

**UNIVERSIDAD AUTÓNOMA DE BAJA CALIFORNIA
FACULTAD DE CIENCIAS SOCIALES Y POLÍTICA
MAESTRÍA EN ADMINISTRACIÓN PÚBLICA**



**Tesis para obtener el grado de
Maestro en Administración Pública:**

**“Efforts to Prevent and Control Non-Point Sources of Water
Pollution in Tijuana and San Diego”**

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Nombre del Tema: “Efforts to Prevent and Control Non-Point Sources of Water Pollution in Tijuana and San Diego”.

Esfuerzos para la Prevención y Control de la Contaminación del Agua por Fuentes No-Puntuales en Tijuana y San Diego.

| Planteamiento | Preguntas de Investigación | Diagnóstico | Hipótesis | Objetivos | Marco Teórico |
|--|---|---|---|---|--|
| <p>Las ciudades de Tijuana y San Diego comparten una misma región natural que forma parte de la cuenca del Río Tijuana. Se trata de una zona en constante proceso de urbanización, el cual ha conllevado contaminación de recursos tan importantes como el agua, en gran medida causada por fuentes no-puntuales, es decir fuentes dispersas y múltiples representadas principalmente por la acción de muchos individuos. Se trata de un reto difícil que requiere de acciones locales cada vez más efectivas.</p> | <p>¿Qué dice la literatura especializada sobre prevención y control de la contaminación?</p> <p>¿Qué esfuerzos se están llevando a cabo en Tijuana y en San Diego para prevenir y controlar la contaminación del agua?</p> <p>¿Pueden esperarse avances para un posible proceso de homologación ambiental en Tijuana y San Diego?</p> | <p>Ambas ciudades vecinas procuran proteger sus cuerpos de agua; pero sus situaciones sociales y económicas son diferentes, por lo cual deben adaptar sus medidas a las condiciones propias, sobre todo en Tijuana, donde la escasez de recursos propia de un país en desarrollo es factor que promueve la búsqueda de alternativas y nuevas vías de acción. Partiendo de estos esfuerzos puede avanzarse en la cooperación y en un posible proceso de homologación de objetivos y resultados ambientales en Tijuana y San Diego.</p> | <p>Se toman medidas para prevenir y controlar la contaminación del agua en Tijuana y en San Diego; pero con recursos más limitados, en Tijuana deben explorarse nuevas acciones para ser más efectivos e incrementar el paso de un posible proceso de homologación de resultados ambientales en Tijuana y San Diego, pues hay ventajas en ambas ciudades que lo pueden favorecer.</p> | <p>Obj. General.</p> <p>Ver un posible proceso de homologación ambiental sobre prevención y control de la contaminación del agua en Tijuana y San Diego.</p> <p>Obj. Específicos.</p> <p>1. Conocer acerca de las medidas recomendadas para prevenir y controlar la contaminación.</p> <p>2. Conocer medidas que se están aplicando en Tijuana y en San Diego.</p> <p>3. Conocer elementos favorables en la situación de ambas ciudades para la convergencia ambiental.</p> | <p>-El enfoque de manejo de cuenca.</p> <p>-Conceptos de prevención y control de la contaminación.</p> <p>-La protección institucional del medio ambiente y de los recursos hidrológicos.</p> <p>-La participación social.</p> <p>Histórico.</p> <p>-La cooperación ambiental transfronteriza.</p> <p>-Los pasos institucionales y de creación del marco jurídico en materia de protección del medio ambiente.</p> |

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| Marco Jurídico | Indicadores Nominales | Indicadores Operativos |
|--|--|---|
| <ol style="list-style-type: none"> 1. Ley de Aguas Nacionales 2. The United States Clean Water Act 3. Normas Oficiales Mexicanas (NOM) 4. Acuerdo entre México y los EE.UU para la Cooperación y la Protección del Medio Ambiente en la Región Fronteriza (Acuerdo de la Paz, 1983) 5. Ley del Equilibrio Ecológico del Estado de Baja California | <p>De Perspectiva y Visión</p> <ol style="list-style-type: none"> 1. Entorno Geográfico y Transfronterizo 2. Los Objetivos Ambientales. 3. Entorno social y económico. 4. Acciones Gubernamentales. 5. Involucramiento Ciudadano. | <p>Niveles de contaminación.</p> <p>Capacidad de Monitoreo ambiental.</p> <p>Simplicidad administrativa y factibilidad económica.</p> <p>Grado de Participación Comunitaria.</p> <p>Medidas de Cooperación Transfronteriza.</p> |

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1. INTRODUCTION.

There are many kinds of territorial demarcation based on ecological criteria. One of them is the watershed. A watershed is a territory that rains into a river or body of water. This kind of geographical demarcation has the advantage over other natural units of being more clearly well defined and of having a determined territory. Besides, from its conception takes into account the absolute key role of water in the processes of life, as well as its importance for the human economy. A watershed management approach has been proposed by many academics and non-government organizations interested in the adoption of environmentally conscious public policies.

There has been an emerging awareness worldwide of the importance of addressing planning and development issues as well as environmental issues. Introducing ecological criteria to urban planning with aspects such as ecosystems delimitation has been part of the efforts in this direction. Specialists agree that a watershed is a logical ecological unit that delimitates a region because its boundaries are well defined. When we view ourselves as part of a watershed, we acknowledge the importance of water to all life processes and the interrelations to biodiversity and even to economic activities. It is a holistic way of seeing things, and thus a convenient approach to seek sustainable development (Barham, 2001, cited in Villegas, et.al 2004).

