for states to petition through a written application for a No Discharge Area (NDA) designation from EPA, which may only be approved if EPA determines that there are adequate and reasonably available facilities for the safe and sanitary removal and treatment of sewage. Within No Discharge Areas, neither treated nor untreated waste may be released from a vessel. NMMA has always supported the designation of No Discharge Areas only when an adequate number of open, operable pumpout facilities are available to boaters.

In 1992, Congress passed a second legislative remedy in the Clean Vessel Act (CVA). CVA established a five-year federal grant program, administered by the U.S. Fish and Wildlife Service (FWS), authorizing \$40 million from the Sport Fish Restoration Account of the Wallop-Breaux Aquatic Resources Trust Fund for use by states to establish a network of pumpout stations at marinas throughout the United States. Congress reauthorized the program in 1998, providing \$50 million to establish additional pumpout stations to serve as alternatives to the overboard disposal of untreated sewage. Under the law, CVA grants provide up to 75 percent federal matching funds for education programs for recreational boaters regarding the environmental pollution problems associated with untreated sewage discharges from vessels; information on the location of pumpout stations; construction, maintenance and operation of pumpouts; pumpout boats, and any activity necessary to hold and transport sewage to sewage treatment plants. Grantees are responsible for 25 percent of the costs under the program.

NMMA helped secure the passage of the Clean Vessel Act in 1992, as well as reauthorization of the program in 1998. NMMA worked closely with the present Congress to secure another round of reauthorization—as well as increased funding—for

the Act through legislation to reauthorize the Wallop-Breaux Aquatic Resources Trust Fund, which houses the Act. Following an aggressive lobbying campaign by NMMA and a coalition of interested parties, President Bush signed into law on August 10, 2005 the Transportation Equity Act: A Legacy for Users (TEALU), which included language reauthorizing the Wallop-Breaux Aquatic Resources Trust Fund. The language in this bill included a recapture of the entire 18.3 cent gasoline tax attributable to motorboats, which will mean more than \$110 million additional dollars each year for boating safety and fish restoration programs.

The Clean Vessel Act also dedicates a portion of its total funding for educational outreach programs regarding the environmental and human health effects of dumping untreated sewage overboard. This outreach campaign is made possible by the support and cooperation of marina owners and operators, many of whom are members of the Association of Marine Industries (AMI), as well as North American pumpout manufacturers, all of which voluntarily pledged to affix the national pumpout symbol developed by FWS on every unit they produce. Other outreach efforts conducted through the National Clean Boating Campaign include educational seminars and distribution of promotional materials such as pamphlets and posters that provide tips on how to protect the environment while boating. According to FWS, the overall “awareness campaign has reached thousands of boaters through magazines, newspapers and television.” This number does not include the on-the-ground outreach at marinas and other boating facilities, and at events such as NMMA-sponsored Clean Boating Week, which have reached additional thousands. The mere availability of pumpout facilities at marinas has likely heightened environmental awareness among boaters and led to proper waste disposal, something which has been anecdotally documented by the Service. Clearly, the Act has had considerable success, much of which was made possible through the cooperative efforts of various segments of the marine industry. From the passage of the Act up to 1999, the grant program “resulted in 49 States receiving \$47.6 million for 207 grants,” and “involve[s] surveys and plans in 33 coastal States, construction of 2,730 pumpout and 1,778 dump stations in 45 States, and education programs in 40 States.”

Marine Sanitation Products

Marine sanitation device manufacturers are also providing consumers new, products to protect the marine environment from boat sewage. Manufacturers are working hard to develop and market innovative technologies that treat, store and contain waste more effectively and result in fewer environmental consequences for habitat and fish species. For example, Raritan Engineering Company’s Lectra San, MSD, treats waste through a process of maceration and electrolytic decontamination. Raritan has also developed the ManaGerm, which utilizes an aerobic biological sewage treatment system in which air, water and naturally occurring bacteria biologically convert waste to water and carbon dioxide. Headhunter Inc, produces a new chemical-free MSD, the TidalWave HMX, which uses a four stage system featuring a patented crossflow separation technique to thoroughly destroy biomass and treat waste water. Standard models can treat up to 50,000 US gallons each day.

Manufacturers are also developing environmentally-friendly products to limit holding

tank odors. Sealand's line of holding tank products eliminates odors without using formaldehyde, glutaraldehyde, quaternary salts or other harsh chemicals. In these and other instances, marine sanitation device manufacturers are increasingly offering boaters the opportunity to practice stewardship-related behaviors by providing innovative technologies which effectively mitigate the environmental concerns associated with marine waste.

VI. The Sound of Boating: Voluntarily Quietening American Waterways

Manufacturers of boats, engines and marine accessories are working proactively to limit noise from boats and prevent its potential negative impacts for human and marine populations. In this area, the industry's aggressive self-regulation has far outpaced any government mandates. In May 2003, NMMA joined the efforts of the National Association of State Boating Law Administrators (NASBLA) to quiet waterways across the country so that both boaters and non-boaters can enjoy the natural environment.

The NMMA Board of Directors, which is comprised of representatives from all aspects of the boating industry, unanimously voted to endorse the NASBLA Model Noise Act, sample legislation that restricts boat noise.

