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Reducing Pollutants in Industrial Stormwater Runoff: Improved Water Quality Protection Using Prioritized Facility Regulation

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by

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Note to Reader:

The original of this document contains color that is necessary for understanding the data.

The original dissertation is on file with the USF library in Tampa, Florida.

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REDUCING POLLUTANTS IN INDUSTRIAL STORMWATER RUNOFF:
IMPROVED WATER QUALITY PROTECTION USING
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ABSTRACT

Stormwater pollutants originating from industrial facilities can lead to degraded water quality, even in residentially dominated regions of the country. The National Pollutant Discharge Elimination System permit program regulates stormwater pollutants generated at industrial sites using Multi-Sector General Permits (Generic permits) for industrial facilities and a permit requirement for Municipal Separate Storm Sewer System (MS4) operators. All industrial facilities within 11 broad categories of industry are responsible for self-identifying the need to comply with the Generic permit, and subsequently, implementing self-selected pollution prevention strategies. MS4 operators are required to identify and inspect “high risk” industrial and commercial facilities that may be contributing substantial pollutant loads to the MS4, in addition to other requirements. This is partially in recognition that compliance with the Generic permit has been poor. This dual level of regulations is designed to enhance water quality protection, however, the reliance on local inspectors to develop a definition of “high risk” has led to irregular implementation.

This research developed a methodology to identify industrial facilities and then screen out facilities that may not require inspection by the MS4 operator. Phone questionnaires were administered to 250 industrial facilities. Results were validated using fenceline visits and on-site inspections with local inspectors. Overall compliance by participating facilities with the Generic permit was approximately 10%.

Neither the Generic permit nor the MS4 permit has been effective because numerous facilities have gone unregulated. Currently, the Generic permit has attempted to regulate too many facilities, many of which may not be affecting water quality. MS4 “high risk” inspections have not improved compliance with Generic permit either because of the prioritization of facilities. The reliance on local interpretation, which requires MS4 operators to select a definition of “high risk” based on their desired level of water quality protection and available resources, can potentially exclude many facilities from inspection. Adopting a definition of intensity for regulating industry may both improve compliance with the General permit, ensure water quality protection, and improve resource usage.

CHAPTER I – INTRODUCTION

This research was developed to address the current regulatory control of pollutants originating in stormwater runoff associated with industrial activity. Water quality is a concern to citizens of the United States and regulations have been promulgated to improve the quality of the nation's waterbodies. Industrial facilities have the potential to contribute pollutants to stormwater, thereby affecting receiving waterbodies, such as lakes and estuaries, into which stormwater drains. Industry is present in some capacity in most urbanized regions of the country. Regulations designed to reduce pollutants from industry, however, can be burdensome and costly. These regulations require both industrial facilities and local municipalities to be permitted. However, differences in federal and local permit language can lead to heterogeneous enforcement and regulation of industry, based on the interpretation of permit requirements by local agencies.

This paper begins with a brief explanation of water quality concerns and the current water quality regulations, especially those related to industrial stormwater runoff. This will highlight the need for more effective regulations. The paper then reviews the research objectives in Chapter Two. The literature review in Chapter Three explores environmental regulations, policy evaluations, current water policy research, and the research setting in greater detail. Chapter Four explains the research methodology developed to assess the effectiveness of the dual-level system of industrial stormwater

regulations, as implemented in a typical residential Florida county. Chapter Five presents the research results, followed by a discussion of additional relevant findings in Chapter Six. The paper ends with research conclusions in Chapter Seven and then applicable references and appendices.

I. A. Water Quality in the United States

Federal regulations designed to improve water quality in the United States have been in existence for 35 years, yet evidence of substandard water quality persists. Poor water quality can arise for a number of reasons, including such varied sources as residential and stormwater discharges, atmospheric deposition, and direct discharges of industrial wastes into receiving waterbodies. The U.S. Environmental Protection Agency's *National Water Quality Inventory: 2000 Report* noted that 39% of assessed rivers, 45% of assessed lakes, and 51% of assessed estuaries were "polluted." These figures were even poorer than the results from the 1998 report. Additionally, the majority of the nation's waterbodies – as much as 81% of our river miles – have not been studied yet (USEPA, 2000). Houck (2002) stated that of the 19% of the nation's river, lakes, and estuaries that have been assessed for pollution, "approximately one-third of America's waters do not meet water quality standards."

In Florida there are more than 1.2 million acres and 16,000 miles of impaired waters in 2004 (WCEI, 2004). In the Tampa Bay region of Florida alone, nearly 150 waterbody segments were impaired for at least one pollutant in 2002 (FDEP, 2002). Typically, these waterbodies are polluted with sediments, pathogens, excess nutrients, oil, grease, heavy metals, and various other pollutants (Kubasek and Silverman, 2005; Horner *et al.*, 1994).

Many federal and state laws have been enacted to combat some of these problems and to improve the quality of the nations' waterbodies. However, while federal legislation, specifically the Federal Water Pollution Control Act, has improved water quality since the early 1970s (even with setbacks occurring in recent years), many waterbodies are still not clean enough to support activities such as swimming and fishing (Houck, 2002).

Current water quality regulations include provisions to address all potential sources of water pollution, however, industrial stormwater may be less effectively regulated. Although current stormwater regulations are extensive and burdensome to industry, the shift from traditional "command-and-control" practices (those that rely on penalties, numeric limits, and often dictate pollution abatement technologies) to self-identification and self-selected pollution prevention strategies by industry may have caused poor compliance and insufficient management of pollutant generating activities. In order to effectively manage water quality, however, all potential pollutant sources should be identified, controlled, and regulated, as appropriate.

Two permit programs currently address pollutants originating in industrial stormwater runoff. The National Pollutant Discharge Elimination System requires industrial facilities to apply for a permit to discharge pollutants to stormwater and, subsequently, implement self-selected pollution prevention strategies. The federal regulations also mandate permits to local municipalities, such as counties and cities, to reduce pollutants in their municipal separate storm sewer systems. A component of the local permits involves the prioritization of industry for inspections. This research examined and assessed the effectiveness of the dual-level system of federal and local

industrial stormwater regulations, as implemented in a typical residential county in Florida.

Poor water quality can occur due to various natural and anthropogenic threats. Of the anthropogenic sources, they are generally categorized as either point or non-point sources. Point sources originate from a stationary and identifiable source, such as a publicly operated treatment works (POTWs) or an industrial plant. Non-point sources include indirect discharges from a variety of sources, such as runoff from residential, industrial, and agricultural lands, and atmospheric deposition. Non-point sources are more difficult to control because of their diffuse nature. Subsequently, federal, state, and local enforcement of non-point sources has lagged. Partially due to extensive controls on point sources, it is widely believed that non-point sources are the more significant threat to water quality today (Rosenbaum, 2002).

Non-point source pollution is a threat to water quality across the nation and Florida is no exception. Within the Tampa Bay region of Florida, non-point sources contributed 63% of the total nitrogen loading to Tampa Bay between 199-2003 and are also contributors of phosphorous, total suspended solids, and biochemical oxygen demand (Poe *et al.*, 2005). Urban runoff can also contain oxygen-demanding substances, metals, pathogens, petroleum hydrocarbons, and synthetic organics (Horner, 1992 *in* Horner *et al*., 1994). Currently, industrial runoff is the number one contributor of zinc and copper loading, and, along with commercial land, has the highest pollutant loading production of all the stormwater sources (Horner *et al.*, 1994).

Recent attempts to regulate non-point sources have been only marginally successful and, while non-point source pollution is now recognized as a threat to water

quality, the use of self-monitoring approaches makes it difficult to compare to traditional command-and-control regulations. Because the NPDES industrial stormwater regulations incorporate pollution prevention strategies and narrative reduction goals, it is more difficult to determine success than when using numerical water quality limits.

This research focused on industrial runoff, as it has previously received less scholarly attention. Industrial stormwater runoff deserves regulatory and scholarly evaluation, however, as it is a source of heavy metals, chemicals, excess nutrients, and sediments – all of which can degrade the quality of receiving waterbodies (Duke and Bauersachs, 1998; Line *et al*., 1996). The often-cited results of the National Urban Runoff Program (Athayde *et al*., 1983) acknowledged that the issue of industrial runoff deserved further investigation, as it was not specifically included in that study. Since that report, numerous researchers including Duke and Pitt have investigated industrial stormwater, however, there has been little focus on the prioritization of industrial facilities, as directed in local permits.

Industry is present in most urbanized areas of the country. While certain areas support a larger industrial base; Los Angeles, California or New York, New York for example; industrial activities and their processes are a potential pollutant source in any region containing industry. This research focused on Pinellas County, Florida, located in west central Florida (Figure 1). Pinellas County is the state's second smallest county in area, but it is the most densely populated and houses more than 2,000 manufacturing and transportation facilities (see Tables 1 and 2). These industries range from small, one-person operations to multi-national corporations. As in other urbanized areas, industry is a visible component of Pinellas County.

Industry may contribute pollutants to stormwater and, therefore, necessitate regulation; however, it may be unnecessarily burdened with regulations. The Multi-Sector General permit, which is issued to all industrial facilities listed in the NPDES regulations, includes a permit application fee and subsequent pollution prevention strategies which can cost thousands of dollars, depending on the individual site. Even facilities that do not require a permit must pay for a No Exposure Certification. There is little data compiled about whether these burdensome regulations are of value and how industries can be prioritized so that only those that are potentially contributing pollutants to stormwater are required to comply. This research has strived to make recommendations that improve water quality protection while, at the same, reducing the regulatory burden for many facilities.

I. B. Clean Water Act

The Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), represents the first major federal regulation designed to improve the health of waterbodies in the United States. The earliest versions of the act focused on protecting water quality through the regulation of point sources. This was a natural first step as point sources are generally easier to identify and regulate. Despite billions of dollars in federal spending and participation by government agencies, however, goals set by the policy have not been accomplished (WEF, 1997 and Adler, 1997). For example, the goal of improving water quality to the level necessary for safe swimming and fish consumption has not been met even after 30 years (USEPA, 1996). This is evident by the persistence of fish consumption advisories listed by the EPA (2005). In Florida, for

example, 71 separate waterbodies had active fish consumption advisories in 2005, sometimes for as many as eight nekton species (NLFA, 2005).

I. C. National Pollutant Discharge Elimination System Permit Program

Urban runoff, including industrial stormwater, was first addressed in the 1987 CWA amendments, which included the National Pollutant Discharge Elimination System (NPDES) Permit Program (NPDES, 1995). The NPDES permit program requires point sources to be regulated through the use of a permitting system. While the permit program was originally enacted in 1972 for the control of wastewater, it was re-authorized to extend to other sources of water pollution. The Natural Resources Defense Council (NRDC) sued the EPA in 1972 to require typically labeled “non-point” sources, including storm sewers, to be regulated as point sources (NRDC, 1999). While the outfall of a stormwater system is now classified as a point source of pollution, for regulatory purposes, this research will continue to classify industrial stormwater runoff as a form of non-point pollution.

The NPDES regulations have become more stringent and specific since their original enactment and now regulate operators of municipal separate storm sewer systems (MS4s), construction sites, and industrial and commercial sources, such as manufacturing plants or transportation facilities. The federal NPDES industrial stormwater regulations mandate compliance by all industrial facilities listed under 11 categories, either by Standard Industrial Classification (SIC) code or narrative description (40 CFR 122.26 (b)(14)(i)-(xi)). Regulated industries range from mining operations and auto salvage facilities to lumber yards and electronics manufacturers. The available permits are discussed in further detail in the Literature Review, but require a facility to apply for a

Multi-Sector Generic Permit (Generic permit) and, subsequently, implement a variety of pollution prevention strategies to limit pollutant exposure to stormwater. This form of regulation is a departure from the water quality end-of-pipe approaches used for direct pollutant discharges, such as POTWs and industrial wastewater. While the regulations specify that industries must apply for a permit if they discharge pollutants into stormwater, many industries are either unaware that this permitting system exists or have chosen not to comply (Duke and Shaver, 1999).

The NPDES permit program also mandates permits for operators of municipals separate storm sewer systems (MS4s). An MS4 is defined by the Florida Department of Environmental Protection as a, "publicly-owned conveyance or system of conveyances (i.e., ditches, curbs, catch basins, underground pipes, etc.) that is designed for the discharge of stormwater to surface waters of the State" (FDEP, 2005a). MS4s may be owned by municipalities, counties, colleges, drainage districts, or other entities. The Pinellas County government holds a MS4 permit, along with 22 incorporated cities in the County. The NPDES program is now administered by the State of Florida.

The local MS4 permit, issued by the Florida Department of Environmental Protection, requires municipalities to protect the water quality of their MS4s and provides for this protection by mandating inspection of "high risk" industries, among other responsibilities, such as eliminating illicit discharges or limiting runoff from residential areas. MS4 permit holders, such as Pinellas County, are required to implement a comprehensive stormwater management program to reduce contamination of stormwater runoff and prohibit illicit discharges to the MS4s (FDEP, 2005a). One requirement is to identify priorities, inspect, and monitor for "high risk" industries. There is flexibility in

how industries are identified and inspected, and permit holders are encouraged to tailor the definition and approach to best serve their location, industrial community, and resources.

This dual system of regulations includes some overlap, as facilities subject to the NPDES guidelines may also be inspected by local regulators. Therefore, an industrial facility located in an urbanized region subject to a MS4 permit may simultaneously be required to obtain an industrial stormwater Generic permit, under the federal or state NPDES program, and may also be regulated by the MS4 permit holder, such as Pinellas County. This dual system of regulations is designed to add a layer of protection for the water quality in MS4s, as compliance by industry with the Generic permit has been low. However, this overlapping system is confusing and may be over-reaching. The MS4 permit holders are expected to propose a definition of “high risk” and appropriately identify and inspect industrial facilities. However, the undefined phrase “high risk” may hinder MS4 permit holders in their ability to ascertain which facilities are more likely to contribute pollutants to stormwater. This research hypothesized that Pinellas County (County), along with other Florida MS4 permit holders, has not adequately defined the term “high risk” in order to protect its MS4 water quality, nor has it improved universal compliance with the Generic permit.

The federal NPDES requirements cover facilities within 11 broad categories of industry; however, more specificity in the state MS4 permit may label some industries, even those with a Generic permit, as not “high risk”. This research has suggested that some industries may be unnecessarily burdened by the industrial stormwater regulations. Conversely, some industries may require compliance but have not proactively identified

themselves and implemented pollution prevention strategies. This research assessed the strengths and weaknesses of the federal and local (MS4) requirements and how coordination could be improved.

I.D. Evaluation

This evaluation focused on industrial stormwater regulations implemented in Pinellas County, Florida as a means to assess whether the NPDES permit program for industrial stormwater is effective at protecting water quality in this same county. The CWA contains various subsections that approach water quality protection from different perspectives. The NPDES industrial stormwater regulations rely on self-identification by industry, pollution prevention strategies, and narrative water quality descriptions. These regulations affect industry, government agencies, and the public. While the regulations are extensive and currently include provisions for both point and non-point sources of pollution, it is still unclear how effective they are at protecting water quality and, specifically, whether pollutants originating in industrial runoff should be more extensively regulated. The use of flexible approaches in the industrial stormwater regulations allows industry and governmental agencies to tailor the regulations to their needs. However, it also complicates evaluation strategies. This ambiguity is most apparent in the local MS4 permit language.

The purpose of this evaluation was to assess the effectiveness of the dual system of industrial stormwater in order to recommend more appropriate implementation measures. Public policies should be periodically evaluated to determine if they are effective. Some recommendations for improvement may include: revising statutory language to aid in implementation strategies, prioritizing affected parties or recipients of

services, devoting greater resources to implementation, or discontinuing the policy if highly ineffective. This evaluation focused on strategies to improve the agency interpretation of statutory language and to prioritize industrial facilities subject to the dual level of industrial storwmater regulations.

CHAPTER II – RESEARCH OBJECTIVES

This research was designed to identify limitations and potential improvements in the dual-level system of stormwater regulations for industry, both in the regulatory design and the implementation. The overall objective of this research was to evaluate the effectiveness of the National Pollutant Discharge Elimination System (NPDES) industrial stormwater regulation Multi-Sector Generic permit (Generic permit) as implemented in a typical urban region subject to the municipal separate storm sewer system permit. This research examined the industrial stormwater aspects of the Pinellas County, Florida Municipal Separate Storm Sewer System (MS4) Permit and compliance by industries in the same jurisdiction with Florida statewide regulations. Pinellas County, Florida is a densely developed urban region where commercial and residential land uses predominate, but where numerous facilities are defined as "industrial" by NPDES stormwater regulations.

Issued under the NPDES Stormwater Program, the State of Florida's MS4 permit system contains a clause designed to support the Generic permit with a redundant effort by MS4 permit holders. In order to reduce contamination of stormwater runoff, MS4 permit holders are required to inspect all "high risk" commercial and industrial discharges. This is a departure from the Generic permit requirements that mandate all industrial facilities within the 11 industrial categories to self-identify, self-monitor, and design their own pollution prevention plans. While inspections may be performed on

industrial facilities, inspections by the agency that issues the Generic permit are not a necessary component. The requirement of MS4 permit holders to inspect “high risk” facilities is designed so that MS4 operators will monitor those they judge to be important for protecting water quality, in order to add to the accountability for these facilities. Rather than subject all industrial facilities within 11 NPDES categories (that have not obtained a No Exposure Certification) to inspection, the MS4 permit adds this more rigorous enforcement approach to a limited number of facilities. The designation of “high risk” is intentionally vague. Implementation of this component, however, may be improved by recommending a strategy for prioritizing industrial facilities.

The research had three specific objectives. First, it assessed the potential usefulness of a proposed method to identify facilities in Pinellas County subject to either or both sets of regulations for industry, and compared that method to alternative methods now being applied by the Pinellas County Department of Environmental Management and other MS4 operators throughout Florida. Second, it utilized first-hand evaluation of a subset of facilities to attempt to develop a practicable definition of “high risk” based on the intensity of industrial activities exposed to stormwater. The research then compared that definition to the definition of “included” facilities under Florida and U.S. regulations. Third, the research used these observations to make recommendations that could improve the ability to protect the quality of stormwater, through the regulations for industry in the NPDES nationwide/statewide system, the Florida MS4 permit requirements, or both. Upon completion, the research also recommended useful steps in the implementation process, such as increasing education and outreach to industry that may be efficient uses of MS4 operators’ resources.

Finally, the research evaluated the applicability of these results, including the benefits of environmental policy evaluation, the degree to which these findings could be generalized and/or transferred to other jurisdictions, including the applicability of methods to select “high risk” facilities in county or municipal permit holder boundaries. Recommended policy changes to the Generic permit and MS4 permit may benefit industry and implementing agencies both in Florida and the nation.

CHAPTER III – LITERATURE REVIEW

The literature review explains current research and knowledge of environmental regulations and policy evaluations. The review begins by explaining environmental regulations prior to the 1970s and the evolution of water quality statutes, including the current regulation of stormwater runoff associated with industrial activity. The necessary treatment of this potentially polluting source is addressed throughout the review of environmental regulations. The literature review then discusses the importance of evaluating public policies, such as environmental regulations, by explaining the process of creating public policy, why they should be evaluated, and how environmental policy evaluation has evolved. This section also reviews previous evaluations of the Clean Water Act regulations. The literature review then examines current policy research on the Clean Water Act and NPDES stormwater regulation. Finally, the literature review explores the term "high risk" and how the MS4 permit has been interpreted by various permit holders throughout the state. Finally, it establishes the regulatory setting of the research. It addresses the similarities and differences between the research location compared to the State of Florida and the nation and the outlines the State's authority to administer the federal industrial stormwater regulations.

III. A. Environmental Regulations

This section discusses the evolution of environmental regulations, starting with regulations from the 19th century and ending with the current system of regulations developed for controlling stormwater pollutants originating at industrial sites.

III. A.1. EARLY ENVIRONMENTAL REGULATIONS

Many of the federal regulations that currently protect our air and water quality were developed in the 1970s. Prior to this decade, federal regulations had already been enacted, however, the statutes passed in the 1970s have established the framework for current environmental policies. Several dramatic incidents that occurred in the 1960s – the dumping of hazardous wastes in the Love Canal neighborhood of Niagara Falls, New York; a large oil spill off the coast of Santa Barbara, California; and the Cuyahoga River that actually caught fire in Cleveland, Ohio (Kubasek and Silverman, 2005) –helped initiate the development of the current federal environmental polices. Public demand for better environmental quality following these visible events resulted in swift and stringent federal regulations.

Federal regulations specific to water quality were in place prior to the 1970s, however, they targeted navigational hazards, rather than health issues. For example, the Refuse Act of 1899 "prohibited the dumping of solid wastes into commercial waterways" for the purpose of improving navigational safety (Switzer, 2004). This act required discharges to receive a permit from the U.S. Army Corps of Engineers, for which 415 were issued between 1899 and 1972, coinciding with the passage of the CWA (Smith 2000). It was not until 1912, with the establishment of the U.S. Public Health Service,

that waterbodies were monitored for pollution levels that could negatively affect humans, rather than for navigational safety alone (Switzer, 2004).

The Water Pollution Control Act (PL 80-845), passed in 1948, was the first significant federal legislation to grant (limited) authority to the federal government to regulate interstate water pollution (Switzer, 2004; WEF, 1997) and provide funding for research and the construction of sewage treatment plants (Adler *et al.*, 1993). This law directed the U.S. Surgeon General to develop comprehensive plans to eliminate or reduce pollution of interstate waters (WEF, 1997). Substantial funding was allocated as five-year grants to local governments to aid in the construction of municipal wastewater treatment plants. The total five-year budget was $112.5 million and included an additional $5 million study fund for the control of industrial pollution (WEF, 1997). This law was limited to pollution problems arising in interstate waters. State and local governments were ultimately responsible for the quality of their own waters (Smith, 2000), as the federal government was reluctant to limit the state's authority. Since water quality protection is not listed as a federal responsibility, the authority is delegated to the states through Amendment X of the Constitution. Federal involvement and enforcement was, therefore, limited.

Federal involvement in water policy increased during the 1950s and 1960s with the passage of four statutes. Point sources of pollution, specifically municipal wastewater, were addressed in these regulations, while other pollution sources, such as industrial discharges and non-point sources were essentially ignored (WEF, 1997). The Federal Water Pollution Control Act of 1956 (PL 84-660) provided more substantial subsidies for the construction of sewage treatment plants (Adler *et al*., 199), a large contributor to

degraded water quality at the time. Five years later, amendments were added to the Act (PL 87-88). While federal assistance for treatment plant construction increased, Congress still had only a limited role in controlling water pollution (WEF, 1997). The 1965 Water Quality Act (PL 89-234) increased federal enforcement ability and also required states to establish water quality standards for interstate waters by 1967 (Switzer, 2004; USEPA, 1996). The newly created Federal Water Pollution Control Administration (FWPCA) was granted the authority to set standards if the states failed to do so within one year (WEF, 1997). The act addressed both surface waters and groundwater (Switzer, 2004).

The setting of standards on a statewide basis was difficult and did not result in significant water quality improvements. Little technological expertise had been developed for assessing water quality and state governments relied on dischargers to supply them with the data needed to develop standards (WEF, 1997). Additionally, the regulators shouldered the burden of proof and were required to "demonstrate a direct link between a discharger and a water quality problem" before enforcing the standards (USEPA, 1996). The ineffectiveness of these standards highlighted the need for a more comprehensive and implementable policy. Finally, the Clean Water Restoration Act of 1966 (PL 89-753) further increased federal spending on municipal treatment plants (WEF, 1997). The yearly funding authorizations rose to $1.25 billion in fiscal year 1971 (up from $50 million in fiscal year 1961) (WEF, 1997).

III. A.2. THE CLEAN WATER ACT

The genesis of the current water quality regulations was in the 1970s. In 1970, the Refuse Act Permit Program was added as an update to the Rivers and Harbors Act of 1899 (USEPA, 1996). This act required dischargers to obtain a federal permit from the

U.S. Army Corps of Engineers before discharging into public waterways. This program was mandated through Presidential Order on December 23, 1970, but was later challenged in the lawsuit *Kalur v. Resor*, which determined that issuing a permit to an individual facility might require the concurrent filing of an environmental impact statement, under the National Environmental Policy Act of 1969 (USEPA, 1996). The application of a permit program was incorporated into the passage of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), which included the NPDES program. These amendments were important because of the inclusion of "end-of pipe" controls, commonly referred to as "command and control" strategies, in addition to water quality standards (USEPA, 1996).

Public concern for water and air quality was the impetus for the swift and unanimous passage of two federal regulations. Senator Edmund Muskie of Maine led the effort to pass a more authoritative and effective water control act, likening the presence of water pollution to a "cancer which threatens our very existence and which will not respond to the kind of treatment that has been prescribed in the past" (Adler *et al*., 1993). The FWPCA (P.L. 92-500; 33 U.S.C. 1251), also called the Clean Water Act (CWA), was passed in 1972 over the veto of President Nixon (Kubasek and Silverman, 2005). The objective of the CWA was to "restore and maintain the chemical, physical and biological integrity of the Nation's waters" (WEF, 1997). The goals of the CWA included eliminating the discharge of pollutants into navigable waters by 1985, prohibiting toxic discharges in toxic amounts, and making all waterbodies "fishable and swimmable" by 1983 (CWA Section 101(a); Adler *et al*., 1993; Rosenbaum, 1995). Pollution would be

allowable, but only in amounts consistent with technological and economic achievability. Senator Muskie declared this a “life or death proposition for the Nation” (CWA, 1993).

These original and somewhat lofty goals of the CWA were not accomplished through the regulation of point sources, despite the billions of dollars spent to upgrade municipal wastewater treatment plants (Rosenbaum, 1995; Smith, 2000). By the 1980s, the EPA recognized that some waterbodies remained degraded, and non-point sources were noticed as important. Although non-point sources of pollution were recognized as contributing to poor water quality throughout the nation, enforcement and resources continued to be directed to point sources. A 1972 Senate report stated that the water quality of the nation would not be restored until the “very complex and difficult problem of non-point sources (are) addressed” (CWA, 1993). The report also acknowledged that controlling non-point sources was beyond the technology of control of that time (CWA, 1993).

The Natural Resources Defense Council (NRDC), a non-profit environmental agency that is involved in litigation, sued the EPA in 1972 over the exclusion of stormwater as a point source of pollution in the NPDES permit program (NRDC, 2002). The Supreme Court ruled in favor of NRDC and required EPA to re-evaluate its NPDES program. In response to this, the EPA began performing research on urban runoff and later included stormwater runoff in the CWA 1987 Amendments.

The attempted regulation of non-point sources required credible scientific proof before it was incorporated into federal regulations. Following the 1972 amendments and the NRDC lawsuit, the National Urban Runoff Program, administered by the EPA , developed information on urban runoff between 1978 and 1983 in order to

> "…help provide local decision makers, States, EPA, and other interested parties with a rational basis for determining whether or not urban runoff is causing water quality problems and, in the event that it is, postulating realistic control options and developing water quality management plans, consistent with local needs, that would lead to implementation of least cost solutions" (Athayde *et al.*, 1983).

The study concluded, through monitoring efforts, that residential, commercial and industrial lands are sources of pollutants to receiving waters (Horner *et al.*, 1994). This important source of water pollutants would first be addressed in 1987.

III.A.3. NON-POINT SOURCE POLLUTION

Non-point pollution sources are currently regulated as point sources under the NPDES permit program, however, they are still classified as non-point by some researchers and scientists. This research, while not ignoring the current regulatory definition, has chosen to address this area as it was traditionally classified, due to its inherent differences from point sources, such as industrial wastewater discharges.

Non-point source pollution can take many forms, such as atmospheric deposition, agricultural runoff, residential runoff, and urban runoff. Urban runoff may include stormwater runoff from residential streets and yards, runoff from construction sites, runoff from parking lots and highways, and industrial stormwater runoff. The EPA includes storm water runoff, snow melt runoff, and surface runoff and drainage in its definition of "storm water" (40 CFR § 122.26(b)(13)).

While agricultural runoff is likely the most problematic non-point source, urban runoff may have the potential for greater water quality impacts due to the toxic substances that it contains (Smith, 2000). Industrial stormwater runoff is simply precipitation that comes into contact with industrial processes, such as precipitation that

runs across businesses and commercial sites, before it is incorporated into other water sources, including storm sewers, drainage ditches, and receiving waterbodies. Horner *et al.* (1994) described urban runoff as "a by-product of the land's interaction with rainfall." This interaction can affect the surface across which the runoff flows and can "dislodge and transport surface particles," carrying with it a variety of pollutants from diverse and diffuse sources (Horner *et al.,* 1994).

Non-point source pollution is more difficult to control and/or treat for many reasons. Because runoff is affected by rainfall, it is a sporadic and unpredictable occurrence, unlike many permitted point-source discharges. The discharges occur over a diffuse area and may interact with differing substrates and pollutant sources throughout the watershed (Burton and Pitt, 2002). EPA has determined that "storm water runoff from major metropolitan areas is a significant source of pollutants discharged to waters of the United States" (USEPA, 1996). Many states, although instructed to address this source of pollution in 1985, still have not done so adequately (Smith, 2000). Numerous other researchers have expressed the importance of increasing research and control mechanisms for non-point source pollution, including urban stormwater (Desbordes and Hémain, 1990; Field and Pitt, 1990; Marselek 1990; and Smith, 2000)

III.A.4. ESTABLISHMENT OF THE NATIONAL POLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS PROGRAM

The National Pollutant Discharge Elimination System (NPDES) was added as an amendment in 1972 to the CWA to Title IV (Permits and Licenses) in Section 402 to more effectively control point (discrete, stationary) sources of pollution, such as power plants or POTWs (33 U.S.C. 1342). It focused on conventional, toxic, and non-

conventional pollutants and provided that “the discharge of any pollutant to waters of the United States from any point source is unlawful, except if the discharge is in compliance with a NPDES permit” (33 U.S.C. Section 1342 (a) (b) and 60 FR 189:50803). A permit is defined by the USEPA (1996) as a “license for a facility to discharge a specified amount of a pollutant into a receiving water under certain conditions.” The form of the permit can vary depending on the source of pollutants.

Effluent limitations were established for the point sources based on industry activities, pollutant type, and waterbody characteristics. Kubasek and Silverman (2005) noted, as of 2005, over 40,000 sources were regulated by these permits nationwide, while Smith (2000) suggested that more than 66,000 individual permits were issued by 2000. While this system of permits lessened point source pollution by identifying, permitting, and monitoring discharges, the program omitted some sources necessary to protected water quality.

The EPA exempted urban runoff from the first NPDES amendments if it was not contaminated by industrial or commercial pollutants. Local agencies were instructed to manage stormwater discharges, instead, through non-point source pollution prevention controls. This strategy was employed in part to reduce the resource and administrative burden of permitting stormwater sources.

Congress recognized that many states had failed to issue NPDES permits for point source discharges of stormwater following the 1972 amendments (NPDES 1995). It was believed that more extensive legislation would be necessary to control both unregulated point sources and the growing influence of non-point sources. Due to the NRDC ruling, and supported by results of the NURP study, non-point sources would be regulated as

point sources under the amended NPDES permit program. The 1987 CWA Amendments established the framework for addressing stormwater discharges (Section 402 (p)), and the requirement for EPA to issue NPDES permits for stormwater discharges associated with industrial activity (Section 402 (p) (4)). The amendments established a permit application procedure and also instructed the EPA to develop a schedule for establishing regulations and issuing permits for stormwater discharges (NPDES, 1995; ADEC, 2004). This was an important step as it established stormwater discharges as a form of point source pollution (which could then be permitted and controlled), rather than as a non-point source.

III.A.5. NPDES STORMWATER REGULATIONS

The final NPDES Stormwater Permit Program regulations were published on November 16, 1990 (55 FR 47990). Final rules were published both on April 1, 1992 (57 FR 11394) and December 18, 1992 (57 FR 60444). They included the first regulatory definition of "storm water discharge associated with industrial activity" as "the discharge from any conveyance which is used for collecting and conveying storm water and which is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. The term does not include discharges from facilities or activities excluded from the NPDES program" (40 CFR 122.26(b)(14). Industrial activity is also defined in these regulations as:

> "…includes, but is not limited to, storm water discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters; sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water" [40 CFR 122.26(b)(14]).

Additionally, the regulations included descriptions of affected industrial activities, either by narrative description or by a Standard Industrial Classification (SIC) code. The SIC codes utilize a standard four-digit numeric coding system by the President's Office of Management and Budget (OMB, 1987) to describe industrial processes. SIC codes were also used by the U.S. Census Bureau to categorize establishments by their primary activity but have since been replaced by the North American Industrial Classification System (NAICS) codes (U.S. Census Bureau, 2005).

The Standard Industrial Classification (SIC) Codes, while widely used, are not ideal for environmental protection. Because an industrial facility is able to self-select its code, rather than being assigned one by a U.S. agency of business, it has the ability to utilize different codes for different purposes, such as revenue statistics, facility employment data, or wastewater discharge characteristics (Duke and Shaver, 1999). The four-digit SIC codes are also limited because they do not incorporate the level of detail needed to differentiate between similar industrial activities. The North American Industrial Classification Scheme (NAICS), with its six-digit approach, encourages more specificity in activity identification.

The federal and state regulations have continued using the SIC codes. The narrative descriptions included seven categories of industrial activity, for example, landfills and hazardous waste treatment, storage, and disposal facilities. The five categories of industrial activity by SIC code included both heavy manufacturing and light manufacturing. Interestingly, industrial facilities were only subject to these regulations if their primary industrial process was included in the listed SIC codes. Auxiliary activities do not require permit coverage (Dodson, 1999).

The current guidelines specify 11 industrial categories that may be required to apply for an NPDES permit for stormwater discharge (40 CFR 122.26 (b)(14)(i)-(xi). Some industries, such as cement manufacturers, are not eligible for exemption and are required to obtain a separate NPDES stormwater discharge permit (40 CFR 411). While permits are issued separately for construction sites, they are listed a category (x) on the industrial list.

At the time of initial rulemaking, certain "light industry" (category xi) was exempt from compliance if it could demonstrate no exposure to stormwater. Additionally, construction sites less than five acres were exempt. This guideline was challenged, however, by the Natural Resource Defense Council in *NRDC v. EPA* on June 4, 1992 in the Ninth Circuit United States Court of Appeals. As a result, light industry is no longer conditionally exempt and now is required to apply for a "No Exposure Certification" if its processes do not contribute pollutants to stormwater (FDEP, 2001). These guidelines went into effect during Phase II of the NPDES permit program and required facilities to the file a "No Exposure Certification" by February 7, 2000 (64 FR 235). This revision potentially protects water quality if numerous light industrial facilities are contributing pollutants to stormwater, yet it may also increase the regulatory burden for lesser polluting facilities.

Affected industries (those deemed to require a permit) were required to apply for an individual, group, or general permit. Individual permits were designed for larger industrial sites and required the facility operators to include information related to the topography of the sites, an estimate of impervious area, a description of significant materials exposed to stormwater, a certification that outfalls have been tested and

evaluated, previous on-site leaks, and quantitative water quality data for a variety of pollutants (OOW, 1995). Many states declined to issue individual permits except in exceptional cases due to the increased burden for both industry and the agencies. Group permits were issued for a finite period to industries performing similar processes. The application resulted in an individual or general permit but utilized a group application. Group permits were received by September 30, 1991 for Part 1 and October 1, 1992 for Part 2. Group permit applications were not accepted after these dates and new facilities cannot be added to the list (Dodson, 1999). Therefore, these permits are no longer an option for stormwater facilities.

General permits were developed and issued to cover multiple facilities within a specific category (USEPA, 1996). Rather than obtain an individual permit, a larger number of facilities can be covered under a single general permit. Facilities, however, must be located within a specific geographical area, such as Pinellas County, and have common elements, such as stormwater point sources or similar industrial operations (40 CFR § 122.28; USEPA, 1996). The general permit process is less rigorous for both industry and the permitting agency, making it the preferred version for smaller industries.

III.A.6. MULTI-SECTOR GENERIC PERMIT (MSGP) FOR INDSUTRIAL ACTIVITY

The general permit is currently issued by the FDEP as the State of Florida Multi-Sector Generic permit for Stormwater Discharge Associated with Industrial Activity (Generic permit) (FDEP, 2004). While the FDEP has substituted the word “generic” for “general,” the legal requirements of industrial facilities are the same when issued by the FDEP rather than the EPA. Facility operators must first file a Notice of Intent (NOI) to

acquire coverage under a Generic permit (FDEP, 2000c). This application does not require water quality data and is limited to general facility information. Facilities are instructed to use up to four, 4-digit SIC Codes that best represented the "principal products or activities provided by the facility" (60 FR 189:50811). Required information also includes facility name, address, and contact information; any NPDES permit numbers; name of receiving waterbody(s); indication whether quantitative water quality data has been conducted and, if so, the concentration of pollutants in stormwater; and a certification of a stormwater pollution prevention plan (OOW, 1996). Industries that applied for and obtained a Generic permit were then instructed to develop site-specific Best Management Plans (BMPs) and Pollution Prevention (P2) strategies (NPDES, 2005). Numeric limits for water quality pollutants were not developed. This strategy of BMPs and P2 strategies, therefore, provides flexibility to industry and allows individual facility owners or operators to select site-specific plans. As discussed earlier, this approach may decrease the burden for industry, but may complicate evaluation, as universal standards are not applied for all industrial facilities. Although facilities were instructed to take and analyze water quality samples during several rain events during the second and fourth year under the permit, routine sampling is not required nor is the adherence to uniform water quality standards (60 FR 50807).

This research has only addressed the first-stage of compliance with the Generic permit, which was defined as the filing of a NOI by Duke and Beswick (1997). Undertaking this step, however, does not ensure that stormwater quality will actually improve (Dodson, 1999). Improvement only occurs when thoughtful storm water pollution prevention plans (SWPPP) are developed and implemented, thereby modifying

industrial sites or practices. In recognition of this, new industries are required to complete and implement a SWPPP prior to commencing industrial operations.