For many years several groups in the border region have been exploring the idea of a watershed approach to better address binational environmental management. The groups promoting or suggesting a watershed management approach range from NGO's, academics, and government agencies, among others. The Good Neighbor Environmental Board (GNEB) ---an independent federal committee that advises the U.S. President and Congress on environmental and infrastructure needs of border states with Mexico--- recommended an institutionalized border-wide watershed approach on its fourth report (GNEB, 2000, p.3, cited in Villegas, et.al 2004). The GNEB also suggested that federal funding should be provided for actions and programs that adopt a watershed approach (GNEB, 2000, p.3,

cited in Villegas, et.al 2004). The XXI Border Governors Conference’s joint declaration of August 2003 in the city of Chihuahua acknowledged the importance of watersheds. They requested that the United States Environmental Protection Agency (U.S. EPA) and the Secretariat of the Environment and Natural Resources (Secretaria del Medio Ambiente y Recursos Naturales, SEMARNAT) host a U.S.-Mexico strategic planning session to address management issues of shared water resources in the border region and provide additional funding for expanded monitoring of shared watersheds (Border Governors 2003, cited in Villegas, et.al 2004).

The Tijuana River Watershed is a natural area that has one part in Mexico and one part in the United States. This natural demarcation encompasses the international boundary between the cities of Tijuana, Baja California in Mexico and San Diego, California in the United States.

| Area geográfica | | XII Censo General de Población y Vivienda 2000/Vivienda/ | |
|-----------------|------------------------------------|--|--|
| | | Total de viviendas habitadas 2000 | Total de viviendas particulares habitadas que disponen de drenaje y disponen de agua entubada dentro de la vivienda 2000 |
| 02 | Baja California | 609 667 | 390 354 |
| 02001 | Ensenada | 92 269 | 53 213 |
| 02002 | Mexicali | 190 343 | 134 181 |
| 02003 | Tecate | 18 992 | 11 718 |
| 02004 | Tijuana | 292 579 | 185 232 |
| 02005 | Playas de Rosarito | 15 484 | 6 010 |

Figure 1

Total Households in Baja California (first quantitative data column: “Total de viviendas habitadas 2000”)

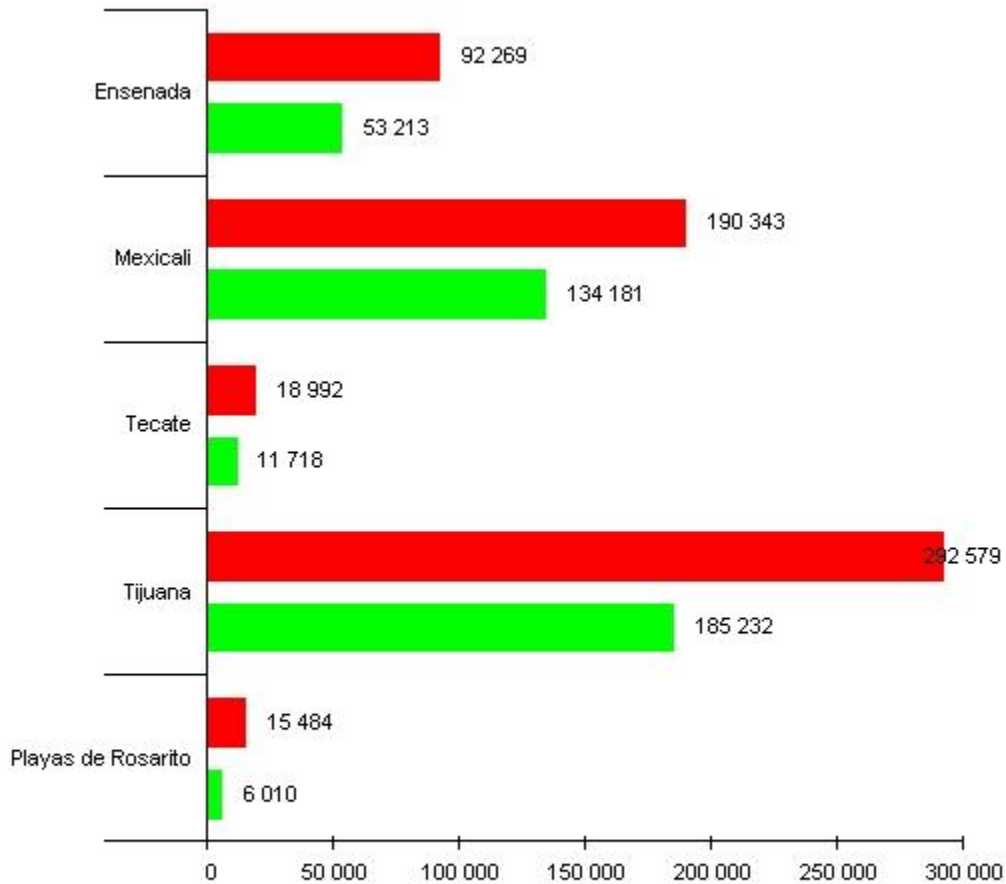
Total Households in Baja California with Water and Sewer services (last column of quantitative data)

Source : 2000 Census. INEGI.

Next illustration:

Graphical representation of Figure 1.

First bar represents total households. Second bar represents total households with water and sewer services.



Fuente: INEGI

www.inegi.gob.mx

Note: The availability of a sewer system is a factor to prevent water pollution by non-point sources.

A binational watershed management approach has been proposed for this area. Tijuana and San Diego form a big urbanized area where daily activities include actions taken by

individuals and businesses that pollute and render unusable the local bodies of water and aquifers.

According to studies, most part of water pollution comes from dispersed origins like individual persons and workshops, which are known as non-point sources. Much of the damage caused by these non-point sources happens when storm runoffs deposit their pollutants into the local aquifers and surface bodies of water. What goes to the storm sewage system, one can expect, goes to the local streams, rivers and aquifers.

Municipalities and public agencies in both sides of the border try to implement programs that reduce the magnitude of this problem.

The United States Environmental Protection Agency mentions that States report that contamination by non-point sources constitute the main problem faced today for water quality (EPA, 2003).

1.1 This project.

By carrying out qualitative research, this paper explores current efforts taking place at the local level aimed at preventing and controlling the pollution of the bodies of water and aquifers by non-point sources and storm runoff in the neighbor cities of Tijuana and San Diego, and explores ideas that could be applied in the future to improve the present situation.