Through the combined effort of NMMA and NASBLA, the Model Noise Act has now been adopted by a high percentage of the states where boat noise had become a major source of complaints, mostly from shoreline residents. The Act requires all boats with above-water exhaust to employ exhaust silencers (mufflers) to reduce exhaust noise. To demonstrate compliance with this requirement, boats must not produce noise levels in excess of 88 dBA (90 dBA in some states) when subjected to a stationary-mode test standard. The Act also limits the shoreline sound level to 75 dBA for individual boats. Compliance with these restrictions has been accomplished by industry development of high quality exhaust silencers on boats with above-water exhaust. To date, 32 states have adopted noise regulations equivalent to the standards set forth by the Model Noise Act, and NMMA actively lobbies other state legislatures to do so.

The personal watercraft (PWC) industry has moved rapidly to reduce noise emissions from its watercraft. Personal watercraft manufacturers, in the absence of government regulations, have invested over \$1 billion over the last several years to develop technologies to reduce both noise and hydrocarbon emissions from their vessels. Some of these technologies include baffles, insulation, and resonator-equipped mufflers. Employing these new technologies, personal watercraft manufacturers have reduced noise emissions by some 70 percent since 1998.⁴⁴ In sensitive aquatic environments, the Personal Watercraft Industry Association (PWIA), endorses the use of shoreline sound measurement laws and the establishment of slow-or no-wake zones, as well as the development of educational programs that promote environmentally-sensitive PWC use.

VII. Marine Accessories: Marketing Stewardship through Product Innovation

Marine businesses are working to develop environmentally-friendly technologies in order to position themselves as innovators and market leaders and meet consumer demand. Such an approach allows companies to keep pace with competitors, improve brand reputation, and in many ways determine the direction of the market. As consumers increasingly demand environmentally-sensitive products, the boating industry is responding boldly and enthusiastically. Many marine accessories and components manufacturers are demonstrating leadership in support of advancing clean boating technologies and products that improve the overall environmental performance of the industry. Introducing these products into the marketplace serves two vital functions that contribute to aquatic stewardship. First, these products draw attention to environmental concerns with boating which they claim to mitigate or avert. Second, they empower boating consumers to take personal responsibility for protecting the environment. Purchasing is an affirmative act, and it involves a choice between or among competing products. The act of purchasing a product which is branded as good for the environment signals that a boating consumer is both knowledgeable about the skills and behaviors necessary for being a good aquatic steward and willing to make a personal investment in the environment. That these products have flourished in a competitive marketplace is a measure of the effectiveness of green marketing initiatives based on environmental branding.

Savvy marketing professionals within the boating industry have long understood the appeal of environmentally-sensitive products. In a race-to-the-top style of competition, many industry leaders have sought to establish a reputation for having products which minimize the human impact on the environment. These companies have sought to increase the appeal of their products by communicating their environmental commitment directly to customers, competitors, peers, distributors, and others. The success of this type of marketing is premised on two central foundations: (1) a good product which does not harm the environment; and (2) consumer demand fueled by an ingrained environmental ethic.

NMMA encourages and supports the development of innovative new products through the NMMA Innovation Awards, which are awarded with substantial publicity to companies in the marine industry that have developed interesting new products. NMMA, and its partner in this endeavor, Boating Writers International (BWI), issue the awards at NMMA-owned or -sponsored industry events, such as boat shows and product exhibitions. Many of the products selected represent environmental solutions—accessories designed to address a particular environmental concern which may be perceived to be tied to boating. NMMA specifically awards an Environmental Innovation Award to recognize what has become a niche market in the boating industry which focuses on manufacturing products that minimize boating's impact on aquatic systems across a broad spectrum of environmental concerns. These awards serve to reward companies that have elected to take an environmentally responsible corporate posture, to encourage other companies in the industry to do so, and alert consumers about the availability of these products and the companies that make them. Many of the green products listed below have been honored by NMMA as leading examples of the marine industry's commitment to environmental responsibility

For example, Clean Water Solutions, Inc. has developed a line of products that mitigate petroleum pollution by efficiently bio-remediating oil and other pollutants; these products

target marinas, boat bilges, catch basins, and holding tanks. Immediate Response Spill Technologies' (IRST) CI Agent is another petroleum pollution option that uses revolutionary technology to solidify petroleum-based spills and encapsulate them into a removable mass. Clean Water Solutions, Inc. was awarded the NMMA Environmental Innovation Award at NMMA's Accessories Trade Show Las Vegas in July 2005. Power Service's Diesel Kleen Performance Improver with Cetane Boost exceeds industry standards for thermal stability and improves diesel fuel's resistance to thermal and oxidative degradation to improve engine efficiency.

Several manufacturers are developing new, innovative products to prevent spillage. Racor Parker Filtration's Lifeguard line of fuel/air separators has an automatic shut-off feature which trips to let you know your fuel tank is full. Davis Instruments has patented a fuel-resistant bottle designed for temporary attachment to the hull, over the fuel tank vent, to capture any spillage that would otherwise run into the water. Bocatech Inc. produces a bilge mate switch that does not switch when oil is present in the bilge which prevents oil from polluting surrounding waters. EMP Industries SaniSailor BilgeMate Systems eliminate harmful oily bilge water from entering our waterways by integrating high suction peristaltic vacuum pump with an oil and water separator along with a hydrocarbon accumulator and suction hose to cleanly and conveniently remove oily bilge water from recreational boats.