III.A.7. MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) PERMITS

In addition to permits held by individual industries, NPDES permits, in the form of MS4 permits, are issued to various counties, municipalities, drainage districts, colleges, etc., that operate an MS4. These permits were initiated during the 1987 amendments. An MS4 is defined by the FDEP as a "publicly-owned conveyance or system of conveyances (i.e., ditches, curbs, catch basins, underground pipes, etc.) that is designed for the discharge of stormwater to surface waters of the State" (FDEP, 2005a). Permit holders often operate under a joint permit among multiple local municipalities or county governments in a fashion similar to flood control districts. Permit holders are required to protect the water quality of the MS4s through a stormwater pollution prevention and management program (SWMPP) (FLS000005, 2004). This plan may utilize pollution prevention measures, treatment or removal techniques, stormwater monitoring, or other appropriate means to reduce contamination of stormwater runoff and prohibit illicit discharges (FLS000005, 2004).

The NPDES MS4 permits began by targeting larger urbanized areas and were first issued to large MS4s (serving more than 250,000 persons) and medium MS4s (between 100,000 and 249,999 persons) following the November 16, 1990 regulations (55 FR 47989). Phase II of the Storm Water Regulations were promulgated in 1999 and included municipalities less than 100,000 persons (60 FR 40230). These permits were issued on a jurisdiction-wide basis to the MS4 operator, rather than to an individual POTW (e.g., wastewater discharges) (USEPA, 1996).

There is considerable flexibility in how MS4 water quality can be protected on a local level. The State of Florida MS4 permits include multiple SWMP requirements, such as maintaining and operating stormwater collection systems; reducing pollutants from roadways; limiting the use of fertilizers, pesticides, and herbicides; detecting and eliminating illicit discharges; reducing pollutants from construction sites; and reducing pollutants from industrial activity (FLS00005, 2004). Part II, Section 8 of the Pinellas County Final MS4 Permit (FLS00005, 2004) specifically addresses industries and the requirements of the MS4 operator:

> 8. *Industrial and "high risk" Runoff:* The permit holders shall continue to implement a program to identify and control pollutants in stormwater discharges to the MS4 from any municipal landfill(s); hazardous waste treatment, storage, disposal and recovery facilities; facilities that are subject to EPCRA Title III, Section 313; and any other industrial or commercial discharge that the permit holders determine is contributing a substantial pollutant loading to the MS4.
>
> To satisfy the two (2) requirements of this section, the permit holders shall:
>
> a. *Identification of Priorities and Procedures for Inspections:* In accordance with the schedule provided in Part III.A.8.a, the permit holders shall continue to identify all targeted facilities and determine priority sites. Inspection procedures and schedules for the identified facilities shall be implemented.
>
> b. *Monitoring for "high risk" Industries:* To satisfy the requirements of this section, the permit holders shall implement the SWMP elements identified in Part III.A.8.b of this permit.

The term "high risk" contained in the MS4 permit, therefore, includes three specifically listed dischargers, plus a broad category to cover any other industrial or commercial discharge that may be affecting the MS4 water quality. The task of defining the "other" category, which will be referred to as "high risk" throughout this research, is the responsibility of the local MS4 operator, and can vary depending on local conditions and priorities.

The Pinellas County Department of Environmental Management (PCDEM) has addressed this requirement by inspecting industrial facilities that fall within the unincorporated Pinellas County boundaries (Weed, 2004). These inspections have included the three specifically listed categories of industry within the "high risk" definition, including landfills; hazardous waste treatment, storage, disposal, and recovery (TSDF) facilities; and facilities subject to EPCRA Title III, Section 313. The County has also included other facilities that have been labeled as "high risk" by the County. This possible inspection list has included both industrial facilities subject to the Generic permit, but also industrial sites, such as automotive repair shops, that are not regulated by the Generic permit, but that may contribute substantial pollutant loads to the MS4. The County has not inspected commercial sites, such as retail operations, at the time of this research. The County has focused on manufacturing, waste management facilities, and salvage yards (Weed, 2004).

A full-time employee has been added to the department to inspect industrial facilities, however, the inspector is also tasked with other duties, such as responding to citizen complaints (Weed, 2004). Even with a more limited scope, the County personnel may potentially need to inspect hundreds or even thousands of industrial facilities. The approach suggested by this research of prioritizing facilities based on phone outreach may improve the County's efficiency by first targeting those facilities with a greater intensity of industrial activities exposed to stormwater and that may be contributing pollutants to the MS4.

III. A. 8. REQUIREMENTS OF THE REGULATED COMMUNITY

The NPDES program relies on dischargers to obtain a permit in order to legally discharge pollutants into the nations' waters. Essentially, it is illegal to discharge pollutants without a permit; however, permitted discharges have been allowed. The way in which the regulations have dealt with different pollutant sources and medias varied. Wastewater treatment plants, for example, may have been required to sample effluent daily or hourly and then report the results to the permitting agency. Some of these facilities may have employed a full or part-time employee simply to take and analyze water samples and to prepare reports for the permitting agency. This represents a significant effort on the part of the regulated community to comply with permit requirements. Other discharges have been dealt with more laxly. For example, discharges to stormwater that may be incorporated into other urban runoff or directly into receiving waterbodies, have been relatively unregulated.

Industries that are subject to stormwater regulations have very limited water quality sampling, once they have implemented BMPs. The reporting form is simplified and could likely be completed by any employee trained in basic sampling methods. Compliance with these regulations, in terms of numerical sampling data, does not constitute a large burden to these industries. The desired method of pollution control relies on voluntary pollution prevention strategies, specific to each individual facility.

Even when water quality parameters are measured and analyzed, the secondary and future effects of pollutants cannot always be determined. If a goal of the CWA is for all waterbodies to meet their designated beneficial uses, more complete assessments of water quality are needed.

Failure of the CWA to improve the nation's water quality may stem from its reliance on self-monitoring and its case-by-case application of regulations (Smith, 1995). While this flexibility may be appreciated by industries, it makes it difficult for compliance to be measured and enforced. The CWA, unlike the Clean Air Act (CAA), has failed to establish nationwide criteria for certain pollutants. While the CAA sets numeric limits for a suite of air pollutants and then allows states or localities to strengthen the requirements, the CWA relies on state and local agencies to establish criteria and implement regulations. Regulators and those in the regulated community have usually promoted local control of localized issues, such as those affecting waterbodies. According to Smith (1995), usually "state governments do not object to administering new programs, provided that they are given the funds necessary for implementation with an appropriate amount of local discretion." While local discretion may be necessary for local industry compliance, it allows regulators to write increasingly broad regulations and prohibits analysis across spatial scales. The way in which a program is implemented in one region of the country may be vastly different than how it is implemented in another region.

III. B. Policy Evaluation

The following section will explain the rationale for evaluating policies. The literature review has already established the water quality regulations that are currently in effect and the general development of the industrial stormwater regulations. As discussed previously, the use of self-identification, narrative standards, and self-selected pollution prevention strategies in the Generic permit and the use of the term "high risk" in the MS4 permit is a departure from the traditional command-and-control regulations utilizing

numeric water quality standards. For these reasons, it is important to evaluate the effectiveness of the industrial stormwater regulation's approach at protecting water quality. Regardless of the policy, evaluation is a necessary step that can help ensure policy makers and citizens that resources are being used effectively or that can suggest applicable improvements to current policies.

II.B.1. RATIONALE FOR POLICY EVALUATION

There are thousands of policies that have been made throughout the course of American history. The number of bills that are introduced into the legislature each year signifies the considerable effort that is made to ameliorate recognized problems and needs. In 2001, for example, 6,089 measures were introduced in Congress during the first session of the 107th Congress (US Courts, 2002). The numerous public policies, including environmental policies, are created because of a recognized societal need. The evolution from a recognized problem to an implemented public policy involves numerous players and steps.

It is widely perceived by public policy scholars that the evolution of a policy typically follows a predictable path (Jones, 1984; Gerston, 2002). The policy process begins when an event, either natural or man-made, has an impact on persons in society and is considered to be a problem. When this problem cannot be dealt with on an individual or personal level, affected publics may seek help from the government (Jones, 1984). Incidentally, the role of government has increased, due in part to the emergence of new complex issues, such as environmental regulation that cannot be solved on a local or state level (Gerston, 2002).

In addition to recognizing that a problem exists, other factors are necessary in the development of public policies. Fiorino (1995) described the policy making process as involving a "window of opportunity" in which conditions or issues that are defined as problems; the political stream, involving interest groups, institutions, and others that bring issues to the attention of government; and policy alternatives for responding to problems all come together.

In a rational decision-making framework, policy makers, once apprised of a problem, will conduct research and develop policy proposals. "Rationality" was defined by Fiorino (1995) as a "conscious decision to make the most of the available resources to achieve whatever it is one sets out to accomplish." This, subsequently requires clear and agreed upon goals, clearly defined political options, fully informed people, and adequate information regarding the possible consequences of various options (Fiorino, 1995). The proposals should contain goals-measurable outcomes through which success can be evaluated, and plans-specific means for achieving the goals. The various policy proposals should be evaluated, with the most effective proposal being chosen.

A completely rational framework is not realistic, although it is a state for which to strive. Simon (1976) has used the terms "satificing" and "bounded rationality" to describe the actual decision-making process. "Satificing" suggests that policy makers choose acceptable policies when they become available, rather than waiting for the best policy to arise. "Bounded rationality" implies that decision makers are "bounded" by factors such as time, information, money, and their own understanding (Fiorino, 1995). Therefore, the most effective policy may not be chosen due to various influences, such as the need to develop a policy within a certain timeframe or within a restrictive budget. Decision

makers should be aware of the tenets of rational decision-making while, at the same time, understanding their own limitations.

Legitimation, or majority-coalition building, is also a necessary step before a bill will be approved by the legislature. Even necessary and well-written policies can fail if they do not generate enough political support. The process of majority-coalition building includes much compromise and will usually create a policy that is "broad and diffuse" (Peters, 2004) in an effort to please many and build support. The policy-making system involves a series of compromises. Assuming that original and new supporters are still accepting of the final policy and that majority approval was generated, appropriation should occur effortlessly. This is the final step of the policy process prior to implementation.

While decision-making in a rational format will deliver a policy that should be implementable and successful, politics are at work throughout the entire policy-making process, especially the final steps. The final policy may be considerably different than the original framework, due to negotiation, compromise, and other political factors. Additionally, the implementation of a policy may be different than the intention of policy makers. Consequently, well-intentioned policies can break down at various stages throughout the process, leading to a policy that makes incremental steps at best.

Regardless of the original intent of policy makers, policies tend to cause small, rather than large, changes. The term "incrementalism" describes the small steps that accompany policy formation and implementation. This form of policy making is gradual and relies on adjustments to already existing policies (Jones, 1984). There are both advantages and disadvantages to this system. The public policy process has been

criticized for failing to deliver substantial impact and enact desired changes, especially by those involved in the initial stages of policy formulation. Those interested in major changes such as reformists will likely have to wait until subsequent policies are developed and approved, as most policies only make small changes. Decisions often rely on past decisions (Fiorino, 1995), ensuring that policies build upon the small changes made in previous years rather than relying on dramatic changes. This process, termed "muddling through" by Lindbloom (1959), however, ensures that policy mistakes can be easily corrected. Additionally, there is greater stability in policies that are based upon past experiences and this gradual process allows goals to emerge gradually (Lindbloom, 1959 *in* Fiorino, 1995). While subsequent amendments to the CWA can be described as incremental, the original statute represented a drastic7 and ambitious effort that set the stage for later regulations (Fiorino, 1995).

Policy implementation is what occurs "between the formal enactment of a program by a legislative body… and its intended and unintended results" (Mazmanian and Sabatier, 1981). It has also been described as a "process of *interaction* between the setting of goals and the actions geared to achieving them" (Jones, 1984). Although there is often a blurring of lines between the formulation/adoption of a policy and its implementation, Mazmanian and Sabatier (1983) suggested that the stages be considered separately. Policies can, however, be modified during the implementation process. Regardless of the original intent and subsequent passage of a policy, failure to implement a program as instructed or not at all, can negate the original goals. There are additional challenges at this point.

Mazmanian and Sabatier (1983) discuss several crucial variables that can affect policy implementation, including: tractability of the problem, diversity of the behavior being regulated (industrial activities, for example), the extent of behavioral change required, the clarity and precision of legal objectives, initial allocation of financial resources, integration within and among implementing institutions (EPA, FDEP, and Pinellas County, for example), and public support. The authors then suggest six conditions that may lead to effective implementation: clear and consistent policy objectives; a sound theory incorporating principal factors and causal linkages, assignment of implementation duties to appropriate agencies, leadership ability in implementing agencies, program support by constituency groups, and consistency of statutory objectives over time (Mazmanian and Sabatier, 1983). This research will describe in following sections why the industrial stormwater regulations are less effective than originally intended, based on some of these principles.

Policy implementation may suffer if the goals and directions are not clearly defined. Statutory interpretation by bureaucrats may be necessary for complex policy issues, however, some policies lack the clear and instructive language necessary for successful implementation. The vague language used in the Florida MS4 permits to describe “high risk” industrial facilities may simultaneously empower local officials to implement region-specific appropriate strategies, while increasing their burdens and responsibilities. Conversely, vague language may lead to inconsistent interpretations and, possibly, weaker implementation overall (Jones, 1984). Additionally, programs that are not funded or not funded sufficiently can suffer. This may be especially common when responsibilities for implementation are delegated to lower levels of government, as

illustrated with the NPDES permit program. Determining how successfully programs are implemented leads to the final step of the policy process.

Once a policy has been approved, appropriated, and implemented, the policy process is not complete. Policy evaluation is a final and important step. Evaluation allows policy analysts to determine the impact of a policy on the targeted group, while noting secondary effects of the policy as well. Unless this step is completed, it is difficult or impossible to ascertain whether a policy has accomplished its intended goals. Policy analysis occurs for scientific or theoretical reasons- to understand the causes and consequences of policy decisions for the sake of increasing societal knowledge, or for professional or empirical reasons- in order to apply the social science knowledge to the solution of practical problems (Benton, 2004). An important objective of any policy evaluation, however, is the evaluation of whether certain programs are worth continuing and, if not, how they can be appropriately revised (Jones, 1984).

The establishment of goals is a crucial part of policy making and, while it does not always occur during formulation, it can benefit persons that implement the policy, evaluate the policy, or are affected by the policy. The policy process should begin with goal setting and prioritization because, unless goals are specified, it is difficult to critique whether a policy has been effective. A lack of goals also increases the difficulty of implementing policies. Bureaucratic agencies or other persons assigned with implementation should not have to guess as to the goals of the policy. Doing so may alter the policy makers' original intent, while increasing the demands on implementing agencies. Additionally, unclear or broad goals may result in a policy that achieves unintended or undesired results.

This research has strived to evaluate the dual-level system of industrial stormwater regulations, based on the original and continuing goals of the CWA. These types of evaluations of environmental policies are important, yet they may occur too infrequently.

II.B.2. ENVIRONMENTAL POLICY EVALUATION

Evaluation is a critical part of any policy process, regardless of the intended audience and goals. Environmental policies require evaluation because, as important and visible components of American society, they can achieve desirable societal effects, but also require resource allocation. Resources that are devoted to environmental protection, whether they are focused on reducing air emissions or controlling pollutants in industrial stormwater, cannot be used for other programs. Additionally, federal, state, and local agencies are often forced to prioritize programs in order to maximize available resources. Ideally, resources should be directed to problems that are the most deserving (Fiorino, 1995). Evaluation provides an opportunity to determine the actual results of intended policies and whether limited resources are being used wisely (Fiorino, 1995).

While policy and program evaluation is common for other public policy areas, such as education, social, or health programs, it is relatively rare in the environmental field (Knapp and Kim, 1998). Environmental problems are complicated to solve because they rely both upon rational decision-making processes, as well as other influences, such as cultural goals and personal desires, such as the desire for protected parks or free-flowing rivers. Fields such as environmental science are based upon the scientific method and ideally present unbiased, fact-based research. This reliance on empirical information is evident in the myriad data and information sources, ranging from water samples and

animal population studies to hydrological maps and computer modeling. Even so, a study by the General Accounting Office from 1995 suggested that "many of the data that EPA uses to characterize environmental quality are either incomplete, missing, or obsolete-problems that encompass all media areas" (Solomon, 1998).

Non-scientific factors are also important to consider when making and implementing environmental policy. Regardless of the quantity and quality of data available, "making environmental policy is above all else about government" (Fiorino, 1995). Therefore, it should be understood that other factors come into play when making policy. According to Birch (1998), environmental policy "may be the area in which quasi-experimental designs and practical evaluation techniques can work together to produce sound policy interventions."

Notable influences on environmental policy making include visible environmental disasters, such as the spilling of oil from the Exxon Valdez; media attention, such as the widely-publicized 20th anniversary of Earth Day; and citizen initiatives, such as those in California which required companies using or producing toxic chemicals to report them to local citizens (Fiorino,1995; Oates, 1999). Local conditions can also shape policies and direct resources, depending on the nature and severity of local environmental problems. Air pollution, for example, is a more problematic in areas such as Los Angeles, California, that are typically in non-attainment zones (areas that do not meet the national air quality standards), whereas the contamination of estuaries and open oceans is more problematic for coastal states. Subsequently, state and local organizations may allocate greater resources for locally important issues.

The administrative branch can certainly affect policy formation, passage, and implementation. The resistance of President Nixon to pass the CWA could have led to a drastically different outcome had his veto not been overturned. As noted earlier, the Reagan administration's focus on decreasing regulatory burden for private industries led to the qualitative goals and strategies employed by the NPDES industrial stormwater regulations. The allocation of resources and the priority of environmental protection by the administration can alter how polices are interpreted and implemented. Although the focus on environmental issues decreased during Clinton's eight years in office, he attempted to enact numerous last-minute policies, including the consideration of developing the EPA into a Cabinet level position (Switzer, 2004). Many of those policies, such as designating new national monuments, have since been overturned or rolled back as a result of President George W. Bush's administrative policies and his choice of political appointees to environmental positions (Switzer, 2004). The influential effect of the administration on environmental policy should not be ignored. In addition to making or repealing policies, the conscious desire to implement or not implement current policies can impact how problems are addressed. Failing to implement a policy is a form of action in and of itself (Benton, 2004).

Environmental policy evaluation is also complicated by the fact that environmental problems may be inherently complex and may not fit neatly into political boundaries or even environmental resource areas. Policies such as the CAA and the CWA compartmentalize broad issues into artificially small pieces (Fiorino, 1995), however, an environmental contaminant is not always restricted to one media. Polluted air emissions, from factories or automobiles, for example, initiate as an air quality problem. When

pollutants and particulates fall back to the Earth's surface as wet or dry deposition, it may fall onto waterbodies, lead to water quality effects. Some toxic materials may be regulated by more than one regulation. Environmental issues may also extend beyond political boundaries. It is widely believed that, in order to improve water quality, management and abatement of pollution should occur on a watershed level (Burton and Pitt, 2002; Horner *et al.,* 1994). A watershed is geographic portion of land that drains to a common waterbody, such as a lake or ocean. Pinellas County, Florida is not contained wholly within one watershed; while some portions of the County drain to the Tampa Bay, other portions drain into the Gulf of Mexico (See Figure A-1). Therefore, numerous political entities need to cooperate to successfully attack environmental problems. While this may seem insignificant, it illustrates the complexity that is inherent in many environmental issues.

This complexity, unfortunately, often makes it more difficult to establish clear, causal linkages. "Indicators" of policy success are desirable and can help determine whether policies have accomplished their goals. It may be difficult, however, to link these measures to actual environmental results (Fiorino, 1995). Horner *et al.* (1994) also noted the difficulty of understanding how aquatic organisms will be affected by urban runoff discharges, such as industrial stormwater. Because local variability is also important, deleterious effects may occur in one region of the country but not in another.

Successful evaluation is also hindered by the fragmentation of federal programs that are administered at state and local levels (Mangun, 1998). Once lower levels of government accept primacy for implementation, the role of EPA may shift from implementing policies to establishing national standards and conducting program reviews

(Mangun, 1998). While the EPA may collect data on how a program is being implemented, it is unlikely that program review will extend beyond "bean counting;" EPA may be more concerned with compliance rates that actual improvements in water quality, for example (Mangun, 1998).

Finally, as discussed in Section III.C.3, current environmental program and policy evaluations rely heavily on self-monitoring by industry, which is infrequently verified through monitoring by regulators (Solomon, 1998). Because pollutant-generating activity is often decentralized or diffuse, monitoring efforts are difficult if not performed proactively by regulated entities (Magat and Viscusi, 1990). Additionally, violations are generally treated leniently, as evident by the few examples of CWA penalties issued to facilities not in compliance (Solomon, 1988).

Nevertheless, environmental policy makers should strive for policies that maximize social resources and that can be created, implemented, and evaluated in a rational process (Fiorino, 1995).

This applied research is useful because it is a precursor to policy reformulation and more effective policy making. Applied research can identify weaknesses in policies, regardless of their originations. In addition to political factors involved during the policy process, other factors can weaken a policy and hinder successful implementation. The CWA has been amended numerous times to accommodate increased knowledge, improved technology, citizen demands, or as a result of lawsuits. It could be argued however, that rather than continuing to amend the CWA, a new system for the regulation of stormwater may be preferable. The MS4 inspection requirement, in particular, appears to be the kind of policy adaptation, termed "satisficing" suggested by Simon (1976). The

NPDES system was established to limit discharges from point sources of pollution, such as wastewater, using numeric limits and command-and-control strategies. It was not until the NRDC lawsuit against EPA that stormwater runoff was included as a point source in the 1987 NPDES amendments. This may not be the most appropriate manner in which to regulate this source.

In addition to the incongruence between point sources and stormwater runoff, the industrial stormwater regulations were also promulgated during the 1980s when the Reagan administration had a mandate to reduce burden on industry and reduce governmental regulation (Rosenbaum, 2005; Switzer, 2004; Vig and Kraft, 2003). Therefore, the regulations take the form of pollution prevention, narrative water quality standards, and self-identification by industry. This structure, however, is very different from the regulatory prescription for wastewater and industrial discharges that are potentially more burdensome due to their use of numeric limits.

The self-implemented nature of the stormwater regulations generates low compliance with the Generic permit. This failure of the Generic permit system, in turn, led to the need for industry inspections by MS4 permit holders. The redundancy of regulating industrial facilities for pollutant discharges to stormwater may not be necessary if compliance on an industry-wide basis with the general permit were higher.

Subsequent lawsuits by the NRDC have continued to alter the treatment of industry under the NPDES permit program. For example, conditionally exempt “light” industry and smaller construction sites (less than five acres) are now required to follow the identical guidelines as “heavy” manufacturing and larger construction sites (see *NRDC v. Costle*). While the stricter guidelines that exist today may be beneficial for

water quality improvement, the amendment process illustrates their imperfect nature. They demonstrate incremental steps whereby amendments were made unto existing regulations rather than proposing a new policy that may have been more effective at addressing stormwater runoff. The purpose of this research evaluation has been to assess how the redundant permits work together and how they could be improved.

III.B.3. EVALUATION OF THE CLEAN WATER ACT REGULATORY APPROACH

The broad goal of the CWA is to improve the nation's water quality through the reduction of pollution. The CWA uses a multi-pronged approach for reducing water pollution, thereby, improving aquatic, ecological, and human health. This section will discuss the various regulatory strategies available for the protection of water quality, ranging from command-and-control numeric limits to purely voluntary pollution reduction programs. The industrial stormwater regulations are unique because, while they are not voluntary, they were established based on the principles of self-identification and self-selected BMP strategies.

Within the environmental field, there are numerous methods in which environmental compliance and/or protection are achieved. The most prevalent form is "command-and-control" regulations, whereby standards are set within the law (Lyon and Maxwell, 2001). The CAA and the CWA both utilize forms of command-and-control. The NPDES wastewater regulations and the CAA permit program rely on end-of-the-pipe (or stack) solutions. The CWA incorporates numerical effluent limitations in its regulation of point source discharges, such as industrial wastewater or POTWs (CWA Section 301, Title III). The CAA sets ambient air quality standards and establishes

emission limits for a variety of pollutants (CAA Section 501). This means that waste products, whether released to the air, water, or land, are to be treated chemically, biologically, or physically prior to their release into the environment. These waste products are still produced, however, treatment efforts are required to reduce their toxicity, strength, or quantity to meet specific numeric limits at the point of discharge and in ambient conditions. Terms such as “Best Available Technology” and “Best Available Control Technology” have been used to describe the standards that are applied, based on the treatment technology. In many cases, specific technologies have been prescribed in the regulations, such as the catalytic converter as a reducer of harmful automobile emissions. In other cases, facilities are given a permit for a specific load or concentration of pollutant and are responsible for researching and designing the most cost-effective strategies for their industry and needs. These strategies, however, have been criticized by economists and industry as being inflexible and expensive (Lyon and Maxwell, 2001). Essentially, each individual facility is treated equally, although the cost and effort to attain compliance may vary greatly between and among industries and individual facilities.

While practical as a first step in an essentially new environmental arena, command-and-control is not the only option, nor is it always the best option for industry, regulators, or the public. Other innovative solutions exist that allow industry to be more involved and to choose options that are less burdensome. Economists and industry are generally supportive of self-monitoring and individualized management plans. Market-based initiatives began in the late 1980s (Lyon and Maxwell, 2001) as a response to the command-and-control rigidity. For example, an air emissions-trading program through

the CAA allows industry to trade emissions credits between other industries. An individual facility, therefore, has the option of purchasing and utilizing pollution-reduction technology, or purchasing available emissions credits. In theory, the total air emissions will remain unchanged and facilities will be allowed to choose their most appropriate management strategies.

Another departure from command-and control approaches is to reduce or eliminate pollution sources during the production processes themselves, rather treating waste products after they are generated. Pollution prevention, or P2, has become a popular, but often voluntary, approach to reducing hazardous wastes. The concept of P2 was to reduce environmental maladies by not producing harmful substances that would be disposed of via the various environmental medias. This idea began to take hold in the 1990s when firms would voluntarily produce fewer waste products than the level required by the law (Lyon and Maxwell, 2001). Following are several examples of voluntary, regulatory, or industry-led initiatives.

Voluntary approaches and self-reporting by industry have primarily been applied to hazardous or toxic substances. The “33/50 Program” was initiated following the EPA’s increased focus on toxic substances. Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, commonly known as the Emergency Planning and Community Right-to-Know Act (EPCRA), requires that companies report releases of more than 400 different chemicals (Lyon and Maxwell, 2001). These amendments focused on larger quantity generators and the EPA required that the chemical release data was made available to the public as the Toxics Release Inventory (TRI). As a result of these new requirements, the EPA proposed a voluntary strategy in February 1991 (Lyon

and Maxwell, 2001; USEPA, 1999). The “33/50 Program” encouraged firms to reduce their emissions of 17 toxic chemicals by 33% by 1992 and by 50% by 1995 (USEPA, 1999). Emissions for the selected chemicals decreased by 42% from 1991 to 1994; still, the program was criticized because it lacked regulatory penalties and did not require firms to participate (Lyon and Maxwell, 2001). The “33/50 Program” is an example of a purely voluntary program.

The “Responsible Care” Plan was an industry-led initiative that was started in 1985 by the Canadian Chemical Producers Association in response to the industrial accident in Bhopal, India that killed 2,500 people and injured 200,000 when methyl isocyanate gas leaked from a Union Carbide storage tank (Lyon and Maxwell, 2001). The US and the British Chemical Industries Association (CIA) began programs in 1989 (Lyon and Maxwell, 2001). Over 200 companies have taken part in the program, which strives to improve environmental performance, safety measures, and public disclosure.

Involvement in voluntary, self-regulating programs can be beneficial to the environment and to industry. Improving efficiency of production, thereby limiting waste products, can save resources and increase a firm’s bottom line. Utilizing fewer chemicals and/or applying best management strategies can reduce occupational hazards and improve employee-working conditions. Designing and utilizing more efficient or cleaner technologies may better prepare firms for future regulations, especially if greater reductions are forthcoming. Advertising or publicizing concern for the environment can improve public image, especially following visible events, such as the Bhopal accident. Firms that voluntarily reduce emissions and dischargers may have a competitive advantage over larger polluters, although some researchers challenge the idea that

pollution prevention can raise “both corporate profits and consumer well-being” (Lyon and Maxwell, 2001). Finally, demonstrating proven reduction strategies may stave off future regulatory monitoring, offering a sort of assurance that their firm will be treated more favorably or be subject to fewer inspections than other firms (Lyon and Maxwell, 2001; Maxwell and Decker, 1998).

On a local level, communities often employ various pollution prevention programs and encourage voluntary participation from area businesses. In the Tampa Bay region, for example, nitrogen-discharging facilities, such as power plants, phosphate industries, and agriculture, have voluntarily agreed to reduce nitrogen loads to the bay as part of a “Nitrogen Management Strategy” (TBEP, 1998). This cooperative partnership of local governments and industry is essential for protecting the health of Tampa Bay, as well as providing “reasonable assurance” to the FDEP that water quality improvements are possible, in lieu of preparing a TMDL for the estuary. Other communities engage local businesses, such as auto repair shops or salvage yards, in pollution prevention training and best management practices.

The NPDES industrial stormwater regulations’ General Permit is one component of the broad CWA. Although targeted industries are required to pay a permit fee and implement various pollution prevention strategies, fines on industry are rarely assessed (Solomon, 1998). There have been various penalty structures built into the CWA to address negligent or intentional violations of certain sections or to permits (by a federal or state government). Negligent violators may be fined up to $25,000 a day or spend up to one year in jail while knowing violators could face $50,000 a day in fines and up to three years in jail; these fines and incarceration duration can double for a second

conviction (CWA Section 309). Additionally, persons who falsify information, including material statements or applications, may be fined up to $10,000 a day and up to two years in jail (CWA Section 309). It has been uncommon, however, for fines to be assessed for failure to comply with industrial stormwater regulations, especially if a facility has failed to file a NOI (Weed, 2004). In essence, there have been few real consequences for industries that do not comply.

Additionally, the Generic permit program relies on self-identification of facilities. An individual facility may elect to not comply, choosing to wait until they are forced to comply, rather than doing so proactively. Therefore, a facility that "slips under the radar" may go undetected for decades, potentially saving significant resources. The policy desires to engage the industrial community in voluntary pollution prevention measures and best management practices. A substantial goal of the policy, consequently, should be to educate industrial owners, operators, and staff about the impact that industrial facilities may have upon stormwater and, their regulatory requirements. A broader goal of community education regarding stormwater pollution may also be important.

The NPDES industrial stormwater regulations, as discussed, are not voluntary. Failure to apply for a permit and proceed with approved best management strategies and water quality sampling can result in fines of up to $25,000 a day and possible incarceration. However, as demonstrated in other regions of the country, compliance with these regulations is low (Duke and Shaver, 1999; Duke ,2006). In Pinellas County, less than 100 facilities had an active Generic permit as of September, 2005 (FDEP, 2005b). The list of Generic permits included all industrial facilities, not just the four industrial categories targeted by this research. The total number for those categories was less than

20 facilities. The current industrial stormwater program relies of self-identification by industry. While compliance is not voluntary, industry has essentially been free to not comply until forced to do so. Freeman (2000) suggested that self-identification is an example of participation by the regulated community. Limited research on this subject has revealed that it may be grossly ineffective, with compliance hovering around 10% or less (Duke and Augustenborg, 2005).

The poor compliance with the Generic permit has, subsequently, led to the need for MS4 inspections of "high risk" industrial facilities. This has functioned as an ad hoc quasi-experimental addition to the regulations (Birch, 1998), with little evaluation of the effectiveness of the approach. Besides research by Duke, few scholars or public agencies have addressed these regulations. The MS4 permits have been designed so that the EPA or state-permitting agency can delegate the task of finding facilities that may be contributing pollutant loads to stormwater to the local agencies and MS4 permit holders. This is in recognition that the Generic permit has failed to affect many facilities and serves as a practical response to a failed policy. Additional research on this approach could improve understanding of weaknesses and allow for improved policies.

III.C. Current Water Policy Research

The following section explores current research on the CWA and its industrial stormwater regulations. It addresses the lack of research tailored specifically to industrial stormwater regulations. A brief section describes the industrial literature written for the regulated community and the general sentiment regarding the industrial stormwater regulations. The regulatory review then discusses research performed on other environmental regulations that incorporate self-regulation tactics.

III.C.1. CLEAN WATER ACT AND NPDES INDUSTRIAL STORMWATER REGULATIONS

Numerous efforts have been made to assess the Clean Water Act as a whole, such as "The Clean Water Act 20 Years Later" by Adler *et al.*, (1993) and "The Clean Water Act Updated for 1997" by Water Environment Foundation (1997), however, there is little mention of the industrial stormwater regulations in these texts. Research on the effectiveness of these regulations has been scarce and available research regarding industrial stormwater has typically been related to best management practices, rather than the effectiveness of the regulations. Many of these articles have appeared in journals published by industry organizations, rather than in peer reviewed scholarly journals, and have served as compliance guidance for the regulated community. A search of policy journals revealed even fewer resources. The majority of the published research on industrial stormwater compliance has focused on the economics of compliance. These studies assumed that compliance was occurring and were designed instead to determine the resources required by industry to comply with the NPDES stormwater regulations. While this information may be useful to government and industry, it has done little to identify the numerous facilities that have not complied with regulations.

One of the few attempts to learn more about the industrial stormwater regulations was performed in the mid 1990s. The Water Environment Federation surveyed industrial facilities to determine the cost of compliance with stormwater regulations and the strategies perceived to be most effective by industry at reducing pollutants (WEF, 1996). WEF sent questionnaires to 7,500 industrial facilities nation-wide and received input from 584 (a return rate of 8.2%). This study is problematic in that it relied on a self-

selected sample of industry that may not reflect the views of the entire industrial population. Nevertheless, the results have been presented here as an example of research that has been performed, regardless of its limitations.

Industry reported that pollution prevention plans, capital improvements and annual maintenance fees cost upwards of $30,000 (WEF, 1996). Less than one-third of the respondents felt that water quality improvements were worth the expenditures. Most reported that simple pollution prevention; incorporating good housekeeping, spill prevention and response, preventative maintenance, visual inspection, and employee training; were the most effective strategies (WEF, 1996). Of the available site modifications, ponds and containment structures, along with increased and improved storage, were rated highest (WEF, 1996).

Industrial owners and operators reported that compliance with regulations, in the form of pollution prevention plans and best management practices, was expensive to implement, with the average cost for preparation of a P2 plan at $7,500 (WEF, 1996). More importantly, the respondents noted that the regulations were complex and burdensome and that there was little or no follow-through by the enforcing agencies. They also felt that other pollutant sources or discharges caused more pollution and that remote and small sites should not be controlled, as compliance was a hassle for small businesses (WEF, 1996). Although 59.6% felt that water quality improved as a result of water quality analyses, only 9.2% thought that there was a significant improvement and the majority responded that a disproportionate amount of money was required for only minor improvements to water quality (WEF, 1996).

The WEF study illustrates the incompleteness of knowledge regarding compliance with industrial stormwater regulations. While a concerted attempt was made to contact a representative sample of industries throughout the country, there was little information on the multitude of facilities that were technically required to comply but had not yet fulfilled that obligation. Research by Duke *et al.* (1999a) provided more complete knowledge on the poor compliance rates, but not about the impact of non-compliance on water quality. The WEF study, while limited, did address some of the reactions by the regulated community that may be reluctant to self-identify and implement potentially costly BMPs.

The U.S. General Accounting Office examined urban runoff programs in a 2001 report to Congress (USGAO, 2001). The study examined local government actions and the measures needed to control stormwater runoff. However, the study did not address industrial facilities (USGAO, 2001). The report, entitled "Better Data and Evaluation of Urban Runoff Program Needed to Assess Effectiveness" fell short of its objective of making thoughtful recommendations by failing to include analysis of the industrial stormwater regulations. The conclusion, which was spelled out in the title, was that evaluation of various urban runoff programs is needed. This research has responded by addressing the potential impact of stormwater discharge origination from industrial facilities.

Although more attention has been paid to point sources of pollution, even data supporting discharge reductions are inadequate. Each industrial facility that discharges pollutants from a point source is required to obtain an NPDES permit. EPA is then responsible for issuing effluent guidelines and collecting effluent data. A 2004 evaluation

report by the Office of Inspector General found that the lack of systematically collected data for industrial point sources could not support statements made by the EPA suggesting pollutant reductions in the billions of pounds (OIG, 2004). A response by the Office of Water highlighted the lack, and subsequent necessity, of actual pollutant discharge data (OIG, 2004). The importance of this report was the realization that even the point source industrial NPDES regulations, which have been more closely monitored than the stormwater regulations, have been inadequate and have lacked the necessary data to evaluate effectiveness. Some of the cited improvements to the point source NPDES regulations could also apply to the stormwater regulations. For example, the Office of Inspector General concluded that "issuing water discharge permits in a timely manner has been a challenge for EPA" (OIG, 2004) and that the program "suffers from a marked insufficiency of information to make managerial decisions, because EPA has not developed a systematic way of collecting such information" (OIG, 2004). It is expected that the industrial stormwater regulations have suffered similar weaknesses due to unclear direction regarding implementation, especially in the MS4 permits.

III.C.2. DISCUSSION OF INDUSTRIAL STORMWATER REGULATIONS IN INDUSTRIAL LITERATURE

The industrial community has approached the stormwater regulations with mixed reactions. In general, larger and more organized industries, such as chemical manufacturers, have taken proactive steps to deal with these and other environmental regulations. For example, the U.S. Chemical Manufacturer's Responsible Care Program has strived to "improve environmental, health and safety performance in response to

public concerns" (King and Lenox, 1993). This program represents self-regulation, designed to increase pro-active pollution control.

Coverage of industrial stormwater regulations in industry newsletters or professional magazines has typically focuses on ways that businesses can comply with the regulations or addresses criticisms or concerns. For example, in an article in *Pollution Engineering*, a discussion of Phase II NPDES stormwater regulations reviewed the six minimum control measures and suggestions for BMPs (Barnard, 2002). A discussion in *National Petroleum News* stated, "nationwide permits are costly and can be time-consuming to obtain" (Barlas, 2000). The focus of the article was on the lack of regulations for convenience stores and gasoline stations, seen as positive for the industry. Industries that were included under the stormwater regulations were thought to "have it tough" (Barnard, 2000).