1.2 Thesis statement.

Due to scarce resources for regulation enforcement in Tijuana, more community involvement, incentives and an innovative approach should be promoted in Tijuana in order to increase the pace of a possible homologation process with San Diego in regards to environmental goals like the prevention and control of water pollution by non-point sources.

1.3 Benefits.

Since Tijuana and San Diego form a transborder region and share a part of the same watershed, and considering the fact that environmental problems can transcend international boundaries, it is important to have organized local efforts aimed at preventing and controlling water pollution by non-point sources in both sides of the border. It is also important to acknowledge the great benefits of learning from what it is being done in a neighboring city that shares the same natural region but experiences different social and economic conditions.

In addition, by trying to homologize the results of environmental policies, more communication and coordination is encouraged, and the synergies that can arise from working together can produce better improvements for the environment in both sides of the border.

1.4 Summary.

This paper has presented an introduction to depict the project it represents. Its investigation work basically qualifies as qualitative research.

A literature review on related contents will follow.

Notes on the methods of research used here will come next.

Later, the results and findings that unfold from the work in this paper-project are given.

After this section, it comes one with conclusions. Finally, there is a word on possible further related research.

2. Literature review.

According to Hirsch (et.al., 2001) there is not much knowledge on the issue of non-point sources of water pollution and the effects of their contaminants in the quality of our water and the human health. One can see in his position that we need to have a more complete panorama based on science and in a more thorough study of the conditions and patterns

found in our sources of water and watersheds in general. This would be the basis, for example, for better watershed management policies in urban areas. Nevertheless, some data, though, has been collected, and shows information like the following: (1) “volatile organic compounds (VOCs), used in plastics, cleaning solvents, gasoline, and industrial operations, occur widely in urban ground water throughout the United States” (Hirsch, et.al. 2001) and (2) “population density, which is strongly related to traffic density, is a predictor of lead and zinc concentrations in the environment” (Hirsch, et.al. 2001). Worthy of note is the remark that “effective solutions(...) depend on the commitment of a multitude of individuals because non-point pollution results largely from everyday activities” (Hirsch, et.al. 2001).

There is literature on the issue of pollution control and researches done on this subject that have produced knowledge that can be applied to formulate reasonable alternatives.

There is an article-report by Ribaudo (1999) published by the Economic Research Service of the United States Department of Agriculture on the field of economic incentives as instruments for non-point pollution control. It speaks about the use of taxes or subsidies to influence the way activities that can pollute are conducted. It says that there is not a single instrument that could be generally applied as the only and best solution to run-off pollution by non-point sources. According to the article, there are many circumstances to consider, and there are not enough ways at present time to accurately evaluate the performance of most single instruments aimed at achieving the reduction of water pollution by non-point sources. What it is recommended here is that the agencies in charge of controlling pollution by non-point sources use a variety of instruments, like incentives in the form of subsidies to stimulate certain ways of doing things, taxes that punish negative externalities and the implementation of pertinent rules, standards and a permit issuance system. Education and research also have a role to play in the reduction and control of water pollution by non-point sources. This article-report gives a perspective and systematic analysis of several policy instruments that can be used by government agencies that try to improve the situation of water pollution by non-point sources. It also indicates that in order to arrive to the best suited combination of policy instruments to control water pollution by non-point sources, an empirical assessment of a local situation has to be carried out first,

because these instruments should be selected to be adequate for the local conditions and the goals that environmental policy wants to achieve in a given locality. This article-report focus more on rural water pollution but has relevant concepts that can be useful for environmental policy applications in urban environments. It also recommends a watershed approach to water pollution control, and it speaks in favor of an active role of the federal government, based on the grounds of the Clean Water Act of 1972 and the Clean Water Action Plan of 1998. This article-report says that the federal government can coordinate the work of local and state governments to achieve national goals and mitigate the conflicts arising from transboundary water issues. It says that the federal government can better support research and facilitate the implementation of programs based on scientific data by local governments. Another important role of the federal government is the establishment of minimum standards that should be observed in every state and locality. The establishment of these standards have advantages that mean advancing to the national goals of water quality.

One section of this article-report is dedicated to the role of the education of producers as a policy instrument for the prevention and control of water pollution from non-point sources.

In this section it is said that education programs are popular because most of the infrastructure to implement them is already in place, because they are "a benign form of intervention"(Ribaud,et.al, 1999) in the sense for example that these education programs do not force anybody to conduct themselves in a particular way, and because there is the probability that better practices that have a positive result in water quality are adopted by the participants. But the author points out that education programs can more probable succeed in encouraging the adoption of better practices for water quality when these actions also increase profitability, or when there is enough altruistic attitudes in the participants or when the costs of reduced water quality affects them directly. If these features are not present, education programs may not translate into the adoption of better practices and thus the objective of achieving better water quality may not be met.

There are also contributions by authors working with the World Bank, like Hemamala Hettige (et.al,1996) and David Hanrahan (1997).

Hettige (et.al, 1996) prepared an article that appeared in the publication “World Development” in December 1996. This article speaks about the determinant factors to abate pollution in developing countries. It presents the findings of a recent study carried out in South and Southeast Asian countries. According to these findings, the countries of South and Southeast Asia are incorporating to their public administration systems, environmental standards and regulation frameworks that are somehow similar to the ones that exist in developed countries; but these regulations tend to be less clear and their enforcement is procured with more limited resources and not very well trained personnel in many instances. But despite these circumstances, not only very pollutant production facilities can be found in these countries, clean production plants can be found as well. An analysis of plant characteristics and economic and social factors and their relation to environmental performance is showed: bigger scale, efficiency and the use of new technology works in favor of cleaner production; public ownership works against it. Foreign ownership looks to be a neutral factor. Community pressure can make a difference as a social and external factor to induce cleaner production facilities. This community action and intervention seems to obtain better results where higher levels of income and education are present. This article also mentions that even though the formal regulation framework seen in this study may not be as effective as it should and may have several weak points, its existence propitiates environmental progresses that otherwise may not have taken place.