Another product which is beginning to penetrate the marine market is biodiesel, a fuel made from renewable sources like soybeans and natural fats and oils. Although increasingly common in commercial marine applications, such as charter boats and water taxis, biodiesel fuel is relatively new to the recreational sector, with only a small number of private marinas in the U.S. making it available to boating consumers. Nevertheless, interest in this eco-friendly product continues to grow, and biodiesel is the fastest growing alternative fuel in the U.S. Pure biodiesel fuel (B100) contains no petroleum, and can be used in any diesel engines "with few or no modifications." The fuel is good for marine engines, burns efficiently, and significantly reduces soot emissions. The most common formula of biodiesel fuel, B20 (80 percent regular diesel and 20 percent biodiesel), biodegrades three times as fast as regular diesel, mitigating the environmental impact of spills. An NMMA-backed federal tax incentive, which went into effect January 2005, should further increase the availability of the fuel.

The marine industry has been proactive in other areas as well. When it became clear that phosphate-based boat soaps degrade water quality and contribute to algal blooms and low dissolved oxygen levels, the industry developed and made available a series of non-toxic, non-phosphate based, biodegradable boat soaps, which have a minimal impact on the aquatic environment. The marine industry is increasing its reliance on silicon, Teflon, and similar slick-surface, non-fouling agents rather than toxins to keep marine growth off boat bottoms as well. Natural Marine's new One and Only Spot Remover is a unique, color safe oxygen release gel that removes spots without the use of bleach or other hazardous materials. Many manufactures are also developing more environmentally-friendly paint strippers. Pettit's Bio-Blast and Sea Hawk's Marine Paint Stripper 1280 are biodegradable products that remove antifouling paint without the use of traditional toxic chemicals.

Marine Generators and Mufflers

Westerbeeke, a prominent manufacturer of generators for the marine market has garnered several honors for developing and marketing revolutionary products that limit carbon monoxide emissions. Carbon monoxide is a colorless, odorless, and extremely poisonous gas that can have fatal consequences when inhaled. Westerbeeke's Safe-CO generators use a combination of innovative engineering and electronic fuel injection to reduce carbon monoxide emissions by 99% compared to conventional generators. Westerbeeke, already a recipient of an NMMA Innovation award for its small gasoline-fueled generator in 2003, was honored again last year as the winner of the 2005 Electrical Systems Innovation award from NMMA. Gentek recently developed the compact Gen-Kleen, the first product that protects boating waters by removing hydrocarbon contamination from generator exhaust

Batteries and Horns

Amptronix, Inc. is introducing ABC-DS12, an innovative 12V Battery Desulfator that prolongs the life of lead batteries. By utilizing the power of the battery and returning it as a surge or pulse, the Battery Desulfator, actually delays and reduces sulfation within the battery, the primary cause of premature failure. The product can also revive many old batteries to a state of normal functionality. The SeaSense EcoBlast Refillable Air Horn is a chemical-free refillable horn that does not introduce CTC toxins into the air when used. The horn is refilled using a bicycle pump and contains no batteries or disposable metal containers.

Mooring and Sonar Products

In some marine environments, such as marine sanctuaries, coral reefs, and other sensitive or essential habitats, mooring a boat can disturb certain benthic communities and wildlife. New elastic mooring technologies have been designed by companies such as Hazlett-Marine and Seaflex to specifically address the increasingly stringent environmental regulations associated with marina siting and construction.

IOC Guide to Sport, Environment and Sustainable Development

Link:

<http://www.olympic.org/content/news/media-resources/manual-news/1999-2009/2007/01/23/ioc-guide-to-sport-environment-and-sustainable-development/>

OLYMPIC MOVEMENT'S AGENDA 21

**Sport for
sustainable development**

Link:

http://www.olympic.org/Documents/Reports/EN/en_report_300.pdf

Marine manufacturers are developing advanced scanning technology to give boaters the ability to prevent injury to marine life. Interphase's line of iScan sonar products provides boaters long-range bottom to surface color sonar up to 1,200 feet, helping to protect manatee, whales and other aquatic species. These and other products in the accessories marketplace are pursued because there is consumer demand and when companies offer more pioneering, state-of-the art products, they in turn help shape consumer preferences. Nevertheless, the success of aquatic stewardship education programs will have a direct bearing on consumer purchasing, and will ultimately benefit those marine businesses who are marketing a green product.

VIII. Advancing Clean Boating through Education, Legislation & Outreach

In a December 2004 article published by the American Fisheries Society, the authors attempt to define "aquatic stewardship" and outline the components of programs fostering the ethic of personal responsibility which forms the basis for stewardship. The article emphasizes that a successful aquatic stewardship program should convey three fundamental elements: (1) awareness of aquatic systems; (2) personal investment in the environment; and (3) knowledge and skill in the behaviors of a good aquatic steward. The boating industry, although not in the business of designing or implementing aquatic stewardship education programs, participates, either directly or indirectly, in all three components, particularly in making accessible to boaters certain behavioral options that constitute desirable aquatic stewardship. The businesses that make up the membership of NMMA are already proactively contributing to aquatic stewardship education and outreach, and many have been leading this effort for quite some time. The historical significance of the boating industry's financial and political support in helping to establish and maintain environmental initiatives is significant. This section will outline specific aquatic stewardship education initiatives undertaken by either NMMA and its affiliates, or by prominent members of the industry, along with specific legislative proposals that NMMA is working on to help protect the environment.

