

POLLUTING JUST FOR THE FUN OF IT: TWO-STROKE ENGINES ON MISSION BAY

SUMMARY

This report is the outcome of an investigation into the City of San Diego's management of Mission Bay with respect to the polluting effects of two-stroke engines. Two-stroke engines are used to propel personal watercraft (PWC) and powerboats. PWCs, otherwise known as jet-skis or water-bikes, have a different design configuration concerning their length-to-horsepower ratio and thrust capacity from any other vessel. The majority use two-stroke engines and, along with other vessels that use the same kind of engines, produce pollution. This pollution results from the uncombusted oil and gasoline that two-stroke engines discharge into the water and air during their operation. Three different kinds of engines are used to propel PWCs as well as other power vessels: (1) two-stroke; (2) four-stroke; and (3) two-stroke, direct gasoline injection.

Among these engines, the four-stroke engine produces almost no pollution. On the other hand, the recently introduced-into-the market, direct-fuel-injection, two-stroke engine has achieved a 75 to 90 % reduction in uncombusted materials, and a commensurable reduction in the pollution yield, as compared to the carbureted two-stroke. These achievements surpass the most stringent Environmental Protection Agency (EPA) and State of California Environmental requirements. This is the reason for focusing exclusively on the two-stroke engine.

Statutes exist at the Federal, State, and local level which directly address the discharging of oil and gasoline as well as the attendant pollution problem of U.S. waterways in general and those of Mission Bay in particular. Yet, these statutes are not enforced by the appropriate city departments designated to have jurisdiction over the management, protection and preservation of Mission Bay.

The Grand Jury recommends that statutes should be strictly enforced and violators prosecuted. It also recommends that the City authorize the lifeguards, who patrol Mission Bay in boats and have the means of issuing citations and making arrests, to police and protect the Bay from the oil and gasoline polluters.

PURPOSE OF THE STUDY

The purpose of this study is to respond to a complaint addressed to the Grand Jury concerning pollution problems and resultant closures of Mission Bay. While investigating the complaint, the Grand Jury noted that a number of agencies and departments of the City of San Diego were already involved in studying various aspects of the pollution problem in Mission Bay. For this reason, the Grand Jury focused its efforts on the City's management of a relatively new source of pollution; that is, the two-stroke conventional marine engine used in powerboats and PWCs. The

decision to concentrate on the two-stroke engine stems from the recent increase in the popularity of the PWC that has resulted in an explosion in their number using the Mission Bay facilities. As a result, the Grand Jury found there is an urgent need to study the polluting effects of the two-stroke engines in Mission Bay. In this sense, it addresses the substance of the complaint, albeit partially, expecting that all other forms of pollution have been or will be addressed by the various agencies and departments of the City of San Diego in the near future.

BACKGROUND INFORMATION

A. Introduction

Mission Bay is a valuable resource of San Diego that annually draws many visitors and tourists. The responsibility for preservation and protection of this small body of water lies directly with the City of San Diego. The Grand Jury finds that the Bay is being polluted every day from many sources; e.g., sewage spills, runoffs and polluted waters from creeks. Two-stroke engines are used in both personal watercraft and small powerboats. The pollution from two-stroke engines occurs even though there are numerous laws promulgated for the expressed purpose of preventing it. Why this is permitted is not clear. It is clear, however, that pollution does occur, and the City of San Diego does not comply with the statutes at the Federal, State or local level.

On any given day, one may see a number of PWCs racing around Mission Bay. These vessels use an inboard, internal combustion engine powering a water jet pump as its main source of propulsion. To minimize their weight and cost, they were constructed to use a conventional two-stroke marine engine.¹ PWCs are mainly used for recreational reasons and designed for speeds of up to 70 miles per hour. Their popularity has grown considerably over time, and they now represent a substantial percentage of the total sales of the boating industry. This unprecedented growth in the use of two-stroke engine PWCs generally caught Federal, State and local regulatory authorities and agencies unprepared to evaluate the implications and impact of their use on the environment.

B. The Polluting Effects Of The Two-Stroke Engine PWCs

Two-stroke engine PWCs contribute to pollution in two ways. First, they pollute the air by producing hydrocarbons and nitrogen oxides. Second, they pollute the water by discharging uncombusted oil and gasoline. Of these two forms of pollution, this report concentrates on the latter.

The main characteristic of the carbureted two-stroke engine is that the gasoline enters the combustion chamber at the precise time the exhaust is leaving. The ensuing mixing of the intake and exhaust gases results in raw gasoline passing directly out of the engine along with the cooling water. This is called the “scavenging process”, and it has been determined and

¹ Personal watercraft, as defined in 36 CFR §1.4(a) (2000), refers to a vessel, usually less than 16 feet in length, which uses an inboard, internal combustion engine powering a water pump as its primary source of propulsion. The vessel is operated by one person sitting, standing or kneeling on a seat that lies within the perimeter of the hull of the vessel itself. The length is measured from end-to-end over the deck on a line that is parallel to the centerline of the vessel.

corroborated by a large number of studies showing that 25 to 40 percent of the oil and gasoline used by these engines leave the compression chamber unburned².

The uncombusted gasoline of the conventional two-stroke marine engine goes first into the water, not the air. This muffles the sound. Approximately one half of this uncombusted oil and gasoline, evaporates immediately depending on water and air temperature. If the uncombusted oil and gasoline amount to 30 percent, for example, approximately one-half will spill in the water and remain there for some time.³ The gasoline constituents of the exhaust, including the HCs benzene, toluene, ethylbenzene, and xylene (BTEX compounds) will continue to evaporate from the surface of the water.⁴ If the constituents mix to more than a 3.3-foot depth, the evaporation rate slows down considerably and depends on the speed these chemicals mix with the water. These gasoline constituents can mix to 9-12 foot depths and remain there for up to two days.⁵ In addition, MTBE (Methyl Tert-Butyl Ether), an additive used to oxygenate gasoline, is more soluble and mixes more rapidly with water than any other gasoline constituents. It also lingers in the water for longer periods of time.⁶ The Environmental Protection Agency (EPA) lists MTBE as a possible human carcinogen and places it on the drinking water contaminant list.⁷

Laboratory experiments have shown that when fish were exposed to even low concentrations of gasoline constituents, they suffered genetic and reproductive defects. At high concentrations, the same constituents became very toxic.⁸ The effects of conventional marine engine exhaust (i.e., two-stroke) is of interest because small boats as well as PWCs can reach all parts of water bodies, including the very shallow ones.⁹ This is of paramount importance since wildlife usually resides in the shallow parts of the water such as those in Mission Bay.