David Hanrahan (et.al., 1997) has an article called “Persuasion and Incentives” that speaks about alternative ways to prevent and control pollution in our world. He prepared it with the staff of the World Bank's Technology and Pollution Policy Unit. The article describes tools that can be used by environmental government agencies as incentives to stimulate better practices and achieve their environmental goals. These tools constitute a complement or some cases even an alternative to the traditional regulatory systems. The first tool that is mentioned here is the application of the leverage that public opinion can provide to force companies to comply with environmental standards. The power of public opinion can work for example where there are formal regulations in place that can be requested to be applied more strictly to a certain establishment by popular demand. Where there are not formal regulations in place, the power of public opinion can fall upon a

pollutant company for example, and pressure them for environmental compliance by negotiating and letting them feel the negative possibilities of social unrest scenarios and political action. Adequate and accurate reports should be provided to the community leaders that engage in these negotiations.

Continuing with the application of the leverage that public opinion can provide to force companies to comply with environmental standards, this article goes on mentioning the forces of the market that can work in favor of this environmental compliance. Basically, the reputation of a company matters and can impact its revenues, and when it comes to environmental performance, the company's reputation can be at stake. Customers, suppliers and other company stakeholders can judge it and push for the adoption of voluntary commitments that seek environmental goals. Public recognition is the key concept here. It is mentioned that the World Bank promotes the conveyance of industries, the community and local governments to address the priorities of environmental course of actions. An actual example of the use of this public opinion tool by government agencies to enhance environmental compliance is Indonesia's PROPER program. In the face of growing pollution problems, the environmental protection agency of Indonesia came out with a creative program to rate the environmental performance of the country's production facilities. Once the ratings are determined, comes the disclosure stage, where the results of these monitoring are made available to community groups and other kinds of organizations. To make the results of these inspections public empowers the people. The leverage of public opinion here consists on letting the forces of the market and the community compels polluters to correct their bad practices if they exist. Proceeding this way the government agencies in charge of enforcing the environmental laws can save on administrative, operational and legal costs, for which usually there is not enough funding in developing countries. Another interesting result of this tool is that companies that sometimes try not to give much data to inspectors now try to divulge their good environmental conduct, with the consequence that agencies can be better informed.

Another instrument for improving environmental performance that can be applied is the implementation of a process to flexible regulations to make environmental policy more proactive and locally focused. The most common approach to conduct environmental

policy has been a traditional one based on issuing permits, carrying out inspection and enforcement in general. But if the approach becomes more proactive, more concentrated in preventing pollution before it occurs instead of centering it on cleaning what has been polluted already or just looking for situations that are pollution problems to be fixed, then the production and management processes at the companies can be impacted and pollution levels further reduced. In regards to localizing some standards and norms, the authors say that having national laws and standards is convenient because it can provide clear rules that everybody is expected to follow, promotes uniform and equitable requirements and facilitate the achievement of national goals. But there are localities that may have particular conditions that impose for example different compliance costs to companies, or that need to elevate standards, or introduce innovative regulation mechanisms, etc. In these cases regulation systems could be open to adaptation and enrichment according to local needs. This article mentions the hypothetical example of a local authority that in a watershed requests that an industry association appoints a representative to a council with the task of determining rules and standards for water discharges. This representative would be accountable for the performance of the industry. An advantage in cases like this is that when the companies of a given industry discuss between themselves and improve in some way their environmental results, the progress is achieved with less administrative and operational costs of the environmental enforcement agencies.

The next tool mentioned here for environmental improvement is the implementation of self regulatory schemes, namely environmental management systems, EMS. Sometimes incentives and disclosure of environmental performances do not produce enough betterment, but if a self regulatory mechanism is added then that situation can improve. An environmental management system is basically a program consisting of procedures that a company puts in place to have a better environmental performance. They usually include an assessment of their environmental impact, definition of goals, an action plan, monitoring and reporting activities. In this area of environmental management systems, there has been increasing attention for the work of the International Organization for Standardization (ISO) that is trying to define certain characteristics that an EMS should have. They have come out with the ISO-14000 series of standards for environmental management. An

established series of standards mean a common base for comparisons and outside verifications, and also prepare the grounds for certification. The potential that this type of environmental certification has and its possible ramifications to international trade issues is building up attention from developed countries due to the possibility of utilizing environmental certification as trade barriers or requisite to enter a market. Notwithstanding what has been said, it is not clear to a number of specialists whether the generalization of self regulatory mechanisms like environmental management systems analogous to ISO-14000 can appropriately supplant the inspections, audits and reports that may be mandated by government regulations (Hanrahan, et.al. 1997). This article makes a brief notice of the pilot program that is being tried in Mexico to transfer the ISO-14000 practices of big companies to their suppliers. It is hoped that this experience could be applied in other countries.

The last tool mentioned in this article is the use of market-based instruments, basically meaning the creation of pollution charges for companies and subsidies or financial incentives to encourage better environmental behaviors. This kind of tool is supposed to be more flexible and cost effective than "uniform command-and-control regulations"(Hanrahan, et.al. 1997). But the implementation of programs that use market-based instruments should be carefully designed in order to effectively lead to the desired environmental improvements.

The article ends by reminding that solely relying on "punitive approaches"(Hanrahan, et.al.1997), specially when enforcement resources are scarce, is not effective enough, and that persuasion and incentives give regulation agencies more means, for example to adjust their efforts to local circumstances, and be able to achieve more objectives and improve the environment in a better way. Still, the new tools showed here may not work for everybody: "...there will always be some polluters who resist persuasion and incentives, and for these there must be a credible threat of real punishment. The old saying holds: "walk softly but carry a big stick." (Hanrahan, et.al. 1997)

Some authors have also written about the idea of a kind of environmental services bonus that can be paid to the proprietors of certain pieces of land in exchange for not developing them and protect this way the natural processes that occur in those lands that provide

important “environmental services”. For example, a local community could opt to pay an owner of a piece of land for not constructing there because it is an important aquifer recharging zone (Espejel, Ileana and Paul Ganster, 2004).