The NMMA Water Watch Program

In the early 1990s, NMMA secured a one-time \$25,000 grant from EPA to develop and distribute educational materials directly to boaters at the point of purchase. This educational brochure, called the Water Watch program, was one of the first comprehensive clean boating brochures to be developed and represented the first time that such materials were systematically distributed to boating consumers. The Water Watch brochure, called "What Boaters can do to be Environmentally Friendly," includes a top-ten list of eco-friendly boating practices, including adherence to federal marine sanitation rules, use of biodegradable cleaning agents, proper fueling to avoid spills, control of bilge water, and others. The brochure explains in detail the environmental concern at issue and outlines a set of actions that boaters should take to mitigate risks to aquatic systems. Once the brochure was finalized, NMMA, using grant monies as well as its own resources, distributed the brochure to marine dealers nationwide and to every consumer who purchased a new boat that year, a massive undertaking. The dealers were to provide to boating consumers the brochure with the packet of informational materials (owner's manual, warranty documentation, etc.) that comes with the purchase of new boat. Although the program was not extended because the grant expired after one year, NMMA continues to make this brochure available upon request. More importantly, as federal and state agencies develop similar educational materials

for boaters within their jurisdictions, they have drawn heavily on the expertise and advice contained in the Water Watch brochure, often employing virtually identical language. In that regard, the legacy of this particular outreach initiative has been sustained over the long term, extending beyond its own life and reaching thousands of boaters nationwide.

The Tread Lightly! Campaign

Tread Lightly!® is a national, nonprofit organization based in Utah dedicated to empowering “generations to enjoy the outdoors responsibly through education and restoration.” Although the program began in 1985 in the U.S. Forest Service as an effort to address growing participation in outdoor recreation, Tread Lightly! became a private endeavor in 1990, funded by a variety of “individual members, corporations, dealerships, clubs, retailers and other organizations interested in spreading the message of responsible and ethical use of the outdoors.” In 1997, Tread Lightly! expanded from its traditional focus on land issues to include water-based recreation. In addition to its Tread Trainer™ program designed to produce a network of instructors of the campaign’s responsible recreation message, the organization also produces a multitude of educational pieces for outdoor enthusiasts, including a guide to responsible personal watercraft (PWC) use. Tread Lightly! also develops public service announcements (PSAs) focused on spreading the message of aquatic stewardship. In this way, Tread Lightly! serves as an “ethical and educational force in bringing together and unifying a broad spectrum of stakeholders including agencies, industry, media, conservation and enthusiast groups, and concerned individuals who share a common goal --to find a balance between humans and nature.”

Tread Lightly! also seeks to increase dialogue and expand government-industry partnerships regarding environmental stewardship. From 2000-2002, NMMA and PWIA sponsored Tread Lightly!’s Convergence Dialogue Series, which was designed to “open lines of communication, build common ground, and discuss pertinent issues and challenges facing the future of responsible outdoor recreation by bringing together representatives from various forms of recreational interests.” This series brought together state and federal resource management agencies, conservation organizations, resource users, industry, and other stakeholders, who worked to identify common challenges facing responsible recreation, including stewardship education, and develop an agenda for future cooperation and actions. Water-related recreation was a major focus of the series.

NMMA and PWIA, along with the individual manufacturers of personal watercraft have provided significant support and technical expertise to the Tread Lightly! campaign over the years. The campaign has reached eight million people each year through its print public service announcements in enthusiast magazines, and another eight million through the display of its public service announcements (PSAs) as signage on public lands. Since 2003, as a result of boating and water recreation enthusiast magazines donating advertising space to the Tread Lightly! campaign, the initiative has communicated its responsible recreation message to at least 3.8 million boaters, anglers, and other water recreationists.

The FishAmerica Foundation

Recreational boating and fishing are closely tied, with approximately 60-70 percent of boaters claiming to use their boats for angling. The FishAmerica Foundation, founded and largely financially supported by boating and fishing companies, represents a highly successful conservation grant giving program, well-regarded within the conservation and environmental communities. According to the Foundation, FishAmerica provides “nearly \$1 million in matching grants each year to community partners across the country. Over the last 20 years, FishAmerica has provided more than \$6 million for nearly 750 grassroots conservation projects that improve fisheries habitat and fishing opportunities.”

Environmental Legislation

The NMMA Government Relations team monitors legislation and lobbies policymakers on behalf of the environment in Washington DC and in state capitals around the country.