The need for BMPs and P2 strategies has increased the focus on innovative and cost-effective techniques. Industrial literature serves the needs of the regulated community through discussions of manufactured BMPs for stormwater, suggesting that maintenance will soon "become more routine" as more NPDES regulations are approved (Singer Coxe, 2002). The need for quantitative evidence to show that BMPs function as promised is also explained, especially given the resources needed for some BMPs (Singer Coxe, 2002).

Once a facility has filed a NOI, the selection of BMPs appropriate to the individual facility has been demonstrated to be costly and time-consuming. A benefit-cost analysis of several stormwater quality management practices in Los Angeles, California suggested an eight-step method for choosing a management practice (Kalman *et al.*,

2000). While this model may have been more appropriate on a basinwide scale or by local stormwater agencies, the inclusion of steps such as “establish pollution concentration thresholds” and “estimate economic values for unimpaired beneficial uses” (Kalman *et al*., 2000) illustrated the difficulty in selecting BMPs that are not only cost-effective but also environmentally desirable.

It is important that industry recognizes its responsibility under the CWA and responds proactively to regulations (Horner *et al.*, 1994). Industry and trade journals can serve as appropriate educational tools. Compliance rates may improve if, in addition to addressing the costs and BMP strategies, these articles explained the potential effects of industrial pollutants. This may serve as a useful information portal for agencies implementing the industrial stormwater regulations.

III.D. Regulatory Setting

This section will explain the regulatory authority of the State of Florida to implement the NPDES regulations and then provide a discussion of the various approaches throughout the State to address the “high risk” requirement of the MS4 permit. Various MS4 permit holders were contacted regarding their interpretation of the phrase and their subsequent implementation strategies. These demonstrate the variety of approaches used and compare them to the Pinellas County strategy. The section concludes with a brief description of the characteristics of Pinellas County, Florida, the research study location. It will do this by comparing the industrial makeup of the county with the State of Florida and the United States figures. This serves to assess whether the study location is very similar or very different than the state and nation as a whole, which could influence the transferability of the research results.

III.D.1. STATE IMPLEMENTATION OF FEDERAL REGULATIONS

The State of Florida currently regulates and issues permits for stormwater discharges within the state. In October, 2000, the EPA granted authority to the State of Florida to implement the NPDES stormwater regulations through Rule 62-621.300(5) (a), F.A.C. (FDEP, 2000b; FDEP, 2004). The state adopted the federal regulations and its subsequent revisions as the state regulations. The Florida Department of Environmental Protection (FDEP) is, therefore, responsible for issuing individual, group, and general permits to industrial facilities; construction permits; and MS4 permits. Pinellas County was issued its MS4 permit on March 1, 2004. The permit holders include the unincorporated county, along with 22 municipalities (FLS000005, 2004).

The Pinellas County government is responsible for implementation within the unincorporated Pinellas County, while the individual municipalities are responsible for their own implementation. Industrial inspections within the unincorporated areas are performed by the Pinellas County Department of Environmental Management (DEM). The City of St. Petersburg, also located in Pinellas County, was issued its own MS4 permit and, therefore, was not included in this research

III.D.2 INTERPRETATION OF "HIGH RISK" BY FLORIDA MS4 PERMIT HOLDERS

The nebulous phrase "high risk" used in the MS4 permits is been significantly different from the clearly defined industrial categories used in the Generic permit language. In order to more accurately address the success of Pinellas County's interpretation and to demonstrate weaknesses in the current regulatory language, several other Florida MS4 permit holders were contacted regarding their "high risk" industrial

identification and inspection approach. This presentation of local interpretation has been included to demonstrate the inconsistencies between the federal definition of included facilities, based on the 11 categories of industry, and MS4 permit language, which has relied on local interpretation.

Prior to contacting MS4 operators, it was already understood that “high risk” is defined differently by MS4 permit holders. It is important to note, however, that none of the contacted MS4 operators have incorrectly defined “high risk.” The individual implementation strategies chosen by MS4 operators may be shaped by many factors, such as how densely populated or industrialized a jurisdiction is or the resources available for implementation. Because “high risk” classification may be intimately linked to the local area, the operationalized definitions from other permit holders have been used only for generating ideas and making comparisons. However, they were also useful as a tool signifying the level of effort undertaken by each MS4 permit holder in identifying and inspecting “high risk” facilities.

It was originally hypothesized that Pinellas County was utilizing a more extensive and thorough, but also more resource-intensive, approach than this research proposed. It was also suggested that attempting to define the term “high risk” may be a useful exercise for other municipalities and could help guide permit holder inspection priorities, especially those in the beginning stages of implementation.

The undefined phrase “high risk” contained in the Pinellas County permit is identical to that for other MS4 permit holders in Florida. Examples from the EPA website also suggested that this language has extended beyond Florida and may be used in the MS4 permits for numerous other states. Sample MS4 permits for Texas and Oklahoma,

for example, utilized the same language with regards to industrial facilities (CC, 2005; OC, 2005).

Informal interviews were conducted with nine different MS4 permit holders throughout Florida to determine the manner in which industrial and "high risk" runoff is addressed. The contacted MS4 permit holders ranged from small, incorporated cities to larger county departments. Although there were some similarities, such as an emphasis on hazardous materials, the formal or informal "high risk" definitions varied widely.

The Pinellas County MS4 permit is jointly held with 22 other municipalities. Among them, the City of Largo focuses on facilities that are subject to the industrial pre-treatment program with the rationale that if a facility utilizes a substance that is hazardous enough to be a problem for wastewater, then it may be hazardous to stormwater also (Sepessey, 2005). While the Stormwater Program Coordinator defined "high risk" as "anything that would harm the environment or cause a problem for the stormwater or sanitary sewers," he also noted that light manufacturing probably did not fit into the "high risk" classification. The City of St. Petersburg, a separate permit holder within Pinellas County, focuses on facilities from the FDEP's list of EPCRA Title III, Section 313 facilities (listed explicitly in the MS4 permit) (Adams, 2005). Inspected facilities that are fully enclosed and have no processes or equipment in contact with precipitation would still be "high risk" if utilizing or producing hazardous materials, but would not, in the city's opinion, be required to apply for the Generic permit. If the city were to expand its current program, it would utilize the list of SIC codes, along with current business operating permits (Adams, 2005). The City of Tallahassee uses only the three categories listed in the MS4 permit to identify "high risk" facilities, i.e., landfills, TSDFs, and

EPCRA Title III Section 313 facilities (Watkins, 2005). The use or production of hazardous materials is also important to this permit holder. In addition to seeking out facilities with hazardous materials, the city utilizes EPCRA thresholds for hazardous material when defining “high risk” facilities. The term “high risk” is only assigned to facilities with hazardous materials (Watkins, 2005).

The use of the Small Quantity Generators (SQG) list was cited by both Miami-Dade County and neighboring Hillsborough County. Within Miami-Dade, more than 8,000 industrial facilities used, produced, or disposed of hazardous materials of wastes at the time of the interview (Abrahante, 2005). While there is no formal industrial stormwater inspection program, these facilities have all been inspected on a periodic basis by other county departments. This county has chosen to implement separate permit requirements for SQGs that require an annual permit, ranging from $175 to over $7,000 (Abrahante, 2005). Facilities are prioritized based on the disposal practices, ranging from no off-site disposal to direct discharge to a receiving waterbody. Along with the permit cost, the facilities are inspected and given BMP and P2 suggestions. Although this approach has included a significant quantity of facilities utilizing hazardous materials, there has been no emphasis on compliance with the Generic permit. Inspections include stormwater aspects, however, inspectors do not focus on increasing awareness or compliance with the Generic permit (Abrahante 2005). The programs that currently inspect SQGs were originally intended to protect Miami-Dade County’s groundwater, not MS4s or receiving waterbodies (Abrahante, 2005). Therefore, pollutant discharges to MS4s are less important.

Hillsborough County also performs inspections at thousands of SQG facilities, plus it has supplemented its list with facilities on the EPA's TRI list (Glicksberg, 2005). The SQG list includes both facilities that may contribute pollutants to stormwater and those that likely will not, such as retail cellular stores located in shopping malls (Glicksberg, 2005). Regular SQG inspections have been expanded to include stormwater violations, however, separate stormwater inspections to support the Generic permit have not been implemented. Hillsborough County officials have expressed interest in more accurately defining "high risk" for their jurisdiction by both narrowing the SQG list and expanding the program beyond SQG facilities.

In contrast to the above examples, both the City of Lakeland and Polk County have expanded, or are in the process of expanding their industrial lists beyond the three listed industry types or those using hazardous materials by incorporating the NPDES industrial classifications by SIC code. The Polk County NPDES stormwater section compiled a list of approximately 365 facilities that is inspected every five years (Mikolon, 2005). More than 70 facilities have been inspected each year. Polk County began expanding beyond the three listed categories by utilizing various industry lists, such as those from the county or the Central Florida Development Council (Mikolon, 2005). The county prioritizes facilities based on stormwater controls, stormwater discharge points, erosion, routine maintenance of stormwater controls, facility products and services, waste disposal practices, and other aspects (Mikolon, 2005). On-site inspections, therefore, are an important component for prioritization. The City of Lakeland, an incorporated city within Polk County, is undergoing a similar process and is attempting to determine the most appropriate meaning of the term "high risk," a term that

is not currently used in the city (Larrow, 2005). It is likely that the City of Lakeland program will be similar to the program already established in Polk County.

Finally, the City of Jacksonville defines “high risk” as any facility listed in one of the 11 industrial categories defined by EPA. The city actively updates its industrial databases using lists from various agencies, such as the FDEP, Department of Health, and the St. Johns River Water Management District (Adeshile, 2005). The city does not target any specific industrial category or SIC code and inspects each facility between three and four times annually. Facilities that do not have any exposure to stormwater are retained on the city’s “high risk” list (Adeshile, 2005). The City of Jacksonville’s definition and approach have best supported the Generic permit by inspecting all facilities equally, however, it they may not have accomplished the goal of prioritization of facilities that was intended for MS4 permit holders.

Pinellas County has incorporated several components into its “high risk” definition. In addition to the three listed industrial categories, the County first prioritizes facilities based on location. The County proactively inspects facilities within impaired watersheds, giving priority to those with proximity to MS4s or waterbody, or those the potential to discharge into MS4s based on their elevation (Weed, 2005b). SIC codes are also used for identifying facilities, along with complaints received by the department. Additionally, the County inspects facilities not subject to the Generic permit, such as automotive repair shops (Weed, 2005b).

Additional factors are important during the on-site inspections. For example, there is considerable emphasis on good housekeeping practices, existing BMPs, and integrity of the structure (Weed, 2005b). The actual materials being used, stored, or disposed of

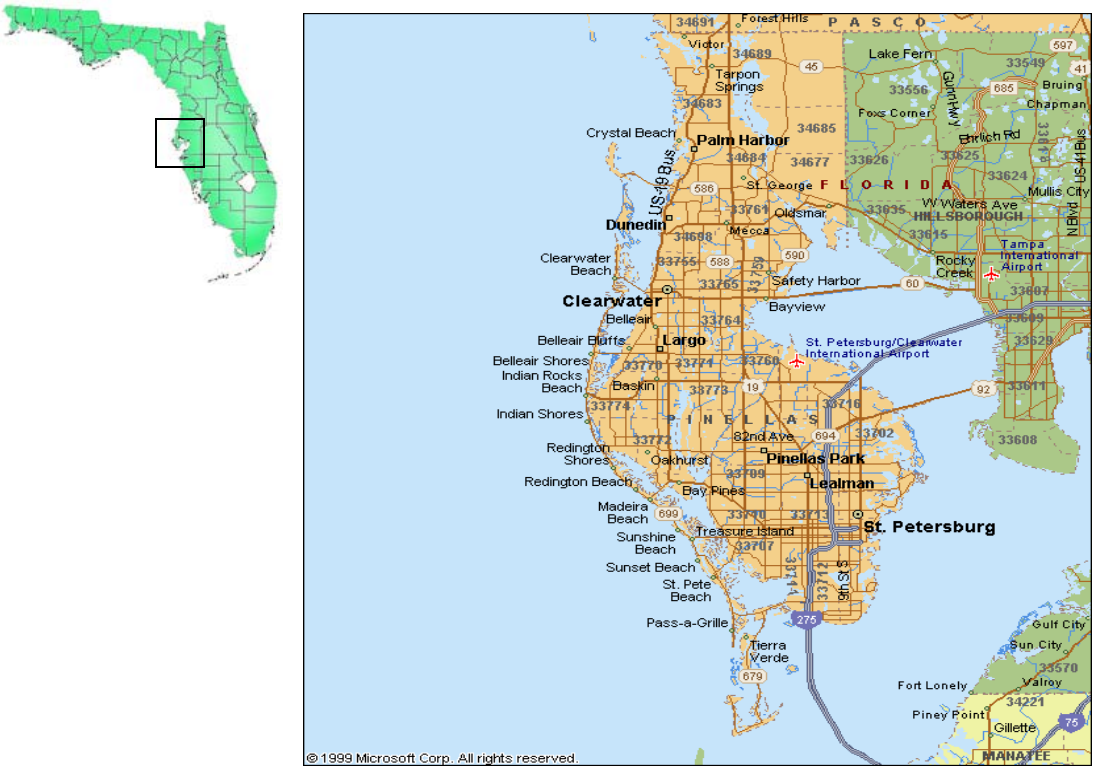
outside, especially hazardous materials, are scrutinized and may determined a facility's potential to contribute pollutants to stormwater. A more thorough discussion of the County's inspection process will be presented in the Results chapter.

While local control can lead to more direct and effective implementation, the lack of clear guidelines may lead some permit holders to under inspect facilities, while others may devote too many resources to this program. This research has proposed a quantitative definition for high risk based on the intensity of industrial activities exposed to stormwater as an alternative for prioritization and implementation of the MS4 permit requirements.

III.D.3. COMPARISON OF PINELLAS COUNTY TO STATE AND NATIONAL INDUSTRY AVERAGES

This research conducted an assessment of the industrial stormwater NPDES regulations in Pinellas County, Florida. Pinellas County is the second smallest county in the state of Florida; however, it is the most densely populated (TBRPC, 2004). The following graphics depict the location of Pinellas County within the State of Florida and some of the zip codes within the County that were used for this research.

Figure 1. Pinellas County, Florida



Residential areas dominate Pinellas County and less than 10% of the County acreage is zoned for industry (TBRPC, 2004). However, industry is present and information from the EPA suggests that over 1,600 industrial and commercial facilities are utilizing toxic substances in the county (TRI, 2004). Based on U.S. Census data, nearly 1,400 industrial facilities are operating amongst an estimated 26,295 businesses in general (PCED, 2005) as shown in Table 1.

Table 1. Manufacturing Statistics for Pinellas County, State of Florida, and the U.S.

From U.S. Census Data

Type of facility by SIC Code	United States Total # of Facilities[1]	Florida Total # of Facilities [2]	Pinellas County (With St. Petersburg) Total # of Facilities [3]
All Businesses	643,0633	38,8525	26,295
All Manufacturing	37,7776	1,6304	1,397
20	20,878	704	31
21	105	21	*
22	6,155	181	13
23	23,411	1,139	55
24	*36,735*	*1,246*	*58*
25	12,095	768	48
26	6,496	184	10
27	62,355	3,317	244
28	12,371	534	41
29	2,147	48	2
30	16,892	676	66
31	1,839	72	8
32	*16,393*	*894*	*37*
33	6,275	118	11
34	*37,985*	*1,374*	*147*
35	56,383	1,627	226
36	*17,104*	*750*	*84*
37	12,387	1,066	98
38	11,727	585	102
39	18,043	1,000	94

[1] US Census (2003), [2] US Census (2002), [3] US Census (1997), * Data was not found for this SIC code for Pinellas County from the US Census.

Pinellas County exhibited both similarities and differences to Florida and national manufacturing statistics (see Table 2). Within the four target SIC codes, Pinellas County contained a smaller percentage of lumber and wood products facilities (4.15%) than both the United States average (7.64%) and the Florida average (9.72%). The percentage of stone, clay, glass, and concrete facilities was 2.65%, compared to the Florida average of 5.48% and the national average of 4.34%. However, the percentage of fabricated metal products facilities (10.52%) was higher than the national average of 10.05% and the Florida average of 8.43%. Electronic and other electric equipment facilities (6.01%) were also more abundant in Pinellas County than in Florida overall (4.60%) or the United States (4.53%). Due to the smaller size of the County and limited developable land, this county may be more conducive to smaller industrial facilities, such as electronic manufacturers. A larger number of fabricated metal products and electronic components facilities were contacted during the research due to their larger presence. The County and State averages used for this comparison, however, contain facilities located outside of the study area in St. Petersburg. Therefore, the businesses operating only within the research area may differ slightly from the above figures.

Although there are some differences between the research county and the state and national averages, the County is similar enough that the research recommendations could be applied to other jurisdictions following minor modifications.

Table 2. Manufacturing Statistics for Pinellas County, State of Florida, and the U.S. From U.S. Census Data by Percentage

Type of Facility by SIC Code	United States Total by % of all Manufacturing	Florida Total by % of all Manufacturing	Pinellas County (With St. Petersburg) by % of all Manufacturing
All Manufacturing	5.87	4.20	5.31
20	5.53	4.32	2.22
21	0.03	0.13	*
22	1.63	1.11	0.93
23	6.20	6.99	3.94
24	*9.72*	*7.64*	*4.15*
25	3.20	4.71	3.44
26	1.72	1.13	0.72
27	16.51	20.34	17.47
28	3.27	3.28	2.93
29	0.57	0.29	0.14
30	4.47	4.15	4.72
31	0.49	0.44	0.57
32	*4.34*	*5.48*	*2.65*
33	1.66	0.72	0.79
34	*10.05*	*8.43*	*10.52*
35	14.92	9.98	16.18
36	*4.53*	*4.60*	*6.01*
37	3.28	6.54	7.02
38	3.10	3.59	7.30
39	4.78	6.13	6.73

* Data was not found for this SIC code for Pinellas County from the US Census.

CHAPTER IV – METHODOLOGY

This research has developed a process for identifying industrial facilities that are subject to the federal and/or local regulations, including those that pose a "high risk" for contributing pollutants to stormwater. A comprehensive list of all industrial facilities was developed using existing databases from a variety of sources. This broad list was then narrowed down to those facilities that are technically required to comply with the Generic permit based on their SIC codes and/or inclusion in one of the four categories of industry listed in the County's MS4 permit as requiring inspection. A subset of the facilities (based on their SIC codes and geographical location) was contacted by phone to determine the industrial processes occurring on-site, whether they were required to comply, and the degree to which they may be performing pollutant-generating activities. To verify the phone questionnaire results, fence-line visits were performed on a subset (roughly 35%) of those facilities. The research also accompanied County personnel on a small number of facility visits to observe the County's process for determining whether facilities are "high risk" as a means to further check the validity of phone contact and fenceline inspections.

The proportion of facilities in compliance with the regulations was assessed using the phone results to determine which facilities were technically required to comply with the Generic permit. All facilities determined to be subject to the Generic permit were assessed as to the intensity of their pollutant generating activities. That assessment used

information from the phone questionnaires regarding the intensity of potentially polluting industrial operations exposed to stormwater at each facility. The results were tabulated using a quantitative scale and facilities were assigned "intensity" scores. The operational definition of three "intensity" categories (high, medium, and low) was generated using the results from the phone questionnaires and fenceline visits. This was then compared to the working definition of "high risk" used by both Pinellas County and other MS4 operators in Florida tasked with inspecting "high risk" facilities.

Results from the list-and-survey and fenceline visit approach were also compared to the results of a selected group of the County's on-site inspections to assess the usefulness of the phone survey. The County inspected approximately 40 facilities throughout the research period, although not all were of the four SICs targeted by this research. Some of those facilities identifying with the other SIC codes were contacted, however, in order to strengthen the comparison between the methods, but were not included in all of the analyses. Agreement between phone questionnaire results and fenceline visits to the County's on-site results further reinforced the usefulness of the method.

IV. A. Developing the Industrial Facility List

The first step to identifying facilities regulated by the NPDES and MS4 industrial stormwater regulations was to compile a list of the universe of industries operating in Pinellas County, Florida. The need to develop lists in this way and the inadequacy of any singles type of existing list for the purpose of stormwater regulations for industry was discussed in Duke *et al.* (1999). Methods similar to that research were applied for Pinellas County. Because this was the first known attempt to generate a comprehensive

list of facilities for this purpose, it was not possible to compare the efforts or facility information to other lists.

Numerous existing and publicly available databases were used to develop a generalized facility list, including various federal, state and local government organizations; and a purchased database. Each of the solicited sources were created for purposes other than identifying facilities subject to the Generic permit, however, they each contributed to the complete list. For example, the FDEP tracks industrial facilities that are already in possession of a Notice of Intent (NOI) to comply with industrial stormwater regulations, along with facilities that have an NPDES permit for point source discharges. The EPA tracks facilities that use hazardous materials, required under the Resource Conservation and Recovery Act. EPA also retains information for industries that were permitted prior to 2000 and receives current Generic permit information submitted by the FDEP. The Pinellas County Economic Development (PCED) recently purchased a database from InfoUSA® that includes industry and commercial operations in the county. While the PCED was primarily concerned with the economic viability of the county (PCED, 2004), this list was useful to supplement the sources from public entities. In the end, this list accounted for the largest portion of facilities within the database.

The original data sources and the final list of industrial facilities may still not have adequately represented all of the industry operating in Pinellas County. None of the original lists were generated with information specifying industrial activities of the type specified in the Generic permit, such as activities exposed to stormwater. Because the Generic permit relies on self-identification by its regulated community and compliance is

far from complete, the exact identity of that community is poorly understood (Duke, 1999). Some facilities were expected to pose a higher risk for contributing pollutants to stormwater because of their industrial processes. For example, facilities that operated completely indoors, such as photocopy centers, are technically required to comply with federal regulations but may not be contributing pollutant loads to stormwater. An effort was made, also, to include a variety of industrial classifications, however, some of these industrial categories were not targeted for phone outreach. The list-developing process of this type is required in any jurisdiction to identify facilities that may need to comply.

Literature reviews were useful for determining the characteristics of typical industrial facilities. While an individual facility may have been listed on an existing database because of toxic chemical use or release, the mode of transmission may not have been to stormwater. This research focused only on pollutants discharged in urban stormwater, recognizing that direct discharges to surface or groundwater, along with air emissions, are also important contributors to degraded water quality. It should be noted that the Pinellas County MS4 permit directs the permit holders to inspect not only industrial facilities, but commercial operations as well (FLS000005, 20004). While parking lots located at retail stores and other commercial activities may contribute pollutants to stormwater, they were not included in this research for several reasons. First, these facilities are not subject to the federal Generic permit regulations; therefore, comparing the effectiveness of the two regulations was not possible. Second, the County has chosen not to focus implementation efforts on these sites (Weed, 2005a). Lastly, in absence of an accepted definition of “high risk,” water quality data from these sites, and

federal guidelines for commercial operations, making accurate assessments regarding the importance of these sources would be limited and speculative at best.

The combined lists were scrutinized and facilities were extracted that fell into one of the four categories of regulated facilities defined in the Pinellas County MS4 permit: landfills; hazardous waste treatment, storage and disposal facilities; facilities subject to EPCRA SARA Title III Section 313; and any other facilities that may be contributing a substantial pollutant loading to the MS4. As the NPDES industrial stormwater regulations address 11 categories of industry and continues to utilize of Standard Industrial Classification (SIC) Codes, each of the applicable codes were initially included. SIC codes were used to further classify industrial activity within the county.

IV.B. Maintaining the Industrial Facility Database:

The initial facility list was created using a Microsoft Access ® database program. Information input into the database included, but was not limited to: facility name, contact information, contact person, SIC code(s), facility type or industrial description, current or expired Generic permits, and original list source. Some facilities were listed on multiple sources, such as a municipal POTW industrial pre-treatment list, the TRI list, the InfoUSA® list, and the FDEP list of NOI filers. It was vital to identify the original data source because some contact and other facility information differed by source. This allowed for updates to be made to the database, while maintaining the integrity of the original lists. The comprehensive facility list retained identifying information, such as facility name and contact persons, as all data fields were obtained through publicly available sources. It was assumed that any interested citizen or researcher could duplicate

this effort and compose an identical list of facilities. The following table represents the various sources used and the number of industrial facilities derived from each.

Table 3. Sources of Industrial Facility Information

Industrial List Source	# of Facilities
EPA Past Generic Permits	85
EPA Current Generic Permits	87
EPA TRIS	40
EPA TRI Explorer	48
FDEP	23
FDEP Industrial Wastewater	19
Pinellas County DEM	30
Pinellas County 313 List	7
Pinellas County HWTSDF	2
City of Clearwater POTW	16
City of Oldsmar POTW	4
City of Largo POTW	10
City of Largo IPP	11
InfoUSA	1802

IV.C. Selecting a Subset of Industry

The broad list of all industrial facilities that might need to comply with the Generic permit within Pinellas County was approximately 2,000 facilities. A subset of these facilities was selected for telephone outreach to make a better informed determination about the need to comply. A completely randomized selection of facilities may have only reached a few industries in each category, therefore, extrapolating that data to the entire county would have been unrealistic and statistically weak. Rather than learn a small bit of information on many facility types, the research outreach efforts targeted facilities within four industrial categories only. The subset of facilities was selected as follows.

IV. C. 1. PRIORITIZATION BY INDUSTRIAL CATEGORY

Four SIC Codes/industrial categories were selected for several reasons. Each industrial category exhibited important characteristics. First, there existed a large enough subset of the facilities from each category operating in the County to support statistical analyses. Second, each industrial type listed in the NPDES regulations produced a marketable product, rather than solely performing a service. This was important so that the same questionnaire could be administered to each facility with equal success. Third, the businesses were significantly different in terms of raw materials, final products, and equipment usage to yield interesting conclusions. Fourth, it was expected that the industries would occupy different physical facility types, ranging from large, outdoor sites to smaller, completely enclosed sites. Finally, the four two-digits SIC codes included both “heavy” and “light” categories of industry. While each were required to comply similarly with the NPDES regulations due to the NRDC lawsuit (NRDC, 2002) it was possible to determine whether differences exist between the categories that would contradict the NRDC findings.

The four categories of industry included SIC Code 24: lumber and wood products (lumber); SIC 32: stone, clay, glass, and concrete (stone); SIC 34: fabricated metal products (metal); and SIC 36: electronics and other electrical equipment (electronics). The “light” industry group included SIC 2434: wood kitchen cabinets; SIC 323: products of purchased glass; all SIC 34 codes except SIC Code 3441: fabricated structural metal; and all of the SIC 36 codes. “Heavy” industry included the remaining SIC codes with the applicable two-digit prefixes. Among the subset of facilities, some may have been also categorized as TSDF or TRI facilities. Because facilities were selected randomly or by

saturation, each individual facility had an equal chance of being contacted regardless of inclusion on additional lists. The research did not conduct surveys on landfills, although they are listed as a priority for MS4 permit holders, as the telephone questionnaire would have required significant modification and results could not be analyzed similarly.

IV.C.2. PRIORITIZATION OF FACILITIES BY GEOGRAPHIC LOCATION

After the subset of facility categories was selected, the sample was narrowed down further depending on geographical location. Several sections of the County were preferentially targeted to coincide with the County's inspection methods. That was useful for this research because it allowed some of the contacted facilities to be visited by the researcher to help verify results. It did not bias results because there was no reason to believe facilities in those areas were different in their industrial activity types, industrial activities, intensity, or requirement to comply with the Generic permit compared to the rest of the County.

Pinellas County inspectors began in the northeastern County because it exhibited a higher degree of industrialization (based on aerial photographs) than other areas. For the County's purposes, it was more practical, economically and temporally, to target areas that contained a higher proportion of industrial facilities. The County then shifted to watersheds of special concern – either those with documented water quality impacts or those with upcoming Total Maximum Daily Load deadlines (a program that requires an extensive pollutant assessment and reduction strategy). It was believed by the County officials that facilities located in impaired watersheds may have been partially contributing to poor water quality via stormwater discharges associated with industrial activity.

The purpose of contacting the same facilities as the County was to compare the results from the phone questionnaire and fenceline visits with those from the more thorough on-site inspections. Conclusions regarding compliance rate and need to comply with the regulations within the targeted SIC codes were compared to on-site inspections of a small number of facilities in those same locations. Although this research was performed to assess the effectiveness of the industrial stormwater regulations, it was also expected that the research could be applied and serve as a useful tool for local environmental agencies.

The County requested that the research prioritize industrial contact based on geographic location, similar to its own inspection locations. The County was interested in learning more about facilities in the impaired Cross Bayou watershed, for example, because of documented poor water quality. For the purposes of this research, the County translated this into six "target" zip codes within and around this watershed (see Figure A-2). It was not the responsibility nor intention of this research to document water quality problems. Instead, the County zip codes were used to focus the research effort and generate useful conclusions for the County. An additional zip code in the northeastern County was added to the "target" list to encompass the facilities that were inspected prior to this research effort. Therefore, seven zip codes were "targeted." Calls to industrial facilities outside the seven zip codes were also necessary to increase the sample sizes and allow for statistical analyses.

IV.C.3. SAMPLING SCHEME

Industrial facilities were selected both within the seven target zip codes and outside the target zip codes. Due to the request by Pinellas County that the Cross Bayou

watershed area be examined, each facility in the six Cross Bayou watershed zip codes plus the northeastern County zip code identifying with one or more of the four two-digit SIC codes (24, 32, 34, and 36) was included. Each facility was handled equally within the target zip codes with a letter sent and phone calls made to every facility. The samples were filled out by adding industrial facilities outside the target zip codes but within the target SIC codes. In order to retain the equality of samples, the remaining facilities were chosen randomly. Facilities located in non-target zip codes were entered into a Microsoft Excel ® spreadsheet. Each facility was randomly assigned a number between 1 and "x" that was not based on location, name, or SIC code. Facilities were then selected using the software program's random number generator until the desired number of facilities was selected.

The required sample sizes for each SIC code was a minimum of 30 facilities. The call list was developed with more than 30 facilities in each category with the expectation that a 100% response rate was not possible. It was hypothesized that some facilities would no longer be in operation, would not be "industrial," would identify with a different industrial classification, would be unreachable, or would refuse to participate in the research. A breakdown of these responses is discussed in the Results section.

IV. D. Confidentiality Protocol

This research was approved by the University of South Florida's Institutional Review Board (IRB) because it involved contact with human subjects. Information learned during the phone questionnaires could potentially cause an individual and/or facility to be found in violation of the CWA. As mentioned earlier, this could result in a

monetary penalty up to $25,000 and/or incarceration of up to two years. While the researchers were not qualified to make these legal decisions, if raw data including personal identifying information were shared with governmental agencies, this assessment could be made and facilities could be fined. The IRB approval protected the rights of research participants. Therefore, the research design and methods were structured to respect this confidentiality. An explanation of the confidentiality protocol has been noted in the appropriate following steps.

The research proposal and all survey instruments were reviewed and approved by the IRB. Additionally, all involved researchers completed a training course to verify that IRB protocol would be followed. Consequently, raw data is not available to any agency or individual. Aggregate results have been instead and provided sufficient information to make policy recommendations. The promise of confidentiality likely increased the response rate and willingness of industrial employees to participate in the research. Copies of the IRB exemption certificates, including approval of survey instrument modifications have been included in Appendix 2.

IV.E. Surveying Industries – Introductory Letter

A one-page letter (see Appendix 3) was sent to each selected facility prior to phone contact. The letter was directed to the environmental compliance manager or whoever was responsible for environmental compliance and was familiar with the day-to-day operations at the facility. In some cases, an appropriate contact was listed on a public source; this name and title was used when available. The purpose of the letter was to introduce the research and its objectives, and to verify the validity of the research team and its affiliation with the University of South Florida. The letter also explained the

confidentiality of the survey results to encourage honest and complete responses. Data, as mentioned in Section IV.D., has only been released in aggregate form and the targeted list of facilities was destroyed following the survey process.

A secondary objective of the letter was to increase the response rate to the phone questionnaire. By notifying facilities in advance of the questionnaire, the environmental compliance manager or other appropriate personnel were apprised of an upcoming phone call and may have been more inclined to participate. The letter in no way revealed how the industrial facility should respond to the individual questions and should not have biased the results. The letter also served as a record for the facility that they were contacted and participated in the academic survey.

IV.F. Surveying Industries: Administering the Phone Questionnaire

Phone questionnaires were used to verify the accuracy of data sources, to determine which facilities may need to comply with federal regulations, and the potential for a facility to contribute pollutants to stormwater.

To preserve confidentiality, the questionnaire was divided into two separate questionnaires that were administered sequentially. Each facility was assigned an arbitrary code based on the researcher's first name and the sequential order of calls. The coding scheme was developed to be entirely arbitrary and to avoid any code choices that could identify the facility, such as abbreviations of the industrial facility name, environmental compliance officer's name, or facility address. This code was included on both parts of the questionnaire so that results could be tabulated by the researchers.

This coding was needed to link the survey results with the individual facilities for several reasons. First, it was necessary to correlate survey responses with original data

sources to assess the validity of each source. The code was also used in conjunction with the fenceline visits (see Section IV.H.), in order to compare the information obtained over the phone versus that seen from public roadways. The completed surveys, however, were filed separately from the coding schemes. Separate databases were created, and identifying information was only included on the first part of the questionnaire. The coding key was destroyed after the fenceline visits and comparison with County inspections were completed. Therefore, anyone who reviews the data in the future will not be able to link the survey results to the individual facilities or their employees.

IV.F.1. DATABASE ACCURACY QUESTIONNATIRE

Part I of the phone questionnaire was entitled "Database Accuracy," (see Appendix 4) and was designed to test the accuracy and usefulness of the various primary data sources. Facility compliance personnel were be asked to verify the information in the research database, including facility name, contact address and/or physical facility address, contact person, primary business activity(s), and SIC code(s). Consequently, an assessment was made regarding the accuracy of the public data sources. This indicated whether certain data sources were more reliable or up-to-date than others. This information was kept separate from the answers to the process-related questions, in order to ensure confidentiality, and was only used to critique data sources and the current database. This accuracy assessment may be useful to other MS4 permit holders that desire a list of facilities in their area.

The results of the "Database Accuracy" questionnaire were recorded in a Microsoft Access ® table (see Appendix 5). The relative fields included text boxes for the code, facility name, phone number, contact name, address, and business activities.

The SIC codes(s) were entered into numerical boxes. Responses related to the accuracy of the contact information were coded as a “1” for “yes,” a “2” for “no,” and a “3” for “don’t know.” A comments section was included for any qualitative or supporting information.

IV.F.2. INDUSTRIAL STORMWATER REGULATIONS QUESTIONNAIRE

Part II of the phone questionnaire was entitled “Industrial Stormwater Regulations.” Questions were derived from the federal permit language that specifies industrial processes and activities that may require compliance with the Generic permit.

The first questions inquired about general awareness of the industrial stormwater regulations and whether the facility had been contacted by any federal, state, or local agencies specifically regarding industrial stormwater runoff. This helped to gauge the existence and/or usefulness of education and outreach efforts made (or not made) regarding the federal regulations. It was hypothesized that awareness of the regulations would be low. Additionally, facilities that had already been contacted and/or inspected by PCDEM were expected to respond differently to the questions. If, however, facilities still exhibited a general misunderstanding or unawareness of the permits, this was used to evaluate the success of education efforts that occur during County on-site inspections, all of which were completed within a year of this research.

Some general questions were also added regarding to the size of the facility (the facility itself plus surrounding area, and any green space or grassed areas) and the number of employees. This information was used to generalize the size and employment of facilities in the County and further understand the type of facilities operating within the four industrial classifications.

The majority of the questions addressed the industrial processes that occurred on-site and the intensity that pollutants that could be incorporated into stormwater. All of the primary questions could be answered using “yes,” “no,” or “don’t know” responses. Facility personnel were given the opportunity to request further clarification (to an extent) and additional information was noted on the questionnaire form. Examples of questions included:

“Does your facility blend, alter, or modify materials, products, or chemicals at this facility?,”

“Does your facility operate a shipping and receiving area where material or products are loaded or unloaded? If so, is this area uncovered or ever exposed to precipitation when it rains?,”

“Does your facility store waste liquid material outdoors, for example, drums of spent lubricants, still bottoms, or paint? If so, is this area larger than four-to-five drums,?” and

“Does your facility operate miscellaneous equipment outdoors, such as coolant tanks, air compressors, or generators? If so, is this equipment ever exposed to precipitation?” The complete questionnaire is included as Appendix 6.

In order to facilitate responses and to encourage participants to complete the questions, several of the questions requested the participants to explain the intensity of activities, such as the number of off-site vehicles used, the capacity of liquid tanks, the frequency of an activity, or whether or not the activity was conducted outside, allowing for possible contact with precipitation or stormwater. For many of the questions, a “yes” response to an initial question led to additional questions designed to qualify the intensity

of the activities. Intensity questions were generally related to the quantity of materials or equipment used, the size in area of the facility where they were conducted, or the frequency of occurrence of industrial activities. Questions also addressed whether the activities, materials, or equipment included exposure to precipitation or stormwater. The follow-up intensity-related questions were critical for devising a scoring scheme for high, medium, or low intensity. They were designed to differentiate facilities that perform activities frequently or on a larger scale from those that perform activities only occasionally or on a smaller scale.

IV.F.3. INTERPRETATION OF SURVEY RESULTS

The questionnaire was designed using specific information from the Generic permit such that a "yes" response to any question regarding exposure of an activity, process, or equipment to precipitation signified that the facility may need to comply with federal regulations. "No" responses to all questions signified that the facility need not comply with the Generic permit and may be eligible for the No Exposure Certification. While the questionnaire results could not definitively determine need to comply, if the answers were accurate and truthful, they would cover nearly every condition in which a facility should comply. The surveys were considered a reliable indicator of need to comply with the Generic permit. The survey results allowed the researchers to hypothesize whether a facility may need to comply with federal regulations and/or may warrant inspection by the County. It was important to note, however, that the research team did not attempt to determine absolute need to comply – this determination should be left to trained government personnel. Along those lines, the research team did not share

opinions or recommendations with the industrial participants related to their need to comply, even if asked.

The surveys had a second set of findings that were considered reliable and meaningful regarding the effectiveness of the regulations. The results of the questions were used to identify facilities that were technically required to comply but where few processes came into contact with stormwater and would cause a facility to be labeled as low intensity. That is, a candidate group of facilities that could be considered not “high risk” and that displayed the rationale for a prioritization step of the kind performed in this research.