There is an article by Lyn Turney and Catherine Pocknee (2005) that speaks about the use of the new information and telecommunication technologies, like the Internet, in the execution of qualitative research projects. It says that sometimes it is difficult to convey persons to participate in certain focus groups that are supposed to engage in face to face research procedures, and that these difficulties can happen for several reasons, including physical dispersion of the target population and reluctance to join in face to face open contact. The authors employ the term "virtual focus groups" used by Adler and Zarchin (2002). The article continues describing the experience of their case study and brings into view some recommendations, like the further use of on-line discussion boards, the utilization of a university telecommunication infrastructure and the particular appropriateness of virtual communication tools to carry out qualitative research with difficult to access or recruit persons. The article also incorporates a note on equity and social justice aspects that should be considered when applying or utilizing information communication tools (ICTs) for qualitative research. It basically makes the point that "asynchronous ICTs" are preferable over "synchronous" communications tools, because they give time to persons that are not very familiar or educated in the use of computers, to prepare the steps they have to take to submit their answers (Turney and Pocknee, 2005). It concludes saying that new communication technologies will offer new opportunities to incorporate more populations that were previously difficult to include into many research projects.

There are many books on the Social Science of Economics that have a chapter that mentions the subject of pollution control. Representative examples of this are the two books entitled "Economics", one by Stanley Fischer (et.al, 1989) and the other by Wonnacott (1983), both published by McGraw Hill and used as textbooks in schools and universities.

2.1 Similar projects.

There are many efforts taking place worldwide for improving the conditions of the environment. There are an increasing number of studies and researches being carried out to have more knowledge about environmental issues. By proceeding in this direction, a better understanding about options to prevent and control many kinds of pollution, including water contamination, can be achieved and later applied.

Parts of the world's projects on environmental issues that go beyond international boundaries have been undertaken in Europe. This has been favored by the integration policies that exist in the countries of the European Union.

International efforts on the environment can also be found along the United States-Mexico border zone. This region has the challenge of having substantial social and economic asymmetries. These contrasting conditions are not commonly found in other places of our planet and pose a particular need for creative responses that take this circumstance into account.

There are programs in the San Diego-Tijuana transborder region that have an impact on the prevention and control of the contamination of local bodies of water, both surface and underground. In the two cities regulations and programs that can affect the level of water quality in natural spaces have been created and are being carried out by different agencies.

A paper that looks into these efforts happening in these neighbor localities which at the same time tries to incorporate a transborder view of these urban events is not a prevalent occurrence.

3. Methods of research.

On the grounds that there is available literature related to this paper-project, a significant part of the work being done has been focused on the search for relevant publications. In this search, the World Wide Web has been the main source of articles and data. The Internet is a convenient and pertinent place to explore for scientific reports,

documents, statistics, etc. because it is loaded with huge amounts of information. Some documentary research in libraries has also been undertaken.

Another research activity that has been interesting to carry out is the interviewing of persons active in areas related to this thesis-project.

The investigation for this thesis-paper could be basically qualified as qualitative research.

3.1 Describing information gathering.

A significant amount of time dedicated to information gathering has been spent in front of a computer browsing in the Internet looking for relevant web pages, articles, etc. Time has also been employed to speak by telephone to previously selected public agencies trying to reach persons that could talk about actual situations and activities taking place. The arrangement of appointments for interviews was another objective of these calls. Several interviews were finally carried out. Other tasks included visiting libraries and reading continuously.

The EcoTijuana Industrial Expo was a fortunate event that happened during the preparation of this thesis-project. It was an exposition organized in the city of Tijuana that gathered environmental public agencies, recycling companies, corporations that wanted to show their commitment to the environment and the media. It was possible to meet several persons that are involved in activities that have an impact on water pollution prevention and control.

3.2 Interviews.

Ms. Martha Sandoval, with an educational background in Chemistry, is the head of the Tijuana office of the Mexican Environmental Protection Enforcement Agency, the "Procuraduria Federal de Proteccion al Ambiente", also known by its acronym "PROFEPA". She was interviewed by telephone first. After a few days, a brief visit to her

office was able to be arranged and she took the time to speak in person about issues related to this thesis-project.

Interviews were the occasion also to gather publications prepared by the same agencies that were being visited.

Other persons were interviewed, including public servants visited in the State government building in Tijuana, the Municipal government building of Tijuana and the Eco-Tijuana-Industrial Expo event that took place on November 22, 2005.

Here are mentioned:

Mr. Alejandro Montiel, Director of the Municipal Institute for the Youth, Instituto Municipal de la Juventud.

Marco P. Espitia V., student of the CECYTE (Colegio de Estudios Cientificos y Tecnologicos Estatales) High School, El Florido campus.

Mr. Juan Vega, Deputy Director of the Municipal Environmental Protection Department.

Ms. Ivonne Vazquez, G.A.N. recycling company.

Ms. Xochitl Eguiarte, Chief of the Analysis Section of the Department of Ecology of the State of Baja California.

Ms. Guadalupe Navarro, Audit Section of the Department of Ecology of B.C.

Mr. Edgar N. Flores B., Engineer of CESPT (Comision Estatal de Servicios Publicos de Tijuana) water utility.

Ms. Cristhabel Verdugo, Analysis and Audit, Department of Ecology of B.C.

Ms. Monica E. Tamayo, Coordinator of Emissions Monitoring, Department of Ecology of B.C.

Mr. Antonio Martorell, Corporate Sales Representative, Telefonica Movistar cellular telephone company.

Ms. Alma P. Tovar A., RIMSA recycling company.

3.3 Data collection.

The data used in this thesis-project have mainly come from secondary sources. An additional source has been direct interviews.

3.4 Internet

The Internet has been widely employed as the principal instrument for information research. Having the background of recognizing certain key concepts related to water pollution issues, search engines available in the web have been put to work to find Internet sites that by containing these concepts or words lead us to relevant and more ample information.

Another course of action has been to go directly to the web pages of organizations or institutions that are involved with the issues addressed in this thesis-project. The Internet has advantages as a tool for data collection. It can be practical, economical, schedule adaptable, and certainly abundant with information.