The Wallop-Breaux Aquatic Resources Trust Fund

In addition to the Water Watch program, NMMA has been and continues to be a major player in the political fights which seem to inevitably accompany the authorization of funds for the Wallop-Breaux Aquatic Resources Trust Fund (ARTF) a user-pay fund, used to enhance the boating and fishing experience. Congress allocates funds generated directly by boaters through taxes on motorboat fuel and fishing tackle, along with other fees. Part of the monies generated by the tax are dedicated to specific environmental restoration and protection projects, including coastal wetlands restoration, a variety of sport fish restoration programs, grant programs for the construction of pumpout stations under the Clean Vessel Act, and monies for the Recreational Boating and Fishing Foundation (RBFF), which actively researches and promotes conservation among boaters and anglers. Significant dollars go directly toward funding state-based aquatic stewardship education programs. More than \$4 billion has been collected and invested in the program since its inception.

The Sport Fish Restoration Account of the Aquatic Resources Trust Fund has been nothing if not successful. The funds in the account are generated through a ten-percent excise tax on certain items of sport fishing tackle; a three-percent excise tax on fish finders and electric trolling motors; import duties on fishing tackle, yachts and pleasure craft; interest on the account; and a portion of motorboat fuel tax revenues and small engine fuel taxes authorized under the Internal Revenue Code. Funds for state sport fish restoration and related programs are apportioned on a formula basis and pay up to 75 percent of the cost for approved programs, including restoration efforts, land acquisition, research on habitat and fish stocks, surveys and inventories of fish populations, and the development and improvement of boating facilities, among others. States are also directed to use up to ten percent of the funds for aquatic stewardship education and boating access facilities.

Wallop Breaux monies are also used to fund critical education programs. To name but one example, the Fish and Wildlife Research Initiative of the Florida Fish and Wildlife Conservation Commission, a state agency, has developed a series of Boating and

Angling Guides to inform boaters and anglers about Florida's coastal and marine ecosystems. The guides, which originally appeared in 1992 and are divided regionally, consist of maps displaying the “distribution of natural marine resources” along with text explaining “the role of the marine habitat in the health of the marine ecosystem and how boating and angling behavior can influence the environment.” According to the Florida Fish and Wildlife Conservation Commission, over 1.9 million guides have been printed to date. Monies from Wallop-Breaux are also directed to the Recreational Boating and Fishing Foundation (RBFF) in order to carry out a National Outreach and Communications Program.

In order to ensure that the Wallop-Breaux monies are reauthorized and dedicated appropriately, NMMA has worked closely with the American League of Anglers and Boaters (ALAB), which spearheaded the coordinated effort by stakeholders to secure passage of reauthorizing legislation in the 109th Congress. ALAB is comprised of 34 member organizations, including NMMA, Association of Marina Industries, American Fisheries Society (AFS), American Sportfishing Association (ASA), International Association of Fish and Wildlife Agencies (IAFWA), Trout Unlimited (TU), and Boat Owners Association of the United States (BoatU.S.). In addition to featuring Wallop-Breaux as an issue at NMMA's annual legislative conference, the American Boating Congress, the association's government affairs staff routinely meet with congressional staff in order to advance the consensus legislative objectives of ALAB, which include creating a permanent appropriation of funding, as well as a reallocation of the fuel tax receipts, part of which have heretofore been redirected to the General Fund for deficit reduction rather than to the boating and angling accounts for which they were intended. The recapture of the diverted funds, a major advocacy coup in 2005, now means that an additional \$110 million a year will be directed back into the Wallop-Breaux account.

Marine Debris

Clean water is the foundation for an enjoyable boating experience, which is why protecting the environment is a priority for the recreational boating industry. NMMA testified in support of S. 362, a bill that seeks additional monies for National Oceanic and Atmospheric Administration (NOAA) and the U.S. Coast Guard to improve enforcement of illegal vessel-based pollution and debris, before a joint committee of the United States House Resources Subcommittee on Fisheries and Oceans and the House Transportation Subcommittee on Coast Guard and Maritime Transportation in 2005. The bill proactively deals with marine debris such as discarded rope and line that foul propellers, and plastic bags and sheeting that clog seawater intakes and damage marine ecosystems and human health. The U.S. Congress approved the legislation in December 2006 and the President has signed the measure into law. NMMA will work with appropriate federal agencies to ensure that the established programs are funded and properly implemented.

Invasive Species

NMMA is also supporting several pieces of legislation that address the increasing menace of invasive species on America's waterways. NMMA is working with the United States Senate to draft a comprehensive bill that would: identify aquatic invasive species and how they are transported; set protocols, systems and standards to monitor

the efficiency and efficacy of prevention methods; and establish ballast water and sediment standards for vessels of the armed forces.

Until recently, only 13.5 cents was sent to the Aquatic Resources Trust Fund, which was only a portion of the 18.3 cents that is collected on motorboat and small engine fuels.

IX. The Clean Marina Program: Achieving Sustainable Marina Ecosystems

Over a decade ago, NMMA initiated an effort to recognize leaders in the marina industry who were striving to implement policies and protocols that fostered clean marinas. One such effort, the Recreational Boating Facilities Environmental Responsibility Award, generated considerable national publicity and facilitated efforts to draw attention to clean marina programs. In an attempt to build upon this program, NMMA worked with European marine industry counterparts to develop a program to certify clean marinas, known as the Blue Flag Program. After lengthy consultations with administrators of the European program, NMMA and its partners sought out the Marine Environmental Education Foundation (MEEF) to implement and administer a similar education and certification program in the United States. Despite efforts by industry to implement this endeavor, a lack of available federal grant monies hindered, for a time, further progress and led to a series of ad hoc, yet highly successful, efforts by states, in conjunction with the National Clean Boating Program, to implement clean marina programs. To date, Clean Marina programs have been developed in 18 states, the District of Columbia, several federal agencies, and the Tennessee Valley Authority TVA.