The final questions asked the participants if they knew whether their facility was subject to the Generic permit and, if so, whether it had already fulfilled the first stage of compliance by filing the NOI. That information, along with the determination of need to comply, could be used to assess the proportion of compliance. This proportion of facilities in compliance could then be compared with other parts of the U.S. (Duke and Shaver 1999).

All facilities were encouraged to learn more about the federal and local regulations by visiting the FDEP via website or contacting the agency by phone. The research team recommended that each facility receive more information, regardless of its responses. The percentage of facilities requesting information signified the general interest in the program and/or research and also served an educational purpose as a useful educational tool. Therefore, the survey process was believed to be a potentially useful tool to increase compliance in Pinellas County, although no follow-up was envisioned to measure the effect of that recommendation.

A separate Microsoft Access ® database was maintained for the industrial stormwater regulations questionnaire (see Appendix 7). Relative fields included the code number, SIC code(s) and quantitative responses to the questions. A “yes” response was coded as a “1,” a “no” response as a “2,” and a “don’t know” as a “3.” Some questions, such as those related to intensity, were coded with alpha characters rather than numerals. For example, if a facility employed between one and four employees, it was coded as an “A” whereas five to 19 employees was coded as a “B.” Other questions required the participant to volunteer a specific number, such as the capacity of a storage tank or the dimensions of a plant yard. Those values were entered exactly as recorded. Additional qualitative or supporting information was included in a comments section for clarification of answers.

The database was designed to facilitate queries and analysis of the data. For example, a simple query could identify the number of facilities that operated industrial equipment outdoors or the number that blended, altered, or modified materials, products, or chemicals outdoors. This information was useful in determining the most frequent activities that could contribute pollutants to stormwater overall and within each industrial category. For example, lumber companies may have been more likely to operate machinery outdoors but electronics producers may have been more likely to store drums of hazardous waste outdoors. These comparisons could highlight common pollutant generating activities for each industry types.

IV. G. Phone Research Protocol

Several components of the phone outreach were developed to ensure that surveys were administered with the same success at the beginning of the research as at the end.

Standard protocol was developed to improve the uniformity of delivery among researchers and the clarity for industry participants.

IV.G.1. PRE-TEST PHASE

The phone survey development included an initial testing stage, which, incidentally, resulted in useable data. The questionnaire was administered to SIC code 34 industries in "non-target" zip codes prior to initiating contact with "target" zip code facilities. The purpose of this step was to test the survey instrument for clarity and ease of administration by the researchers. Minor adjustments were made that improved the style and flow of the phone conservations, but did not significantly alter the content of the questionnaire. For example, minor typographical errors and word changes were made and the delivery of the informed consent language was shortened in order to respect the time limitations of the participants. No questions were added or removed from the original questionnaire. Additionally, the order of questions remained the same and minor word modifications did not affect the participants' understanding or responses to the questions. The purpose of the modifications was to enable the surveyors to more fluidly and consistently deliver the questions.

The survey procedure during the pre-test stage was identical to the procedure following the pre-test. Letters were sent to each contacted facility and the same information was provided at the completion of the survey. Additionally, the same amount of effort was dedicated to contacting facilities during the pre-test stage. For example, callbacks were made with the same dedication and persistence as for industries within the

"target" zip codes. For these reasons, the results of the pre-test were included in the results.

IV.G. 2. SELECTING THE CALL LIST

Phone calls were made to 250 facilities throughout Pinellas County. As discussed earlier, phone calls were first made to fabricated metal products facilities outside of the "target" zip codes during the pre-test period and these calls were incorporated into the final results. Phone calls were then made to every facility within the four target SIC codes and within the seven target zip codes. A random selection of facilities outside the target zip codes was then selected to complete the samples. The research strived for 30 or more calls to each industrial category. There were significantly more fabricated metal products facilities within the County, therefore, a larger sample size was also contacted. The following table describes the number of facilities on the original database and how many were contacted. Please note that these figures represent the primary SIC codes generated from the original database. Because some facilities identified with a different SIC code when performing the questionnaire, these numbers do not coincide with the final results by SIC codes. This table describes the original sample size with the understanding that some industry would be classified incorrectly. These number also do not include facilities outside of the four industrial categories that were contacted because of their prior inspections by the County. The final completion rates and other results have been presented later.

Table 4. Selecting the Call List

Industrial Category	Database Total	Contacted Total	Target Zip Codes	Target Zips Contacted	Other Zip Codes	Other Zips Contacted
Lumber	35	35	18	18	17	17
Stone	46	40	15	15	31	25
Metal	156	116	79	79	77	37
Electronics	65	48	32	32	33	16
Total	**302**	**239**	**144**	**144**	**158**	**95**

IV.G.3. RESEARCH PHONE CALL PROTOCOL

Phone calls were made by four different researchers over a four-month period. Each researcher participated in a training procedure that included feedback on the initial questionnaires, role-playing, and Institutional Review Board training. The confidentiality protocol elements and on-line training were especially important. Prior to beginning the survey collection efforts, researchers met to discuss potential modifications to the questionnaires, such as improving awkward or unclear language, and adding additional information to clarify questions for industrial facility personnel. Changes were made to the questionnaires based on the strategy sessions both prior to IRB approval and following the pre-test period. No substantive changes were made to the questionnaire forms and no changes of any kind were made during the data collection period.

Facilities were contacted on various days each week, including calls made on all five working days. Researchers generally began making calls at 8:00 AM, suspending calls between 12:00 PM and 1:00 PM, and then contined until 5:00 PM. The working hours for individual researchers varied based on their other commitments. If facilities could not be reached on the first call, the researchers would either inquire as to a preferable day and time to call back or would purposively select a different time. For

example, if an individual could not be reached before 9:00 AM, the researchers would call in the afternoon, experimenting with different days and times until the individual could be reached.

The success and ease of survey completion varied widely among the contacted facilities. During the initial phone call, each researcher asked to speak with the contact person (from the database) or the "environmental coordinator." If there was no such employee, the researcher briefly described the research and asked to speak with whoever was familiar with the environmental activities and the day-to-day operations at the facility. If not directly connected, the name, title, and extension were noted for follow-up calls. In many cases, the owner or president of a company was the most appropriate contact point. In other cases, a manager was best qualified to complete the survey. Every effort was made to speak with someone at the local Pinellas County site. While larger companies with satellite offices may have an environmental coordinator in a headquarters office, this research required contact with someone who was on-site and familiar with the local facility. While familiarity with environmental regulations may have been lost, these local employees were likely to be more familiar with the facilities' operations, daily habits, and storage practices.

A small number of surveys was completed on the first phone call. These instances occurred when an appropriate contact person could be identified, either beforehand from the various data sources, or through the facility personnel, and that person was available and willing to participate in the research immediately. In most cases, however, several attempts were needed to reach the correct person, select a convenient time to complete the survey, or receive a returned phone call from the facility. Most facility calls were

answered by an employee, however, 10 facilities, or 4% of the total sample only had an answering machine. Regardless of contact with an individual or an answering machine, a message or voice mail was never left on the first attempt. The researchers were instructed to hang up if an answering machine was operated on the first call. If a receptionist or other employee could not locate the appropriate contact person or if that individual was not available, the researchers inquired as to a more appropriate day and time to return the call. After the second call, a message or voice mail could be left, although, if a receptionist instructed the researcher to retry the call that same day or on the following day, no message was left. If the following attempt was not successful, a message was left. Researchers provided their name, university affiliation, a brief description of the survey, a reminder of the confidentiality agreement, and the phone number for the research office. The policy research office voice mail included a brief description of the study to increase the participant's certainty of the research legitimacy.

IV.G.4. DISCONTINUATION PROTOCOL

A diligent attempt was made to complete the survey for each contacted facility and the follow-up efforts were the same for each facility. Since the targeted list was carefully selected, based on SIC codes and location, the importance of obtaining complete results for as many facilities as possible was stressed to the researchers.

It was not always possible to complete questionnaires for each selected industrial facility, regardless of the diligent efforts of the researchers. Some questionnaires could not be completed for the following reasons:

- facility information was incorrect (e.g., phone number incorrect or disconnected even after cross-checking with various on-line directories),

- facility was no longer in operation,
- facility performed different industrial processes (not included within the four target industrial categories),
- facility was not industrial (i.e., no industrial processes occurred; may be retail/sales/warehouse),
- facility actively refused participation (personnel stated that they preferred not to participate), or
- facility passively refused participation (personnel did not respond to request for contact).

Facilities where personnel could not be reached after numerous attempts were classified as "passive refusals." Although a verbal refusal was not given, the failure of industry personnel to return phone calls or accept calls from the researchers, signified a desire to not participate in the research. Phone calls were discontinued earlier if no direct contact was made with an employee. Three messages were left at each facility if only an answering machines was available. Each message included the name of the researcher, identification of University of South Florida as the research institution, the purpose of call, the confidentiality protocol, and the research office phone number. Facilities were listed as "passive refusal" two weeks following the third message.

A greater number of attempts was made to facilities where personal contact had been made, usually with a receptionist. Researchers left four messages with either a receptionist for a specific individual or on that individual's voice mail or answering machine. Researchers, however, were instructed to complete a minimum of six calls to facilities where an individual name was provided. If multiple calls were completed on the

same day, (e.g., the researcher was instructed to call back in a few hours), it was only counted as one call. While a passive refusal designation could be assigned after six calls, including four messages, researchers were allowed to complete two additional calls if individuals appeared to be interested in the research but, for whatever reason, were unavailable during the call periods.

IV. H. Surveying Industries - Conducting Fenceline Visits

Fenceline visits were performed at approximately 50 facilities throughout the County. Visits were performed in four County zip codes. The first zip code was located in the northeastern county, in order to overlap with completed County inspections. Two of the five Cross Bayou watershed zip codes were randomly selected, along with a randomly selected non-target zip code. The final non-target zip code was chosen to observe any possible differences between the target and non-target areas, although none were noted. A random sample of facilities was then selected from each of the four SIC codes. The final sample included facilities that were scored in each of the three intensity ranges. Additionally, several facilities were selected that passively or actively refused to participate or could not be reached. The purpose was to determine if those facilities did not participate because they were high intensity or for other reasons. Fenceline results were not tabulated for this small subset. The fenceline visits incorporated some facilities that were already inspected by the County, some that may have been inspected following this research effort, and additional facilities. Only a few facilities had been visited by the County inspector prior to this research.

Answers given to the phone questionnaire by the industry participants were assumed to be true, however, the fenceline visits tested this hypothesis through ground-

truthing. The research team visited between 10-20% of the facilities that participated in the survey and that may need to comply with federal regulations or that may be eligible for No Exposure Certification. The fenceline visits were used to authenticate the phone survey by identifying on-site processes and their potential for contact with stormwater.

The fenceline visits were designed to provide more accurate and detailed information about industrial processes that occurred at some Pinellas County industries and the potential for stormwater violations. Nevertheless, they were not expected to be as extensive and accurate as the on-site inspections performed by trained County personnel. The purpose, again, was not to make judgments about the need to comply but, rather, to observe any equipment or processes that may necessitate compliance. Essentially, the fenceline visits were intended to disprove or fail to disprove the phone questionnaires and determine if the scoring method was effective. It was an attempt to verify information that was discussed over the phone. If the fenceline visits did not disprove the results from the phone methods, then this would increase the validity of the phone survey.

The fenceline visit form (see Appendix 8) included elements from the phone questionnaire plus additional questions related to on-site treatment of stormwater. The initial questions focused on general facility characteristics, such as whether the facility was found and if industrial activity was evident. Researchers then recorded the approximate size of the complete facility and any green space. The majority of the questions addressed the evidence of industrial activities, such as manufacturing, outdoor process equipment, shipping and receiving areas, storage of raw/intermediate/waste materials, and the existence of a plant yard/access roads/rail lines. For each, the researcher noted whether the activity occurred, did not occur, or was uncertain (either

because it was not seen or there was no visible evidence). These final categories were utilized if portions of the facility were not visible to researchers from the public roadways.

The industrial activity questions were designed to complement the phone questionnaire results. While the exact wording and order of the questions differed, it was possible to compare responses from the phone questionnaire with the fenceline visits. Finally, several questions addressed evidence of stormwater management practices, such as detention or retention ponds, berms or grassed swales, or other BMPs. These questions were not included in the phone questionnaire as they were more related to the second stage of compliance than the first stage (filing of an NOI). These aspects, however, would likely be noted during an on-site inspection.

In addition to verifying the answers to the phone survey, the fenceline inspection form attempted to quantify occurrences and determine intensity by allowing researchers to include descriptions of observed activities. This was used in lieu of pre-set categories in order to increase flexibility and to more accurately re-create the County's inspection process. Due to the smaller number of fenceline visits, it was more manageable to compare results using descriptions rather than pre-set categories.

All observations were made from public roadways with a team of no fewer than two individuals. No contact was made with facility employees and, if asked questions or requested to leave, the visit was terminated early. The visits did not consist of inspecting the property itself, only the operations that were plainly visible from public areas.

Although the phone questionnaire was able to determine only whether a facility may have been technically required to comply with federal regulations, the fenceline

visits were able to strengthen the high intensity assessments. It should be noted, that classifying facilities based on fenceline visits entailed some value judgments by researchers in order to coincide with the “high risk” definition developed by this research. In the absence of a pre-determined and legal definition of “high risk”, MS4 permit holders would also have to use judgment when classifying facilities as “high risk.” As noted earlier, important components of the fenceline visits included quantifying the size of the plant yard or loading docks, noting the quantity of scrap material or waste products outside, recording the number of vehicles operating outside, and noting any other potentially high-risk behaviors. This exercise was designed to be similar to the on-site inspections performed by the County.

The fenceline visits succeeded in two ways. First, they were able to assess whether the phone survey was successful at identifying all types of activities that would lead to a requirement to comply. Second, similarity between phone survey data and fenceline visits was used to test the truthfulness and accuracy of participant responses to the phone questionnaire. For example, if 80% of facilities that answered “yes” to question “12” regarding storage of bulk dry materials were observed to have these characteristic during fenceline visits, the phone questionnaire was determined to be 80% successful for that particular question. Additionally, researchers could intensity classifications generated from questionnaire results to the industrial activities seen in the field.

The fenceline visits allowed an intensity classification to be proven or disporven. Although a “high risk” definition was developed in the field, based on fenceline visits, it was not a rigorous as the scoring scale used for phone responses. First, the intent of the fenceline data was not to determine absolute need to comply or “high risk” behavior. The

primary objective of the visits was to test the accuracy of the phone questionnaires. Although the fenceline visits were partially designed to constitute a less time-consuming option than a full on-site inspection, they were not designed to function independently. The inspection forms would be useful if County inspectors were driving through an area and wanted to gather preliminary data on a facility. However, the fenceline process was not significantly different than the current County practices, which included a brief visual inspection of facilities prior to an on-site inspection.

Second, the status of researchers was considerably different than for County officials. A government official with environmental compliance authority could be expected to gain full access to any facility on demand. Researchers for this project had no such authority and would be permitted access only if a facility chose to allow this. As noted earlier, by limiting the visits to public roadways, it was not possible to view the entire facility site in some cases. An authorized inspector would likely have full access to the site, including the inside of facilities. Further, some information could only be gained through personal contact with facility employees, such as the occurrence of vehicle maintenance or the number of employees. A full County on-site inspection could include each of the appropriate elements, but would also require additional time and resources. Finally, while the fenceline visits were not intended to classify a facility as a certain intensity, they were useful for testing the methodology and may still be an appropriate first step for County officials.

IV. H. 1. DATABASE MANAGEMENT

Fenceline data were entered into a separate database containing fields pertaining to the size and quantity of facility areas, equipment, storage areas, waste materials, etc.

and stormwater management practices (see Appendix 9). Facility contact information was retained in the database because all information was obtained from publicly accessible areas and did not include contact with human subjects. In order to respect confidentiality, however, this thesis does not include individual facility information, for example, "ABC Components had seven vehicles maintained outdoors, four drums of spent lubricants, and a half-acre plant yard." This information was less useful than ability of the fenceline visits to test the accuracy of responses to phone questionnaires and to note the most frequent industrial activities among SIC codes and/or among all facilities.

IV. I. Comparing Research Results with Pinellas County Efforts

The research methods employed in this project were compared to the current Pinellas County inspection process. As the Pinellas County MS4 permit requires identification and inspection of all facilities contributing a "substantial pollutant load" to the MS4s, the County has chosen to inspect all identified "high risk" industrial facilities within unincorporated Pinellas County. Rather than developing a prioritized facility list first, the County industrial stormwater personnel have conducted industrial inspections, as noted previously, on a geographical basis, based on the intensity of industrial facilities or the watershed classification. The on-site inspection process has allowed the County to determine whether a facility is contributing pollutants to stormwater by viewing the entire facility and its processes. These results are more detailed and accurate than is possible using a phone questionnaire or fenceline visit, although they are also more time-consuming.

County inspections were performed only for a small number of targeted facilities. Prior to this research, the County had already completed the majority of its original

inspections (21) in the northeast County. Five additional inspections were performed in other areas of the County. (Additional inspections were also completed throughout the research period). Nine of the original inspected facilities identified with one of the four target SIC codes, however, the remaining 16 did not. These facilities were contacted using the phone questionnaires to address any perceived differences between the two methods. Although the facilities did not always perform the targeted processes, the phone questionnaire was still applicable to other industrial activities.

The results of the County inspections were used to verify and compare the data from the phone surveys and fence-line visits. The on-site inspection should have allowed the County to establish “high risk” or high intensity status of targeted facilities and should have also identified if there were facilities that were not identified using the pre-existing lists. The County, however, does not specifically label a facility as “high risk” during the inspection period. Therefore, this result was not obtained. It was believed, however, that the County could make this recommendation if the inspector judged it appropriate. The comparison between the research results and those obtained by the County was used to highlight whether on-site inspections were a necessary first step in determining compliance or if SIC codes and phone surveys could effectively narrow a list to only those with a higher intensity of activities that could contribute pollutants to stormwater. The presence at on-site inspections was also used to assess differences between the way in which this research has defined “high risk” and how a MS4 operator would define or apply the term.

Following initiation of this research, the County performed an additional 20 inspections. In total, the County has inspected approximately 40 facilities per year (based

on its first year of inspections). While it may be useful to inspect a larger number of facilities, the County is tasked with other responsibilities related to its MS4 permit. Newer requirements, such as the TMDL process for impaired waterbodies (e.g., Cross Bayou), resulted in a temporary cessation of industrial inspections.

CHAPTER V – RESULTS

The results section begins with a discussion of the effectiveness of the Generic permit as implemented in Pinellas County, Florida based on the phone questionnaire results. This is followed by a discussion of the MS4 permit, starting with an explanation of the "high risk" definition based on the intensity of industrial activities exposed to stormwater. Next is an examination of the design of the permit and how that compared to its actual implementation in Florida, especially, Pinellas County. This is followed by a discussion of the characteristics of industrial facilities in Pinellas County, including the most common pollutant-generating activities for each industrial category. The usefulness of the methodology to classify the intensity of industrial activities is then assessed, followed by an evaluation of the overall effectiveness of the methodology. The chapter concludes with a review of the accuracy of the database and the survey methods employed.

V. A. Compliance with the Multi-Sector Generic Permit

Compliance with the Generic permit was determined by tabulating the proportion of contacted facilities that filed the Notice of Intent (NOI) to comply with the Generic permit (termed “proportion of facilities in compliance”). The proportion of facilities in compliance with the first-stage requirement was tabulated for all facilities contacted during the phone questionnaire. Facilities that noted familiarity with the Generic permit were asked if they had filed the NOI. These results were also compared to a database of

NOI filers available on the FDEP website (FDEP, 2005b). Compliance, for the purpose of this research, was limited to the filing of an NOI. While the long-term goal of the NPDES industrial storwmater program is to improve water quality protection through the use of BMPs and P2 strategies, the assessment of secondary requirements was beyond the scope of this research. First-stage compliance rates were analyzed overall and by industry type using SIC codes.

Compliance with the federal regulations was used as a metric for assessing the effectiveness of the regulatory language and structure. Because the NPDES industrial stormwater regulations have relied on self-reporting by industry, the proportion of facilities in compliance may indicate the success of this approach and whether industry has pro-actively educated itself regarding its regulatory requirements. This comparison also aided in the understanding of how regulations should be written and the degree of specificity required for compliance and successful implementation.

Compliance with the Generic permit was very low for contacted facilities within Pinellas County. The following table shows the proportion of facilities in compliance based on several classifications. Facilities, based on their responses to the phone questionnaire, have been placed into three categories in order to compute the proportion of facilities in compliance with the NOI. The first category, “not industrial” includes facilities that were retail stores or warehouses and were not conducting any industrial or manufacturing processes. These facilities would not require the Generic permit and, therefore, were not included in compliance calculations. Facilities that “probably need not file” had either zero exposure or a low intensity of industrial activities exposed to stormwater. These facilities may qualify for the No Exposure Certification. Facilities that

"probably must file" included both medium and high intensity sites that, based on their responses, were conducting activities that would technically require compliance with the Generic permit. These fields were then compared to the number of facilities that noted filing of the NOI.

Table 5. Proportion of Facilities in Compliance with the Generic Permit

Industrial Category	Need not File (Not Industrial)	Probably need not File (Zero or Low Intensity)	Probably must File (Medium, High Intensity)	Actually Filed NOI	% Filed of Medium, High	% Filed of Total
Lumber	2	13	4	0	0%	0%
Stone	6	12	9	6	66%	29%
Metal	5	38	37	5	14%	7%
Electronics	8	12	11	3	27%	13%
Total	**21**	**75**	**61**	**14**	**23%**	**10%**

The proportion of facilities in compliance ranged from zero percent for lumber producers to 66% for stone producers when viewing only facilities that had either a medium or high intensity of industrial activities exposed to stormwater. However, if one compares compliance with all facilities that were industrial in nature, the proportion of facilities in compliance is even poorer. Because the federal regulations require a facility either to file the NOI or qualify for the No Exposure Certification, each of the contacted facilities, based on their SIC codes, would technically require compliance on some level. Overall, the proportion of facilities in compliance was only ten percent.

The results from this research generally supported information related to NOI filers available on the FDEP website (FDEP, 2005b). However, the actual compliance rates may have been slightly different than suggested by this research, with an increased proportion of lumber facilities in compliance, but with a lower proportion of facilities in compliance for the other three industrial categories. The survey completion rate was

approximately 50% for each industrial category, with a slightly higher completion rate for fabricated metal products facilities. None of the industry participants within the lumber products facilities noted that an NOI had been filed, yet five have completed them throughout Pinellas County, according to the b. The proportion of lumber facilities in compliance could be as high as 14%. For the remaining facilities, it was possible that compliance was even poorer than demonstrated by this research.

The FDEP has compiled records of the facilities that have filed the NOI and has posted these lists on its website. The version utilized for this research was updated in August, 2005 and was expected to be accurate. The following table provides results of the proportion of facilities that filed the NOI in the County. The research columns represent the total number of facilities that completed the entire questionnaire, how many stated that they had filed the NOI, and the proportion of contacted facilities that had filed the NOI. The FDEP columns include the total number of facilities listed on the research database, the number of facilities that filed an NOI according to the FDEP, and the proportion of total facilities in the County having filed the NOI based on the research database totals.

Table 6. Comparison of Compliance Rates with FDEP NOI Filers Database

Industrial Category	Facility Surveys Completed	NOI Filers (based on phone questionnaires)	% NOI Filers (based on phone questionnaires)	Facilities in County (from research database)	NOI Filers (from FDEP website)	% NOI Filers (from FDEP website)
Lumber	17	0	0%	35	5	14%
Stone	21	6	29%	46	11	24%
Metal	75	5	7%	156	10	6%
Electronics	23	3	13%	65	4	6%
Total	**136**	**14**	**10%**	**302**	**30**	**10%**

Although the complete database generated for this research was also expected to be accurate, it was possible that not all industrial facilities were identified and included on the list. If a given percentage of the County industrial population was not represented on the database, the proportion of facilities in compliance would be even poorer. The overall proportion of facilities in compliance based on the completed surveys was approximately 10%. The proportion was significantly higher for stone, clay, glass, and concrete products manufacturers, possibly because cement manufacturers, which are within SIC code 32, have been required to apply for a specific permit and cannot receive exemption from the permit. Also, the facilities that reported filing an NOI were generally larger (in size and/or employees) subsidiary companies operated by a parent corporation. Many of these employed a full-time environmental compliance manager, which may have increased the facilities' recognition of the need-to-comply with the regulations.

The Generic permit, therefore, has not been effective at regulating industrial facilities within Pinellas County, Florida. There was a low compliance rate with the Generic permit for each of the four industrial categories contacted during this research. The majority of facilities, especially smaller sites, had not filed the NOI to comply with the industrial stormwater regulations. These results have supported similar findings for other regions of the country.

An extensive research effort from Los Angeles, CA concluded that only about 15% of manufacturing facilities that were required to obtain a Generic permit had filed an NOI (Swamikannu *et al.*, 2001). Although the research included additional facilities subject to the Generic permit that were not contacted during this research, the proportion of manufacturing facilities (which included the four industrial categories targeted for this

research) was significantly lower than for other categories of industry. A comparison of NOI filers in selected metropolitan regions (operating MS4 permits) in Florida, Texas, California, and Arizona demonstrated even poorer compliance rates for two categories targeted in this research –stone, clay, glass, and concrete producers and fabricated metal producers (Duke and Augustenborg. 2006). Facilities producing stone, clay, glass, and concrete products (SIC 32) had an NOI filing rate of nine percent in Florida, whereas metal fabricators (SIC 34) had a filing rate of only two percent (Duke and Augustenborg, 2006).

The prevalence of low compliance by industrial facilities with the Generic permit was also demonstrated in Pinellas County. However, the proportion of compliance for two industrial categories with the NOI was slightly different than the results of several metropolitan areas of Florida. Duke and Auguestenborg (2006) concluded that only nine percent of stone, clay, glass, and concrete facilities were in compliance in other Florida MS4-permitted areas, whereas results from Pinellas County suggested that roughly one-quarter of all the facilities were in compliance. Pinellas County was not included in the research by Duke and Augustenborg (2006). Facilities within SIC code 32 in Pinellas County may have been less similar to those operating in other regions of Florida. Results from fabricated metal products facilities were also slightly higher at either six percent or seven percent, compared with two percent suggested by Duke and Augestenborg (2006). Again, facilities operating in Pinellas County may have been different, implementation may have been more effective, or the research may have omitted a larger number of facilities than originally expected. Regardless of the differences between research efforts,

none of the four industrial categories demonstrated a high proportion of facilities in compliance.

V.A.1. AWARENESS OF THE GENERIC PERMIT BY CONTACTED FACILITIES

Awareness of the Generic permit was addressed by asking the participants if they were familiar with the permit. Each of the facilities contacted during the research was technically required to either file an NOI or obtain a No Exposure Certification, based on their SIC codes or industrial activities. Therefore, each of the facilities should have exhibited some awareness of the regulations, especially since the regulations have been in place for nearly 15 years. The low proportion of facilities that were aware of the permit, depicted in the following table, suggests that outreach to facilities may be inadequate or that industry has not taken the necessary steps to meet its regulatory requirements.

Table 7. Proportion of Facilities Aware of the Generic Permit

Industrial Category	Facility Surveys Completed	Facilities Familiar with Generic permit	% Familiar with Generic permit	Facilities Reporting Filing of NOI	% Filing of NOI
Lumber	17	1	6%	0	0%
Stone	21	8	38%	6	29%
Metal	75	11	15%	5	7%
Electronics	23	8	35%	3	13%
Total	**136**	**28**	**21%**	**14**	**10%**

The proportion of facilities exhibiting familiarity with the permit was higher than the proportion of facilities in compliance, although the average total for all of the facilities that completed the questionnaire was still less than 25%. According to the survey results, over half of the facilities that were aware of the permit had not followed through with their regulatory requirements of filing an NOI.

These results suggest two occurrences. First, either educational outreach regarding industrial requirements has been poor, leading to low awareness of the regulations or industrial facilities have been disinclined to proactively determine their regulatory requirements. It is likely a combination of both factors. Second, even when a facility has been made aware of their regulatory duties, less than half in the County fulfilled their requirement by filing for an NOI or a No Exposure Certification. This suggests that the penalties for non-compliance are not sufficiently strict to warrant compliance by all facilities.

A portion of the contacted facilities may not have been required to obtain a Generic permit, however, the majority likely should have filed an NOI. Twenty-three facilities of the 136 facilities (17%) that completed the questionnaire did not perform any of the industrial activities included on the questionnaire that may contribute pollutants to stormwater. Because the federal regulations mandate compliance regardless of intensity, the remaining 113 facilities likely should have applied for a Generic permit.

Overall, it is unlikely that the Generic permit will have positive impacts on improving water quality in Pinellas County because compliance has been so low. Similarly, awareness of the Generic permit by industry was also poor, indicating that attempts to inform the regulated community of its compliance duties have been inadequate. Alternatively, poor compliance and lack of awareness of the Generic permit may indicate a weakness in regulations that rely on the regulated community to self-identify its need to comply.

V. B. Effectiveness of the MS4 Permit in Improving Water Quality and Improving Compliance with the Generic Permit

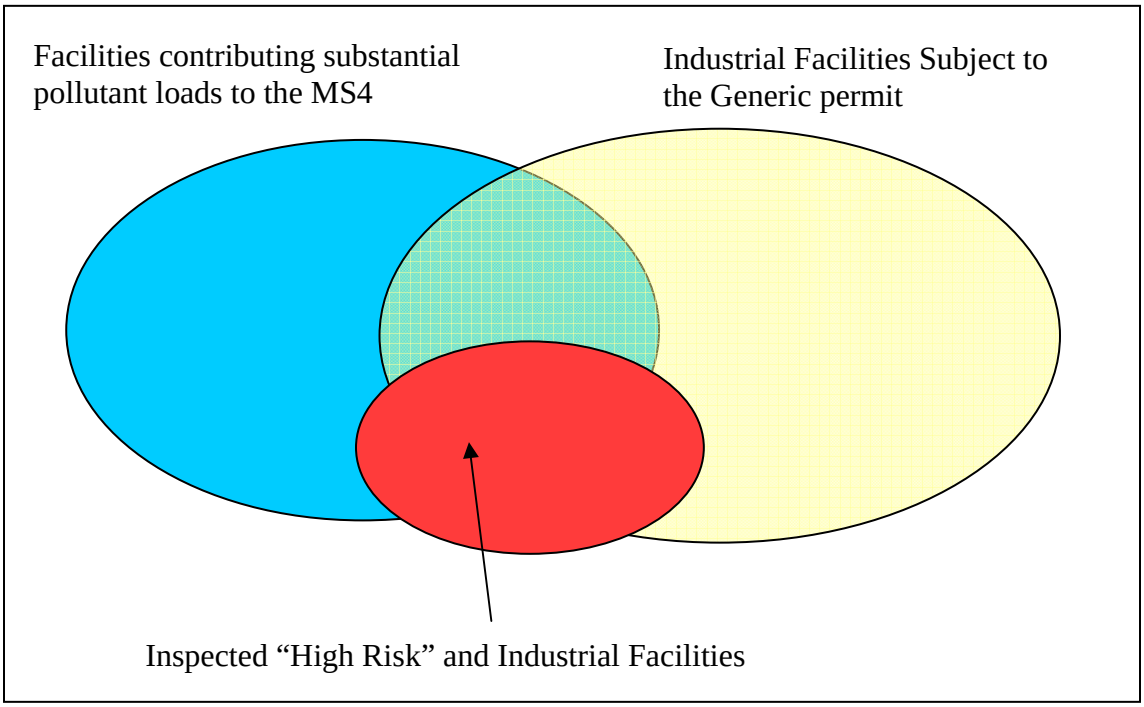
This section addresses the potential usefulness of the "high risk" inspection as a way to improve MS4 water quality and, possibly, improve compliance with the Generic permit. Industrial inspections, as required under the MS4 permit, have not improved compliance with the Generic permit, but may have improved MS4 water quality. The effectiveness of the MS4 permit has been evaluated primarily through the interpretation of the phone questionnaire results and by developing a "high risk" definition. This section will explore the broad concept of "high risk," how it has been defined by this research, and how that compares to other MS4 operator implementation strategies. Then it will review the classifications of industrial facilities based on this definition. This will be instrumental for the following section, which presents results of the phone questionnaires, related to common pollutant-generating activities at Pinellas County industrial facilities.

V.B.1. "HIGH RISK" DEFINITION

This research addressed the effectiveness of the MS4 permit requirements for protecting stormwater quality from pollutants originating at industrial sites by examining the term "high risk" and proposed an operational definition of "high risk" based on the intensity of industrial activities exposed to stormwater. This was performed to evaluate the usefulness of adding local regulations (via MS4 permits) to the "global" requirements of the Generic permit. A more quantifiable intensity definition could aid the County and other MS4 permit holders in future implementation efforts. This is followed by a presentation of facility classifications, based on this research's "high risk" definition.

The MS4 requirements essentially address both industrial and other facilities that could contribute pollutant loads to stormwater. Although the County has chosen not to inspect commercial facilities, such as large retail stores, there is the potential to include commercial sites in the inspection process. Represented graphically, the MS4 permit is structured to identify only the facilities contributing substantial pollutant loads to the MS4. If this approach were successful, it would improve water quality, but only burden the greatest potential polluters, thereby saving resources. The following diagram is intended to illustrate the concept of "high risk," and those facilities subject to the Generic permit. It should not be assumed that the diagram is to scale or represents the relative proportion of each business type within Pinellas County, or any other region subject to the Generic permit.

Figure 2. Diagram of "High Risk" Facilities



Ideally, the MS4 permit would allow the County, for example, to target only "high risk" facilities. This would likely be comprised of some industrial facilities (including those not subject to the Generic permit), but also non-industrial facilities, such as commercial sites. In practice, inspections to non-"high risk" facilities would probably also occur, especially if "high risk" were not clearly defined. A properly defined "high risk" term may allow for only "high risk" industrial facilities (those shown in green) to be inspected. Currently, within the industrial category, it would be expected that not all facilities would be "high risk." This diagram suggests that a fairly large portion of all industrial facilities would not be "high risk," however, this could not be conclusively verified. Results from this research suggested that approximately 55% of the facilities that completed the questionnaire had a low intensity (possibly none) of pollutant generating activities. Therefore, inspections of those facilities may not constitute the best use of County resources.

The definition of "high risk," based on the intensity of industrial activities exposed to stormwater, functioned as a quantitative survey score that was computed using questionnaire results following the survey completion, rather than a qualitative definition. It may be possible to construct a useful narrative definition, using the scoring protocol, in follow-up research.

The "high risk" definition was developed using the results of the phone questionnaires and was supported by the fenceline visits. A detailed coding scheme (see Appendix 10) was devised, incorporating "yes" or "no" elements, plus those addressing the intensity of activities. A point value between zero and one was assigned for each activity addressed on the questionnaire. The detailed coding scheme was designed to

account for the intensity of activities at individual facilities, including the frequency of activities, the quantity of materials, or the total area of storage or plant yards, for example. A facility that noted using five or more forklifts outdoors every day and during precipitation events would receive a higher point value for that activity than a facility that only used one forklift on a monthly basis and never operated it while it was precipitating. The scoring was intended to be sensitive to differences between individual facility operations and practices, however, it was not intended to classify certain activities as more likely to contribute pollutants to stormwater than others. A thorough evaluation of which activities generate the greatest pollutant loads and, therefore, would warrant the highest point values, would require additional inspections and, possibly, water quality sampling. The intent of the intensity scoring scale was to separate facilities that technically would require compliance with the Generic permit from those that may actually be impacting MS4 water quality and may require inspection. Therefore, it was less important to which activity a facility answered “yes” than the fact that a facility did answer “yes” to a few, several, or many activities.

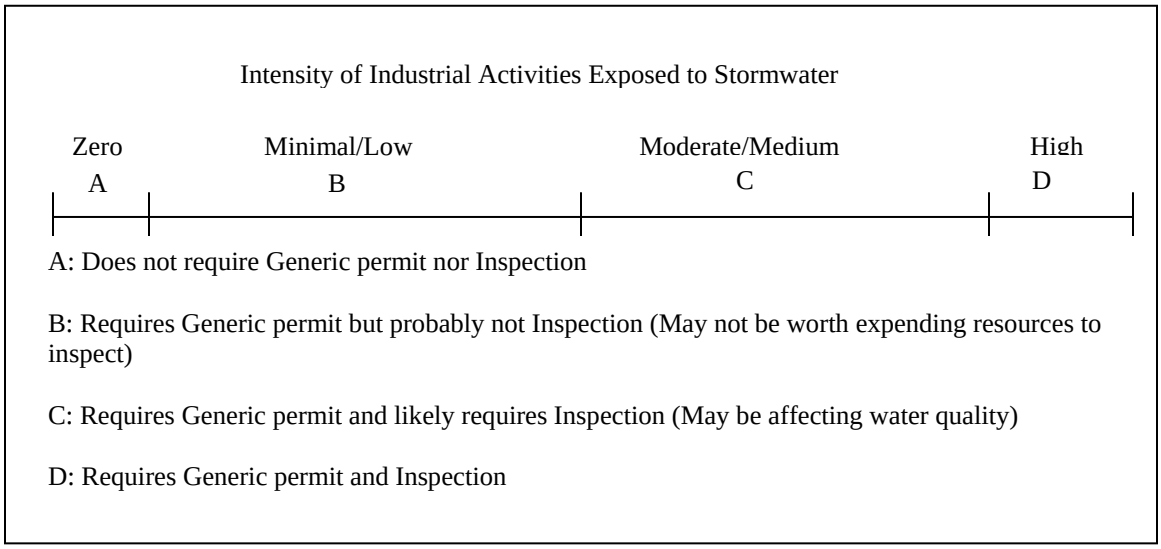
The total scores were tabulated and facilities were grouped into three intensity categories: low, medium, and high. Facilities with a low intensity of industrial activities exposed to stormwater answered “yes” to very few or no activities, whereas a high intensity facility would have answered “yes” to a large number of activities. Facilities within the medium intensity range could neither be categorized as likely not requiring an inspection but could not be definitely classified as requiring an initial inspection either.