3.5 The telephone.

The telephone is a useful tool for research because it allows conducting needed interviews saving transportation time and working time both to the interviewer and to the interviewed. Sometimes it is easier to get information this way, probably because it is more convenient to the interviewed person and this probably makes him more comfortable and willing to participate. This happened during the course of this thesis-project and relates to what is said in the article of Turney and Pocknee (2005) in regards to the convenience of using telecommunication technology to carry out qualitative research.

3.6 Libraries.

Libraries have been visited too. Libraries offer abundant opportunities to gather acquired facts contained in documents, books and many kinds of other pertinent publications. They are also providers of access to the internet and electronic databases.

3.7 Computer analysis tools.

Basic computer software has been utilized, primarily to organize data, and sometimes to explore the probability of looking for signals of possible correlations.

4. Results and findings.

The Clean Water Act of 1972 has a goal that could be described as advancing towards fishable and drinkable waters in the United States (City of San Diego Web page, 2005). Based in the mandate of this law, the U.S. Environmental Protection Agency established the National Pollutant Discharge Elimination System (NPDES), which is a permit issuance program. This program is aimed at point sources, like the discharges of sewer systems owned by the cities and counties. So permits are issued for state water authorities, cities and counties conditioned to certain steps that they should put in place to reduce contamination. In the case of San Diego, the California Regional Water Quality Control Board issued a five year water discharges permit to the cities of San Diego County under certain requirements. Based in this process, the city of San Diego came out with its Storm Water Pollution Program and its Urban Runoff Management to comply with the requirements of this discharge permit, which has pollution reduction goals. These programs put important attention on regulations, enforcement and control. They also include best practices guidelines for households and businesses focused on reducing pollution by non-point sources.

The issue of water pollution has been addressed by the government agencies involved in this matter in the cities of San Diego and Tijuana. Private sector organizations that have an interest in this concern have a participation too in the local efforts to prevent and control water pollution.

Disperse sources of water pollution like automotive repair workshops, households and individuals are known as non-point sources. These non-point sources constitute one of the main origins of water pollution, in part because of their quantity and multiple locations, particularly in urban areas. This dispersion leads us to the problem of monitoring and controlling them as producers of pollutant and toxic substances.

San Diego and Tijuana are highly populated cities and have diverse industries and businesses.

Both cities have incorporated environmental criteria to different sections of their strategic development plans. Documents like the Plan Estrategico de Tijuana account for the growing importance given to Sustainable Development.

The cities of San Diego and Tijuana share a transborder region and they certainly share its natural environment, and therefore, its problems. It has been said that "transboundary cooperation seems to be the most rational tool for handling border issues" (Lara 2001, p.65 , cited in Villegas, et.al 2004), and fortunately this seems to be happening between the cities of San Diego and Tijuana in regards to areas of pollution prevention and control. The municipal government of Tijuana is introducing an environmental self regulatory instrument for small industrial, commercial and service sector establishments. This program is called "Negocio Verde", Green Business, and its design is based in the San Diego Area Green Business Program, which provided advice and operational training to its Tijuana's counterpart. At present time this Green Business program in Tijuana is being focused in establishments related to the automotive industry, like vehicle repair workshops. This kind of businesses handle a considerable amount of hazardous materials of common utilization, like motor oil and batteries, which have an elevated potential to contaminate water if they are not disposed of properly. The Green Business program is being implemented working together with the local chapter of the National Chamber of Commerce, CANACO, and is helping to introduce the concept of an Environmental Management System to many local businesses that are not familiar with it. Things like tramps for motor oil spills in automobile repair workshops and more materials to recycle are part of the measures included in this program that the Tijuana city government is nowadays undertaken, Oceanology specialist Mr. Juan W. Vega M., deputy director of the municipal environmental protection department of Tijuana points out.

The Agreement between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area, known as the 1983 La Paz Agreement, established a framework for cooperation on the

reduction, elimination or prevention of sources of air, water and land pollution (EPA, 2001, cited in Villegas, et.al 2004).

The 1944 Water Treaty deals with boundary water issues in the United States- Mexican border. It gave the International Boundary and Water Commission (IBWC) the responsibility of managing water issues of the Rio Grande, the Colorado River and the Tijuana River. The IBWC and its Mexican counterpart, the Comision Internacional de Limites y Aguas (CILA) oversee the compliance of the boundary and water treaties between the two countries.

They also operate and maintain the infrastructure built as a result of the agreements (IBWC, 2004 , cited in Villegas, et.al 2004). IBWC/CILA have passed a series of minutes reflecting agreements of both countries to share important technical data, to work jointly to identify measures of cooperation on drought management and to establish a framework for cooperation by both countries to develop joint studies that address the use of water for ecological purposes, among others (IBWC, 2004 , cited in Villegas, et.al 2004).

In 1981 the presidents of the United States and Mexico, Reagan and Lopez Portillo, established the U.S. -Mexico Binational commission to provide a forum for meetings between cabinet-level officials fro both countries (Van Schoik, et.al., 2004 , cited in Villegas, et.al 2004). As a result of recommendations of the Binational committee, the Border Liaison Mechanism (BLM) was established in 1993 to have a somewhat formal tool for local authorities in the border to convene to address particular problems and challenges. The General Consuls from the border cities convene the involved parties. The BLM is useful because it enables local governments and agencies from both sides of the border to directly engage in transborder collaboration (Villegas, et.al 2004).

The most recent program border-wide is the Border 2012 program, which has its legal basis in the La Paz Agreement. It is a ten year program created by the U.S. Environmental Protection Agency and the Secretariat for the Environment and Natural Resources (SEMARNAT) in collaboration with U.S. and Mexican Border States governments, border tribes, the U.S. Department of Health and Human Services, the Mexican Secretariat of Health and others. The plan is a joint effort to improve the environment and public health along the U.S.-Mexican border through locally generated decisions. The program has

regional workgroups, border-wide groups and policy forums, all of them with their respective ask forces to help achieve the mission of the program (EPA Border 2012 program , cited in Villegas, et.al 2004).