Petrochemicals released from two-stroke engines float on the surface micro layer and settle within the shallow waters of bays, lakes, and oceans, where marine life is primarily young and vulnerable. These areas are the base of the food chain, inhabited by fish eggs, larvae, algae, crab, shrimp and zooplankton. Recent research on the subject has demonstrated that chromosomal damage, reduced growth and high mortality rates of fish occur at extremely low levels of hydrocarbon pollution.¹⁰ Such pollution may very well be bioaccumulating, poisoning the marine environment. This is primarily due to polycyclic aromatic hydrocarbons (PAHs).

² Correll, Mindy. Carbureted 2-Stroke engines. Pollution Prevention Team, Department of Environmental Quality, State of Oregon, 1999. Web site: www.deq.state.or.us/programs/P2/reports/marine-engines.html

³ Correll, Mindy, op.cit.

⁴ Office of Water, Drinking Water and Health fact sheets; Consumer Acceptability Advice & Health Effects Analysis on MTBE, U.S. Environmental Protection Agency, Washington, D.C. 1997. Office of Water. Drinking Water & Health Fact Sheet, National Primary Drinking Water Regulations for benzene, ethylbenzene, toluene and xylene. U.S. Environmental Protection Agency, Washington, D.C. 1998.

⁵ Miller, Glen C. & Mary Fiore. Preliminary Study on Gasoline Constituents in Lake Tahoe. University of Nevada, Reno 1997.

⁶ Office of Water, Drinking Water Advisory sheet, 1997; The Blue Ribbon Panel, 1999; Office of Mobile Sources, Methyl Tertiary- Butyl Ether. Environmental Protection Agency web site www.epa.gov/oms/consumer/gasolines/MTBE.html 1999.

⁷ EPA Federal Register, Vol. 63, no. 40, 1998.

⁸ Ericson, Balk L., et al. Effects of exhaust from two-stroke outboard engines on fish. Institute Of Applied environmental Research, Stockholm University, 1994; Koehler, Michele E. & John Hardy. Effects of Outboard Motor Emissions on Early Developments of the Killifish *Oryzias Latipes*. Western Washington University, 1999; Tjarlund, Ulla, et al. Further Studies of the Effects of Exhaust from two-stroke outboard Motors on Fish. Marine Environmental Research. Elsriier Sciences Limited, Great Britain. 1996. Otis, J.T., et.al., Toxicity of Ambient Levels of Motorized Watercraft Emmissions to Fish and Zooplankton in Lake Tahoe; California/Nevada, USA, University of Bordeaux, France, 1998.

⁹ Davis, Chip. Personal Watercraft Use to be Regulated in the Parks. 1998. National Park Service; Web site: www.aqd.gov/pubs/yir98/chapte01pg3.html; National Park Service. Personal Watercraft Use Within the NPS System. Department of Interior, Washington, D.C. 1998. National Park Service web site: www.nps.gov/refdesk/lpwcrule.html.

¹⁰ Giesy, John, P. Untitled. Michigan State University. 1997; Tahoe Research Group. The use of 2-Cycle Engine Watercraft on Lake Tahoe: Water Quality and Limnological Considerations. University of California, Davis 1997.

PAHs are substances that are contained in petrochemicals that form highly toxic and persistent compounds known to be: (a) carcinogenic to mammals; (b) ubiquitous contaminants that bioconcentrate; and (c) acutely phototoxic to aquatic organisms within minutes or hours.¹¹ Through controlled experiments, Professor John Giesy determined that it takes .05 ppb (parts per billion) of PAHs in the water to cause a 10 percent decrease in the zooplankton. This quantity of PAHs in the water will kill all zooplankton in a 30- minute test. The New York State Department of Environmental Conservation considers PAHs so dangerous that it regulates them at the same toxicity level with polychlorinated biphenyls (PCBs).

C. Regulatory Restrictions on The Two-Stroke Engine PWCs

In the early 1990s, the National Park Service commissioned a number of studies concerning the impact of two-stroke engine PWCs on the Florida Everglades. These studies showed that the use of such PWCs was incompatible with the health of Everglades National Park in a variety of ways. They showed that the use of two-stroke PWCs over emerging vegetation, shallow grass flats and mud flats was detrimental to their health, and also affected the life of birds and other living things that feed on such grasses. As a result, the National Park Service banned the use of two-stroke engine PWCs at Everglades National Park in 1994.¹²

The National Park Service and several other agencies have taken steps to limit and prohibit the use of two-stroke engine PWCs in lakes and other waterways until research on their environmental impact yields more authoritative and conclusive results. To date, more than 34 states have either implemented, or are about to implement, regulations managing or prohibiting the use of PWCs. The Fish and Wildlife Service and the National Oceanic and Atmospheric Agency (NOAA) have treated PWCs differently from other classes of watercraft. NOAA regulates the use of PWCs in most national marine sanctuaries, and the Court of Appeals for the District of Columbia declared that such a micro-specific regulation of PWCs is valid. The Court in *Personal Watercraft Industry Association v. Department of Commerce* [D.C. Cir. 1995 48F.3d 540] ruled that an agency can discriminate and manage PWCs, as long as the agency explains the reasons for such discrimination.

In February 1997, the Tahoe Regional Planning Agency voted unanimously to ban in Lake Tahoe two-stroke internal combustion engines, including those used in PWCs, because of their impact on water quality. This ban was subsequently modified by Ordinance No. 99-3, adopted in January 1999, that states: "... As of June 1 of 1999 conventional marine engines greater than 10 horsepower (other than auxiliary sailboat engines) are no longer allowed on Lake Tahoe. Until October 1, 2001, electronic gasoline injection 2-stroke engines, purchased before January 27, 1999, that meet US EPA standards or are auxiliary engines for sailboats, are allowed on the lake. Finally, 4-stroke engines, DFI 2-stroke, and any watercraft that meets CARB's 2001 or the US EPA 2006 emission standards are allowed on the lake. These rules apply to used engines as well as new ones".¹³

¹¹ Giesy, op. cit.; Long, Russell. *2-Stroke Engines Pollute 2-Much: The # 1 Source Of pollution In U.S. Waterways*. Earth Times August 97, 1/21/03.