V. B.2 EFFECTIVENESS OF THE METHODOLOGY AT CLASSIFYING INTENSITY OF INDUSTRIAL ACTIVITIES

The objective of the methodology, in addition to determining the proportion of compliance by industrial facilities, was to develop a measure practicable definition of "high risk" that may aid in the implementation of the MS4 permits. This was done by assessing the intensity of industrial activities exposed to stormwater. The true measure of industry's pollutant contributions would require water quality sampling, which was beyond the scope of this research. The phone questionnaire was designed to score industry activities by their potential to contribute pollutants to stormwater. The scoring scale was a quantitative device for determining intensity of activities that could, consequently, contribute pollutant loads to stormwater.

Industrial facilities are varied in nature – some sites may have or no impact on stormwater while others may contribute substantial pollutant loads to MS4s and stormwater. This research found that, while some facilities did not perform any outdoor activities (based on the phone questionnaire), others identified with numerous activities. A useful outcome would be a survey instrument sensitive and inquisitive enough to accurately separate those facilities that 1) should apply for the Generic permit from those that could quality for no exposure and 2) select only "high risk" facilities for inspection. If all industry were plotted on a scale from zero to high intensity, a useful conclusion would be the identification of the exact point along that scale when a facility became high intensity and, therefore, warranted inspection.

Figure 3. "High Risk" Definition Based on Intensity of Activities Exposed to Stormwater



Facilities within the zero intensity range (A) would neither require the Generic permit nor inspection by MS4 operators. Those within the minimal/low range (B) may technically require the Generic permit, but may not be contributing enough pollutants to devote resources to improving their compliance. Facilities within the moderate/medium range (C), however, may technically require the Generic permit and may be negatively affecting water quality, justifying inspection. On the far end, facilities within the high range (D), may both require the Generic permit and inspection by local MS4 operators.

The zero (A) and low (B) intensity ranges of facilities were fairly well defined. If a facility answered "no" to all questions or "yes" to very few on the phone questionnaire (See Appendix 10), it was classified as low intensity and may not be a priority for County inspections. The methodology has been useful in omitting a proportion of facilities that were low intensity. Utilizing the phone questionnaire in this way could save the County resources because it would not have to inspect the low intensity facilities.

A goal of this research was to assist in defining the point at which a facility exhibited a high intensity of industrial activities exposed to stormwater and would, therefore, require inspection (D). An MS4 permit holder could place the intensity lines anywhere along the intensity continuum, depending on the level of water quality protection desired and the available resources for implementation. For example, the City of Jacksonville may place the high intensity line very near the zero or minimal/low ranges, whereas an MS4 operator only concerned with hazardous materials, may place the line closer to the far right end of intensity.

This research, using the phone questionnaires and a quantitative scoring scale, has suggested a high intensity range that could be determined following phone outreach. Fenceline visits generally supported the phone questionnaire results, making them an important but, not necessarily a required first step for finding “high risk” facilities. However, to truly test this definition, it may require water quality samples from industrial facilities within a broad range of intensity classifications. It may be possible, following water quality analyses, to identify specific activities, types or quantities of materials, and/or frequency or intensity of activities that lead to poor stormwater quality. The scoring scale developed by this research could serve as a useful metric.

This research was the most limited at defining facilities in the moderate/medium range (C). It may be necessary to perform additional site inspections to determine whether medium intensity facilities were, in fact, high or even low intensity instead. Making the distinction between medium and “high risk” facilities may require an initial site visit. This could increase County inspections, however, it may be the only manner in which high intensity facilities could be categorized effectively.

If the goal of the “high risk” term is to improve the effectiveness of the regulations at reducing pollutants in stormwater, while also reducing the resources needed for implementation by MS4 permit holders, an appropriate threshold for high intensity activities will be necessary. This research has developed a method that can eliminate low intensity activities and that was generally successful at identifying high intensity facilities. However, a universal definition that could be adopted and/or modified by all MS4 permit holders may require additional research, including water quality sampling.

V.B.3. MS4 REGULATORY SUPPORT FOR GENERIC PERMIT

The "high risk" definition was designed to function for Pinellas County (except St. Petersburg), but could be applied to other jurisdictions with appropriate modifications. As evident by the numerous implementation strategies employed by other Florida MS4 permit holders, many interpretations of the phrase “high risk” have been developed and implemented. This is to be expected, as local conditions can also vary widely. MS4 operators have been given the responsibility of defining “high risk” for their jurisdiction, based on the level of water quality protection desired and the available resources for permit implementation. While this task could be useful for local inspectors that are familiar with industrial facilities within their permit boundaries, it may lead to irregular implementation of the regulations. For example, an industry that was labeled as “high risk” in Pinellas County may not have been classified as such in an area with a more narrow definition of “high risk.” Conversely, a facility that was not determined to be high intensity by this research, due to an absence of industrial contact with stormwater, may have been classified as “high risk” in an area such as Jacksonville, which has

adopted a more stringent approach. This definition may require adjustments when applied and tested in other counties or municipalities.

The Municipal Separate Storm Sewer System (MS4) industrial requirements were not effective at improving compliance with the Generic permit, however, there existed the potential for water quality improvements. The MS4 requirements were added after the NPDES permit program for industrial facilities, suggesting that they were partially designed to address the low compliance rate by industry with the Generic permit. The goal of improving compliance with the Generic permit has not been achieved in the County through the “high risk” inspections.

In theory, the prioritization of facilities could improve resource allocation, while also protecting water quality of the MS4s. The County’s decision to target facilities in known industrial areas or in impaired watersheds was a logical choice for meeting its regulatory requirements, such as preparing TMDLs. The industrial stormwater regulations can be burdensome to industry, especially those with little potential to contribute pollutants to stormwater. Therefore, it could be useful to only inspect “high risk” facilities. However, in practice, numerous facilities that pose a threat to water quality may have been overlooked. The following table reviews the interpretation of “high risk” by several Florida MS4 permit holders. These approaches were previously presented in the Literature Review section. This table presents a summary of the “high risk” definitions and the potential for improvements to both MS4 water quality (intended results) and support of the Generic permit (conducted results).

Table 8. "High Risk" Definitions as Intended and Conducted by Florida MS4 Permit Holders

MS4 Permit Holder	"High Risk" Definition	Intended Results for Improvement of MS4 Water Quality	Conducted Results for Support of Generic permit
Pinellas County	Location (e.g., impaired watershed) SIC Codes, Complaints On-site characteristics Hazardous Materials	Good (Prioritization using Material Usage and Impaired Watersheds), On-site characteristics important	Marginal (Less than 40 facilities visited in 1 year)
City of Largo	Industrial Pre-treatment list (Hazardous materials)	Limited (Excludes light manufacturing)	Poor (No current attempt to expand program)
City of St. Petersburg	EPCRA Title III, Section 313 Facilities (MS4 category #3)	Limited (Addresses only one required facility type)	Poor (No current attempt to expand program)
Polk County	NPDES SIC Codes, Site Characteristics	Very Good (Addresses Facilities from all 11 industrial categories), On-site characteristics important	Very Good (70 facilities inspected every year; inspected every 5 years)
City of Lakeland	NPDES SIC Codes, Site Characteristics	Very Good (Addresses Facilities from all 11 industrial categories), On-site characteristics will also be important	Potentially Very Good (In process of adopting same approach as Polk County)
City of Jacksonville	NPDES SIC Codes	Excellent (Equal treatment of all facilities), Solicited numerous facility lists	Potentially Over-reaching (Every facility with appropriate SIC code is "high risk")
City of Tallahassee	Small Quantity Generators (SQG) List, 3 listed facility types (MS4), Hazardous materials	Marginal (Numerous facilities inspected through SQG program)	Marginal (No intent to expand current program) Over 25,000 facilities in City but not considered "industrial" by City
Hillsborough County	Small Quantity Generator List, Hazardous materials	Marginal (Numerous facilities inspected through SQG program but not all affecting stormwater)	Potentially Good (Intent to narrow SQG list for stormwater inspections and expand current program to facilities outside of SQG list)
Miami-Dade County	Small Quantity Generators List, SQG Permit Program, Hazardous materials	Good (SQG Facilities inspected at least every 3 years) Prioritization of SQG	Marginal (No intent to expand current program to facilities without hazardous materials), Generic permit not mentioned during site visits

The County interpretation of the MS4 permit requirements has not improved compliance with the Generic permit as desired. The County has not identified and inspected all of the facilities that may have a high intensity of pollutant-generating activities. Based on the questionnaire responses, 61 of the 136 (45%) of the participating facilities could not be ruled out as having either zero or low intensity of industrial activities exposed to stormwater. Because those facilities that could not be eliminated based on the phone questionnaires, they may require inspection in order to adequately protect MS4 water quality and to improve compliance with the Generic permit. Following inspection, the total number of "high risk" facilities could be re-calculated.

The industrial inspectors from both Pinellas County and the City of Jacksonville referred to their function in relation to the Generic permit as "educators" (Weed, 2005b; Adeshile, 2005). For many facilities, their first experience with the stormwater regulations may have occurred during contact with the MS4 permit holder. Whether a facility was being inspected or simply given information regarding an upcoming inspection, it often had little awareness of the Generic permit requirements prior to that contact. The role of the MS4 permit holder has essentially been to provide education relevant to the Generic permit, note problem areas and suggest ways that the facility could improve its management practices. Results of the County inspections and conversations have been copied to the FDEP, however, it is not the responsibility of any MS4 permit holder to ensure compliance with the Generic permit. Therefore, once a local inspector has been assured that on-site activities are not endangering the MS4s and has completed the necessary paperwork and procedures, his/her role is complete. The local agency may choose to initiate follow-up inspections, however, if local ordinances have

not been broken, there may be little that a County inspector could do to improve compliance. It is the responsibility of the FDEP, as the permit issuer, to ensure that industrial facilities are filing for the NOI and, subsequently, implementing BMPs and P2 strategies.

Previous research has suggested that the actions by MS4 permit holders have not improved compliance with the Generic permit. Duke (2005) tabulated the proportion of facilities in compliance with the first-state requirements (filing of an NOI) among MS4-permitted regions and other regions of Florida, California, Texas, and Oklahoma. Because NOI ratios in MS4-permitted areas corresponded well with statewide NOI ratios for most of the targeted industry sectors, the findings suggested that "few or no programs specific to MS4 permit holders have had powerful influences in promoting compliance among industrial facility operators." Even the inspection program in Miami-Dade County, which has included over 8,000 individual facilities, has not encouraged facilities to comply with the Generic permit (Gambino, 2005; Abrahante, 2005).

The MS4 "high risk" language has served as a regulatory adaptation, designed to compensate for poor compliance with the Generic permit by involving local officials in deciding which facilities are the most important for stormwater protection. The "high risk" phrase is fundamentally different than the regulations developed for industrial facilities because of its reliance on interpretation prior to implementation.

It is not surprising that the MS4 permit holders have chosen to implement the requirements differently than the EPA may have chosen for them. With the exception of the City of Jacksonville that considers every facility subject to the Generic permit as "high risk," the other contacted MS4 permit holders have prioritized industry in some

way. The rigorousness of the prioritization certainly varied by jurisdiction. Some MS4 permit holders have inspected only a fraction of the industry in their boundaries, while others have made a considerable effort to identify and inspect numerous facilities. The important fact, however, is that none of the MS4 permit holders that participated in this research have been incorrect in their definitions and implementation strategies.

The benefit of vague statutory language is that local agencies have the authority to choose what is best for their regulated community, citizens, and their own agencies. A large permitted region with a high population of industry could allocate significant resources to inspecting industrial facilities if they were believed to be contributing substantial pollutants to the MS4s. Conversely, a smaller incorporated city with few industrial facilities could re-direct resources to greater priorities, assuming it has taken the steps to verify that industry was not a significant pollutant source. If water quality is acceptable to citizens and local bureaucrats, very little oversight may be required for industry. Depending on, but also regardless of local conditions, the MS4 permit holder has had substantial flexibility in how it implements its requirement to identify and inspect "high risk" industrial facilities.

V. C. Characteristics of Pinellas County Industrial Facilities

This section addresses the overall characteristics of County industrial facilities that participated in this research. It begins with a discussion of general facility characteristics, such as size and industrial processes, and then reviews the most common pollutant generating activities identified. It is followed by a comparison of common pollutant generating activities being performed at high and medium intensity facilities

and explores the differences in these categories. The section then discusses the common pollutant generating activities by industrial category.

V.C.1. INDUSTRIAL FACILITY PHYSICAL CHARACTERISTICS

Industrial facilities that participated in this researched ranged from small one-person operations to large facilities employing 200 persons or more. Facilities were divided into three categories for both facility size and employment. Facilities smaller than one acre were considered “small,” those between one and three acres were considered “medium,” and facilities larger than three acres were considered “large.” Regarding facility employment, sites employing 19 persons or less were considered “small,” those employing between 20 and 49 were considered “medium,” and those employing 50 persons or more were considered “large.”

The majority of facilities (66%) were smaller than one acre with medium and large facilities making up roughly half each of the remaining 34%. Approximately 55% of the participating facilities were low intensity, with 21% and 24%, respectively in medium and high intensity facilities.

Table 9. Facility Size by Intensity Classification

	Facility Size			
Intensity Classification	Small	Medium	Large	**Total**
Low	64	8	4	**76**
Medium	20	4	3	**27**
High	6	10	17	**33**
Total	**90**	**22**	**24**	**136**

Overall, smaller facilities were more likely to have a low intensity of pollutant generating activities, with 70% of the total being classified as low intensity. Of the medium-sized facilities, 36% were low intensity and 45% were high intensity. More than

70% of the larger facilities were high intensity. These results suggest that higher intensity facilities may be more likely to operate larger sites, whereas low intensity facilities may operate smaller sites.

Table 10. Proportion of Facilities within Facility Size Ranges

	Facility Size		
Intensity Classification	Small	Medium	Large
Low	71%	36%	17%
Medium	22%	18%	13%
High	7%	45%	71%

Similar trends were seen for employment size. Nearly 70% of the facilities that participated in the research employed 19 or less people and, among those, 66% were low intensity facilities. There were slightly more large employment facilities (19%) than medium employment facilities (13%), however, six of the 14 large facilities employed more than 200 employees.

Table 11. Facility Employment by Intensity Classification

	Employment Size			
Intensity Classification	Small	Medium	Large	**Total**
Low	62	8	6	**76**
Medium	17	5	5	**27**
High	15	4	14	**33**
Total	**94**	**17**	**25**	**136**

Facilities with fewer employees were most likely to be low intensity (66%). More than half of the facilities employing a larger number of persons (56%) were classified as high intensity.

Table 12. Proportion of Facilities within Employment Ranges

	Employment Size		
Intensity Classification	Small	Medium	Large
Low	66%	47%	24%
Medium	18%	29%	20%
High	16%	24%	56%

V.C.2. COMMON POLLUTANT-GENERATING ACTIVITIES

Industrial facilities that participated in this research commonly performed or associated with similar pollutant-generating activities. Overall, the most commonly reported activities were the storage of small amounts of bulk material (usually a dumpster) with 105 responses, the storage of other materials (usually wooden pallets) with 81 responses, the use of forklifts or forktrucks exposed to precipitation or stormwater runoff (48 responses), operating an uncovered shipping and receiving area (56 responses), and operating small process equipment (such as compressor, coolant tanks, or generators) that is exposed to precipitation (37 responses). The raw values are shown in the following tables. The fields in parentheses represent activities that may not contribute pollutant loads to stormwater, e.g., operating an air compressor outside, but which were needed for follow-up questions, e.g., whether the equipment was exposed to precipitation or storwmater runoff. The most commonly-occurring activities within the three intensity classifications are shown in Figure 6.

Figure 4. Industrial Activities Reported by All Facilities

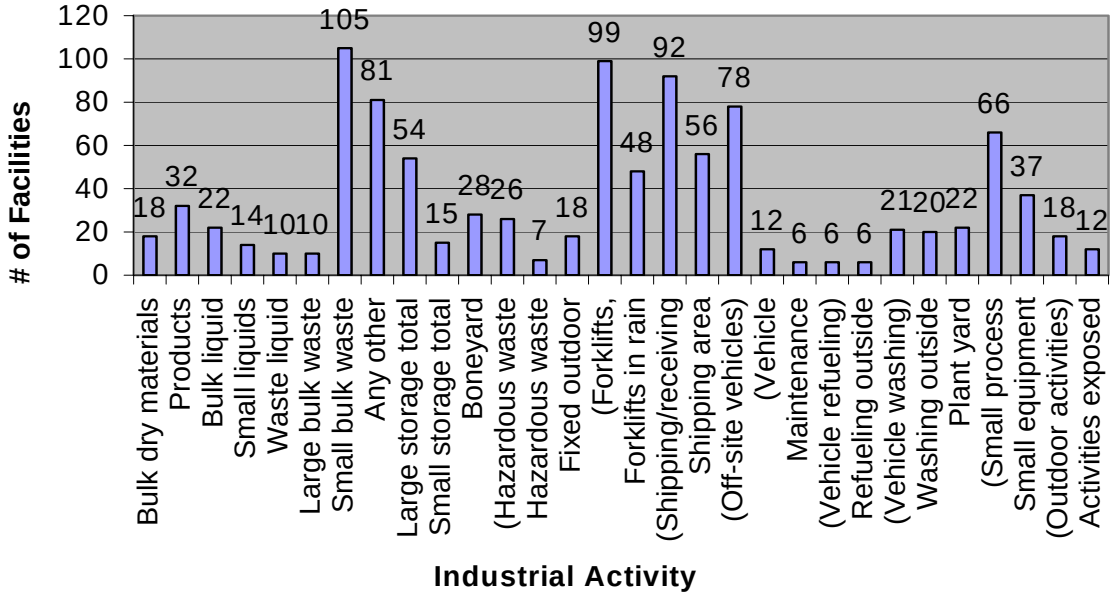


Figure 5. Industrial Activities Reported by Intensity Classification

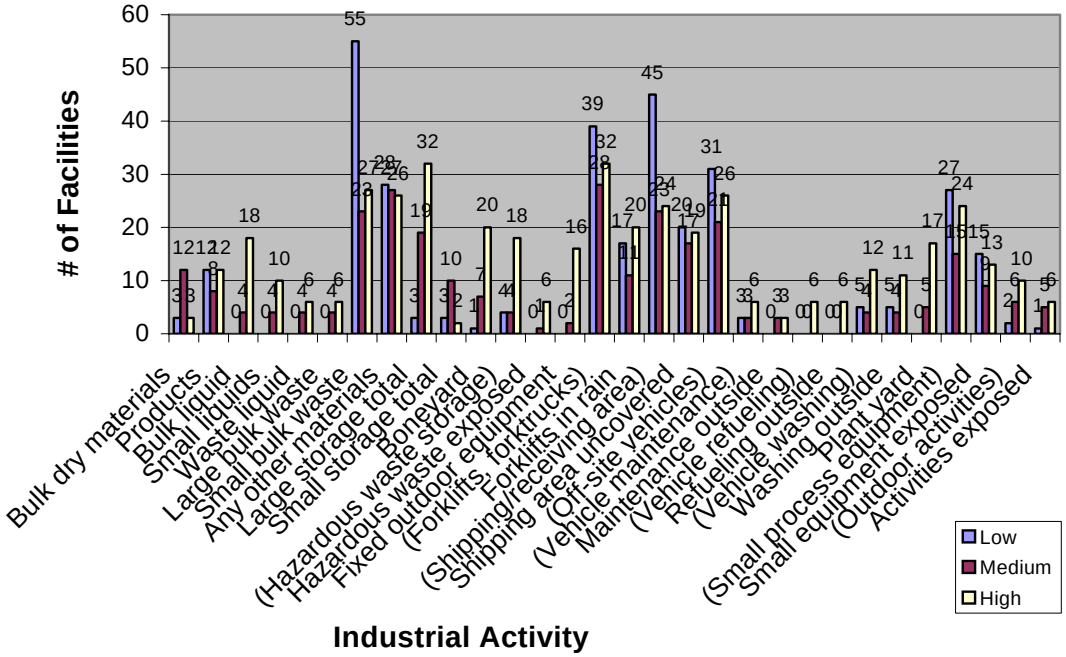
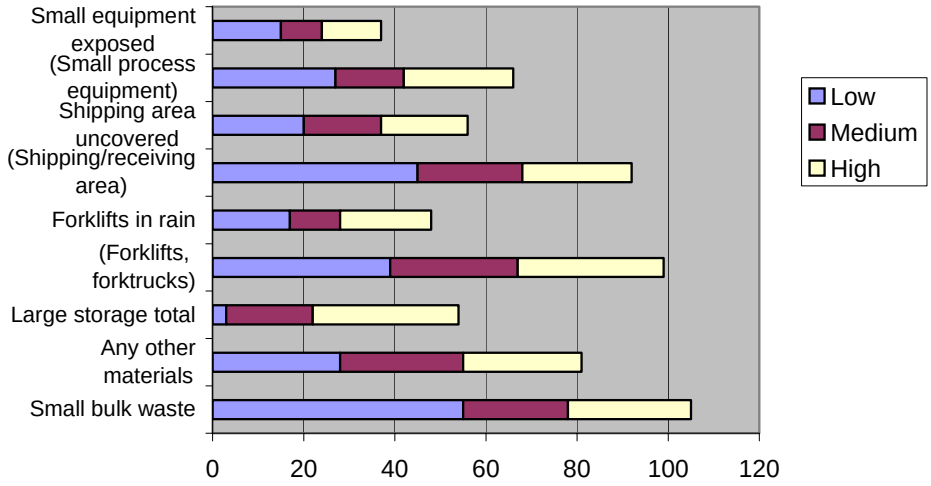


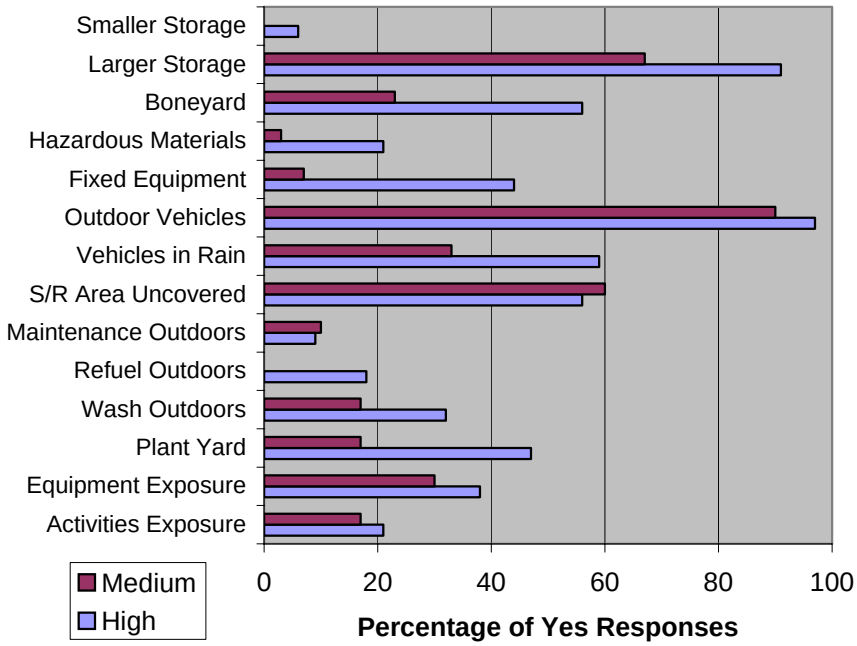
Figure 6. Common Industrial Activities at all Facilities by Intensity Classification



V.D. Common Pollutant-Generating Activities – Comparison Between High and Medium Intensity Facilities

The following section demonstrates that low intensity facilities do perform certain activities that may generate pollutants, such as storing materials outdoors. In total, 12 (of 76) facilities stored completed products and 28 stored miscellaneous materials outdoors, 17 operated forklifts during precipitation events, and 15 operated small process equipment that was exposed to precipitation and/or stormwater runoff. However, based on the intensity scoring scale, a facility could perform only a limited number of activities before it was classified as either medium or high intensity. The remaining discussion of common pollutant-generating activities focuses on the high and medium intensity facilities, especially noting their similarities and differences. Results for the high intensity facilities proceed those for medium intensity facilities. For example (15%, 20%) signifies 15% of high intensity and 20% of medium intensity. The values are shown below.

Figure 7. Common Industrial Activities by Percentage at High and Medium Intensity Facilities



There were noticeable similarities between high and medium intensity facilities when viewing aggregate results of common pollutant generating activities. For the most part, the activities that the contacted facilities engaged in were similar, however, the percentage of facilities answering "yes" to activities was slightly higher for the high intensity facilities. In addition, the high intensity facilities generated a larger number of "yes" responses, thus leading to a higher overall score. The most common activities reported by both high and medium intensity facilities were the storage of materials, products, or waste materials outdoors; outdoor vehicle usage, such as forklifts and forktrucks; and the operation of uncovered or exposed shipping and receiving areas.

Nearly all high and medium intensity facilities reported some degree of outdoor storage. Ninety-one percent of high intensity and 67% of medium intensity facilities

noted storage areas larger than 100 square feet or five drums of liquid. Of the remaining facilities, only one facility from each category did not store anything outdoors except for a single well kept dumpster. In total, 97% (33 of the 34 high intensity and 29 of the 30 medium intensity facilities) stored some industrial materials outdoors. Ninety-seven percent of high intensity and 90% of medium intensity facilities operated various vehicles outside. Of these, 59% of the high intensity and 33% of the medium intensity facilities continued using them during precipitation events. Uncovered shipping and receiving areas were noted by 56% of high intensity facilities and 60% of medium intensity facilities.

The least commonly reported activities included having exposed hazardous waste areas (21% and three percent, respectively), maintaining off-site vehicles at the facility (nine percent and ten percent, respectively), refueling off-site vehicles at the facility (18% and zero percent, respectively), and performing industrial activities outdoors with possible exposure to precipitation or stormwater runoff (21% and 17%, respectively).

The most notable differences between high and medium intensity facilities were related to boneyards (56% and 23%, respectively), hazardous waste materials exposure (21% and three percent, respectively), and fixed outdoor equipment (44% and seven percent, respectively). High intensity facilities also had a higher percentage of plant yards (47% and 30%, respectively), which may be due to the slightly larger facility sizes. Smaller storage areas were more frequent for medium intensity facilities, however, this is likely due to the lower overall percentage of facilities utilizing larger storage areas.

High and medium intensity facilities, therefore, may be more similar to one another than originally hypothesized. Although high intensity facilities may associate

with a larger number of potentially pollutant generating activities, there were very few areas in which high intensity facilities dominated. Medium intensity facilities, while answering “yes” to a smaller number of questions, may operate relatively similar facilities. These facilities, therefore, should not be discounted as not having the potential to contribute pollutants to stormwater.

V.E. Common Pollutant Generating Activities by Industrial Category

Pollutant generating activities varied both between industrial categories and, within their high and medium ranked facilities in each category. However, in general, the types of activities reported that may be contributing pollutants to stormwater were not highly correlated with the individual industrial activities. Therefore, the SIC code may be less useful for categorizing facilities as technically required to comply with the Generic permit than activities that are performed to support overall operations.

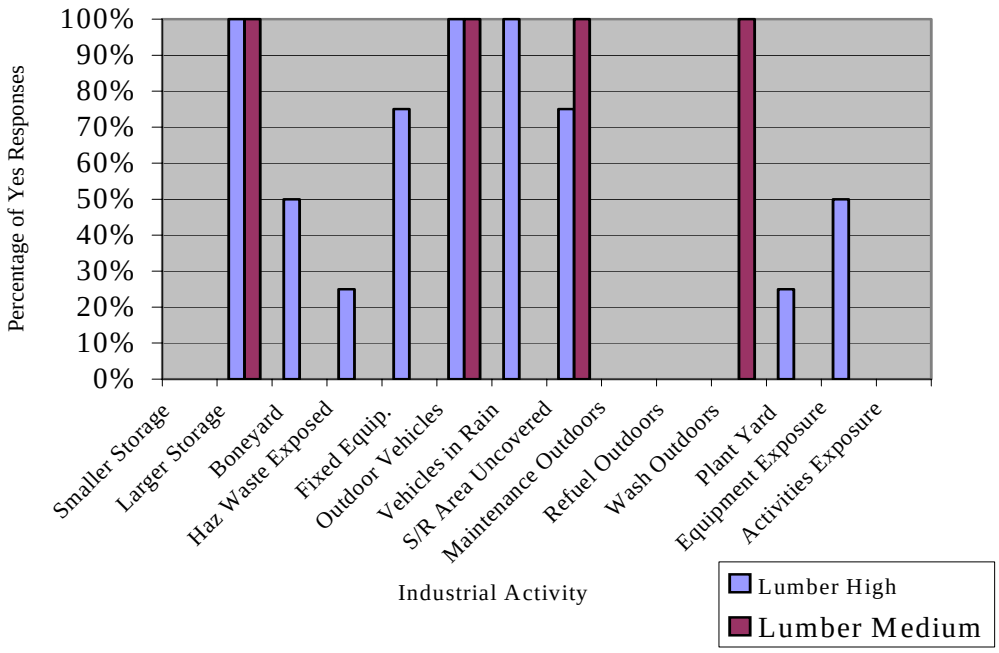
V.E.1. ACTIVITIES AT LUMBER AND WOOD PRODUCTS (SIC 24) FACILITIES

Lumber and wood products facilities were most likely to have larger storage areas (all participating facilities), operate outdoor vehicles (all participating facilities), and utilize uncovered shipping and receiving areas (75% and 100%, respectively) (See Figure 19). However, only the four high intensity facilities reported operating the vehicles outdoors while it was precipitating. Half of the contacted high intensity facilities reported having a boneyard, half noted exposure of outdoor process equipment to precipitation or stormwater runoff, and 75% had fixed outdoor equipment. Only one lumber facility was classified as medium intensity – this participants answered “no” to each of the previous questions but noted that off-site vehicles were washed outside, to which no high intensity facilities reported affirmatively. It is difficult, however, to draw conclusion on this

category of industry, especially for the medium intensity group, due to the small sample size. Nevertheless, it appears that the lumber industry participated in similar potentially pollutant generating activities as other industrial categories surveyed.

Lumber and wood products facilities may be likely to store materials outdoors, operate vehicles outdoors, possibly, in the rain, and operate uncovered shipping and receiving areas. Fixed outdoor equipment and boneyards may also be present.

Figure 8. Common Industrial Activities at Lumber Facilities



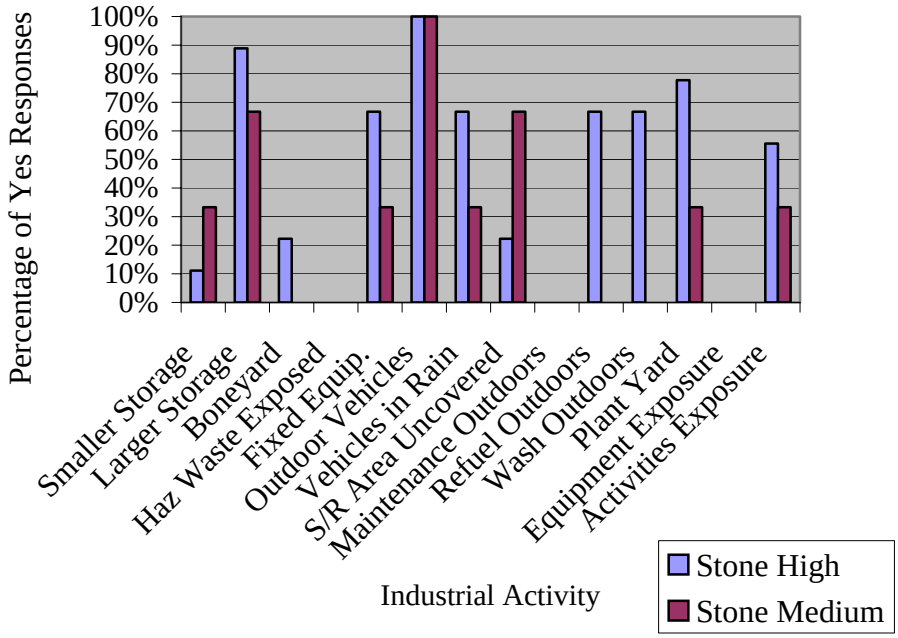
V.E.2. ACTIVITIES AT STONE, CLAY, GLASS, AND CONCRETE PRODUCTS (SIC 32) FACILITIES

Facilities producing stone, clay, glass, and concrete products exhibited slightly higher rates of certain pollutant generating activities than the other three contacted facility types in several categories. Outdoor storage was prevalent at the nine high

intensity facilities (89%) as well as the three medium intensity facilities (67%). The remaining single facility in each category reported smaller quantities of storage. Outdoor vehicles were used at each facility, although two-thirds of the high intensity facilities operated them during precipitation events whereas only one-third of medium intensity facilities did. Plant yards were more common at high intensity (78%) than medium intensity (33%) facilities. Two-thirds of medium intensity facilities operated uncovered shipping and receiving areas compared to only 22% of high intensity facilities. However, this may be due to facility size and makeup. The high intensity facilities were operated on greater acreage and were more likely to have a large plant yard. Due to the nature of concrete manufacturing in the County, buildings operating formal loading/unloading areas may be less common. These facilities, however, may load and unload products and materials within the yard itself. Maintenance of outdoor vehicles was not reported at any facility, although two-thirds of the high intensity facilities both washed and refueled vehicles outdoors at the facility. Exposure of hazardous waste did not occur at any of the facilities and only two facilities combined had a boneyard.

Stone, clay, glass, and concrete facilities, therefore, may be most likely to storage materials outdoors, operate outdoor vehicles and fixed outdoor equipment, and have a plant yard. Off-site vehicle upkeep may also occur at the facility. These facilities may be less likely to use hazardous materials, operate formal loading areas, and store materials and equipment in a boneyard.

Figure 9. Common Industrial Activities at Stone Facilities



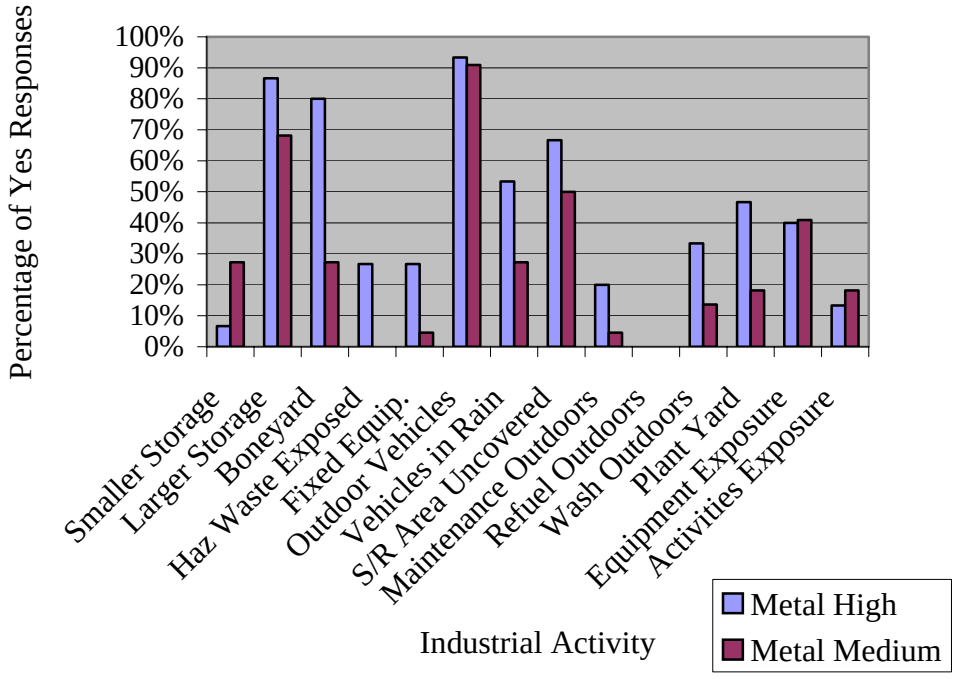
V.E.3. ACTIVITIES AT FABRICATED METAL PRODUCTS (SIC 34) FACILITIES

Facilities that fabricated metal products generally stored materials outside, with only one high and one medium intensity facility reporting no outdoor storage besides a well-kept dumpster. Eighty-seven percent of the 15 high intensity facilities utilized larger storage areas, whereas 68% of the 22 medium intensity facilities did (see Figure 21). Outdoor vehicle usage was also common (93% and 91%, respectively), however, only 27% of medium intensity facilities operated those in the rain, compared to over half (53%) of the high intensity facilities. Uncovered shipping and receiving areas were used at two-thirds of the high and half of the medium intensity facilities. While some maintenance of vehicles occurred during precipitation events, the most common

occurrence was washing, at 33% of the high intensity facilities. Exposure of miscellaneous process equipment was roughly 40% for both categories. The most striking difference between both the different intensity categories and the four different industrial categories was the presence of a boneyard, which was reported at 80% of the high intensity facilities.

The metal fabrication facilities may be likely to store materials outdoors, operate vehicles outdoors, and utilize uncovered shipping and receiving areas. With the exception of boneyards at "high risk" facilities, the occurrence of potentially polluting activities varied greatly among these facilities.