There have been several collaboration efforts, both formal and informal, in the Tijuana River Watershed region to address water issues and resource management. Local efforts of collaboration include the creation of the San Diego Association of Governments' (SANDAG) Committee on Binational Regional Opportunities (COBRO), the Border Water Council (BW), the Binational Watershed Advisory Council (BWAC) and he pilot planning projects such as the Las Californias Initiative and the Tecate River Park to name few (Villegas, et.al 2004).

The Border Water Council (BWC) for the San Diego region and Baja California was created in 1997 through the Border Liaison Mechanism (SANDAG, 2004 p.4, cited in Villegas, et.al 2004). The BWC was created to explore the options for the conveyance of water from the Mexicali and Imperial Valleys to San Diego and Tijuana. The co-chairs of the BWC are representatives of the San Diego County Water Authority (SDCWA) and of the Comision Estatal de Servicios Publicos de Tijuana (CESPT) (Brown, et.al., 2003, cited in Villegas, et.al 2004). Some critiques of this effort are that it was narrowly constrained to water supply issues, the leadership of the meeting limited public participation, and that it was a barrier to advance to an open regional dialogue on binational water resources issues (Brown and Mumme, 2000, cited in Villegas, et.al 2004). Despite critiques, the BWC is recognized as a great effort of binational collaboration and "the first of its kind that included active participation from federal, sate and local water entities from both sides of the order"(SANDAG, 2004, cited in Villegas, et.al 2004)

The Binational Watershed Advisory Council (BWAC) was convened in November 2002 to develop a binational vision for the Tijuana River watershed. The BWAC consists of U.S. and Mexican stakeholders and two co-chairs, one from the United States and one from Mexico. he vision contains the recommendations of local citizens and stakeholders about the ideal state for the future of their watershed. An interesting aspect about this project is that it looks at the watershed in a holistic manner considering not only environmental characteristics, but also social, cultural, and economic aspects of the

watershed, among many others. This effort was organized by the Institute for Regional Studies of the Californias and the Geography Department at San Diego State University, the Autonomous University of Baja California and the Colegio de la Frontera Norte. Funding for this project was from the State of California. The BWAC is now Border 2012's Tijuana River Watershed Task Force (Villegas, et.al 2004)

Current laws, treaties and conventions do not provide specific ways to formally manage international watersheds. However, EPA and CNA have been promoting a watershed management approach.

The clean water act of 1972 and the Safe Drinking Water Act give the United States Environmental Agency (EPA) jurisdiction over watershed management issues and coordination attributes to carry on its tasks. the main objective of this laws is water quality protection, a key element for watershed health.

Pollution levels in the U.S. have been decreasing, in big parts due to the work and the infrastructure constructed by the EPA, but there are still challenges in this field. The EPA has a number of programs to reduce pollution in watersheds all over the United States. By mandate, the EPA has been working in many fronts and creating important tools such as acceptable standards for any substances present in the waters of both urban and farming areas of the United Sates (EPA, 2004, cited in Villegas, et.al 2004)

The current Mexican National Water Law (Ley de Aguas Nacionales, LAN) enacted during the administration of president Carlos Salinas, was reformed in 2004. This reform reflects a new tendency in Mexico towards a more holistic view of water systems. It aims to adopt a watershed management approach to better handle water resources and oversee watershed viability in the future. This reformed law attempts to prevent pollution in watersheds, control the extraction of water and control by promoting rational use f water and its protection. By doing so it also procures the well being of entire ecosystems for which water is so important (Villegas, et.al 2004).

The LAN gives the National Water Commission (Comision Nacional del Agua, CNA) attributions to prevent pollution in watersheds and to coordinate with local governments to implement this policy. the reformed law established Watershed Committees (Organismos de Cuenca) in which representatives from all governments and agencies that are involved

with water issues participate in the creation of local watershed policy. The LAN also enables international coordination in watershed management issues by allowing foreign stakeholders a voice in organismos de cuenca, but not a vote.

The Mexican official Norms (Normas Oficiales Mexicanas, NOM) are laws and standards that deal with the quality of drinking water and with residual water discharges among other things. Watershed policy and infrastructure recommendations by the CNA should be in accordance with the LAN and the corresponding official norms (CNA 2004 and CDDHCU 2004, cited in Villegas, et.al 2004).

4.1 Facts.

In the United States, the Clean Water Act of 1972 gave the U.S. Environmental Protection Agency attributions to establish a water discharge permits system. With this system, the E.P.A. delegated to State regional water authorities the capacity to administer water discharge issues by giving them permits and managing their water improving programs within this framework. The State water authorities issue permits for cities and other local jurisdictions as well that allow them to discharge residual waters through their sewer systems. These permits are given conditioned to the existence of a series of water improvement programs and regulations that include for example better water quality goals and pollution control measures. (City of San Diego web page, 2005)

The programs of the city of San Diego aimed at preventing and controlling water pollution by non-point resources have many regulations and specific rules for many kinds of activities. They provide for extensive inspection and audit capacity. These programs also provide a series of instructions to indicate better practices for many industrial and commercial activities. An important tool for the city agencies trying to prevent and control pollution is their attribution to issue permits for new construction projects, developments and business establishments in general that need to discharge residual waters or that imply some kind of non-point source of water pollution within their space or activities. Actions taken place in San Diego include the preparation of the Watershed Sanitary Survey that reports on sources of water pollution in the supplying watershed. This report also gives

recommendations to resolve these problematic cases. Another activity being carried out in San Diego is the elaboration of a list of local bodies of water that need to be cleaned up. With this list in hand, the process of seeking funding for these cleaning projects can proceed.

In Tijuana the Federal Government, the State Government and the Municipal Government work within their attributions related to water pollution issues. They work in different fronts but their concrete efforts converge.