In 2002, the Association of Marina Industries (AMI), then the Marina Operators Association of America (MOAA), worked with other industry partners to conduct a national workshop designed to address the necessity of implementing EPA's national management measures to control non-point source pollution from marinas and recreational boating. This workshop brought together the National Park Service, U.S. Army Corps of Engineers, TVA, U.S. Fish and Wildlife Service, U.S. Coast Guard, Bureau of Reclamation, numerous state agencies, the marina industry, and the majority of Clean Marina programs in the United States. In total, more than 100 local, state, and federal officials responsible for the development and delivery of clean marina programs as well as national and regional marine trade group representatives attended the workshop. For the first time, the nation's leading clean marina practitioners agreed on a set of Clean Marina Principles. The results continue to have a significant impact on the development of clean marina programs nationwide.

AMI—the new association born out of the January 2005 merger of MOAA and the Institute of Marina Industries (IMI)—has worked closely with states and marina owners and operators to implement clean marina programs based on best practices and educational outreach. For example, AMI offers professional training and program development in furtherance of clean marina objectives. In addition, AMI will continue to advance the cause of clean marinas through the Certified Marina Manager (CMM) program. The CMM designation, requiring extensive marina management training, signals a marina owner's or operator's commitment to professional standards and environmental stewardship. The CMM designation affords marina managers the opportunity to market their marinas as environmentally responsible, and gives them an edge over competitors. Many marina owners are turning to the CMM program to

improve their company's bottom line.

As state clean marina programs continue to gain traction across the nation, AMI has pursued a federal track which would establish a national clean marina program, a goal which would significantly raise the profile of clean marinas and possibly offer a stable revenue stream and grant-giving program. The U.S. Commission on Ocean Policy's Final Report and President Bush's response in his U.S. Ocean Action Plan call for a federal clean marina program. As a result, NMMA initiated an aggressive lobbying campaign with key staff of the Council on Environmental Quality (CEQ), the president's environmental advisory panel charged with overseeing federal environmental programs, to secure federal dollars for a national program. Unfortunately, the present federal fiscal climate has made securing these funds difficult, although AMI and NMMA will continue to advocate for such a program.

The marina industry is increasingly adhering to strong environmental standards and principles. Indeed, industry has worked with government regulators and non-profit organizations to systematically promote aquatic stewardship. The resulting norm which has been developed within the marina industry is beginning to take hold, and it is clear that the future promises additional, voluntary adherence to environmentally responsible marina management. The 1996 EPA study confirms this view, noting that "clearly, the marina industry has begun to embrace the need to promote clean boating, clean facilities, and clean operations." The 25 marinas explored as case studies in that evaluation were, ten years ago, already "demonstrating innovation, determination, and an almost missionary zeal for clean operations." Importantly, the study also determined that the majority of the facilities it evaluated had voluntarily employed clean marina practices in order to "improve their service to boaters and to stay ahead of the regulations."

X. The Corporate Role in Aquatic Stewardship Education: Future Prospects

The desire to advance aquatic stewardship and create a national stewardship ethic with respect to the boating public is one shared by conservation groups, scientific organizations such as the American Fisheries Society, federal and state agencies, and the marine manufacturing industry. For its part, the boating industry will continue to pursue technological solutions to environmental concerns, adhere to environmental regulations, and utilize the marketplace to encourage boating consumers to act responsibly on the water. NMMA believes strongly that, although unconventional, the advertising of environmentally-sensitive products constitutes a form of aquatic stewardship education. Such an approach raises awareness about environmental risks and provides environmental solutions to the users of America's aquatic resources. Affording boaters the choice to affirm and employ their inherent conservation ethic is at once empowering and effective.

In addition, industry has an important role to play in working with those organizations dedicated to conserving and protecting aquatic environments. Industry's role is derived from its recognized corporate social responsibility, as well as the desire to sell product. As has been noted, clean and healthy waters are the foundation of enjoyable boating. Consumers, too, are increasingly demanding products which serve to remedy environmental concerns, rather than exacerbate them.

The products, innovations, technologies, and educational outreach described herein do not constitute a comprehensive or exhaustive litany of the accomplishments and developments within the recreational boating industry. What is presented is meant to provide an illustrative overview and sampling of some of the significant activities and milestones. An overview of this length and scope could not begin to capture each important development or innovation.

Note:

This complete document which includes all references can be downloaded from the National Marine Manufacturers site NMMA.org

BIBLIOGRAPHY

AUSTRALIA

Hawkesbury-Nepean Catchment Management Trust. *Interim Information Management Protocols – State of the Environment Reporting*, Windsor, Australia: 1996.

Healthy Rivers Commission of New South Wales. *Independent Inquiry into the Hawkesbury Nepean River System – Draft Report*, November, 1997.

River Murray Basin Commission. *River Murray Floodplain Planning Guidelines – Draft Discussion Paper*, Canberra, Australia: October, 1992.