Figure 9. Common Industrial Activities at Metal Facilities

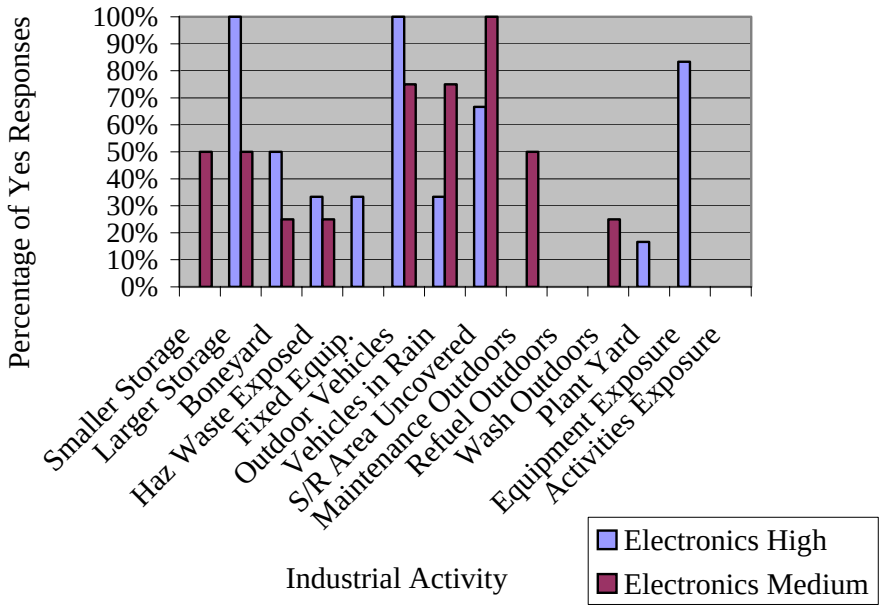


V.E.4. ACTIVITIES AT ELECTRONICS AND OTHER EQUIPMENT (SIC 36) FACILITIES

Electronics producing facilities were likely to store materials outdoors with all six high intensity facilities using a larger storage area. The four medium intensity facilities were split evenly between smaller and larger storage areas. Outdoor vehicle usage was slightly higher at high intensity facilities (100% and 75%, respectively), although each of the medium intensity facilities reported using vehicles such as forklifts during precipitation events, whereas only one-third of high intensity facilities did (see Figure 22). Uncovered shipping and receiving areas were also more common at medium intensity facilities (67% and 100%, respectively). High intensity facilities, however, reported greater exposure of outdoor process equipment (83% and 0%, respectively) and fixed outdoor equipment usage at 33%. Twice the percentage of high intensity facilities had boneyards onsite, yet at least one-quarter of each high and medium intensity reported some exposure of hazardous materials to precipitation (33% and 25%, respectively).

Electronics facilities may exhibit a similar likelihood of storing materials outdoors, utilizing vehicles outdoors, and operating uncovered shipping and receiving areas as the other three categories. However, facilities within this industrial category may be more likely to have exposed hazardous waste storage areas and outdoor process equipment than the other three industry types contacted.

Figure 10. Common Industrial Activities at Electronics Facilities



V.F. Completion Rates of Phone Questionnaires

The following section discusses the completion rates for each of the four industrial categories, including each category's familiarity with the industrial stormwater regulations, especially the Generic permit requirements.

The results have been shown according to the intensity classification, along with the mean scores. While it was useful to examine whether an industry category exhibited a greater percentage of low, medium, or high intensity facilities, the raw questionnaire scores were also useful, as the intensity ranks were based on a scale and not absolute values. Therefore, a facility receiving a score of 3 ½ would be labeled as "high intensity" but may have been less likely to contribute pollutants to stormwater than a facility with a total score of 6. In regards to the complete data set, the mean score was 1.72 with a standard deviation of 1.67. With the exception of stone, clay, glass, and concrete

facilities; each of the industrial categories had a mean score that would be at the low end of the "medium intensity" range.

V.F.1. COMPLETION RATE FOR LUMBER AND WOOD PRODUCTS (SIC 24) FACILITIES

Lumber and wood products facilities returned the second lowest total number of "high intensity" with only four facilities. However, this percentage (24%) is roughly equal to that of the metal industry at 20%. However, 76% of facilities listing SIC 24 as a primary or secondary industrial activity were classified as "low." The mean score of the phone questionnaire was 1.6, meaning that although the majority of facilities would be classified as "low" intensity, the behavior of some higher intensity facilities increased the overall average. The standard deviation was 1.74.

Table 13. Intensity Classifications for Lumber Products (SIC 24) Facilities

Completed Questionnaires	Low	Med	High	Total
Total # Completed	13	0	4	**17**
% of Total Completed	76%	0%	24%	100%

The results for wood kitchen cabinet manufacturers (SIC 2434 "light industry") were all "low intensity" classifications. The average score was 0.78 with a standard deviation of 0.58. These results, however, were only based on four facilities.

For all but one of the low intensity facilities, the total facility size was one acre or less and only one facility noted that it employed 20 or more employees. The facility size and employee number was slightly higher for high intensity facilities. Each of the four high rated facilities was larger than one-half acre and had five or more employees. It is difficult to make strong conclusions; however, it appears that larger facilities may have a

higher intensity of industrial activities exposed to stormwater, based on the research questionnaire. Of the 17 facilities, only one was familiar with the Generic permit and none had filed an NOI. Thirteen of the 17 facilities requested additional information.

V.F.1.a. Familiarity with Regulations

Only one facility participant out of 17 reported some familiarity with the Generic permit. This was a low intensity millwork facility operating on less than one-half acre of land and with four or less employees. None of the high intensity facilities were familiar with the permit. Eight of the 12 low intensity facilities requested additional information, as did all three high intensity facilities.

V.F.2. COMPLETION RATE FOR STONE, CLAY, GLASS, AND CONCRETE PRODUCTS (SIC 32) FACILITIES

Stone, clay, glass, and concrete products manufacturers exhibited the highest intensity of industrial activities exposed to storwmater. Thirty-eight percent of the facilities were classified as “high intensity,” which was the largest percentage of the four industrial types. Overall, 57% of the facilities were “low intensity,” with the remaining five percent, or one facility, classified as “medium intensity.” The mean score from the phone questionnaires was 2.5 with a standard deviation of 2.5. While these results are only based on 21 responses, the mean score was at least 0.7 points higher, or almost three-quarters of a point, than that of the other three industrial categories.

Of the eight highly rated facilities, only one reported a facility size of one acre or less. Four facilities were between one and three acres and two facilities were larger than 10 acres. The employee number for each was either between five and 19 or between 20 and 49. The medium intensity facility was between one and three acres, with an

employment number between five and 19. The low intensity facilities, on the other hand, were all one acre or less and employed no more than 19 employees.

Table 14. Intensity Classifications for Stone, Clay, Glass, and Concrete Products (SIC 32) Facilities

Completed Questionnaires	Low	Med	High	Total
Total # Completed	12	1	8	**21**
% of Total Completed	57%	5%	38%	100%

Each facility classified as producing "ready mix concrete" was scored as high intensity, while each of the facilities producing nonmetallic mineral products was scored as low intensity. The one facility identifying with SIC Code 3231 (glass products of purchased glass) was also scored as low intensity. This code has been included in the "light industry" category.

V.F.2.a Familiarity with Regulations

Familiarity with the Generic permit was reasonably high for the medium and high intensity facilities but poor for the low intensity facilities. None of the low ranked facilities were familiar with the permit, however, the medium ranked facility, along with eight of the nine high intensity facilities were familiar with the Generic permit. Of those facilities reporting familiarity, only one high intensity facility had not applied for an NOI. FDEP listing verified each of the six NOI filers (FDEP 2005b). Over half (six of 11) low intensity facilities declined additional information. Each of the eight facilities noting compliance with first stage requirements declined information, as they believed they were well informed already.

V.F.3. COMPLETION RATE FOR FABRICATED METAL PRODUCTS (SIC 34) FACILITIES

Facilities performing some type of metal fabrication were the most widely surveyed facilities and, therefore, provided a larger data set with which to draw conclusions. Of the 75 facilities contacted, 51% were scored as low intensity, 29% as medium, and 20% as high intensity based on industrial activities exposed to stormwater. The mean score was 1.83 with a standard deviation of 1.82. This score, for an individual facility, would be a "medium intensity" ranking but would be on the lower end of the medium range. Of the low intensity facilities, only six facilities received a score of "zero," meaning that no potential for stormwater pollutants was noted using the phone questionnaire. This does not mean, however, that stormwater pollutants could not or were not being generated at those facilities.

Table 15. Intensity Classifications for Fabricated Metal Products (SIC 34) Facilities

Completed Questionnaires	Low	Med	High	Total
Total # Completed	38	22	15	**75**
% of Total Completed	51%	29%	20%	100%

Facilities that manufactured fabricated structural metal (SIC 3441) are listed separately in the "heavy industry" category. Ten facilities identifying with SIC 3441 were contacted in Pinellas County and demonstrated a higher intensity of industrial activities exposed to stormwater. The mean score was 3.06 with a standard deviation of 1.81. Although this is a small sample size, it may be possible that this category is performing heavier industrial activities that in turn may have a higher intensity of industrial activities exposed to stormwater.

At the low intensity facilities, only eight of the 38 contacted facilities had a facility size larger than one acre and only six employed 20 or more employees. There were no obvious trends in facility size or employee number for the medium intensity facilities – they ranged from less than one-half acre to larger than 10 acres, and from four or less employees to between 200 and 499 employees. Finally, while there was some variability in the high intensity facilities, 12 of the 15 facilities were larger than one acre and all but one facility employed five persons or more.

V.F.3.a. Familiarity with Regulations

Two small facilities had some familiarity with the Generic permit, however, the remaining 26 did not. Of the medium intensity facilities, only four were familiar with the Generic permit and two of those reported filing an NOI. Five of the 15 high intensity facilities were familiar with the Generic permit and three reported filing an NOI. However, only three of those reported filers could be verified by the FDEP on its August 2005 permit list (FDEP, 2005b). Nearly 70% of the medium (16 of 22) and low (25 of 38) facilities requested additional information, although only half (7 of 15) of the high intensity facilities requested information about the industrial stormwater regulations. Two of the NOI filers identified with SIC Code 3441. One additional fabricated structural metal facility was familiar with the regulations.

V.F.4. COMPLETION RATE FOR ELECTRONIC AND OTHER ELECTRICAL EQUIPMENT (SIC 36) FACILITIES

Facilities producing electronic and other electrical equipment were most likely to be scored as low intensity, as demonstrated at 11 of the 20 contacted facilities. Fifteen percent (3 of 20) were classified as medium and 30% (6 of 20) facilities were classified

as high intensity based on survey results. The mean score was 2.0 with a standard deviation of 1.75. This demonstrates that, while the average score is at the low end of the medium range, there is a good deal of variability in the scores, as was evident with the results from other industrial categories as well.

Table 16. Intensity Classifications for Electronics and Other Electric Equipment Facilities (SIC 36)

Completed Questionnaires	Low	Med	High	Total
Total # Completed	12	5	6	**23**
% of Total Completed	52%	22%	26%	100%

There was a significant range in facility size and employee number for low intensity facilities with some being less than one-half acre and others operating on between three and ten acres. The employment totals varied from less than four employees to between 50 and 199. Each of the three medium risk facilities was less than one acre and employed more than five persons. Finally, while one high intensity facility was less than one acre, the remaining five were at least three acres. The minimum number of employees was 50, with three facilities employing at least 200 persons.

V.F.4.a. Familiarity with Regulations

Three of the low intensity facilities were familiar with the Generic permit and, although only one reported filing an NOI, all three requested additional information. Of the remaining eight facilities unfamiliar with the Generic permit, four requested information. None of the medium intensity facilities were familiar with the permit and two of the three requested information. Finally, only one of the six high intensity facilities was familiar with the Generic permit. Three of the surveyed facilities reported

filing an NOI and all but one facility declined additional regulatory information. Two of the NOI filers were verified by FDEP sources (FDEP, 2005b).

V.G. Comparison of Phone Questionnaires to Fenceline Visits

Fenceline visits were performed at 51 facilities, primarily those in the target zip codes, throughout Pinellas County. The facilities were selected arbitrarily based on areas that were the most industrialized – similar to the County's approach. The research targeted between 10-20% of the facilities listed on the master database but 15-20% of the facilities contacted. The earliest visits were focused in the Cross Bayou watershed and the final visits were performed in the northeastern county. Facilities were selected arbitrarily and there was no known or attempted bias for selection. Each facility that was contacted over the phone had an equal chance of being visited via the fenceline. The following table does not include facilities identifying with other SIC codes.

Table 17. Fenceline Visits Completed vs. Database Listings

Industrial Category	# Facilities Visited	# Facilities Called	# Facilities on Database	% Visited Called	% Visited Database
Lumber	7	36	35	19%	20%
Stone	8	42	42	17%	17%
Metal	25	124	165	20%	15%
Electronics	7	48	68	15%	10%
Totals	**48**	**250**	**310**	**20%**	**16%**

The fenceline form (see Appendix 8) was used to identify only practices and activities that were visible from the fenceline and that may contribute pollutants to stormwater. A comparable scoring guide was used to determine a range of risk intensities. As discussed in the Methodology chapter, the fenceline scoring scale was not

intended to stand on its own and, therefore, was not considered a major finding of this research. It was useful, however, for comparing phone questionnaire and fenceline vistis.

Although the fenceline form does not read word-for-word like the phone questionnaire, the basic components regarding material and waste material storage, shipping/receiving, facility description, and equipment location were retained. The attempt was not to mirror the phone questionnaire, but to examine the type of activities and materials that may contribute pollutants to stormwater during a brief visit. Activities such as vehicle usage and maintenance practices could not be examined from the fenceline unless multiple visits were made over a lengthy period. For this reason, facilities that were visited were given a secondary phone questionnaire score. This raw score did not include activities related to vehicle maintenance or outdoor vehicles so that the results from the phone questionnaire would not be artificially higher than those from the fenceline visit.

Results from the phone questionnaire and fenceline visit had the potential to vary depending on the day on which a facility was visited. It was possible that materials were stored outside for only a few days each year and, if visited on one of those days, may result in a different score, however, it was more likely that the facility aspects viewed from the fenceline on any given day would be similar to what would occur on a regular basis and which may, therefore, be reported by industry professionals.

In addition to obtaining a numerical score and intensity rating, the fenceline forms were used in conjunction with the phone questionnaires to disprove or not disprove the answers given by the industrial participants. For example, a facility may have mentioned a shipping/receiving area but answered that the area was not uncovered or exposed to

precipitation. If the researchers visited this facility and identified an uncovered area, these comments were noted on the fenceline form.

Overall, there was good agreement between the phone questionnaires and the fenceline visits. While 51 facilities were visited, only 43 were used for comparisons. Some fenceline results could not be used because the facility had refused to participate in the phone survey, the facility could not be found, or the facility identified with a different SIC code. Of the 43 facilities visited, 6 facilities were classified as medium, rather than low following the visit. Two were elevated from low to high intensity.

Table 18. Agreement between Phone Questionnaires and Fenceline Visits

		Fenceline Results		
		Low	Medium	High
Phone	Low	**16**	8	2
Results	Medium	0	**8**	0
	High	0	0	**9**

The most common disagreements between the phone questionnaires and the fenceline visits were due to exposed outdoor process equipment, such as air conditioners; uncovered shipping areas; and small quantities of scrap or waste material material stored outside. At most facilities, a minor statement was found to be incorrect, such as a shipping area being uncovered when it was noted that it was covered, or a few miscellaneous items that were on the property. Major contradictions were noted at only two facilities, one identifying with SIC 24 and the other in SIC 34.

Table 19. Fenceline Classifications by Industrial Category

Industrial Category	Low	Med	High	Retail	Not Found	Total
Lumber	4	1	2	0	0	7
Stone	1	2	4	0	1	8
Metal	6	11	8	0	0	25
Electronics	4	3	0	0	1	8
Misc. SIC Codes	2	1	0	0	0	3
Total**	15	17	14	1	2	51

** Includes facilities that refused to participate in phone questionnaire.

V.G.1. POSSIBLE WEAKNESSES IN FENCELINE VISITS

Many of the facilities were located in industrial parks that housed numerous and varied industries or other businesses. It appeared that, in some cases, there were shared storage or waste areas that were utilized by the various tenants. While this could not be confirmed, it was suspected that materials and equipment unrelated to the visited facility, but located in a commons area, could be the property of neighboring businesses. It was often difficult to ascertain what materials or equipment were associated with each facility. Additionally, for safety and privacy reasons, portions of some facilities were not accessible. Because the researchers were not invited onto the facility property, observations were made only from public roadways. Therefore, inspection of the back and/or sides of the facility was not always possible. Consequently, some facilities may have been under-rated.

V.H. Comparison of Phone Questionnaire with Pinellas County Inspections

Results from the phone questionnaires were compared to the County's on-site inspection results. The researcher accompanied the County inspector on ten inspections. It was not possible to attend each relevant inspection, however, in these cases, the County

graciously shared its detailed on-site inspection database. The County selected the facilities for inspection, based on its "high risk" definition and location within impaired watersheds. Many of these same facilities were included in this research, because of the emphasis on contacting facilities within the County's "target" zip codes. It was not coincidental, therefore, that the County inspections and research efforts were complimentary.

Although attendance during County inspections was a useful step, direct comparisons could not be made between the phone questionnaires and on-site visits for several reasons. First, the form and content of questions differed slightly. While the County inspections covered areas such as equipment exposure to stormwater, storage of materials and waste products, operation of shipping/receiving areas, and outdoor industrial activity exposure to stormwater; County inspectors classified questions as "true" or "false" and used narrative descriptions, rather than quantitative values. It was difficult to determine the quantity of some items or materials completely enough to compare the database records to the phone questionnaire results. Secondly, certain aspects related to pollution prevention and best management practices were addressed during County inspections that were not included in the phone questionnaire. For example, it was easier to view features, such as oil stains on the pavement or the failure to label a drum of liquids, with full access to the property. The County inspector had greater access to the facility and could view the entire property inside and out. Observations such as "oil sheen in stormwater" or "floor drain leads directly to MS4" were not addressed during the phone questionnaire, as they were not components of the Generic permit. While many observations could be made from the fenceline, this level of

detail was not possible for non-governmental personnel. County inspections were necessarily more thorough, however, they may not be the most appropriate first step for an agency.

In general, however, there was not a substantial number of activities that were visible during on-site visits, but that could not be viewed from the fenceline. For the purposes of confirming the phone questionnaire responses and the intensity classifications, it appeared that fenceline visits were adequate, even if the entire property and details could not be examined.

This research has focused on compliance with first-stage filing of an NOI. Factors such as outside storage of materials, conducting industrial activities outdoors, and operating a shipping and receiving area with contact to precipitation may have disqualified a facility from the no exposure certification. It was assumed that facility features such as stormwater detention ponds or other stormwater BMPs would be incorporated following permit application. The County inspector was also able to identify various stormwater practices and determine direct connections with the MS4. Because this research focused solely on the filing of an NOI, some of these on-site factors, while useful to MS4 operators for protecting MS4 water quality, were not addressed. These factors were related to second-stage compliance and beyond the scope of this research.

The research analyzed the phone and County on-site inspections by comparing the responses from the phone questionnaire to the County observations, using both first-hand experience and detailed observation forms. When possible, the researcher completed the fenceline form while attending on-site inspections in order to replicate the previous efforts. This was then compared to the researcher's actual fenceline visit and the phone

questionnaire results. When it was not possible to attend an inspection, the County's inspection results were used instead.

In each case, materials, equipment, and waste products that were listed on the County database were also revealed during the phone questionnaires. Although some fenceline visits viewed activities that were not mentioned during the phone surveys, this was not noted for any of the County inspected facilities.

Accompaniment during County inspections supported many of the research findings. First, it did not appear that facilities were untruthful regarding their responses during the phone questionnaires. Similar activities and materials were discovered during the on-site inspections as during the phone calls. Therefore, phone calls may be a useful first step that could be followed by thorough on-site inspections, when necessary.

Second, the prioritization of facilities using an intensity scale may benefit the County throughout the implementation process. The proposed scoring scheme was developed based on the responses of Pinellas County industrial facilities. Therefore, it could be used to compare facilities that have not yet been contacted or inspected to determine the relative proportion of "high risk" facilities within the County. The current intensity scale could also be adapted for County inspection purposes to both protect MS4 water quality and encourage compliance with the Generic permit. For example, on-site stormwater treatment may be an important factor for protecting MS4 water quality, whereas the storage of miscellaneous scrap materials on-site may not. Additional activities could be added to the questionnaire and then scored appropriately.

Third, attending on-site inspections with the County demonstrated that inspections may continue to be a useful component of implementation. A more thorough analysis of

industrial activities and their potential to contribute pollutants to stormwater may occur during thoughtful on-site inspections than during the phone calls or fenceline visits. Although phone calls and fenceline visits were useful, additional inspections may be necessary, especially for facilities that may be contributing pollutants to stormwater but may be obviously low or high intensity. Therefore, thorough inspections may be necessary for some facilities, especially those that cannot be easily classified from phone conversations or from the fenceline. However, since over half of the participating facilities were judged to be low intensity, the majority of inspections could be reserved for facilities with the highest intensity of industrial activities exposed to stormwater, rather than treating all of the facilities equally.

V.H.1. COMPARISON OF RESEARCH METHODOLOGY AND LOCAL IMPLEMENTATION OF MS4 PERMIT REQUIREMENTS

A common theme that occurred during conversations with various MS4 permit holders was the need to personally inspect facilities in order to determine "high risk," whether facilities were potentially contributing pollutants, and whether facilities may be required to apply for a Generic permit. Numerous inspectors, as discussed in the Literature Review section, noted that their departments had not formally adopted a definition of "high risk." Some MS4 operators "got a feel" for a facility when on-site and could gauge "high risk" behavior by viewing the housekeeping practices, best management practices, or facility employee attitude. These factors, along with detailed inspection notes such as oil sheen, could not be elucidated from phone conservations or fenceline visits. However, they may influence government personnel during their inspections.

While County personnel have entered facility information into a standardized database, on-site inspections have not followed a standardized procedure. There are both benefits and negatives to this approach. The phone questionnaires and fenceline visits presented the same questions for each facility, regardless of extraneous factors. This method was designed to be replicable and could likely be applied by other researchers or agencies with similar success.

Conversely, local implementation practices may be less structured. This research's approach to stormwater questions likely missed some factors that could be addressed during an on-site visit. For example, an inspector, upon viewing certain materials or equipment, may learn about additional industrial processes by asking follow-up questions. While it was believed that research participants were honest, it was unlikely that every possible activity with the potential to contribute pollutants to stormwater was mentioned. Participants were allowed to elaborate on issues, however, some things were likely overlooked during this process. In addition, because facilities were voluntarily participating, it was not prudent to extensively lengthen the questionnaire. Some additional follow-up questions, however, may strengthen the questionnaire during future research efforts.

The on-site inspections, which were more fluid and holistic, may have been able to identify smaller potential violations that may be missed during the phone questionnaire. However, with the lack of a structured inspection form, it is possible that other areas were not covered that were addressed over the phone. Trained local inspectors may have different "high risk" priorities during inspections than this research or the federal regulations. For example, the storage of various materials outside, while

potentially requiring coverage under the Generic permit, may not have violated local ordinances or be important for the protection of MS4 water quality. An inspector does not have to ask about various activities, such as equipment usage or maintenance of vehicles if they are not priorities. Conversely, the presence of hazardous materials alone may elevate a facility's risk status, depending on local "high risk" definitions. Although the storage of hazardous materials was addressed during the phone questionnaire and fenceline visits, it was viewed in addition to many other potentially polluting activities.

The MS4 operators have been encouraged to develop a "high risk" identification and inspection protocol. Their priorities may have been significantly different than the activities listed in the federal regulations or included in the phone questionnaire. Therefore, they may have intentionally or unintentionally ignored certain activities that would technically require a facility to comply with the Generic permit, if they were not deemed to be of great importance to protecting MS4 water quality. For these reasons, the implementation of the MS4 permit, using a local agency-determined "high risk" inspection process, may not improve compliance with the Generic permit.

V.I. Completion Rate of Phone Questionnaires

A total of 250 calls were made to facilities throughout Pinellas County. Of those, 136 or roughly 54% resulted in completed surveys. A completed survey signified that the research participant answered every question applicable that facility on each of the questionnaires. The reasons for incomplete surveys included: facility not industrial (warehouse, retail store, or sales office only), wrong information (number disconnected, incorrect phone number, facility closed, or residence), passive refusal (failure to make contact with an individual based on the protocol explained in the Methodology section),

active refusal, wrong SIC code, or wrong zip code (outside of the permit boundar). A facility could be labeled as the wrong SIC code if the primary business activity was different than listed and did not fall into the four SIC codes targeted by this research or was listed as a non-target SIC code but was contacted because of prior County inspections. In all cases, the entire surveys were completed for facilities that were willing to participate, regardless of SIC code or physical location, however, those results were not included in the final totals nor used for statistical purposes.

Table 20. Reasons for Incomplete Surveys

Industry Sector	Not Industrial	Wrong Information	Passive Refusal	Active Refusal	Wrong SIC Code	Wrong Zip Code	**Total**
Lumber	2	6	3	4	2	1	**18**
Stone	6	4	2	6	2	1	**21**
Metal	5	15	18	5	5	1	**49**
Electronics	8	6	0	5	3	3	**25**
Total	**21**	**31**	**23**	**20**	**12**	**6**	**113**
% of Incomplete Surveys	**19%**	**27%**	**20%**	**18%**	**11%**	**5%**	**100%**
% of Total Attempted Calls	**9%**	**13%**	**9%**	**8%**	**5%**	**2%**	**46%**

Overall, the highest percentage of incomplete surveys was due to wrong information, making up 28% of the total incomplete surveys and 13% of the attempted calls. In these cases, no actual communication was made with the desired industrial facility, due to an incorrect phone number or a business having closed. Less than 20% of the incomplete surveys were due either to passive or active refusals, however, the combination of these resulted in a loss of 17% of the total attempted calls or 43 individual facilities. Nine percent of the total contacted facilities (18% of the incomplete) could verify that no industrial or manufacturing activities occurred at the facility and, instead, operated as a retail store, a warehouse, or a sales office. If it could not be initially

determined whether a facility could be classified as “not industrial,” the entire survey was administered. A designation of “not industrial” was assigned only after researchers reviewed the completed surveys. Twelve surveys, or 5% of the total calls, were incomplete because the facility identified with an industrial classification outside of the research target codes. Finally, six facilities, or 2% of the total contacted facilities, were physically located outside of the research area, either in St. Petersburg or another county, and, therefore, were not included in the final results.

Although the research desired a higher completion rate, these results were higher than similar studies performed in California. The use of phone questionnaires, rather than those administered through the mail, likely increased the success rate. The majority of the incomplete surveys (roughly 80%) were due to factors outside of the research control. As discussed earlier, numerous directory sources were used to identify a workable phone number for a facility. Facilities either operating as a retail store, not identifying with the target SIC codes, or located outside the target study area could not be included. Active refusals were identified as beyond the researcher’s control because. Each facility was reminded of the brevity of the questionnaire and the confidentiality of results, offered an additional explanatory letter, and allowed to ask questions of the researcher. In some cases, the potential participant still refused. The only area in which completed surveys could have been obtained was for passive refusals. However, throughout the four-month data collection period, multiple phone calls were made to facilities on various days and times, allowing for increased success rate. Passive refusals most often occurred for facilities only operating an answering machine service. It was unlikely that a facility would return a phone call if no personal contact had been made. As discussed in the

Methodology section, a protocol was developed for discontinuing phone calls. The researchers were confident that sufficient effort was made to contact each facility. Overall, the total number of refusals, both passive and active, was considerably lower than originally expected, especially because there was no incentive for industry personnel to participate, except to gain knowledge about the regulations and aid in research efforts.

V.I.1. COMPLETION RATES BY INDUSTRIAL CATEGORY

The overall completion rates for the individual SIC codes were roughly comparable to the aggregate results. The completion rate was 47% for lumber facilities, 50% for stone facilities, 48% for electronics facilities, and 60% for metal facilities. It was not known why the completion rate was slightly higher for the metal manufacturers than the other three categories of industry. Active refusals were most common for stone, clay, glass, and concrete manufacturers and electronics manufacturers as a percentage of the total attempted calls. Passive refusals were most common for metal products manufacturers.

V.J. Usefulness of Phone Surveys as Initial Step

Conducting phone questionnaires for a subset of industrial facilities may be a useful initial step for MS4 permit holders interested in protecting the water quality of their MS4s and more efficiently using resources. Although fenceline visits ranked some facilities higher than the phone scores, the majority of the visits confirmed what was learned over the phone. Thorough on-site inspections may yield more accurate intensity or risk classifications, however, they are also more time-consuming. Due to the general agreement between phone questionnaire results and both fenceline visits and County inspection forms, it is suggested that phone outreach be used as a preliminary step prior

to inspections. This method, however, should be tested in other jurisdictions, especially those that are more industrial, to determine if the validity of responses and the success rates are comparable.

V.K. Accuracy of Database

An intermediate objective of this research was to design a methodology to identify industrial facilities in a given area. This required soliciting various data sources – both publicly available and private sources. The facility lists were categorized as public sources, which included information from various government agencies, and a private list generated by a for-profit (private) company. This was done to recommend which list sources may be the most accurate for compiling a list of industrial facilities in other MS4 operators' jurisdictions.

Overall, the InfoUSA® (private) database was more accurate than those from public sources, such as EPA or FDEP. Of the 250 phone calls made, only 55 or 22% of the facility names and contact information were received using non-InfoUSA® sources. This included facilities that were listed on a public sources, plus the InfoUSA® list, or just on a public list. The majority of the facilities, 195 or 78%, were available only through the InfoUSA® list. It should be noted that, these results only reflected facilities identifying with one of the four target SIC codes. Facility information may have been more complete on various public sources for other industrial categories.

The accuracy of the sources was determined by calculating the number of errors. A total of 172 errors were reported during the phone questionnaires. An error was noted each time a piece of information was corrected by a research participant, however, numerous errors could occur for an individual facility. Each error was recorded as an

individual event, rather than by the total number of facilities for which errors were noted. The errors and the original datasources have been listed as follows:

Table 21. Database Errors by Type: Number of Facilities from Each Source with These Errors

Error Type	InfoUSA® only	Public Sources	Total
Wrong Information	24	8	**32**
Wrong Company Name	15	10	**25**
Wrong Address	23	11	**34**
Wrong Phone Number	20	16	**36**
Wrong Industrial Activity	36	10	**46**
Total	**118**	**55**	**173**

Wrong information referred to a facility that could not be reached, was closed, or was a residence. Wrong company name signified that at least a portion of the name was incorrect. This may have been as simple as adding the word “Incorporated” to the name, or could have signified a complete name change. A wrong address would incorporate minor changes to the address, such as adding a directional suffix, or complete changes in location. In most cases, this designation was not applied to facilities that used a different mailing address than the physical address, unless the mailing address was no longer valid. The designation “wrong phone number” was given if a facility could not be reached using the phone number supplied from previous lists, but could be found using various on-line directory sources. This also included facilities for which no phone number was provided on the original database, but could be found using other sources. For each facility, a minimum of three on-line sources was used to verify or modify phone numbers. This designation, however, was different than the “wrong information” designation, for which a workable phone number could be found. Finally, wrong industrial activity referred to

facilities that did not agree with the database-listed industrial activity. In some cases, a facility performed a similar activity within the same two-digit SIC code, but used a different four-digit SIC code. In other cases, the industrial activity noted by the research participant was classified using a different two-digit SIC code, possibly outside of the target SICs.

Due to the general lack of familiarity with the industrial SIC code, this total was not calculated. The majority of contacted facilities could not verify a SIC code or volunteer the appropriate code. This occurred for several reasons. Many participants, especially smaller facilities, were unfamiliar with the SIC coding system, signifying that this piece of information, which has used extensively in the NPDES industrial stormwater regulations, may not be widely used by industry. Second, some participants were able to confirm or deny an activity and were familiar with the term "SIC Code" but did not know their facility's primary or secondary codes. Finally, some facilities have begun using the North American Industrial Classification System (NAICS). This coding system has formally replaced the SIC coding system, however, many industrial facilities and current regulations have continued using the outdated SIC system. Using a six-digit, rather than four-digit code, the NAICS codes allow for more specificity for industry, especially those dealing with specialized or less common industrial practices. This research has used the SIC codes in order to remain consistent with the industrial stormwater regulations and the information available from many public sources. If a participant supplied a NAICS code, it was converted to the appropriate SIC code using the U.S. Census Bureau NAICS website (NAICS 2005).

Of the 172 errors, 117 were from InfoUSA® sources and 55 from public sources. While it was originally believed that the various public sources would be more accurate, these results have indicated that the InfoUSA® list was, in fact, more accurate given the total number of entries from InfoUSA® entries. While the individual totals for each category were higher for InfoUSA® facilities, this was corrected by examining the proportion of errors relative to the total facility entries.

The largest number of errors were reported as "wrong industrial activity," with 36 errors from InfoUSA® and 10 from public sources. For both database categories, 18% of the facilities (36 of 195 and 10 of 55, respectively) disagreed with their primary industrial activity. This indicates that errors in facility classification may be apparent regardless of the list, especially if the facility personnel was not familiar with the correct SIC code.

Table 22. Strength of Various Data Sources: Percentage of Facilities from Each Source with These Errors

Error Type	InfoUSA® only (of 199 entries)	Public Sources (of 55 entries)
Wrong Information	12%	15%
Wrong Company Name	8%	18%
Wrong Address	12%	20%
Wrong Phone Number	10%	29%
Wrong Industrial Activity	18%	18%

The most common error was incorrect phone numbers listed on public sources. Overall, a larger percentage of errors were cited using public sources. This may have been due to more frequent updating of the private industry source. Several of the public sources, especially those supplied by the EPA, were based on NOI filers, including on the TSDF list, and other sources. These facilities may have been added to the list years

earlier, but may have been retained on the list, even if operations or locations were modified. A company producing industry lists as a profit-making venture, however, may be more inclined to update facility list information, in order to provide a marketable product. Information from the InfoUSA® database suggested that companies were contacted at least once per year to verify contact information (InfoUSA® 2005). Again, while originally hypothesized to be less useful or less accurate than public sources, the InfoUSA® database provided useful and more up-to-date information that benefited the research effort.

CHAPTER VI – DISCUSSION

This section reviews additional information learned during the research process. Some of these pieces were generated from the research results, while others relate to information gathered during the phone survey process and during on-site inspections. This section, while not quantitatively based, is useful for improving the overall understanding of industrial stormwater regulations and how they are being implemented in Pinellas County, Florida.

VI. A. Industry Awareness of Industrial Stormwater Regulations

The most striking finding from this research was the general lack of awareness about industrial stormwater regulations. Although these regulations have been in place for over a decade, it appeared that many facilities, especially smaller ones, have not been adequately informed about their regulatory requirements or have not proactively educated themselves. Because the NPDES stormwater regulations have relied on self-identification by industry, numerous facilities have been able to continue their day-to-day activities unhindered by regulatory burdens, simply by choosing not to comply. The obvious lack of penalties for non-compliance has done little to encourage voluntary action or expedite compliance.

Education may be the most useful tool that MS4 operators could employ to increase compliance with the Generic permit, improve industrial management practices, and, ultimately, decrease pollutant loads to stormwater. The majority of industrial

participants were interested in learning more about the regulations, which may imply that non-compliance is due more to a lack of awareness than a conscious resistance on the part of industry. Several participants that had been inspected by County officials prior to being contacted over the phone noted that they were engaged in the regulatory process and had begun actively making positive changes, such as identifying appropriate BMPs. To ensure that compliance is occurring, however, follow-up phone calls or inspections may be beneficial. The City of Jacksonville, for example, has encouraged its industry professionals to comply with the regulations by acting as a concerned educator, rather than a strict enforcer (COJ, 2005). The City of Jacksonville stormwater department has focused on building relationships and finding ways to facilitate compliance before fines are issued by the FDEP or EPA. This role has served both to educate industry and encourage compliance, while also potentially improving the water quality of its MS4s.

Pinellas County has produced informational flyers using information from FDEP outreach materials. These are provided to facilities during on-site inspections. These types of materials could also be disseminated to local industrial facilities prior to inspections and/or phone calls. Depending on an MS4 operator's anticipated inspection schedule, it may be useful to provide educational materials to facilities that will not be immediately inspected, in order to increase the likelihood that industry will proactively comply with the Generic permit. While not all facilities will proactively comply with the regulations, it may be useful for MS4 operators to establish a more active presence and inform industry of the negative repercussions associated with non-compliance. Each MS4 operator has the potential to develop beneficial relationships with the industry it regulates, however, this may require increased publicity and outreach in a positive

manner. Additionally, outreach materials to the general community may reach industry professionals or concerned citizens, increasing general awareness of industrial stormwater and its potential effects on receiving waterbodies.

VI. B. Industry Reaction to Research Participation

Throughout the data collection period, facilities were given the opportunity to express their interest or comment on the regulations and/or the research. While most facilities were interested only in completing the questionnaire and/or receiving additional information, some participants used the opportunity to express their dissatisfaction or reluctance to participate.

First-stage compliance has required a $500 permit fee, however, subsequent stages require facilities to develop a SWPP, modify practices, train employees, or take water quality samples. Several participants looked upon these aspects of the process less favorably. These participants noted that they were at a competitive disadvantage because, while they were spending resources to comply with the regulations, their neighbors may be contributing pollutants without a permit. A common response was that everyone should be required to comply and incur the costs, not just those that proactively complied. Other facilities complained about the difficulty in obtaining correct water quality samples (a component in subsequent stages of compliance) especially if qualifying rain events occurred outside of business hours. Conversely, some participants believed that pollution was the price one pays for business and that regulations such as these were burdensome to industry and, were generally, not necessary. This negative response, however, was not common, and the majority of participants did not comment negatively on the regulations.

VI.C. Truthfulness of Industry Questionnaire Responses

The comparisons of phone questionnaire responses to fenceline visits and County inspections generally illustrated good agreement. Although there were minor omissions noted after visiting some facilities (such as failing to mention an exposed air conditioning unit or having an uncovered shipping/receiving area), very few facilities exhibited major violations and inconsistencies. The researchers also felt that industry participants were truthful in their responses. Overwhelmingly, the most difficult aspect of the phone survey was determining the correct contact person and finding a time in which he/she was available for participation. However, once an industry professional agreed to participate in the research, the researchers felt that the questions were answered honestly and to the best of the participant's ability.

Prompting by the researchers tended to increase the participant's responses. For example, a participant may have answered that no outdoor process equipment was located outside but would answer "yes" if a specific example, such as a compressor or coolant tank, were provided. Therefore, a failure to recognize certain materials or equipment as important for the research purposes may have been the fault of the survey questionnaire, rather than a conscious effort on the part of participants to withhold information. For many participants, the phone questionnaire may have been the first time in which similar questions were posed and, lacking knowledge about industrial stormwater, may not have realized the importance of some facility activities, even if asked. In general, the researchers did not feel that participants were intentionally withholding information or misleading researchers. If participants were concerned about their responses, they may have been less likely to participate in the research, even with

the promise of confidentiality. The fact that some facilities were scored as high intensity illustrated that participants were honest and forthright, even if it did not improve their image.