¹² 59 Federal Register 58,781.

¹³ Tahoe Regional Agency Ordinance No. 99-3: 1997

In May 1998 the Bluewater Network, a coalition of over 70 organizations representing more than 5 percent of the country's adult population, petitioned the National Park Service to issue a rule prohibiting the use of two-stroke engine PWCs throughout the national park network. The National Park Service responded to this petition by issuing a temporary directive to the various park superintendents banning the use of such PWCs until a final decision was rendered. As a result of the final decision, two-stroke engine PWCs were banned from 67 park units. A follow-up lawsuit forced 13 parks to ban such PWCs after April 22, 2001, and the remaining eight faced a September 15, 2002 deadline.¹⁴

The National Park Service provided a PWC-specific regulation based on the premise that PWCs are different from other watercraft. They are different not only because of their design, but also because of their length-to-horsepower-ratio, thrust capacity, noise impact on visitors, and dismal safety record.¹⁵

In 1998 and 1999 Mission Bay lifeguards issued 651 and 1227 citations respectively. These infractions represented a number of different violations, but none of them deal with the pollution problem of the two-stroke engine PWCs.

D. Selective Count of PWCs In Mission Bay

The following Table summarizes the data provided by the San Diego lifeguards concerning PWC activity in Mission Bay.

The Table also recognizes the seven areas of the Bay in which PWCs are allowed to operate as exhibited in the Figure. These areas are: (1) the Channel, all of West Bay, except Sail Bay; (2) Sail Bay; (3) South Fiesta Island; (4) North Fiesta Island; (5) De Anza Cove and the boat launch area; (6) North Pac; and (7) South Pac. The Table identifies these areas as Sectors 1 through 7. These areas/ (Sectors) are also shown in the Figure.

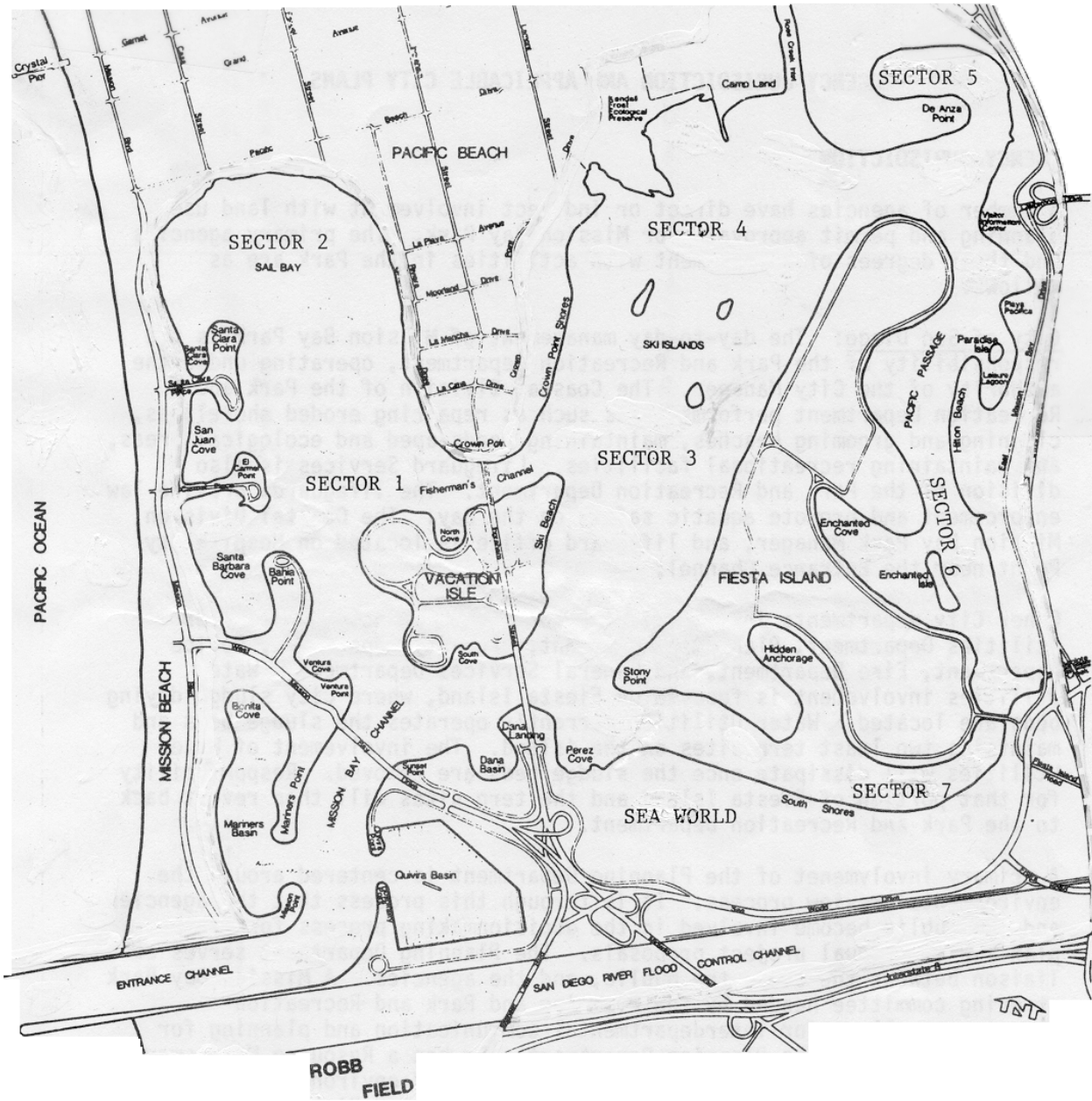
The rows of the Table provide the dates while the columns show the sites and years for which data are available. Data are available for only seven dates from 6/30 to 7/07 and seven Sectors. Lifeguards collected data for each Sector for three years. This accounts for the first twenty-one columns of the Table. The last 3 columns (i.e. 22, 23 and 24) show the total number of PWCs in Mission Bay on a particular date and year. In other words, it shows the sum of the PWCs in all Sectors on a particular date and year. For example, Row 7/04 and column 12 show that in 2002

¹⁴ In a recent announcement, the National Park Service postponed until April of 2003 the ban on PWCs at Lake Mead. The Park Service was directed to have a lake-management plan finalized, as well as environmental impact reports, by September 15, 2002, but it missed the deadline. The September 15th 2002 deadline was the result of an April 2001 federal court settlement agreement between the Interior Department and Bluewater Network, a San Francisco-based environmental group. The group had claimed that, to continue personal watercraft use at the Lake Mead, Lake Mohave and other national recreation areas, park managers must establish rules and show that the machines are not harmful to the environment. The Park Service said that both the environmental impact report and the management plan are now ready and will be released on January 10, 2003.