Vant, W.N. "What Are We Getting Into – Recreation and Water Appearance," *Soil & Water*, Summer 1987.

W.G. Martinick and Associates PTY Ltd. *Greenough River Estuary Management Plan*, April, 1994.

Waterways Authority Noise Committee. *Report on the Control of Noise from Vessels on NSW Waterways*, Sydney, NSW: September, 1996.

CANADA

Hilchey, Tim. "Why Outboards are in Dispute," *The Globe & Mail*, May 24, 1994.

McGregor, Cathy, B. C. Minister of Environment Lands & Parks – several letters of correspondence between the Minister and Gloria Heisterman of Water Ski Canada with regards to boating restrictions on several lakes in B.C.

Ontario Marina Operators Association. *Clean Marine Practices Handbook*, Kingston, Ontario: 1997.

Spray's Water Ski Magazine. "Wake Height" (April 1983) and "Sound Level" (April 1994). Found in package of information from Water Ski Manitoba, Inc.

Stoller, Gary. "Are PWC's Safe?" *Conde Nast Traveller*, New York, August, 1996.
Water Ski Manitoba, Inc. Several letters of correspondence between WSM, Water Ski Canada, stakeholders over establishment of a ski jump at Triple Creek Water Ski Club, and waterskiing at Selkirk Park, Winnipeg, Manitoba: January, 1995.

Winnicki, Maureen. "Tempers Boil Over Fight For Waters – Residents, water skiers at stand-off over creek use," *The Selkirk Journal*. Winnipeg, July 25, 1994.

EUROPE

Federation Française de Ski Nautique. *Le Ski Nautique et L'environnement*, Montbéliard, France: June, 1981.

TNO Industrial Research. *Study on Exhaust Gas Regulations for Pleasure Boat Propulsion Engines – Executive Summary*. Delft, Netherlands: December, 1991.

van Donkelaar, Pieter. "Positive Environmental Effects of Pleasure Boating," *Ambiente*, July, 1994.

Zois-Moros, Athanassia. *Assessment of Water Skiing Environmental Impact*, Athens, Greece, July 1, 1993.

SOUTH AFRICA

Rand Water. *Minutes of the Sixth Sub-Committee (Power Boats) Meeting of the Working Group Regarding the Investigation into and Drafting of Legislation Regarding Small Vessels on Inland Waters Held at Rand*, Johannesburg, South Africa, January 7, 1994.

UNITED KINGDOM

Bickerdike Allen Partners, Letters to Mike Walker regarding the BWSF – Noise Code of Practice, Rotherham, England: May 3, 1995.

British Marine Industries Federation. *A Guide to Boating and the Environment*. Egham Surrey, England.

British Marine Industries Federation. *Steering a Balanced Course – The Boating Industry and the Marine Environment*. Egham Surrey, England, 1994.

British Marine Industries Federation. *The BMIF Environment Project – Poole Harbour – Renowned Internationally for its Ecological, Commercial and Recreational Importance*, Poole, England.

British Water Ski Federation. *Draft Code of Practice for Water Skiing & Noise*. London, December, 1997.

British Water Ski Federation. *Second Draft of Demand for Water Skiing - Memo*, London, England: July, 1993.

British Water Ski Federation. *Ski Boat Driver Award—Candidates Manual*, London

British Water Ski Federation. *Windermere Inquiry—The Establishment of Sites for Waterskiing and Powerboating: The Role of the Sports Council*, London, England: June 20, 1994.

Chapman Warren. *Memorandum of Evidence to the Environment Committee Inquiry into the Environmental Impact of Leisure Activities on Behalf of: The British Water Ski Federation*, London, England: February 3rd, 1995.

Chapman Warren. *Town and Country Planning Act 1990 – Appeal by Mr.R.H. Kindell Against the Decision of Milton Keynes Borough Council to Refuse Permission for Change of Use From Sailing to Water Skiing, Erection of Boathouse, Provision of Compensatory Flood Storage and Provision of 54 Car Parking Spaces: Dovecote Lake, Little Linford, NR Milton Keynes, Buckinghamshire, Wiltshire, England, September, 1992.*

Chapman Warren. *Windermere Inquiry – NPA 28 and 29 Existing Sites and Sites with Potential for further Development for Water Skiing, Power Boating or Jet Skiing*, Wiltshire, England: September 1st, 1994.

Hill, David (Dr.). *Dosthill Pit and Adjacent Areas: Conservation Management Plan: Habitat Prescriptions*. North Yorkshire: Ecoscope Applied Ecologists, June 1998.

Hill, David (Dr.). *Dosthill Pit and Adjacent Areas: Ecology and Nature Conservation – Proof of Evidence*. North Yorkshire: Ecoscope Applied Ecologists, June 1998.

Hill, David (Dr.). *Dosthill Pit and Adjacent Areas: Conservation Management Plans*. North Yorkshire: Ecosphere Applied Ecologists, September, 1997.

Hill, David (Dr.). *The British Water Ski Federation and the Windermere Water Skiers Association—Windermere Inquiry 1994—Nature Conservation at Lake Windermere in Relation to the 10 mph Speed Restriction*, Appendix 8 to the Proof of Evidence of Mr. R. Gillespie, Document no. 35a, Cambridge, England: April 1994.