Similarly, it could not be assumed that facilities that did not participate, either due to active or passive refusals, were necessarily higher intensity. Several fenceline visits were conducted at facilities that refused to participate. While one facility was labeled as high intensity by the research team following a fenceline visit, several others were not. Therefore, while some facilities may have declined to participate because they were conscious of possible violations, time constraints or general business policies prohibiting participation in research studies may have been more influential.

VI. D. Limitations and Possible Modifications to Research Approach

Each component of the research was time-consuming and, therefore, would require resources by MS4 permit holders. The effort to compile information, however, may be less for government officials that have access to more extensive data sources and information.

Phone calls were the most time-consuming step of the research, however, the completion time varied greatly for each facility. Although the entire questionnaire was usually completed in less than ten minutes, it was often difficult to secure a convenient time to speak with the industry participant. The phone protocol was developed to avoid making numerous calls to a facility with no response. As discussed, it was unfortunate that each facility could not be successfully reached, however, it was not realistic to repeatedly contact a facility that was not willing to participate. MS4 permit holders, on the other hand, may have greater success contacting industry professionals. While the

promise of confidentiality likely increased the response rate, facilities were not obligated to participate. Environmental professionals may be able to solicit a faster response if facilities feel they need to participate in order to avoid enforcement or fines.

Numerous fenceline visits could generally be completed within a normal working day. A motivated inspector could visually inspect 30 or more facilities from the fenceline, depending on their proximity to one another. However, preparatory research and facility locations would also be necessary to ensure efficient and effective fenceline visits.

VI.D.1. DATABASE COMPILATION

Although the researchers attempted to solicit numerous data sources to compile the industrial facility master database, some data sources may have been overlooked or not available at the time. Governmental officials may have greater access to certain industrial lists, whether they originate at a tax collectors office or in an environmental department. During this period, officials involved in NPDES regulations and/or stormwater were contacted and asked to share any useful facility lists. It was possible, however, that industry information changed throughout the study period or that some departments with usable industry lists were not contacted. This limitation applied to the larger municipalities, as smaller incorporated areas were not contacted. Because a primary focus of this research was to generate useful information for the County, facilities located in the incorporated areas would, therefore, be less of lesser importance. Many of these facilities in smaller incorporated areas were likely included on the InfoUSA® database, however, the final list most likely excluded some facilities that may be subject to the Generic permit and/or that may require inspection by MS4 operators.

VI. D. 2. PHONE QUESTIONNAIRES

Overall, the phone questionnaires were both informative and easy-to-use by researchers. Industry participants reacted favorably to the length and format of the questions and could generally answer questions without further explanation. However, some questions may be strengthened by including additional examples. For example, the questions related to storage of materials could include other raw materials, such as plastics or fiberglass. The researchers were given flexibility to suggest materials based on the participants' past responses, however, it may be beneficial to include examples cited from this research in future versions of the questionnaire. Follow-up questions related to materials and processes may also be necessary. The specific type of materials and their potential for water quality violations should be investigated. For example, if a facility notes that wooden pallets are stored outside, it would be useful to know if the pallets were made from treated (which may contain formaldehyde) or untreated wood. Drums of waste liquid materials can vary greatly, containing something innocuous like collected rainwater, or highly hazardous substances. The conditions of drums also could not be determined from the phone questionnaires, unless the participants were asked to describe the structure of the drums, any labeling procedures, and other relevant components. This may be beyond the capability of the phone questionnaire and may be more appropriate for fenceline or on-site visits. Some attempt could be made, however, to learn more about the specific materials used on-site either as process materials or waste products.

The order of some questions could be manipulated to provide a better flow for the questionnaire. For example, it may be more useful to ask a participant how many loading docks are on-site before asking if any or all are uncovered or exposed to precipitation.

For the County's purposes (or other MS4 permit holders), questions related to stormwater management and BMPs could also be added. Another useful component may be the proximity to local waterbodies or the elevation, which could be especially relevant during extreme weather events. While the phone questionnaire has been useful for this research, additional questions or modifications to the questions may increase the utility for agency personnel.

VI. D.3. FENCELINE VISITS

The fenceline visit forms could be strengthened by more closely mirroring the phone questionnaires. Although it has been noted that the fenceline visits identified visible materials and practices, comparisons between the two methods may be simplified by adjusting the individual questions, wordings, and placement. The fenceline form did not specifically address hazardous waste and its possible exposure to stormwater. This was not included because it may be difficult or impossible for researchers to distinguish hazardous materials from non-hazardous, especially if drums are unlabeled, for example. In some cases, however, facilities may have clearly labeled materials. This could be addressed in a specific question on the fenceline form. Inspectors may also find other areas in which the fenceline form could be expanded or strengthened, depending on their inspection format and information needs. Items related to drainage of sites into MS4s or other site-related questions could also be beneficial to local inspectors.

VI. D. 4. COMPARISON TO PINELLAS COUNTY, FLORIDA APPROACH

This research could have been strengthened, overall, by increased presence at industrial inspections. The opportunity to accompany the County inspector on several days of inspections was immensely valuable, however, it lacked the thoroughness needed

to make stronger and more conclusive results. This was neither the fault of the researcher nor the County. However, in the absence of a larger sample size, it was not possible, to make recommendations for the four individual industrial categories individually.

The County approach was noticeably different than the research methodology in many ways, even though the on-site inspections were useful for validating the phone questionnaire and fenceline visits. First, this research has proposed a systematic and replicable process for identifying facilities, gathering information, scoring pollutant generating potential, and ground-truthing the results. The questions used in the phone questionnaire were developed from language in the federal NPDES regulations. Therefore, need to comply was dominated by association with activities and processes listed in the federal regulations. Naturally, however, some activities may have the potential to generate a greater load and/or severity of pollutants than others. For example, the storage of some raw materials, such as untreated lumber, may not be as important as the storage of waste liquid materials. These subtleties are not addressed in the federal regulations as industrial facilities are expected to proactively identify whether or not they require the permit based on their industrial activities exposed to stormwater. Facilities technically required to comply but with a low intensity of activities may require less extensive or less expensive BMPs, for example.

Conversely, the County inspections have been individually tailored to each facility visited. It may be obvious to the inspector that certain questions do not need to be addressed, however, this level of knowledge was not possible using a phone outreach strategy. For example, a small facility that shows no signs of vehicle maintenance activities and describes using outside shipping companies may not be asked questions

related to off-site vehicle usage and maintenance activities. On the other hand, viewing the industrial activities as they have occurred may have generated additional questions related to process equipment or materials. As indicated on the County inspection forms, there has been flexibility in how they have been completed. Rather than requiring an answer for each question, that can then be scored, the inspector actively looks for violations of the local stormwater ordinances, which may include oil on the ground, uncovered drums, particulates in the stormwater flow, or direct drainage to the MS4. While all of these activities are important to record and evaluate, it may not be possible to objectively compare them to one another.

Second, the County is limited by its local enforcement authorities and the language of its MS4 permit. The objective of the County (as well as other MS4 permit holders) is to protect the water quality of its MS4, not to require compliance with the Generic permit by each facility technically required to comply. The County has been given the authority to enforce its local Pinellas County stormwater ordinance by noting any possible violations (Chapter 58 Article VI). However, even if violations (e.g., leaking drums) are viewed, unless the inspector can prove that the material is being incorporated into the MS4s in some way, his/her only recourse may be to recommend that another department or the State inspect the property. Therefore, the objectives and final results from the County's industrial inspection program may differ from inspections by the State or EPA that may specifically address compliance with the Generic permit by using the federal language to determine need to comply. The MS4 permit language, while intended to improve compliance with the Generic permit, has suffered because it has delegated MS4 operators to inspect facilities. As demonstrated, the "high risk" definition can differ

significantly from the federal language. It is necessary to understand the possible conflict of interest between the Generic and MS4 permits.

The County, just as other contacted MS4 permit holders, has classified “high risk” differently than this research. As noted by several municipalities, house keeping and management practices are particularly important. The appropriate management of materials is not addressed in the NPDES regulations until a SWPP is being generated and implemented, although poor management practices may certainly affect pollutant generating potential. The handling of hazardous materials and documented compliance with other regulations may also be important to MS4 operators. Other factors such as existing BMPs, elevation, physical building structure, and location were listed as important factors to the County, but do not appear in federal guidelines.

Finally, the County has been empowered to inspect facilities not subject to the Generic permit. Because the MS4 permit specifies that inspections can be performed at any “industrial or commercial discharger that the permit holders determine is contributing a substantial pollutant loading to the MS4,” (FLS00005, 2004), this could extend to other industrial-type facilities, such as automotive repair shops or commercial sites. During 2004, roughly one-third of the County’s inspections were for facilities not listed in the Generic permit requirements. This may indicate that the current federal permit structure has excluded some industrial and commercial sites that may be affecting water quality.

VI. D. 4. a. Recommendations for Improving Local Inspections

The following recommendations are applicable to various MS4 operators throughout the State of Florida. Because this research was conducted in Pinellas County, the recommendations have been tailored to the research study area. The inclusion of the

County, however, does not indicate a weakness in its implementation, but rather, an attempt to apply the research findings.

Overall, the Pinellas County Department of Environmental Management has been proactively inspecting industrial facilities within its boundaries and has increased the awareness of the applicable federal regulations at contacted facilities. By assisting with compliance, the County has been able to suggest site and process improvements to facilities, which may benefit the water quality of the MS4s and help the facilities to comply. Nevertheless, the County's inspection process could be strengthened. The following recommendations may benefit both Pinellas County and other Florida MS4 operators.

First, increased outreach to industrial facilities may lead to some improvements of industrial site and process management. While inspections have previously been unannounced, in order to view normal day-to-day operations, it may be beneficial to increase educational efforts, even if possible violations are amended before inspection. Currently, facilities receive additional information only after they have been inspected. While it is unrealistic to suggest that outreach alone could improve compliance and/or water quality, it may increase familiarity with the regulations. There was not a dramatic change in operations for facilities that were contacted over the phone and then visited during fenceline or on-site inspections. Additionally, only a few of the previously inspected facilities noted that they were actively investigating their regulatory requirements at the time of the phone outreach. However, the threat of an inspection and/or fines by the MS4 operator and/or FDEP may influence a small number of facilities. Additionally, water quality improvements through the use of BMPs and P2

strategies may be more beneficial if they are developed and implemented sooner rather than later.

Second, phone questionnaires could be used to initially screen and prioritize industrial facilities. This may improve the use of MS4 operator resources by simultaneously ruling out facilities that are not likely to contribute pollutants to the MS4s and increasing awareness of the regulations. This could be done by targeting all facilities within a certain watershed basin, zip code, industrial classification, facility size, or other factors. The State, however, should be required to increase the funding for this program in order to cover the costs of outreach materials and phone calls. Local outreach and contact with industrial facilities could greatly benefit the State. Therefore, financial assistance may be appropriate. Otherwise, MS4 permit holders should encourage the State to more effectively implement the regulations.

Third, the final determination regarding whether a facility is required to comply has been assigned to the FDEP. Although the MS4 operators may not judge certain activities as “high risk,” the State (and EPA where states do not have primacy) alone have been granted the authority and, therefore, the responsibility, of implementing the federal regulations as written. This necessarily implies that even minor violations or exposure to stormwater should require a Generic permit, even if a local stormwater ordinances have not been violated. Although the MS4 operators may communicate with FDEP officials by passing along copies of inspection forms, the County inspections may be more effective at increasing compliance by viewing industrial sites both as a local inspector, and as a State or EPA inspector would. This may require additional time inspecting each facility,

however, an increased focus on activities that may require compliance with the Generic permit may ultimately improve compliance.

Fourth, the MS4 operator inspections may be improved by addressing additional and more standardized questions. While this applied research could not learn everything about each contacted facility, every attempt was made to generate sufficient information in order to make comparisons between industries by using a standardized methodology. Alternatively, inspections by MS4 operators may rely on the opinion of trained inspectors, rather than pre-determined questions. Regardless of an inspector's training, the determination of "high risk" behavior may be improved by developing a more formal inspection guideline and protocol.

Finally, the MS4 operators should attempt to define "high risk" as it applies to their jurisdictions, based on the level of water quality protection desired and the available resources. A documented and agreed upon definition may facilitate site inspections and allow for an easier transition to new employees. While current inspection processes (for various MS4 operators) may not require significant modifications, documenting observations that would lead an inspector to classify a facility as "high risk" may allow greater uniformity in implementation. Without a working definition of "high risk," it may be difficult to assess an MS4 permit holder's effectiveness in meeting its MS4 permit requirements.

VI. E. Recommendations for Future Research

This research has suggested a method for identifying and classifying facilities that may have a higher intensity of industrial activities exposed to stormwater. This method has been effectively applied in a residentially dominated Florida county, however, it

would benefit by application in additional study areas, especially those with more industrialized regions. The scoring scheme was developed to identify facilities with a higher intensity of industrial activities exposed to stormwater. Individual permit area or industry characteristics, however, may necessitate modifications to the current version. Trained industrial inspectors may have valuable insight that could strengthen the scoring criteria. Additionally, this method and scoring criteria have only been applied to four industrial categories. Future research should incorporate additional SIC codes and test the usefulness of this method for all industrial types listed in the NPDES regulations.

If the intensity approach is to be successful, it may require additional facility inspections and water quality sampling to more conclusively determine the activities with the greatest potential to contribute pollutants to stormwater.

Additionally, the examination of additional levels of compliance may benefit future research related to the ability of these regulations to control stormwater pollutants originating at industrial facilities. Stormwater management and BMPs were not addressed in this research, however, follow-up research could evaluate the effectiveness of these techniques, possibly recommending the most appropriate techniques based on industry type, location, or facility description. Finally, water quality samples should be taken and analyzed at various industrial facilities to test if high intensity facilities, as identified using these research methods, are in fact contributing more pollutants to stormwater than lower intensity facilities.

CHAPTER VII – CONCLUSIONS

This section reviews the conclusions derived from the research and how they support the research objectives. The results section is ordered similarly to the objectives.

VII.A. Effectiveness of Research Methodology

The research methodology exhibited both strengths and limitations, but was reasonably effective at screening industrial facilities that may not require coverage under the Generic permit and/or local inspection for the protection of MS4 water quality. This methodology could be applied and/or modified by either MS4 permit holders or NPDES permitting agencies to more effectively identify industrial facilities that may contribute pollutants to MS4s or other stormwater conveyance systems.

The methodology succeeded in identifying both facilities that were technically required to comply with the Generic permit and those that likely did not require coverage. By doing so, it supported research from California that identified that a large portion of facilities should be of low priority and should not be included in the federal regulations. The phone questionnaires were based on language in the NPDES regulations, therefore, they successfully identified facilities that were performing activities in those activities. More importantly, the methodology identified numerous facilities that likely do not require a Generic permit.

The process of surveying industry using phone questionnaires and then classifying facilities based on the intensity of industrial activities exposed to stormwater eliminated

over half of the participating facilities that were classified as low intensity and possibly would not require inspection by the local MS4 operator. Results from the phone questionnaires suggest that at least half of the four categories of industrial facilities operating in the County may not be required to apply for a Generic permit. The subsequent fenceline visits and limited on-site inspections verified that the majority of the industry participants reported activities truthfully. The methodology, however, could not conclusively determine high intensity without an initial fenceline or on-site visit. Therefore, visual inspection of facilities may be a useful and required step, especially during the early stages of permit implementation.

The phone questionnaire could be used either by MS4 permit holders or federal and state agencies to eliminate industrial facilities that may not require the Generic permit and/or inspection. This may lead to a more effective use of available resources if implementing efforts are directed to the facilities most likely to cause water quality problems.

VII.B. Development of a Practicable Definition of "High Risk"

The methodology developed a definition of "high risk" based on the intensity of industrial activities exposed to stormwater. The definition and three "intensity" classifications were developed using the results of the phone questionnaires by assigning points values assigned to each activity with the potential to contribute pollutants to stormwater. This method may be more useful for controlling pollutants in stormwater than current regulatory definitions or those being implemented by MS4 operators.

While the SIC code system may be useful for other industrial regulations, especially those regulating direct industrial discharges of process water into receiving

waterbodies, it may not be the most effective way to prioritize facilities for stormwater protection. There were many similarities between activities performed at contacted industrial sites, regardless of the industrial category and/or actual manufacturing processes employed. The final product being manufactured and the intermediate steps may be less important than activities used to support facilities that are more universal in nature. For example, the most commonly reported activities by participating facilities in Pinellas County included: the storage of materials outdoors, the operation of forklifts/forktrucks outdoors, the use of an uncovered shipping/receiving area, and the operation of outdoor process equipment outside. With the exception of specific materials stored outside, the activities listed above were less related to a specific industrial category or SIC code. Therefore, the SIC distinction may be less useful for stormwater protection.

A consideration of the intensity of activities may more accurately reflect the source of pollutants at industrial sites and aid in identifying industrial facilities with the greatest potential to contribute pollutants to stormwater. By incorporating a “high risk” definition based on intensity and prioritization, fewer total facilities may be regulated under both the Generic permit and MS4 inspections. However, this may subsequently allow resources to be targeted at sites with the greatest impacts on stormwater quality.

VII. C. Recommendations for Improvements to the Current Regulatory Structure

The following recommendations are suggested for both the federal Generic permit and the local MS4 permits.

VII.C.1. RECOMMENDATIONS FOR IMPROVEMENT OF THE GENERIC PERMIT

The Generic permit has been ineffective at reducing stormwater pollutants originating at industrial facilities because many industrial facilities have gone

unregulated. The use of the 11 broad categories of industry does not account for individual differences at industrial sites. Overall, there is a wide range in the intensity of industrial activities exposed to stormwater at facilities within the regulated community. The Generic permit, however, does not encourage effective resource utilization because it addresses all industrial sites equally. Not all regulated facilities demonstrate the equal or important effects on the quality of receiving waterbodies. Because the Generic permit, which attempts to regulate all listed industrial sites, has been so under enforced, it has had little ameliorative effects on water quality protection.

If the goal of improved water quality protection is to be achieved with limited resources, the regulations may require a prioritization of industrial facilities within the regulated community. The Generic permit may benefit by utilizing an intensity scale or definition for facilities potentially subject to the permit. It may be more prudent and effective to regulate only those facilities with the greatest intensity of industrial activities exposed to stormwater, rather than attempt to regulate all facilities, regardless of individual on-site behavior. By addressing the regulated community on some scale of intensity, fewer facilities may be required to comply with the Generic permit. A prioritization of the currently regulated community may lead to improved resource allocation and more targeted and effective implementation.

The prioritization approach attempted in the MS4 permits may be appropriate for the federal Generic permits. However, rather than relying on interpretation by the regulated community, the Generic permit may benefit from a more defined term based on intensity of industrial activities exposed to stormwater. This may shift the focus to actual pollutant sources rather than solely on industrial processes. If increased compliance with

the Generic permit is desired, this same definition of intensity should also be incorporated into the MS4 permits. While the goal of each permit program is to improve water quality, the use of dissimilar permit language has hampered its effectiveness. A more universal definition for federal, state, and local permits, may allow MS4 operators to improve compliance with the Generic permit while, simultaneously, improving the water quality of their MS4s. This may increase reinforcement between the dual levels of regulation.

VII.C.2. RECOMMENDATIONS FOR IMPROVEMENT OF THE MS4 PERMITS

The use of the term “high risk” within the MS4 permits is more progressive than the blanket coverage of industrial facilities under the federal regulations, however, because it relies on local interpretation, it has allowed for irregular implementation. The use of prioritized facility identification and inspection, which is required in the MS4 permits, is advantageous because it deviate from the use of the arbitrary SIC codes to focus on activities that may impact MS4 water quality. However, while this approach may potentially improve water quality of MS4s, in addition to saving resources, it has been applied differently throughout the State of Florida, leading to potential inconsistencies in water quality protection. The flexibility in the MS4 permits may benefit local agencies, however, it has allowed local MS4 operators to exclude many facilities from inspection, based on the resources allocated for implementation and the self-selected definition of “high risk.”

A standardized definition of “high risk” for the entire state may promote more uniform implementation of the MS4 permits, so that the level of water quality protection in one region might comparable to other regions. Some degree of local interpretation may be desirable, however, minimum guidelines based on the intensity of industrial activities

exposed to stormwater may provide clearer objectives and lead to more effective implementation by MS4 operators.

If the State of Florida is concerned about improving the water quality of MS4s (from pollutants originating at industrial sites), the State and local MS4 operators will need to devote sufficient resources to bringing facilities into compliance with the Generic permit. This may be accomplished by increasing locally based inspections, so long as the broader goals of the Generic permit and local priorities are addressed. This however, may require state funding for improved implementation at the local level, especially for MS4 operators with limited budgets for industrial inspections. A more active educational outreach program, by State, local agencies, or both may reach industrial facilities that have the potential to contribute pollutants to stormwater, but that cannot be immediately inspected.

In the meantime, MS4 operators may improve implementation of the MS4 permits by first adopting a definition of “high risk.” While many MS4 operators that were contacted for the research have addressed the term in some way, a dedicated approach to prioritizing facilities within their jurisdiction may improve resource usage and water quality by targeting only those facilities with the greatest potential for contributing pollutants to stormwater. The definition should be replicable to ensure uniformity amongst local employees and at inspections. Finally, educational outreach efforts made during contact with the industrial community may improve compliance with the Generic permit and lead to a more informed industrial community.

VII.D. General Applicability of Research Results

The evaluation of environmental policies, such as industrial stormwater regulations, is important and can contribute to necessary policy revisions. Policy improvement cannot occur without evaluation, therefore, research such as this can lead to policies that more effectively achieve their desired results, while utilizing societal resources wisely. Regulations, such as the Generic permit, that rely on self-identification and self-selected implementation by the regulated community may be met with questionable or poor success. The Generic permit, which relies on self-identification by regulated industries, has demonstrated low compliance. The use of self-selected implementation strategies, illustrated by the "high risk" term in the MS4 permits, can lead to irregular implementation when local permit holders decide their level of resource allocation and natural resource protection. Additional investigation of regulations that empower the regulated community, rather than the implementing agencies, may lead to more effective current and future regulations.

The methodology developed for this research could be applied in other MS4 permit jurisdictions. Prioritizing industrial facilities using a phone questionnaire to screen out facilities that may not require compliance with the Generic permit and/or local inspection may reduce the workload of local inspectors and lead to more targeted and useful on-site inspections. MS4 operators may be able to broaden their list of industries potentially requiring inspection by utilizing additional lists of industry, such as those obtained by other governmental agencies and/or for-profit companies. Phone outreach can then identify potentially "high risk" facilities.

Finally, all MS4 operators should be encouraged to proactively define "high risk."

In the absence of a state-adopted definition, the local approach should strive for prioritization of industry based on their potential to contribute pollutants to stormwater, rather than on other characteristics, such as SIC codes, that may be less useful for stormwater protection. Identification and inspection of facilities may be more effective by utilizing a scale of intensity that is sensitive to both water quality protection and resources for implementation.

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Appendices

Appendix 1: List of Acronyms

BMPs:	Best Management Practices
CAA:	Clean Air Act
County:	Pinellas County, Florida (not including the City of St. Petersburg)
CWA:	Clean Water Act (Federal Water Pollution Control Act)
EPCRA:	Emergency Planning & Community Right to Know Act
EPCRA Title III Section 313:	Established the Toxics Release Inventory program
FDEP:	Florida Department of Environmental Protection
FWPCA:	Federal Water Pollution Control Administration
Generic permit:	Storm Water Multi-Sector (General) Generic Permit for Industrial Activities
High Risk:	Undefined term used in MS4 permit for the identification and inspection of industrial facilities
Intensity:	Intensity of industrial activities with the potential to discharge pollutants to stormwater
MS4:	Municipal Separate Storm Sewer System
NAICS Code:	North American Industrial Classification System Code
NOI:	Notice of Intent for Industrial Activity
NOT:	Notice of Termination for Industrial Activity
NPDES:	National Pollutant Discharge Elimination System permit program
NRDC:	Natural Resources Defense Council

NURP:	National Urban Runoff Program
P2:	Pollution Prevention strategy or plan
PCDEM:	Pinellas County Department of Environmental Management
POTW:	Publicly Owned Treatment Works
Proportion in Compliance:	Proportion of total facilities in research database that have filed an NOI
Stormwater Discharge:	Pollutants in storm water discharges associated with industrial activities
SIC Code:	Standard Industrial Classification Code
SIC 24:	Lumber and Wood Products, Except Furniture
SIC 32:	Stone, Clay, Glass, and Concrete Products
SIC 34:	Fabricated Metal Products, Except Machinery and Transportation
SIC 36:	Electronic and Other Electrical Equipment and Components, Except Computer Equipment
SQG:	Hazardous waste Small Quantity Generator
SWPPP:	Stormwater Pollution Prevention Plan
TMDL:	Total Maximum Daily Load program
TRI:	Toxics Release Inventory
TSDF:	Hazardous waste Treatment, Storage, Disposal, and recovery Facility
US EPA:	U.S. Environmental Protection Agency

Appendix 2. Institutional Review Board Research Approval Forms

UNIVERSITY OF
SOUTH FLORIDA

May 18, 2005

Lindsay M. Griffen, BS

RE: Exempt Certification for Application for Exemption
IRB#: 103677
Title: *Evaluation of Dual-level Industrial Stormwater Regulations: An Example from Pinel/as County, Florida*

Dear Ms. Griffen:

On May 17,2005, the Institutional Review Board (IRB) determined that your Application for Exemption MEETS FEDERAL EXEMPTION CRITERIA #2. It is your responsibility to ensure that this research is conducted in a manner consistent with the ethical principles outlined in the Belmont Report and in compliance with USF IRB policies and procedures.

Please note that changes to this protocol may disqualify it from exempt status. It is your responsibility to notify the IRB prior to implementing any changes.

The Division of Research Compliance will hold your exemption application for a period of five years from the date of this letter or until a Final Review Report is received. If you wish to continue this protocol beyond the five-year exempt certification period, you will need to submit an Exemption Certification Request form at least 30 days before this exempt certification expires. The IRB will send you a reminder notice prior to expiration of the certification; therefore, it is important that you keep your contact information current. Should you complete this study prior to the end of the five-year period, you must submit an Application. for Final Review.

Please reference the above IRB protocol number in all correspondence to the IRB or the Division of Research Compliance. In addition, we have enclosed an Institutional Review Board ORB) Quick Reference Guide providing guidelines and resources to assist you in meeting your responsibilities when conducting human subjects research. Please read this guide carefully.

OFFICE OF RESEARCH • DIVISION OF RESEARCH COMPLIANCE INSTITUTIONAL REVIEW BOARDS,
FWA No. 00001669 University of South Florida • 12901 Bruce B. Downs Blvd., MOC035 • Tampa, FL 33612-4799 (813) 974-5638 ·
FAX (813) 974-5618

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to the Human Research Protections Program. If you have any questions regarding this matter, please call 813-974-9343.

Paul G. Stiles, J.D., Ph.D. USF
Institutional Review Board

Enclosures: IRB Quick Reference Guide

Cc: Angie Reagan, USF IRB Professional Staff
L. Donald Duke, PhD, PE

IA-EC-05-01

UNIVERSITY OF SOUTH FLORIDA

. EXEMPTION CERTIFICATION

MEMO: Lindsay M. Griffen, BS

FROM: Institutional Review Board PGS/amr

SUBJECT: Exemption Certification for Protocol No. 103677

DATE: July 7, 2005

On May 17,2005, it was determined that your project entitled, "Evaluation of Dual-level Industrial Stormtwater Regulations: An Example from PineUas County, Florida" met federal criteria, which exempts it from the regulations specified in the Common Rule.

On June 29, 2005, you requested the following change:

- ~ Change in the informed consent process/document: The verbal informed consent language on the Database Accuracy Form has been altered in order to condense the total survey length. The original informed consent language will remain on the survey form but will not be read to each participant unless requested.
- ~ Change in study instruments: Several minor, non-substantive changes have been made to the Database Accuracy Form and the Industrial Stormwater Regulations form. These changes fall into several categories: 1)corrected typos, 2) additional examples or clarifications to ensure more uniform survey delivery, 3) wording changes to improve the flow of questions, and 4) additional information used for coding purposes that will not affect participants.

These changes have been noted in the file and do not impact the eligibility for exemption. The study continues to have Exempt Certification. Please remember that any grants connected to this project must be submitted to the Institutional Review Board for review.

Because the study has been certified as exempt, you win not be required to complete continuation or final review reports. However, it is your responsibility to notify the IRB prior to making any changes to the study. Please note that changes made to an exempt protocol may disqualify it from exempt status and may require an expedited or full review.

If you have any questions, please contact the Division of Research Compliance "IRB Administrative Offices" at (813) 974-9343.

pc: L. Donald Duke, PhD, PE

OFFICE OF RESEARCH • DIVISION OF RESEARCH COMPLIANCE INSTITUTIONAL REVIEW BOARDS,
FWA No. 00001669 University of South Florida • 12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799 (813) 974-5638 •
FAX (813) 974-5618

USF

UNIVERSITY OF
SOUTH FLORIDA

EXEMPTION CERTIFICATION

MEMO: Lindsay M. Griffen

FROM: Institutional Review Board PGS/amr

SUBJECT: Exemption Certification for Protocol No. 103617

DATE: November 10, 2005

On May 17, 2005, it was determined that your project entitled, "Evaluation of Dual-level Industrial Stormwater Regulations: An Example from Pinellas County, Florida" met federal criteria, which exempts it from the regulations specified in the Common Rule.

On November 2, 2005, you requested the following change:

- **Title change, the new title is: "Reducing Pollutants in Industrial Stormwater Runoff: Improved Water Quality Protection Using Prioritized Facility Regulation."**
- **Correction of typos in two questionnaires (misspellings and order of words).**

These changes have been noted in the file and do not impact the eligibility for exemption. The study continues to have Exempt Certification. Please remember that any grants connected to this project must be submitted to the Institutional Review Board for review. .

Because this study has been certified as exempt, you will not be required to complete continuation or final review reports. However, it is your responsibility to notify the IRB prior to making any changes to the study. Please note that changes made to an exempt protocol may disqualify it from exempt status and may require an expedited or full review.

If you have any questions, please contact the Division of Research Compliance "IRB Administrative Offices" at (813) 974-9343.

pc: Dr. L. Donald Duke

OFFICE OF RESEARCI1 * DIVISION OF RESEARCH COMPUANCE INSTITUTIONAL REVIEW BOARDS;
FWA No. *00001669* University of South Florida 12901 Bruce B. Downs Blvd., MDC035 ~ Tampa. FL33612-4799. (813) 974.5638 FAX (813) 974-5618

Appendix 3. Introductory Letter to Pinellas County Industries

USF

UNIVERSITY OF
SOUTH FLORIDA

Date

Individual Name (if available)
Environmental Compliance Manager
Facility Name
Address
City, FL Zip

Weare contacting you as part of a research project learning about industrial facilities in Pinellas County. We are a research team at the University of South Florida, conducting independent research on industrial storm runoff and its regulation in Florida. We would like to talk to you about your facility at (XXXXXX Address XXX), and we plan to phone you soon to ask that you share some information about that facility.

Recently, new state and county regulations were adopted regarding stormwater runoff and its effect on the environment. These regulations and their implementation requirements may affect your business. Environmental protection is important to Pinellas County citizens, contributing to their overall quality of life. However, environmental protection may also be burdensome to industry and businesses, such as yours.

Our purpose in conducting this research is to learn about the day-to-day activities at numerous facilities, in order to help determine the kinds of business activities in the county that may contribute to stormwater runoff. The research results will be useful for determining how effectively environmental regulations are written and how they can be improved in ways that benefit both the environment and businesses. This research may also help to decrease the regulatory burden for facilities such as yours throughout Pinellas County and across the nation.

Someone from the USF team should be contacting you by phone in the coming weeks to ask a series of questions about your facility. It is very important that we speak with the person responsible for environmental management and who is familiar with the on-site activities at this particular facility. If this letter has been addressed to the wrong individual, please direct it to the correct environmental staff person or manager. The phone call should take only a few minutes of your time.

Information that you share with us will be held strictly confidential. This research has been approved by the USF Institutional Review Board, with a carefully designed protocol that will assure we protect the confidentiality of any information we obtain from you and all the other research participants. Results from this research will be carefully protected, and will be made available to the public only in aggregate form in a way in which none of the participants will be identifiable. We plan to publish those aggregate results as part of a Master's Thesis and in other research venues, such as scholarly conferences and journals.

We look forward to speaking with you soon, and we thank you in advance for your assistance.

Sincerely,

Lindsay Griffen
Graduate Student Researcher

L. Donald Duke, Ph.D., P.E.
Associate Professor

ENVIRONMENTAL SCIENCE AND POLICY ▪ COLLEGE OF ARTS AND SCIENCES
University of South Florida ▪ 4202 East Fowler Avenue NES107 ▪ Tampa, FL 33620 (813) 974-2739 ▪
FAX (813) 974-2184 ▪ www.cas.usf.edu/esp

Appendix 4. Database Accuracy Phone Questionnaire

USF Industrial Stormwater Questionnare:2005 Code:

INDUSTRIAL FACILITIES STORMWATER RESEARCH:
DATABASE ACCURACY FORM

!! IMPORTANT: THESE SIX PAGES WILL BE KEPT SEPARATE FROM THE QUESTIONNAIRE RESULTS. REMEMBER TO FILE THESE PAGES IN THE DATABASE ACCURACY FOLDER, AND DO NOT ATTACH OR FILE NEXT TO THE QUESTIONNAIRE FOR THIS FACILITY!!

PRIOR TO COMPLETING THIS QUESTIONNAIRE: FILL IN ALL POSSIBLE BLANKS WITH INFORMATION FROM THE PUBLICLY-AVAILABLE DATA IN OUR DATABASE.

Pinellas County Inspected Facility? _____Yes _____ No _____ Date

USF Fenceline visit completed? _____ Yes _____ No _____ Date

Information Source: Only InfoUSA? _____ Yes _____ No

Survey not Completed: Reason? _____ Wrong Info (Moved, Disconn) _____ No Answer (Correct #) _____ Refusal ____Passive__ Active

____ Retail (Not Industrial)

FACILITY NAME:

_____

PHONE NUMBER:

_____

Calling History

Call#	Date:	Time:	Phone#:	Contact Person or Notes:	Caller's Initials:
#1	____	_____	_____	_____	_____
#2	____	_____	_____	_____	_____
#3	____	_____	_____	_____	_____
#4	____	_____	_____	_____	_____
#5	____	_____	_____	_____	_____
#6	____	_____	_____	_____	_____

Greeting:

"Hello, may I please speak with _____
(CONTACT NAME, IF AVAILABLE) OR *the environmental coordinator at this facility?*

USF Industrial Stormwater Questionnare:2005 Code:

(IF ASKED) ***"The person responsible for environmental compliance at this facility?"***

CONTACT'S NAME: _____

CONTACT'S TITLE: _____ EXTENSION**:** _____

1. WAS INFORMATION CORRECT? **(CIRCLE ONE)** Yes [1] No [2] Don't Know[3]

(IF NO CONTACT NAME, WRONG NAME, OR PERSON NO LONG WORKS FACILITY)

"Would you mind telling me who is responsible for environmental compliance?

2. CONTACT'S NAME: _____

"Do you know the correct title and extension for _____?"

3. CONTACT'S TITLE: _____

4. EXTENSION: _____

"Thank you. Could you please connect me to_____?

IF CONTACT PERSON IS <u>NOT</u> AVAILABLE AT THIS TIME:

5. "What is the best day and time to reach (name) _____?

Day_____Time_____

(IF ASKED WHY INFORMATION IS NEEDED) ***"I am working with a study from the University of South Florida addressing industrial facilities throughout Pinellas County. To complete this study, we need to speak with the person responsible for environmental compliance, and who is familiar with the day-to-day activities at this particular facility. We have received information on this facility from public information and would like to speak with the environmental compliance person for a few minutes. This information will not be forwarded to any agency or shared with anyone except the USF researchers making this phone call – we only want it so we know who is the right person to speak with."***

AFTER WE HAVE REACHED THE PERSON IDENTIFIED ABOVE AS THE CORRECT CONTACT PERSON:

USF Industrial Stormwater Questionnare:2005 Code:

"Hi! My name is _____ I am a graduate student at the University of South Florida. We're doing a study on industrial facilities and stormwater runoff in Pinellas County. Would you mind giving me a few minutes of your time?

(IF NO) *"Is there a better time that I could call back?*

ENTER DAY: _____ TIME:_____

"Thanks. I look forward to speaking with you then."

(IF REFUSAL) *"Ok, thank you for your time."*

(IF QUESTIONS) ***I am part of an independent, unpaid research group generatin information on industries in Pinellas County. We are conducting a 6-month study on industrial stormwater regulations and how they affect Pinellas County industrial facilities and would like to ask you a few questions about processes that occur at your facility.***

We are phoning people from about 200 facilities that were listed on publicly-available lists of Pinellas County industries. Those are the same sources that the County will be using to conduct its own inspection programs, so your participating here – or not – will have no effect on whether the County eventually contacts you for that program. As a result of your participation, however, we may be able to make recommendations to the State and the County about the current regulations, and ways they could be less burdensome to business. At the end of our conversation today, I will also tell you how you can receive more information about these regulations. This may help you be better informed.

(IF YES TO PARTICIPATION) *"Great. Before we get started I'd like to let you know that everything you tell me will be kept confidential. Would you like to hear more about our confidentiality protocol? Did you receive the letter we sent you?* **(WAIT FOR RESPONSE.)**

(IF "NO") ***Would you like to receive another copy? I could FAX or mail you another copy for you to keep in your records. "***

WOULD PARTICPANT LIKE ANOTHER COPY OF LETTER? Yes [1] No [2]

(*THIS BECOMES OPTIONAL, IF PARTICIPANT IS INTERESTED IN MORE INFORMATION) *"Participation in this study is optional and you may withdraw at any time. There is no foreseeable risk to you or your company if you participate, but we would greatly appreciate your time. All information that you provide will be kept strictly confidential and data will be released only in aggregate form as part of regular research publications. That means that your responses cannot be linked to your business. The questions we have included only relate to your businesses facility, not to any personal opinions or information.