¹⁵ The PWC record of safety has always been quite dismal. Although they amount to less than 10% of all U.S. vessels, they are responsible for more than 55 percent of all collisions. In fact, the proportion of accidents involving PWCs is higher than those involving drunk drivers. (63 Federal Register 49,312-17, Sept. 15, 1998). In August 1997, The American Medical association reported, "...the rate of emergency department-treated injuries related to (PWCs) was about 8.5 times higher than the rate from motorboats." In this regard, it would be quite misleading to attribute this dismal safety record exclusively to the skills of the riders. According to the National Transportation Safety Board, "...PWCs have no braking mechanism. They coast to a stop, and while coasting, there is no turning ability." This inability to turn while coasting is the main reason for a very large number of accidents and fatalities throughout the U.S. On this see PWCweekly.com 6/8/02.

(02) and in Sector 4 on 7/04 there were 90 PWCs. The number of all PWCs in the Bay (i.e. in all Sectors) on 7/04 in 2002 (02) is given in Column 24 and it is 436. The total number of PWCs in a particular Sector and year is given by the last row of the Table. For example, in 2000 (00), Sector 3 hosted 272 PWCs during the period 7/01 to 7/04. Unfortunately, the collected data do not represent the same dates. Empty cells show that no data are available for that particular date and year.

FIGURE
MISSION BAY PARK



Map Courtesy of City of San Diego Planning Department

TABLE

NUMBER OF PWCs IN MISSION BAY, BY SECTOR AND DATE FOR THE YEARS 2000-2002

	Sector 1		Sector 2				Sector 3			Sector 4			Sector 5			Sector 6			Sector 7			Totals			
YEAR→ DATE↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
6/30		18			6			62			34			44			11			24				199	
7/01	84	15		18	4		46	27		60	72		47	60		8	18		19	44		282	240		
7/02	28			15			118			67			54			17			30			329			
7/03	23			12			35			72			35			10			20			207			
7/04	32	22	22	25	25	10	73	165	183	42	75	90	45	43	31	20	32	18	45	37	82	282	399	436	
7/06			27			8			51			48			33			7			15			189	
7/07			2			5			36			28			24			20			12			127	
Totals	167	55	51	70	35	23	272	254	270	241	181	166	181	147	88	55	61	45	114	105	109	1100	838	752	

*Sector 1 Channel, All West Bay but Sail Bay
 Sector 2 Sail Bay
 Sector 3 South Fiesta
 Sector 4 North Fiesta

Sector 5 De Anza Cove and boat Launch Area
 Sector 6 North Pac
 Sector 7 South Pac

- Notes: 1. In 2000, July 1st was Saturday, whereas in 2001, July 1st was Sunday. Strictly speaking, the only date that can be compared is July 4th for both years. The increase in the number of PWCs used on that date is 41.5%.
2. Although the Table does not differentiate between two and four-stroke PWCs, nevertheless, two-stroke engines propelled ninety percent of the PWCs shown.

The Table shows that the South and North Fiesta Island sites; i.e., Sectors 3 and 4, are the preferred locations by PWC enthusiasts. On July 4, 2000, 2001 and 2002, these two sites collectively attracted 41% [i.e.(73 + 42) divided by 282], 62% and 63%, respectively, of all PWCs operating in Mission Bay. This percentage increase occurred despite the fact that the total number of PWCs operated in the Bay had already increased by 55%; i.e., from 282 in the year 2000 to 436 in 2002. We do not know all the reasons for such a dramatic increase in the use of PWCs in the Bay. It is reasonable to assume, however, that the recent prohibition of their use in the various National Parks contributed to the increase in the demand for the facilities of Mission Bay.

The approximate dimensions of Sectors 3 and 4, taken together, are 1.5 miles in length and 0.5 mile in width. This area accommodated for the same periods of the years 2000, 2001 and 2002, that is, 7/1 through 7/4, 513, 435 and 436 PWCs, respectively. We remind the reader the numbers of PWCs for the years 2001 and 2002 represent only three days. Similarly, the approximate dimensions of the spaces immediately to the north and to the south of the Fiesta Island Causeway (i.e. Sectors 6 and 7) are 650 ft. in length by 300 ft. in width, and 1,200 ft. in length by less than 400 ft. in width, respectively. The Table, again, shows that during the four-day weekend of the July 4, 2000, and the three days for the years 2001 and 2002, the number of PWCs in Sector 6 amounted to 55, 61 and 45, respectively. The corresponding numbers of PWCs in Sector 7 for the same period were 114, 105 and 109.

The information provided in this Table concerning the distribution of watercraft among the various sites holds true for the whole year. This was confirmed and corroborated in conversations with lifeguards working at Mission Bay.

E. The Polluting Effects of the Two-Stroke PWCs on Mission Bay.

The majority of motorized boats have a horsepower-to-length ratio of 4:1 (e.g., a 22-foot boat will have a 90-horsepower motor). On the other hand, PWCs have a 12:1 horsepower ratio. This configuration of length and horsepower affords fast acceleration, speeds up to 70 mph, and sharp maneuverability. These are the very elements that make PWCs very appealing and exciting to their operators.

Two-stroke engines have remained the same since the 1940s. Unfortunately, the very advantages of the two-stroke engines, lightness and low cost are also the very causes and sources of pollution. To put it another way, private virtue becomes a collective public vice. The private benefits have to be weighed against the corresponding public costs.