House of Commons, Environment Committee. *Minutes of Evidence taken before Environment Committee*. Memorandum submitted by the British Water Ski Federation – Examination of Witnesses, London, England: March 22, 1995.

Flavin, Christopher and Seth Dunn. “Rising Sun, Gathering Winds: Policies to Stabilize the Climate and Strengthen Economies” Worldwatch Paper # 138, Washington, 1997.

Gardner, Gary and Payal Sampat. “Mind Over Matter – Recasting the Role of Materials in our Lives”, Worldwatch Paper #144, Washington, 1998

House of Commons, Environment Committee. *The Environmental Impact of Leisure Activities, Volume I*. Session 1994-95, London, England: July 12, 1995.

Johnson, Dick. “An Eco-Step Too Far?” *International Boat Industry*, April/May 1993.

Johnson, Dick. “Bodensee Research Clears Boating” *International Boat Industry*, April/May 1993.

Lanpheer, Richard. *Recreational Motorboat Sound Level Test Report*. IMEC 17F/01, ICOMIA Marine Environmental Committee. June 21, 1993.

Moss, B. "Conservation Problems in the Norfolk Broads and Rivers of East Anglia, England – Phytoplankton, Boats and the Causes of Turbidity," *Biological Conservation* (12), 1977.

Pearce, Howard. *Water Skiing and the Environment*. Paper presented at the Sports Council's Fourth European Seminar (no year provided).

RPS Clouston. *A Proposal for an Integrated Water Ski and Nature Conservation facility at Denham Green – Pre- application discussion document*, Abingdon, England: September, 1994.

Sidaway, Roger. *Extracts from Sports Council Study 32 – Sport, Recreation and Nature Conservation*. London, England: December 1988.

Sports Council. *Lake Windermere Public Inquiry – The Management Plan and Code of Conduct*, London, England: July, 1994.

Tuddenham, Cecile. *Market Research Survey with Broads Hire Craft Holiday Makers*, Draft Report for the Water Ski Working Group, Item No. 6, Norwich: Broads Authority, November, 1995.

UK Centre for Economic and Environmental Development, *Waterskiing and the Environment – A literature Review*. Cambridge, England: January, 1993.

Ward, David. "Water Skiers Face Ban from Broads," *The Guardian*, March 9, 1998.

Water Ski Working Group, *Assessment of the Impact of Water Skiing on the Broads*, Norwich: Broads Authority, 1997.

Water Ski Working Group, *Water Ski Working Group Report – Report by Management Team*, Agenda Item No. 7. Norwich: Broads Authority, March 2, 1998.

UNITED STATES

Albert, Daniel. "Ski Laws: The Good, the Bad and the Ugly," *Boating Industry*, June, 1991.

American Water Ski Association. *Legal Source Document*, Winter Haven, Florida:1983.

American Water Ski Association. *Waterways Education Manual*, Winter Haven, Florida: 1993.

USA Water Ski -- Several articles written by the USAWS Waterways Education Committee published in *Waterways Education* including:

Cleaning Up Our Shorelines (July/Aug 1990)
Florida Threatens to Curb Boating, Water Skiing (Jan/Feb 1990)
Florida Lawmakers Reject Boating Restrictions (July/Aug 1990)
Learning to Fight and Win Battles in Legal and Legislative Theatres (March/April 1992)

Environmental Engineering, Inc. *Effect of Power Boat Fuel Exhaust on Florida Lakes*, Gainesville, Florida: 1969.

EPA/BIA. *Analysis of Pollution from Marine Engines and Effects on the Environment*. Washington, D.C.: National Technical Information Service, US Department of Commerce, 1975.

Henigar and Ray Engineering Associates, Inc. *City of Naples Boat Traffic Study*, Naples, Florida: 1989.

Honda North America Inc. *The Environmental Challenge*, Corporate Report, 1997.

Knowles, Chris. "Quiet Revolutions," *Cottage Life*, July / August 1995.

Mele, Andre, *Polluting for Pleasure*. New York: W.W. Norton & Company, 1993.

York, Darryl. *Recreational Boating Disturbances of Natural Communities and Wildlife: An Annotated Bibliography*, Biological Report 22, National Biological Survey, U.S. Department of the Interior, Washington, D.C.: May, 1994.

Yousef, Y.A., W.M. McLellon, and H.H. Zebuthh. "Changes in Phosphorus Concentrations due to Mixing by Motorboats in Shallow Lakes" *Water Research* 14:841-852, 1980.

NMMA National marine Manufacturers, Ethanol Fuel Attacks Outboard Engines, Inboard Engines and Fuel Tanks

MISCELLANEOUS

National Rivers Authority. *Blue-Green Algae*, Brochure

MSB Waterways. *Noise Annoys—Keep the Soundwave Down on the Water*. Information flyer

MSB Waterways, *Preventing Waterways Pollution – A boater's guide*, Brochure

Vant, W.N. and R.J. Davies-Colley. *Water Appearance and Recreational Use of 10 Lakes of the North Island (New Zealand)*, Water Quality Centre, Ministry of Works and Development, Hamilton, New Zealand: 1988.

Global Sports Alliance Ecoflag declaration