USF Industrial Stormwater Questionnare:2005 Code:

(IN MOST CASES, OMIT THE FOLLOWING. IF QUESTIONS, ESPECIALLY REGARDING LEGITIMACY, SOME USEFUL LANGUAGE INCLUDES) ***This research is conducted by the Department of Environmental Science and Policy at USF, supervised by Prof. Don Duke. I can give you contact information if you would like to verify that. To safeguard confidentiality, this research has been approved by the USF Institutional Review Board. It is an independent body that verifies our procedures to assure confidentiality of data and protection for research participants.***

"Would you agree to participate in this 10- minute questionnaire? Do you have any questions before we get started?"

PARTICIPANT HAS GIVEN CONSENT TO PARTICIPATE IN QUESTIONNAIRE?
YES[1] NO[2]

IF CONSENT GIVEN, CONTINUE WITH 2-PART QUESTIONNAIRE. IF NOT, PLEASE FILE THIS FIRST PAGE IN THE "NON-PARTICIPANTS" FOLDER.

"First, could you please confirm the information we have for this facility?

6. "Is the correct name of the company that operates this facility:
_____***?*** 6. Yes [1] No [2]

IF NO: ENTER CORRECTION:_____

(THIS IS THE COMPANY THAT OPERATES, NOT THE PARENT COMPANY, ETC.)

7. " Is the correct facility address:

_____? 7. Yes [1] No [2]

CITY: _____ **ZIP:** _____

IF NO: ENTER CORRECTION: _____

_____

8. "Is this where the facility is actually located?" 8. Yes [1] No [2]
(NOT SIMPLY THE MAILING ADDRESS)

9. **(IF NO)** ***"Do you know what the physical, street address is?***

_____?

USF Industrial Stormwater Questionnare:2005 Code:

CITY: _____ ZIP: _____

10. "Our information shows the facility's primary business activity is:

Industrial Activity: _____

"Is that correct? 10. Yes [1] No [2] Don't Know [3]

(IF NO, PROCEED TO QUESTION #16 **).

IN RESPONSE TO QUESTION, IF ANY: BY "PRIIMARY" WE MEAN THE ACTIVITY THAT ACCOUNTS FOR THE SINGLE GREATEST PART OF THE FINANCIAL PROCEEDS AT THIS SPECIFIC FACILITY

11. (IF YES TO #10), "***We show the SIC associated with this activity to be***

SIC___/___/___/___(11)

12. "Do you know whether that is correct? 12. Yes [1] No [2] Don't Know[3]

13. (IF NO TO #12), "*Do you know the SIC for that activity?*

SIC ___/___/___/___(13)

14. AFTER COMPLETING THE QUESTIONNAIRE: USE REFERENCES AT USF TO VERIFY THAT SIC IS CREDIBLE FOR THE ACTIVITY. 14. Yes [1] No [2]

15. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY:

SIC ___/___/___/___(15)

****16. (IF NO TO #10:), "*What is the primary industrial or commercial activity conducted at this facility?***

Industrial Activity: _____ (16)

IN RESPONSE TO QUESTION, IF ANY: BY "PRIMARY" WE MEAN THE ACTIVITY THAT ACCOUNTS FOR THE SINGLE GREATEST PART OF THE FINANCIAL PROCEEDS AT THIS SPECIFIC FACILITY

17. "Do you know the SIC for that activity?

SIC ___/___/___/___ (17)

18. AFTER COMPLETING THE QUESTIONNAIRE: USE REFERENCES AT USF TO VERIFY THAT SIC IS CREDIBLE FOR THE ACTIVITY. 18. Yes [1] No [2]

19**. (IF NO),** RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY:

SIC ___/___/___/___ (19)

OMIT THE FOLLOWING QUESTION IF THERE IS NO SUCH INFORMATION IN OUR FILES AND SKIP TO QUESTION $$:

"Do you also do the following activities?

(IF QUESTIONS) ***According to information you have given to regulatory agencies, and that we have obtained from publicly available sources, ~~that~~ this facility also conducts the following activities that are relevant for regulatory purposes. Can you tell me whether these are correct, and if you know the SICs associated with them?***

20. Industrial Activity:_____ 21. SIC___/___/___/____(21)

22. Industrial Activity:_____23. SIC___/___/___/____(23)

24. Industrial Activity:_____25. SIC___/___/___/____(25)

26. Industrial Activity:_____ 27. SIC___/___/___/_____(27)

AFTER COMPLETING THE QUESTIONNAIRE: USE REFERENCES AT USF TO VERIFY THOSE SICS ARE CREDIBLE FOR THESE ACTIVITIES.

$$ "Are there any other major activities conducted at your site that might be relevant for purposes of environmental compliance?

(IF ASKED) ***That is, do you conduct other activities on-site that would be typical of industrial facilities, such as subsidiary product manufacturing, painting, coating, or altering; or blending or manipulation of raw materials? Can you tell me what those are, and if you know the SICs associated with them?***

28. Industrial Activity:_____ 29. SIC___/___/___/____ (29)

30. Industrial Activity:_____31. SIC___/___/___/____ (31)

32. Industrial Activity:_____33. SIC___/___/___/____ (33)

34. Industrial Activity:_____ 35. SIC___/___/___/____ (35)

USF Industrial Stormwater Questionnare:2005 Code:

AFTER COMPLETING THE QUESTIONNAIRE: USE REFERENCES AT USF TO VERIFY THOSE SICS ARE CREDIBLE FOR THESE ACTIVITIES.

VERIFICATION OF ACTIVITES AND SIC CODES:

36. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#21: ___/___/___/___ (36)

37. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#23: ___/___/___/___ (37)

38. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#25: ___/___/___/___ (38)

39. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#27: ___/___/___/___ (39)

---

40. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#29: ___/___/___/___ (40)

41. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#31: ___/___/___/___ (41)

42. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#33: ___/___/___/___ (43)

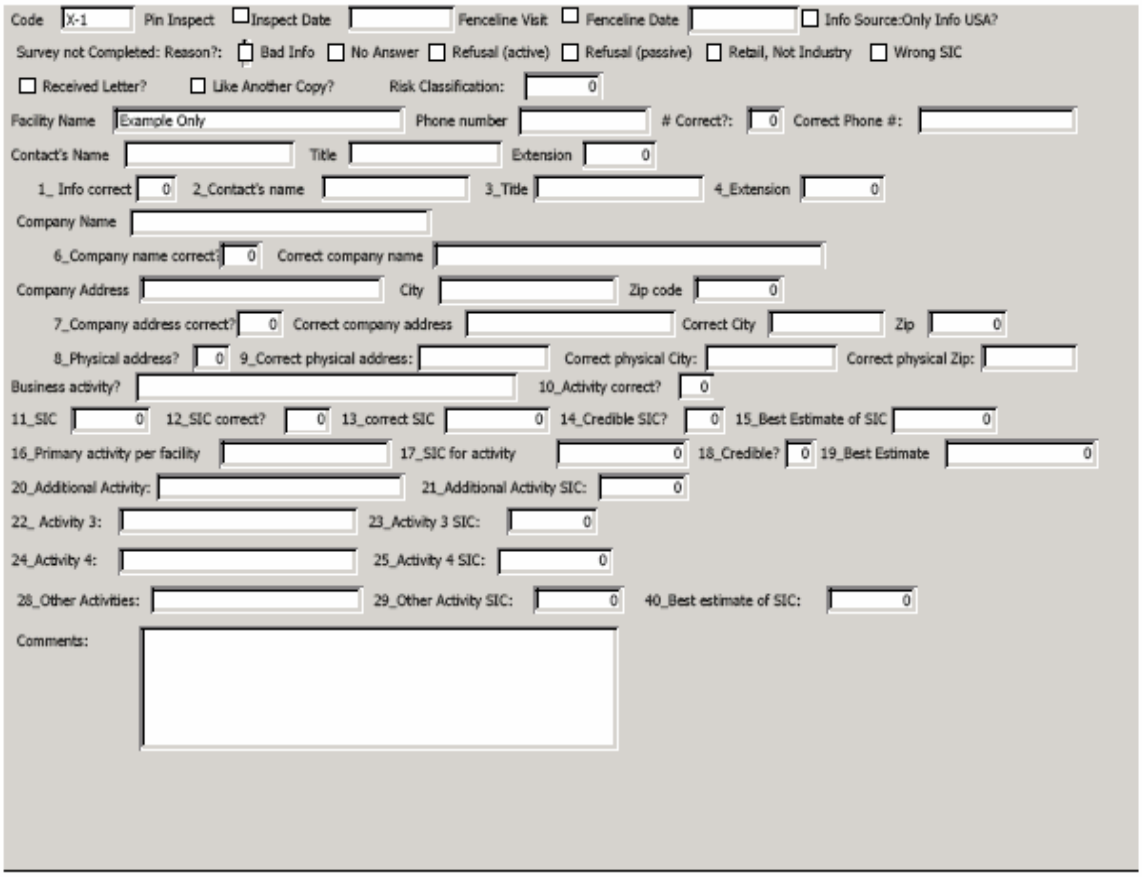
43. IF NO, RESEARCHER'S BEST ESTIMATE OF SIC FOR THAT ACTIVITY

#35: ___/___/___/___ (45)

USF Industrial Stormwater Questionnare:2005 Code:

PLEASE TRANSFER INDUSTRIAL ACTIVITY DESCRIPTION AND SIC(S) TO PAGE 1 OF "INDUSTRIAL FACILITIES QUESTIONNAIRE: INDUSTRIAL STORMWATER REGULATIONS" FORM AND CONTINUE WITH THE SURVEY. THESE PAGES WILL BE FILED SEPARATELY IN THE "DATABASE ACCURACY FOLDER."

Appendix 5. Database Accuracy Database Entry Form



Appendix 6: Industrial Stormwater Regulations Phone Questionnaire

USF Industrial Stormwater Questionnaire: 2005 Code:

INDUSTRIAL FACILITIES QUESTIONNAIRE:
INDUSTRIAL STORMWATER REGULATIONS

INTERVIEWER: ENTER INFORMATION ABOUT BUSINESS ACTIVITY AND SIC FROM THE "DATABASE ACCURACY" PORTION OF THE QUESTIIONNAIRE

Primary Business Activity: _____

SIC ___/___/___/

Additional Business Activity: _____

SIC ___/___/___/___

Additional Business Activity: _____

SIC ___/___/___/___

Additional Business Activity: _____

SIC ___/___/___/___

Additional Business Activity: _____

SIC ___/___/___/___

1. "Now, very briefly, could you tell me, are you familiar with the Florida statewide Generic Permit for industrial stormwater?

1. Yes [1] No [2] Don't Know [3]

Comments: _____

(IF QUESTIONS: "HAVE YOU EVER HEARD OF…"

2. "Have you heard about any publicity or outreach from Pinellas County addressing industrial stormwater runoff?

2. Yes [1] No [2] Don't Know [3]

Comments: _____

USF Industrial Stormwater Questionnaire: 2005 Code:

3. "Has anyone at your facility been contacted by anyone, from federal, state, or local agencies, regarding industrial stormwater runoff?

3. Yes [1] No [2] Don't Know [3]

Comments: _____

4.* (IF YES) "*What agency or agencies have contacted you?

4. _____

5. _____

6. _____

"The rest of my questions are simply about the kinds of day to day activities you conduct at this facility, and the kinds of materials and equipment you use. Some of the phrasing may sound a little odd, but that is because sometimes we are trying to use the same language that Florida uses in its regulatory definitions.

(IF ANY HESITANCY, OR NEED FOR FURTHER REASSURANCE, TRY THE FOLLOWING):
"These questions are not asking for any details of operations, and certainly we don't want any kind of proprietary information about your processes or products. We are trying just to understand the ways that facilities in your business are exposed to rainfall and runoff in their everyday activities."

REMEMBER THAT THE RESPONDENT IS FREE TO DISCONTINUE AT ANY TIME, AND WE ARE NOT TO PRESSURE THE RESPONDENT IN ANY WAY! BUT YOU MAY FEEL FREE TO PROVIDE ADDITIONAL INFORMATION OF THE KIND ABOVE.

7. "Do you manufacture a product at this facility?

7. Yes [1] No [2] Don't Know [3]

Comments: _____

IF QUESTIONS: "FOR EXAMPLE, AS OPPOSED TO CONDUCTING A SERVICE…"

8*. (IF YES) *"What products do you manufacture? …

Comments:_____

_____

USF Industrial Stormwater Questionnaire: 2005 Code:

9. "Do you store, process, or handle raw materials at this facility?

9. Yes [1] No [2] Don't Know [3]

Comments:_____

10.* (IF YES) - VERY BROADLY*! –* "*What kind(s) of materials?

Comments: _____

_____ Don't Know [3]

IF QUESTIONS: "FOR EXAMPLE, WOOD OR METAL USED FOR MANUFACTURING; LIQUID OR DRY BULK MATERIAL; PAINTS, CHEMICALS, OR OTHER SUBSTANCES USED IN MANUFACTURING; OR ANYTHING ELSE?"

11*. "*Do you blend, alter or modify materials, products, or chemicals at this facility?

11. Yes [1] No [2] Don't Know [3]

Comments:_____

"For the following questions I have a list of possible materials or products. Please tell me if any of these are stored outdoors at your facility.

12. _____ Bulk dry materials – such as sand, concrete, wood or metal?

13. _____ Products – such as completed pipes, stone or concrete products?

14. _____ Bulk liquid in tanks, whether process chemicals, products, or anything else?

(IF YES: Approximately how many tanks are located on site– one or two, small or large, or <u>how</u> many?)

15. _____

16. _____ Liquid in smaller containers, such as drums or cans of paints, lubricants, or chemicals in small quantities?

(IF YES: Approximately how many: one or two, five or more?)

17. _____

18. _____ Waste liquid materials, for example, drums of spent lubricants, still bottoms, or paint?

(IF YES: How many drums, approximately, within 5 – 10 drums, at any one time?)

19. _____

20. _____ Large quantities of dry bulk waste – more than fits in a couple of Dumpsters at one time

21. _____ Small quantities of Dry bulk waste – for example, one or two Dumpsters routinely kept outdoors

22. _____Anything else: _____
(e.g., wooden pallets)

23. _____ Don't Know

24. **(IF NOT OBVIOUS FROM ABOVE)** ***"Would the total of these products and materials be more than 4 or 5 drums or a 10 X 10 area?***

24. Yes [1] No [2] Don't Know [3]

(The alternative: More than 4 or 5 drums at any one time, more than a 100 square foot PILE of dry material, or comparable amount)

Comments: _____

25. "Does your facility keep a "boneyard" of scrap metal, disused equipment, and similar materials outdoors?

25. Yes [1] No [2] Don't Know [3]

Comments: _____

26. "Does your facility have a storage area for hazardous wastes, either outdoors in a fenced area or in a temporary metal shed, or similar storage area?

26. Yes [1] No [2] Don't Know [3]

Comments: _____

27. (**IF YES)** ***"Is this storage area ever exposed to precipitation when it rains? (i.e., the storage drums or tanks are enclosed from the rainwater, but the containers themselves are contacted by rainwater)***

27. Yes [1] No [2] Don't Know [3]

Comments: _____

USF Industrial Stormwater Questionnaire: 2005 Code:

28. "Does your facility have fixed outdoor equipment used for material handling?

28. Yes [1] No [2] Don't Know [3]

Comments: _____

IF QUESTIONS: "FOR EXAMPLE, CONVEYORS, MIXERS,…"

***29.* (IF YES) - VERY BROADLY! – "*What kind(s) of equipment and how many of each type? (Is it just one or two small items, or a major item, or many smaller ones?*)**

_____Don't Know [3]

30. "Does your facility use vehicles (i.e. forklifts, forktrucks) outdoors for material handling?

30. Yes [1] No [2] Don't Know [3]

Comments: _____

31.* (IF YES) "*Approximately how many vehicles do you have at this facility?

(ALLOW RESPONDENT TO VOLUNTEER AN ANSWER –
FIT TO FOLLOWING CATEGORIES – PROMPT WITH THE CATEGORIES IF NEEDED)

1 or 2 _____ (A) 3 or 4 _____ (B) More than 5 _____ (C)

Heavy Equipment _____(D) Don't Know _____ (E)

Comments:_____

32.* (IF YES) "*Where are they regularly kept?

(ALLOW RESPONDENT TO VOLUNTEER AN ANSWER –
FIT TO FOLLOWING CATEGORIES – PROMPT WITH THE CATEGORIES IF NEEDED)

Outdoors occasionally, not every day _____(A)

Outdoors some part of the day, every day _____ (B)

Outdoors most or all of the day, every day _____ (C)

Don't Know _____ (D) Inside _____ (E)

Comments:_____

USF Industrial Stormwater Questionnaire: 2005 Code:

33. **(IF YES) "*Do you continue to use these vehicles when it rains, so that they are typically exposed to precipitation if it rains during the work day?***

33. Yes [1] No [2] Don't Know [3]

Comments: _____

34. "Does your facility operate a shipping and receiving area where materials or products are loaded or unloaded?

34. Yes [1] No [2] Don't Know [3]

Comments: _____

35. **(IF YES) "*Are any portions of the loading or shipping area uncovered or exposed to precipitation when it rains?***

35. Yes [1] No [2] Don't Know [3]

Comments: _____

36. "Approximately how many loading areas does this facility have in operation? (Roughly how many trucks could be unloaded at one time?) _____ trucks

Comments: _____

37. "Do you own or operate vehicles for off-site use (i.e., delivery trucks)?

37. Yes [1] No [2] Don't Know [3]

Comments: _____

(IF NO SKIP TO QUESTION # 50 @@)

(IF YES) "*For the next questions, I have a list of possible vehicle maintenance and other activities. Please tell me if you routinely perform any of these operations on your vehicles.*

38."Do you routinely perform any vehicle maintenance at this facility?

38. Yes [1] No [2] Don't Know [3]

Comments: _____

USF Industrial Stormwater Questionnaire: 2005 Code:

39.* (IF YES) *"On approximately how many vehicles?

Number: _____

40. "How often would you say this occurs?" (PROVIDE LIST IF NECESSARY)

Very rarely/only when needed _____ (A) Occasionally _____ (B)

Regular Occurrence _____ (C) Don't Know _____ (D)

41.* (IF YES) *"Is vehicle maintenance ever conducted outside?

41. Yes [1] No [2] Don't Know [3]

Comments: _____

42."Do you re-fuel vehicles at this facility?

42. Yes [1] No [2] Don't Know [3]

Comments: _____

43.* (IF YES) *"On approximately how many vehicles?

Number: _____

44. "How often would you say this occurs?" (PROVIDE LIST IF NECESSARY)

Very rarely/only when needed _____ (A) Occasionally _____(B)

Regular Occurrence _____ (C) Don't Know _____ (D)

45.* (IF YES) *"Is vehicle re-fueling ever conducted outside?

45. Yes [1] No [2] Don't Know [3]

Comments: _____

46."Do you wash any of the vehicles at this facility?

46. Yes [1] No [2] Don't Know [3]

Comments: _____

USF Industrial Stormwater Questionnaire: 2005 Code:

47.* (IF YES) "*Approximately how many vehicles?

Number: _____

48. "How often would you say this occurs?" (PROVIDE LIST IF NECESSARY)

Very rarely/only when needed _____ (A) Occasionally _____ (B)

Regular Occurrence _____ (C) Don't Know _____ (D)

49.* (IF YES) "*Is vehicle washing ever conducted outside?

49. Yes [1] No [2] Don't Know [3]

Comments: _____

@ @ 50. Does your facility have underground storage tanks on-site?

50. Yes [1] No [2] Don't Know [3]

Comments: _____

51.* (IF YES) "*Do you know the total capacity in gallons?

Number Gallons: _____

52. Does your facility possess a plant yard (either paved or unpaved), access roads, or rail lines traversed by carriers of raw materials, products, waste materials, or by-products created, used, or handled by this facility?

52. Yes [1] No [2] Don't Know [3]

Comments: _____

53.* (IF YES) "*Approximately how large is that area, given in the "x" # of feet by "y" # of feet?"

Comments:_____

54. "Does your facility operate miscellaneous small process equipment outside? (For example, coolant tanks, air compressors, generators, or the like?)

54. Yes [1] No [2] Don't Know [3]

Comments: _____

55*. (IF YES) "*Are these items ever exposed to precipitation when it rains?

55. Yes [1] No [2] Don't Know [3]

Comments: _____

56. "Does your facility perform any other activities outdoors that may expose materials or equipment to precipitation or stormwater runoff? (Examples include cutting or shaping products or materials, painting or coating materials, or anything similar?)

56. Yes [1] No [2] Don't Know [3]

Comments: _____

57*. (IF YES) "*Are any of these activities ever exposed to precipitation when it rains?

57. Yes [1] No [2] Don't Know [3]

Comments: _____

"Now, if you don't mind, I'd like to get just a rough idea about your facility size."

58. "Could you tell me the approximate size of the facility within the following ranges? Is the facility…

Less than ½ acre _____ (A) Between ½ and 1 acre _____ (B)

Between 1 and 3 acres _____ (C) Between 3 and 10 acres ____ (D)

Larger than 10 acres _____ (E)

Comments: _____

59. "Is there any substantial portion of that acreage that is lawn or open green space?

59.Yes [1] No [2] Don't Know [3]

Comments: _____

USF Industrial Stormwater Questionnaire: 2005 Code:

60.* (IF YES) *"Can you tell me the approximate size of the lawn or green space, using the following ranges? Is it…

Less than ¼ acre ____ (A) Between ¼ and ½ acre _____ (B)

Between ½ and 1 acre _____ (C) Between 1 and 3 acres _____ (D)

Between 3 and 5 acres _____ (E) Larger than 5 acres _____ (F)

Comments:_____

61. "Could you also tell me approximately how many employees are at this location, if I give you some ranges? Is it...,

1-4___ (A) 5-19___ (B) 20-49____ (C) 50-199____ (D)

200-499____ (E) 500-999___ (F) 1000 or more___ (G)

Comments: _____

(IF QUESTIONS) "*We just wanted to know how to categorize your facility- whether it is large or small. This is important because some smaller companies may be burdened with the same regulations as the larger ones."*

"Finally, I asked you earlier if you had ever heard of the Statewide Generic Permit for stormwater

62. "Do you know whether the facility at this location is subject to that permit?

62. Yes [1] No [2] Don't Know [3]

Comments: _____

63.* (IF YES)*"Do you know whether your facility has submitted the document known as the "Notice of Intent" to comply with the regulations?

63. Yes [1] No [2] Don't Know [3]

Comments: _____

Conclusion:

"That concludes our questionnaire. We are recommending that all facilities that have participated in this research learn more about the federal and local regulations regarding industrial stormwater. If you would like information about the regulations, I can give you a

web address or the phone number for the Florida Department of Environmental Protection. Would you like either of these?

(IF YES) ***http://www.dep.state.fl.us/water/stormwater/npdes/index.htm or (850) 245-8335.***

DID PARTICIPANT REQUEST WEBSITE OR PHONE NUMBER? Yes[1] No[2]

ALLOW TIME FOR PARTICIPANT TO WRITE DOWN THE CONTACT INFORMATION IF DESIRED. REPEAT AS OFTEN AS DESIRED.

(IF QUESTIONS ABOUT WHY THEY NEED TO CALL, ETC) ***"We are not suggesting that you're doing anything wrong or that you need to comply with these regulations. We don't have the training or the authority to make those recommendations. We're just trying to generate information about facilities in the county. However, it's always important to be knowledgeable about different regulations your facility may have to comply with and you may find some useful information. That's why we're recommending that everyone contact either the state or the county to get more information."***

Would you like to receive another copy of the initial contact letter we sent you a few weeks ago?

(IF YES) ***"Should I mail it to the address you confirmed earlier? Otherwise, I will write down your name and address or your FAX number on a separate paper, so that your name and your company's name is not associated with the answers you've just given me. I will send the letter and then destroy the paper.***

TAKE THE INFORMATION IF REQUESTED. AFTER SENDING A COPY OF THE LETTER, DESTROY THE INFORMATION IN THE SHREDDER IN NES 301 MAILROOM.

Do you have any questions about this research effort? If so, I can give you a name and number of the research director at the University of South Florida.

PROVIDE NAME AND NUMBER IF REQUESTED.

Professor Don Duke, (813) 974-8087, or by e-mail at ldduke@cas.usf.edu.

ALLOW TIME FOR PARTICIPANT TO WRITE DOWN THE CONTACT THE INFORMATION IF DESIRED. REPEAT AS OFTEN AS DESIRED.

Closing: "Thank you very much for your participation in this study and have a great day!"

Appendix 7. Industrial Stormwater Regulations Database Entry Form

Appendix 8. Fenceline Visit Form

USF Industrial Stormwater Fenceline Visit: 2005 Code # _____

USF Industrial Stormwater Facility Fenceline Visit Form

Site Visit Date: _____ Researcher Initials: _____
Current Permits: _____ _____ _____ _____ _____

A. Information to be completed prior to field visit.

1. Facility Name:
_____

SIC Code(s): Description:
2. _____ _____ _____
3. _____ _____
4. _____ _____
5. _____ _____

6. Address:_____
7. City: _____ 8. Zip: _____

B. Facility characteristics observable during fenceline visit

9. Agreement with database. *Please circle one of the following:*

A. Facility found – company name and location correct from original database
B. Facility found – name correct, location different
C. Facility found – location correct, name different
D. Facility indeterminable – location found, no sign (name) to indicate company name
E. Facility closed
F. No facility at location

10. Facility Type. *Please circle one of the following – the nearest approximation from visible evidence (i.e., while staying on public right ways).*

A. Industrial, with evidence of activities: plant yard, equipment, etc.
B. Auto salvage yard – significant outdoor scrap, salvage vehicles, parts, etc.
C. Transportation facility – dominated by maintenance, parking, or storage for vehicles
D. Residence with possible evidence of business or industrial activity (describe below)
E. Facility of undetermined type – unclear whether industrial (describe below)
F. Not industrial – office, storage, or other non-industrial activity (describe below)
G. Not industrial – residence with no evidence of business activity
H. Retail – facility is storefront, clearly used primarily for retail sales
I. Other (describe below)

Comments:_____
_____

USF Industrial Stormwater Fenceline Visit: 2005 Code # _____

11. Facility Size: *Approximate area within fenceline. (One acre is approximately the size of football field).*

A. < ½ acre B. ½ to 1 acre C. 1 to 3 acres

D. 3 to 5 acres E. 5 to 10 acres F. > 10 acres

12. Greenspace/lawn size *Approximate size of area not dominated by plant yard, industrial facility, equipment storage, etc.*

A. < ¼ acre B. ¼ to ½ acre C. ½ to 1 acres

D. 1 to 3 acres E. 3 to 5 acres F. > 5 acres

13. Other Comments about facility size and location *(e.g., large loading area, nearly everything contained indoors)*

_____

_____

_____

C. Evidence of industrial activities

Please circle the best description of the following activities and their likelihood of exposure to stormwater (to the extent possible during fenceline observation).

	Yes (A)	No (B)	Uncertain Not seen (C)	Unsure No Visible Evidence (D)
14. Manufacturing activities outdoors	XX	XX	XX	XX
15. Exposed to stormwater	XX	XX	XX	XX

16. Describe: _____

_____

17. Outdoor process equipment: compressors, rooftop equip., etc. in use	XX	XX	XX	XX
18. Exposed to stormwater	XX	XX	XX	XX

19. Type of equipment, quantity: _____

_____

USF Industrial Stormwater Fenceline Visit: 2005 Code # _____

D. Evidence of industrial activities, continued.

	Yes (A)	No (B)	Uncertain Not seen (C)	Unsure From Evidence (D)
21. Shipping and receiving areas	XX	XX	XX	XX
22. Exposed to stormwater	XX	XX	XX	XX
23. How many vehicles, size of area, etc: _____				
_____				
24. Storage of scrap, disused equip. waste bins, etc. (other than single, well kept dumpster)	XX	XX	XX	XX
25. Exposed to stormwater	XX	XX	XX	XX
26. Type of materials, quantity: _____				
_____				
27. Storage of raw materials: bulk matls, liquid drums/tanks, etc.	XX	XX	XX	XX
Notes: _____				
28. Exposed to stormwater	XX	XX	XX	XX
29. Type of materials, quantity: _____				
_____				
30. Plant yard: access roads, rail lines on site	XX	XX	XX	XX
31. Size of plant yard, type: _____				
_____				

(C) Uncertain / Not Seen: Parts of the facility not visible from outside fenceline; the activity/object may be present there.
(D) Uncertain / Unsure of What is Seen: Objects of activities visible during field verification may or may not fit the category.

USF Industrial Stormwater Fenceline Visit: 2005 Code # _____

32. Sites or equip. for trtmt/disposal of wastes or residues, appl'n of process water	XX	XX	XX	XX
33. Exposed to stormwater	XX	XX	XX	XX

34. Describe: _____

_____

35. Areas of past industrial activity, sig. matls. remaining exposed to stormwater	XX	XX	XX	XX

36. Other evidence of stormwater pollutant sources; other comments

E. Evidence of Stormwater Management Practices:

(*Evidence of structural features designed to contain and/or treat stormwater.)*

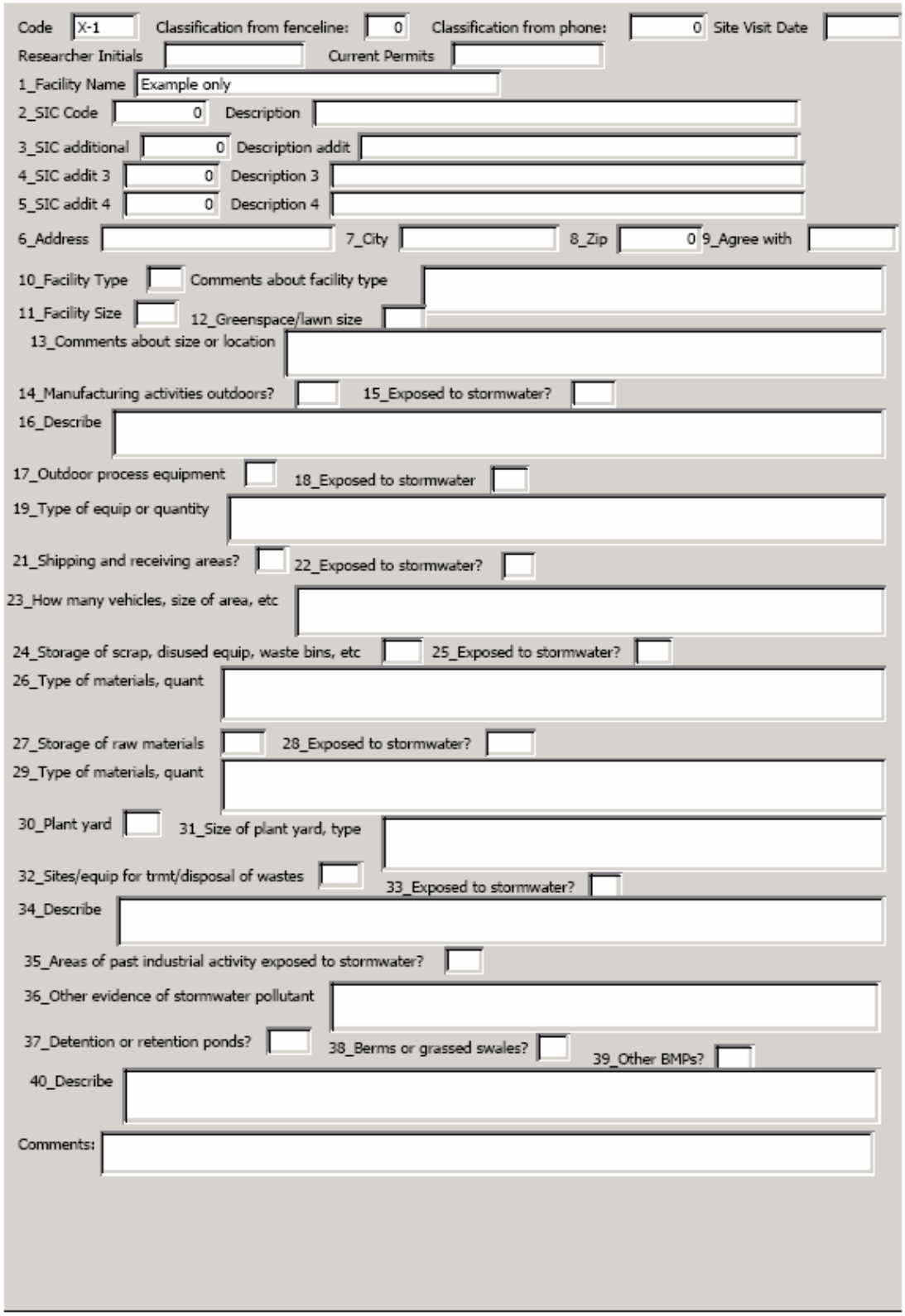
	Yes (A)	**No (B)**	**Uncertain Not seen (C)**	**Unsure No Visible Evidence (D)**
37. Detention or retention ponds	XX	XX	XX	XX
38. Berms or grassed swales	XX	XX	XX	XX
39. Other BMPs	XX	XX	XX	XX

40. Describe: _____

_____

(C) Uncertain / Not Seen: Parts of the facility not visible from outside fenceline; the activity/object may be present there.
(D) Uncertain / Unsure of What is Seen: Objects of activities visible during field verification may or may not fit the category.

Appendix 9. Fenceline Visit Database Entry Form



Appendix 10. Pollutant Generating Intensity Coding Scheme

Industrial facilities were classified as either zero/low intensity, medium intensity, or high intensity of contributing pollutants to stormwater. The results of the "Industrial Stormwater Regulations" questionnaire were tabulated based on a point scale. Each question, or series of questions, was assigned a possible point value, between zero and one. If a facility answered "no" to a question, a value of "zero" was assigned. For some questions, a "yes" response automatically generated a specific point value, whereas for other questions, the quantity of items or frequency of activity determined the final point value. For example, a facility received a higher point value related to outdoor vehicle use if it used a greater number of vehicles outside or stored them outside more frequently. Below are the survey questions and their respective point values. If not specifically listed, a "no" response receives zero points.

Materials 1.	#12-20, 22, 23 ≥ 1 Yes + # 24 No =	½ point.
Materials 2.	#12-20, 22, 23 ≥ 1 Yes + # 24 Yes =	1 point.
Materials 3.	# 21 Yes + #12-20, 22, 23 ≥ 1 Yes (see Materials 1 or 2)	
Materials 4:	# 21 Yes + #12-20, 22, 23 No =	0 points.
Materials 5.	(#24. If quantity given without prompting by facility and total of products is more than 10- 55 gallon drums and/or 500 feet^2 of material) =	1 ½ points.
Boneyard.	# 25 Yes =	1 point.
Hazardous Waste.	# 26 Yes + # 27 No =	0 points.
	# 26 Yes + # 27 Yes =	1 point.

Outdoor Equipment.	# 28 Yes + # 29. 1-2 small items or 1 large item =	½ point.
	# 28 Yes + # 29 ≥ 3 small items or ≥ 2 large items =	1 point.
Outdoor Vehicles.	# 30 Yes + # 31 A + # 32 A or E + # 33 No =	1/8 point.
	# 30 Yes + # 31 A + # 32 A or E + # 33 Yes =	¼ point.
	# 30 Yes + # 31 A + # 32 B or C + # 33 No =	¼ point.
	# 30 Yes + # 31 A + # 32 B or C + # 33 Yes =	½ point.
	# 30 Yes + # 31 B + # 32 A or E + # 33 No =	¼ point.
	# 30 Yes + # 31 B + # 32 A or E + # 33 Yes =	½ point.
	# 30 Yes + # 31 B + # 32 B or C + # 33 No =	½ point.
	# 30 Yes + # 31 B + # 32 B or C + # 33 Yes =	¾ point.
	# 30 Yes + # 31 C or D + # 32 A or E + # 33 No =	½ point.
	# 30 Yes + # 31 C or D + # 32 A or E + # 33 Yes =	¾ point.
	# 30 Yes + # 31 C or D+ # 32 B or C + # 33 No =	¾ point.
	# 30 Yes + # 31 C or D + # 32 B or C + # 33 Yes =	1 point.
Shipping/receiving.	# 34 Yes + # 35 Yes + #36 1-2 docks =	½ point.
	# 34 Yes + # 35 Yes + #36 ≥ 3 docks =	1 point.
Off-site vehicles.	Vehicle Maintenance: # 37 Yes + # 38 Yes +	
	# 39 1-2 + # 40 A or B + # 41 Yes =	¼ point.
	# 37 Yes + # 38 Yes + # 39 1-2 + # 40 C + # 41 Yes =	½ point.
	# 37 Yes + # 38 Yes + # 39 ≥ 3 + # 40 A or B + # 41 Yes =	½ point.
	# 37 Yes + # 38 Yes + # 39 ≥ 3 + # 40 C + # 41 Yes =	¾ point.

Refueling: # 37 Yes + # 42 Yes + # 43 1-2 + # 44 A or B + # 45 Yes = ¼ point.

37 Yes + # 42 Yes + # 43 1-2 + # 44 C + # 45 Yes = ½ point.

37 Yes + # 42 Yes + # 43 ≥ 3 + # 44 A or B + # 45 Yes = ½ point.

37 Yes + # 42 Yes + # 43 ≥ 3 + # 44 C + # 45 Yes = ¾ point.

Washing: # 37 Yes + # 46 Yes + # 47 1-2 + # 48 A or B + # 49 Yes = 1/8 point.

37 Yes + # 46 Yes + # 47 1-2 + # 48 C + # 49 Yes = ¼ point.

37 Yes + # 46 Yes + # 47 ≥ 3 + # 48 A or B + # 49 Yes = ¼ point.

37 Yes + # 46 Yes + # 47 ≥ 3 + # 48 C + # 49 Yes = ½ point.

Underground tanks. # 50 = Not Applicable, for County information only.

Plant yard, etc. # 52 Yes + ≤ 1,000 ft^2 = ½ point.

52 Yes + ≥ 1,000 ft^2 = ¾ point.

52 Yes + ≥ 5,000 ft^2 = 1 point.

Small equipment. # 54 Yes + # 55 Yes = ½ point

Outdoor activities. # 56 Yes + # 57 Yes = 1 point.

Low Intensity = 0 – 1 ½ points

Medium Intensity = 1 5/8 - 3 points.

High Intensity = ≥ 3 1/8 points.