Americans became outraged when the Exxon Valdez spilled its cargo of oil in Alaska. Yet, two-stroke PWCs, because of their sheer number, routinely, but insidiously, spill abundant quantities of oil and gasoline, but we do not experience the same reaction. This is the case, because the volume of such spills, as a single incident, is not as dramatic at one point in time and place. Over time it is possible the accumulated spills meet or even exceed the volume of large concentrated spills in any given location. Contrary to a Valdez-like spill that receives immediate remedial attention and action, spills from two-stroke engine PWCs go unnoticed and no remedial

action is undertaken. This failure to remediate manifests itself into significant accumulation of dangerous pollutants in small bodies of water such as Mission Bay.

The reader will appreciate the seriousness of the problem, as well as the magnitude of spilled oil and gasoline pollutants in parts of Mission Bay, in the following case. Consider the case of the sites south and north (i.e., Sectors 3 and 4) of the Fiesta Island Bay that are designated as PWC sites. The Table shows that in the period of four days during the July 4, 2000 holiday, there were 513 PWCs operating in these two sites. According to a number of PWC dealers and repair mechanics, a typical two-stroke, three-seater PWC consumes approximately 15 gallons of gasoline and 1.5 gallons of oil per 2 to 3 hours of operation at top speed. The corresponding numbers for two-seater PWCs are 10 gallons of gasoline and 1 gallon of oil.

We assume an average consumption for all PWCs of 12 gallons of gasoline and 1.25 gallons of oil in a period of 2 to 3 hours. Given the manner in which PWCs are usually operated, it is reasonable to assume that during a 10 to 12 hour day at the beach, the average operator will use his PWC at least 3 to 4 hours at top speed. It follows then that the average gasoline and oil consumption will be approximately 18 (i.e. 12×1.5) gallons of gasoline and 1.8 (1.2×1.5) gallons of oil.¹⁶ The total amount of gasoline and oil used by the 513 PWCs in both the north and south sites of Fiesta Island Bay during the 4 days would amount to approximately 9,000 (i.e., $18 \times 513=9,234$) gallons of gasoline and 900 (i.e., $1.8 \times 513=923$) gallons of oil respectively. Two-stroke engine PWCs are approximately 90% of the total number of PWCs operating in the Bay and, therefore, used 90% of gasoline and oil. This amounts to approximately, 8,000 [i.e., $9,000 \times (.9)=8,100$] gallons of gasoline and 800 gallons of oil.

Of these amounts of gasoline and oil, 25% to 40% is discharged into the water. Conservatively using an unburned rate of 30%, one may conclude that during the weekend of July 4, 2000, both sites collectively were subject to a spill of approximately 2,500 gallons of gas and 250 gallons of oil. From these quantities of gasoline and oil, 50% evaporated; therefore, the polluting gasoline and oil amount to approximately 1200 and 100 gallons respectively.

To remind the reader, the dimensions of both of these sites are 1.5 miles in length, and 0.5 miles in width, or 0.75 square mile, and the depth is approximately 8 feet. Given these dimensions, the corresponding spills and resulting pollution are excessive. According to the EPA, it takes 100 gallons of gasoline per square mile (i.e., 640 acres) to generate a colored sheen, 200 gallons of gasoline per square mile for a visible film, and 1332 gallons for an oil slick.¹⁷

The gallons of gasoline and oil discharged into Mission Bay are dramatic, but they represent a four-day weekend, not one day. The corresponding numbers for the 4th of July for the years

¹⁶ For simplicity we assume that the total number of PWCs is divided into two equal parts of three and two-seaters. The number of three-seater PWCs is far larger than that of the two-seater. The data provided by the lifeguards do not differentiate between the two and the four-stroke machines. From private conversations we had with a number of lifeguards we discerned that the two stroke PWCs are more than ninety percent of the total. This is so not only because the four-stroke option is only two or three years old, but also because it is substantially more expensive. Our calculations are based on the assumption that the two-stroke PWCs amount to the 90% of the total.

¹⁷ Wagner, Kenneth J. *Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions*, in *Proceedings of a National Conference on Enhancing the State's Management Programs*. Wisconsin Department of Natural Resources. Wisconsin Lakes 1991; U.S. Environmental Protection Agency, Region I: New England. *Do Motorboat Engines Cause Water Pollution?* Website: www.epa.gov/region1/questions/archive/200106_boatpollution.html 01/23/03.

2000, 2001, and 2002 amount to 300, 650 and 737 gallons of gasoline; and 30, 65 and 74 gallons of oil, respectively. The evaporated material contains more gasoline than oil. We shall ignore this fact for the sake of simplicity.

Earlier it was suggested that this report shall not deal with the problem of air pollution, which is quite serious. There is an aspect of air pollution that must be addressed at this juncture. This is the problem of odor. According to Wagner and EPA, a 100-acre body of water, 20 feet deep, disregarding flushing and decomposition, will support 250 hours of power boating, assuming a 10 percent discharge of uncombusted gas and oil before it reaches its threshold of odor.¹⁸ The tolerance level is far lower for more shallow bodies of water and higher emission levels. In the case of Mission Bay, the depth of Sectors 3 and 4 is approximately 9 feet and the emission of oil is 30%. In addition, using once more the 4th of July as a benchmark, and assuming 4 hours of use per PWC, one can see that for the years 2000, 2001 and 2002 the PWCs logged approximately 460, 960 and 1100 hours of boating. This explains why, during the early evening hours when the wind has died down, the gasoline odor around Sectors 3, 4, 6, and 7 is often pronounced.

Regarding Sectors 6 and 7, one can see that the spilled gasoline and oil in Sector 6 on the 4th of July period for 2000, 2001 and 2002 amounted to approximately 300, 300 and 200 gallons of gasoline, and 30, 30, and 20 gallons of oil; half of these amounts remain in the water. The corresponding numbers for Sector 7 are approximately 300, 250 and 250 gallons of gasoline, and 30, 25 and 25 gallons of oil. Given the dimensions of these two sites, the amount of pollution generated by the PWCs remains unacceptable. Lifeguards collected data for the years 2001 and 2002 for a three-day period only, compared to a four-day period in 2000.

In addition to the two-stroke PWCs, during the sampling period, there was a substantial number of other motorboats in the Bay. During the same periods as those shown in the Table for the years 2000, 2001 and 2002, the corresponding number of motorboats in Mission Bay were 911, 583 and 787. According to lifeguards, at least 30% of these boats use a two-stroke outboard engine with the same characteristics and pollution generating problems as those of the two-stroke engine PWCs. The presented calculations do not include any discharge of gasoline and oil from these boats.

One might object to the timing used in these examples. These were the only data available concerning the use of PWCs in Mission Bay. The majority of summer weekends, however, look much like any 4th of July weekend. Other days, although they may not have as much traffic as 4th of July weekends, are nevertheless busy enough to make the oil and gasoline discharging and, therefore, pollution of the water in these two sites of the Bay a continuous process.

At the request of the Grand Jury, lifeguards collected data on the number of PWCs in Mission Bay during September 2002. During the period of August 27, 2002, to September 28, 2002, they counted 723 PWCs, throughout all of the Sectors. Out of these 30 days, PWCs did not record any activity for 6 days because the weather was foggy (September 23, 24 and 25), or it rained (September 6), or the Bay was used by the Thunderboats (September 21 and 22).

¹⁸ Wagner, op. cit.; EPA, op. cit.

Using the same assumptions concerning the consumption of gasoline and oil, by the two-stroke PWCs, it is estimated that the Bay received a discharge of 3500 gallons of gasoline and 350 gallons of oil during those twenty-four days of September 2002. Each day during September 2002, the Bay suffered a discharge of 150 gallons of gasoline and 15 gallons of oil. From these quantities, 50% evaporated, and the other 50% remained in the water for at least 24 hours. Given, the amount of overlapping, the problem might be far more serious than the numbers suggest.

What makes this situation worse is that the tidal action within the Bay is not thorough, thereby allowing gasoline and, particularly oil, in addition to other forms of pollution, to linger for longer periods of time. Studies involving computer simulations and physical modeling show that neither a major configuration of Fiesta Island, nor a removal of the Causeway, would have an appreciable effect on the tidal flushing of these four sites or the Bay.¹⁹

F. Institutional Jurisdiction

Park Rangers and lifeguards are designated as stewards of Mission Bay. Their job is the overall management of Mission Bay to ensure the policing and protection of the recreational areas of the Bay and its natural and cultural resources. It is their duty to maintain the Bay in such a way that it provides San Diegans and visitors a broad range of recreational activities. They are expected to advocate for the welfare of the Bay and its cleanliness. Permitting the use of two-stroke engines in general, and two-stroke engine PWCs in particular, in Mission Bay, contradicts the definition of their job, and directly violates existing statutes. This failure to perform their duty comes with a very specific cost, expressed in terms of an odious, insidious, and unacceptable form of pollution.

The National Park Service has recognized the detrimental impact of PWCs on static, non-flushing waters of lakes. It has banned their use on some waters and is considering such action on others. A brochure distributed by Park Rangers and lifeguards, entitled "City of San Diego, Mission Bay Park, Rules and Regulations," states, "Jet skis, wet bikes, wave runners and similar types of watercraft may use any of the boating areas, following all of the regulations for powerboats..." That brochure was made possible through a grant from the Mission Bay Park Endowment Fund of the San Diego Foundation in 1999. The Mission Bay Endowment Fund was established to maintain and preserve Mission Bay!

Jurisdiction for the management and preservation of Mission Bay Park is set forth in the San Diego Municipal Code, which provides:

Beach Areas-Authority and Control, (a) The Park and Recreation Department of the City of San Diego shall have jurisdiction and control over all beaches owned or controlled by the City of San Diego and all waters abating or adjacent thereto within the limits of the City of San Diego, and all lands

¹⁹ In terms of vulnerability of the various Sectors, our discussions with a number of scientists and officials lead us to believe that Sector 6 is the most vulnerable one followed by Sectors 7, 3 and 4. In fact, recent experiments and observations not only confirmed these findings, but also determined that the salinity of the site North of the Causeway; that is, Sector 6, is considerably higher than that of the Ocean. This high salinity exists despite the fact that Tecolote Creek brings fresh water into this site. The explanation for this higher level of salinity is that the water in this part of the Bay is more or less static. In other words, the flushing is not sufficient, therefore, the water evaporates faster than the water in the Ocean. This is precisely the phenomenon that occurs in lakes. On this see, Henry, K.H., Mission Bay Sewage Interceptor System Protects against Non-Point Solution. Water Utilities Department, The City of San Diego, Undated Manuscript.

heretofore and hereafter owned or controlled by the City, adjoining the waterfront of the Pacific Ocean and the waters of Mission Bay, and it shall be responsible for the control and management of said beaches and lands, and waters abating or adjacent thereto, and of the recreational activities thereon and therein. (b) In the following sections dealing with the same subject, wherever the context thereof shall permit, the term “beach area” shall mean any beach or land in the waters abating or adjacent thereto under the jurisdiction and control of the Park and Recreation Department, as set forth in paragraph (a) of this section. *San Diego Municipal Code §63.20*. [Emphasis added by the Grand Jury (GJ)]

... It is the duty of the Park and Recreation Director, as the City Manager’s designee, to enforce the provisions of this section; and all employees of the Park and Recreation Department charged with the duty of maintaining peace, order and safety in beach areas are empowered to assist the police officers of the City of San Diego in the enforcement of the provisions of these sections including the power to make arrests for the violation hereof. Whenever a power is granted to, or a duty is imposed upon the Director, the power may be exercised, or the duty may be performed by the Park and Recreation Director, or any person the Director may designate for the enforcement of these regulations. *San Diego Municipal Code §63.21*. [Emphasis added by the GJ]

G. Environmental Statutes

Consider now the case of an alternative violation. Suppose an individual empties a 5-gallon bucket of engine oil and gasoline into the Bay in front of a Park Ranger. It is the duty of the Park Ranger to deal with this incident as it is clear that the Federal and State Clean Water Acts, and also a number of other State and local statutes, regulations and ordinances are all consistent with each other. For example: Title 33, Chapter 26, entitled, “Water Pollution Prevention and Control”, 33 U.S.C. §1321(a)(2) states:

“‘discharge’ includes, but it is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping, ...”; 33 U.S.C. §1321(b)(3) “The discharge of oil or hazardous substances (i) into or upon navigable waters of the United States, adjoining shorelines, or into or upon the waters or the contiguous zone, ... in such quantities as may be harmful as determined by the President under paragraph (4) of this subsection, is prohibited...”; 33 U.S.C. §1319(c)(1)(2) Any person who negligently violates § 1321(b)(3) shall be punished by fine of no less than \$2,500 nor more than \$25,000 per day of violation, or by imprisonment for not more than one year, or by both. For the second conviction the fine increases to \$50,000 per day or by imprisonment of two years or both. [Emphasis added by the GJ]

Further, the State of California explicitly provides:

It is unlawful and constitutes a misdemeanor for any person **to discharge, or suffer the discharge of oil by any methods, means, or manner, into or upon the navigable waters of the State** from any vessel using oil as fuel for the generation of propulsion power, or any vessel carrying or having oil in excess of that necessary for each lubricating requirements, in such as may be required under the laws and prescribed rules and regulations of the United States and this State. As used in this Section, the term ‘oil’ means oil of any kind or in any form, including gasoline oil, oil sludge, and oil refuse, and the term, ‘navigable waters of the State’ means all portions of the sea within the territorial jurisdiction of the State, and all inland waters navigable in fact in which the tide ebbs and flows. *California Harbors and Navigation Code §133*. [Emphasis added by the GJ]

And again, the San Diego Municipal code states:

...It is unlawful to **discharge, deposit, or cause or allow to be discharged,** deposited, to pass in or **into the waters of Mission Bay,** any coal tar, refuse or residual products of coal, petroleum, asphalt, bitumen, or any other carbonaceous material or substance. *San Diego Municipal Code §63.25.62*. [Emphasis added by the GJ]

The Park Rangers should issue citations to any individual operating a two-stroke engine PWC for violating the same statutes. This is because, in a period of 4 to 5 hours at top speed, the typical two-stroke engine PWC consumes approximately 18 gallons of gasoline and 1.8 gallons of oil, discharging in the water approximately 30%, or 5 gallons of gasoline and 0.5 gallons of oil. The Grand Jury believes that the statutes address both the person who dumps the bucket of oil and gasoline into the Bay and the operator of the two-stroke engine PWC that discharges oil and gasoline into the Bay. Only the person who dumped the oil and gasoline is likely to be cited, while the operator of two-stroke engine PWCs is allowed to pollute without retribution.

The Grand Jury thinks that the above statutes provide the City with adequate justification to apply the law in the case of two-stroke engine PWCs. However, if there is a dispute as to the adequacy of the above statutes then the City could adopt regulations addressing the problem by enacting specific ordinance(s).

H. Response From the Office of the City Manager

On July 14, 2000, the Office of the San Diego City Manager issued Report No. 00-143 entitled, “Personal Watercraft Use on Mission Bay.” The report was issued as “an information item only” that required no action on the part of the City Council. It recognized that Mission Bay is one of the most desirable locations for PWCs along the Southern California coastline. Referring to the 1994 Mission Bay Park Master Plan Update calling for the retention of dedicated areas for PWCs, and the property management of Mission Bay, the report noted:

The use of PWC[s] on Mission Bay is currently regulated under Federal, State, and Local laws. California Harbors and Navigation Code Section

268 permits the City to adopt restrictions concerning the navigation and operation of vessels subject to the provisions of Section 660(a). Section 660(a) provides that the City can only regulate the use of vessels if the regulations involve time-of-day restrictions, speed zones, special-use areas, and sanitation and **pollution control**. ... [Emphasis added by the GJ]

The City of San Diego, by its own admission, has placed restrictions on PWCs regarding time-of-day, speed zones, and special use areas. It has completely ignored pollution and its control. The rationale for doing so is (1) there are other motorized vessels, other than PWCs that also use two-stroke engines; (2) no study identified a significant pollution problem in Mission Bay due to gasoline from motorized vessels; and (3) the California Air Resources Board (CARB) mandated that all marine engines, including those powering PWCs, must meet a 75% reduction in emission standards by the 2001 model year. This rationale is flawed.

The fact that other vessels also use a polluting two-stroke engine just like the PWCs is an argument **to ban all such vessels, not to ignore the problem and allow all of them to pollute**. [Emphasis added by the GJ] Even if no study exists that addresses pollution in Mission Bay due to gasoline and oil from motorized vessels that does not alter the fact that two-stroke engines cause pollution.

The Grand Jury, however, is aware that the two-stroke outboard engines do not result in as much pollution as the two-stroke engine PWCs. This is mainly for two reasons: First, the configuration of two-stroke engines is very different and Second, because boats using outboard two-stroke engines use their power to go to a particular destination and not to race in a particular area as PWCs do. For these reasons the Grand Jury limits its report to two-stroke engine PWCs.

Finally, CARB's mandate that the 2001 model year two-stroke engines achieve a 75% reduction in emission standards does not address the polluting impact of the two-stroke engine PWC models manufactured during the prior 15 years and still in use today.

What is even more disturbing is that the authors of the City Manager's report ignore the fact that the existing laws prohibit **any** discharge of oil and gasoline in the U.S. waterways and Mission Bay. [Emphasis added by the GJ]

PROCEDURES EMPLOYED

Grand Jury members:

- Reviewed a number of Federal, State, and local statutes, regulations and ordinances. In particular, they reviewed the U.S. Federal Register (FR), the U. S. Code of Federal Regulations (CFR), the California Harbor and Navigations Regulations (H&N), and the San Diego Municipal Code (SDMC).
- Reviewed a number of publications distributed by the Environmental Protection Agencies of both the State and the Federal Government.

- Consulted a number of papers published in scientific journals.
- Interviewed a number of lifeguards and department heads of the City of San Diego.
- Interviewed a number of repair mechanics and sales persons from a variety of two-stroke engines and PWC dealerships in San Diego.
- Visited Mission Bay several times to ascertain site dimensions, PWC activity and wind direction.

FACTS AND FINDINGS

The Grand Jury finds that:

- A. Mission Bay is being polluted from a variety of sources: sewage spills, runoffs and polluted creek waters.
- B. Despite the limited availability of data, the growth of the PWCs using the Bay has been substantial. Between the years 2000 and 2002, the number of PWCs using Mission Bay on the Fourth of July increased from 282 to 436, an increase of 55%. This increase does not represent only two-stroke engine PWCs. This is because the industry has developed cleaner and better alternatives. However, the great majority of PWCs in Mission Bay (lifeguards claim up to 90%) are of two-stroke engine PWCs which are significant polluters.
- C. Two-stroke engine PWCs contribute substantially to the pollution of Mission Bay in two ways. First, they pollute the air by producing hydrocarbons and nitrogen oxides and, second, they pollute the water by discharging uncombusted gasoline and oil.
- D. Scientific studies have shown that 25 to 40% of gasoline and oil used by the two-stroke engines leave the compression chamber unburned. The same studies show that approximately 50% of the uncombusted material is discharged in the water.
- E. The uncombusted material contains MTBE and PAHs. The former substance is more soluble than the gasoline itself, lingers longer in the water, and is on the EPA's list as a possible human carcinogen. The latter substances are highly toxic and persistent compounds known to be: (a) bioaccumulative and poisonous to the marine environment; (b) carcinogenic to mammals; (c) ubiquitous contaminants that bioconcentrate, and (d) acutely phototoxic to aquatic microorganisms within minutes or hours. The New York State Department of Environmental Conservation considers PAHs so dangerous that they are regulated at the same toxicity level as PCBs.
- F. The extent of pollution in Mission Bay, because of the operation of the two-stroke engine PWCs, is considerable. This is particularly true in the case of Sectors 3,4,6 and 7. The number of two-stroke engine PWCs operating in these Sectors on the Fourth of July, for instance, given their dimensions, yield an amount of uncombusted

gasoline and oil which results in more than a thin film left on the water according to an EPA study.

- G. Not all the parts of Mission Bay flush equally well. In fact, some areas (e.g. Sector 6) behave almost like a lake.
- H. Numerous regulatory agencies have imposed restrictions on the use of the two-stroke PWCs. These regulations vary from outright bans of their use to allowing their usage in specific sites.
- I. There is a problem of jurisdiction concerning the management and protection of Mission Bay. The Parks and Recreation Department of the City of San Diego has the jurisdiction but not the means to police Mission Bay; the lifeguards have the means but do not have the jurisdiction.
- J. Statutes exist at the Federal, State and local levels that prohibit the discharging of oil and gasoline upon navigable waters, in general, and Mission Bay, in particular. If these statutes and ordinances at the Federal, State, and local levels are found insufficient for the purpose of citing two-stroke engine PWC operators, the City can adopt its own ordinance(s) to achieve the same effect.
- K. The designated stewards demonstrate inadequate awareness of these statutes concerning oil and gasoline discharge into Mission Bay.
- L. The designated stewards of Mission Bay, either as an act of omission or an act of commission, have not performed all of their designated duties.
- M. Of 1442 tickets issued by the lifeguards during the period 1999 through 2002, not one was issued to two-stroke engine PWC operators for discharging oil and gasoline into the water and polluting Mission Bay.

RECOMMENDATIONS

That the San Diego City Manager, Mayor of the City of San Diego and the San Diego City Council:

- 03-17:** Direct the designated stewards of Mission Bay to apply the local ordinances concerning the polluting effects of the two-stroke engine PWCs on the environment of Mission Bay and cite the violators, or, if it is necessary, enact new ordinance(s) to achieve the same results.

That the San Diego City Manager:

- 03-18:** Authorize also the lifeguards to be responsible for the enforcement of statutes concerning pollution of Mission Bay.

REQUIREMENTS AND INSTRUCTIONS

The California Penal Code §933(c) requires any public agency which the Grand Jury has reviewed, and about which it has issued a final report, to comment to the Presiding Judge of the Superior Court on the findings and recommendations pertaining to matters under the control of the agency. Such comment shall be made *no later than 90 days* after the Grand Jury publishes its report (filed with the Clerk of the Court); except that in the case of a report containing findings and recommendations pertaining to a department or agency headed by an elected County official (e.g. District Attorney, Sheriff, etc.), such comment shall be made *within 60 days* to the Presiding Judge with an information copy sent to the Board of Supervisors.

Furthermore, California Penal Code §933.05(a), (b), (c), details, as follows, the manner in which such comment(s) are to be made:

- (a) As to each grand jury finding, the responding person or entity shall indicate one of the following:
 - (1) The respondent agrees with the finding
 - (2) The respondent disagrees wholly or partially with the finding, in which case the response shall specify the portion of the finding that is disputed and shall include an explanation of the reasons therefore.
- (b) As to each grand jury recommendation, the responding person or entity shall report one of the following actions:
 - (1) The recommendation has been implemented, with a summary regarding the implemented action.
 - (2) The recommendation has not yet been implemented, but will be implemented in the future, with a time frame for implementation.
 - (3) The recommendation requires further analysis, with an explanation and the scope and parameters of an analysis or study, and a time frame for the matter to be prepared for discussion by the officer or head of the agency or department being investigated or reviewed, including the governing body of the public agency when applicable. This time frame shall not exceed six months from the date of publication of the grand jury report.
 - (4) The recommendation will not be implemented because it is not warranted or is not reasonable, with an explanation therefore.
- (c) If a finding or recommendation of the grand jury addresses budgetary or personnel matters of a county agency or department headed by an elected officer, both the agency or department head and the Board of Supervisors shall respond if requested by the grand jury, but the response of the Board of Supervisors shall address only those budgetary or personnel matters over which it has some decision making authority. The response of the elected agency or department head shall address all aspects of the findings or recommendations affecting his or her agency or department.

Comments to the Presiding Judge of the Superior Court in compliance with the Penal Code §933.05 are required by the date indicated from:

<u>RESPONDING AGENCY</u>	<u>RECOMMENDATIONS</u>	<u>DATE</u>
SAN DIEGO CITY MANAGER	03-17, 03-18	07/08/03
SAN DIEGO CITY MAYOR	03-17	07/08/03
SAN DIEGO CITY COUNCIL	03-17	07/08/03