One example of this is the Mexican Environmental Protection Enforcement Agency, the "Procuraduria Federal de Proteccion al Ambiente", also known by its acronym "PROFEPA", the institution in charge of enforcing the federal environmental laws in Mexico. One specific field of responsibility PROFEPA is the area of hazardous materials. PROFEPA can intervene where there are processes of hazardous materials management and disposal. There are many hazardous materials that are used in daily common activities that are carried out in businesses and households. The amount of hazardous materials in our cities that can pollute local bodies of water is quite considerable in part because of how common their usage is. Examples are automotive motor oil and batteries that contain toxic metals. When an automobile repair workshop or an individual does not dispose properly of these materials he becomes a non-point source of pollution. Non-point sources of pollution, according to specialists, are probably the main sources of pollution in our cities. Due to their dispersion, they are difficult to monitor and control.

If hazardous materials are discharged to the sewer drain, to the storm drainage, to the municipal landfill or simply to the street, they can seriously pollute the local bodies of water and aquifers and thus make them unutilizable. Storm runoff is another problematic factor to observe in this situation, because it expands the range of these pollutants over a more ample territory. This fact represents a challenge for environment protection agencies everywhere, in developed and developing countries.

The environmental law enforcement carried out by PROFEPA has two principal sides: its programs can be grouped in two general classifications or kinds of mechanisms. These mechanisms are (1) coercive mechanisms and (2) voluntary mechanisms.

In its origins, PROFEPA was created in great part to focus on big polluters and certain environmental problems that needed immediate attention. With time, this agency enlarged its scope and circuit of action.

In regards to hazardous materials, nowadays PROFEPA carries out inspection audits in all kinds of businesses. Notwithstanding this practice though, there is a mutual understanding with the state environment authority, the Department of Ecology, Departamento de Ecología, that most small and micro generators of hazardous materials fall within the state jurisdiction and control. Usually PROFEPA and State Ecology inspections are done by random selection, but these inspections also occur when there is a denounce from the community against a certain establishment.

Voluntary programs are becoming an increasingly key part of PROFEPA's work to procure environmental law compliance. They basically consist of self environmental audits done by the own participant businesses and an authorized independent auditing unit. After compliance has been verified, then certification can be granted. There are different levels of certification according to the level of environmental commitment and management put in place in a particular establishment.

PROFEPA can also intervene in cases where several entities have to work together to tackle a serious environmental problem. For example, if there is a case of contamination of an aquifer with gasoline, this aquifer has to be cleaned, and it can be expected that the works to complete this cleaning would involve several agencies and companies.

An action that PROFEPA has engaged in is to establish coordination with the association of automotive repair workshops, a section of the organized business that form the Tijuana Chapter of the National Chamber of Commerce, the "Camara Nacional de Comercio, widely recognized in Tijuana with its acronym CANACO. By approaching the organized business community PROFEPA tries to encourage voluntary participation and compliance with environmental directives.

In regards to the bodies of water localized in Tijuana, the National Water Commission, the "Comision Nacional del Agua" known as CONAGUA, handles the administration of these resources and oversees their proper exploitation. The activities of CONAGUA include the issuance of concessions and permits for the exploitation of these water

resources and monitoring according to standards established in pertinent Mexican Official Norms, Normas Oficiales Mexicanas, NOM.

The new Mexican General Law for the Integral Management of Residues, "Ley General de Gestion Integral de Residuos" that has just been enacted and is being gradually introduced, has the characteristic of organizing the different responsibilities of the local, state and federal government. With this law, the local government of Tijuana has more authority in the environmental area and more attributions to enforce environmental laws. The local government of Tijuana is becoming more involved in the prevention and control of pollution by hazardous materials.

Another law that can have an influence in environmental control is the Mexican Access to public information Law, Ley Federal de Acceso a la Informacion Publica, Pharmaceutical Biologist Chemical specialist Ms. Martha E. Sandoval, delegate in charge of PROFEPA in Tijuana thinks. This law entitles citizens to request information produced or gathered by government agencies. Some reports that originate in environmental audits to private companies are not considered public according to initial procedure. But they can be disclosed by the petition of a citizen. This prerogative empowers the community and gives people another tool to procure better environment conditions.

Recycling companies play a very important role in the process of proper disposal of hazardous materials like motor oil and batteries. Through regulation and promotion, and also economic circumstances, more businesses are requiring the services of recycling companies. These companies can collect the hazardous materials produced in the businesses to reutilize them or transfer them to proper disposal sites, Ms. Teresa Ruiz from Recicladora Temarry de Mexico S.A. and Ms. Alma P. Tovar A. of RIMSA recycling company assert.

In regards to cellular telephone batteries, which are increasingly utilized in our daily activities, Mr. Antonio Martorell M. from Telefonica, a cellular telephone service provider, mentions that cellular telephone manufacturers like Nokia can collect batteries from old telephones when they are replaced by newer ones, within the period established by contracts or guarantees. No guidance was given on how telephone batteries outside this scheme could be properly disposed of.

The municipal government of Tijuana is undertaking an innovative community participation project that will impact the environmental conditions of the city. The first stage of this project consists in inviting high school students who have been awarded with a scholarship by the city to participate as juvenile environmental inspectors in their respective neighborhoods. This way they can give back a social service to the community and help local environmental authorities in their monitoring and control of potentially pollutant activities within the city, Mr. Alejandro Montiel C., director of the Municipal Institute of the Youth comments. There are several positive aspects of this program, like its educational reach, the inclusion of the community to carry out policy, and coordination among local agencies with different responsibilities. In this program, city agencies like the Municipal Institute of the Youth, Instituto Municipal de la Juventud, IMJUV, and the local Department of Environmental Protection, Departamento de Protección al Ambiente, work together to put this program in practice and achieve common goals. Many participating high school students were appointed juvenile environmental inspectors in a ceremony that took place outside the municipal government building of Tijuana this November 12, 2005. This program is just starting, but students like Marco P. Espitia of the Colegio de Estudios Científicos y Tecnológicos Estatales, CECYTE high school located in the eastern neighborhood of El Florido, are full of enthusiasm and projects of their own: Marco and his team of fellow students presented a project to reuse the water that is used in wash-stands and received an award in a regional high schools contest.

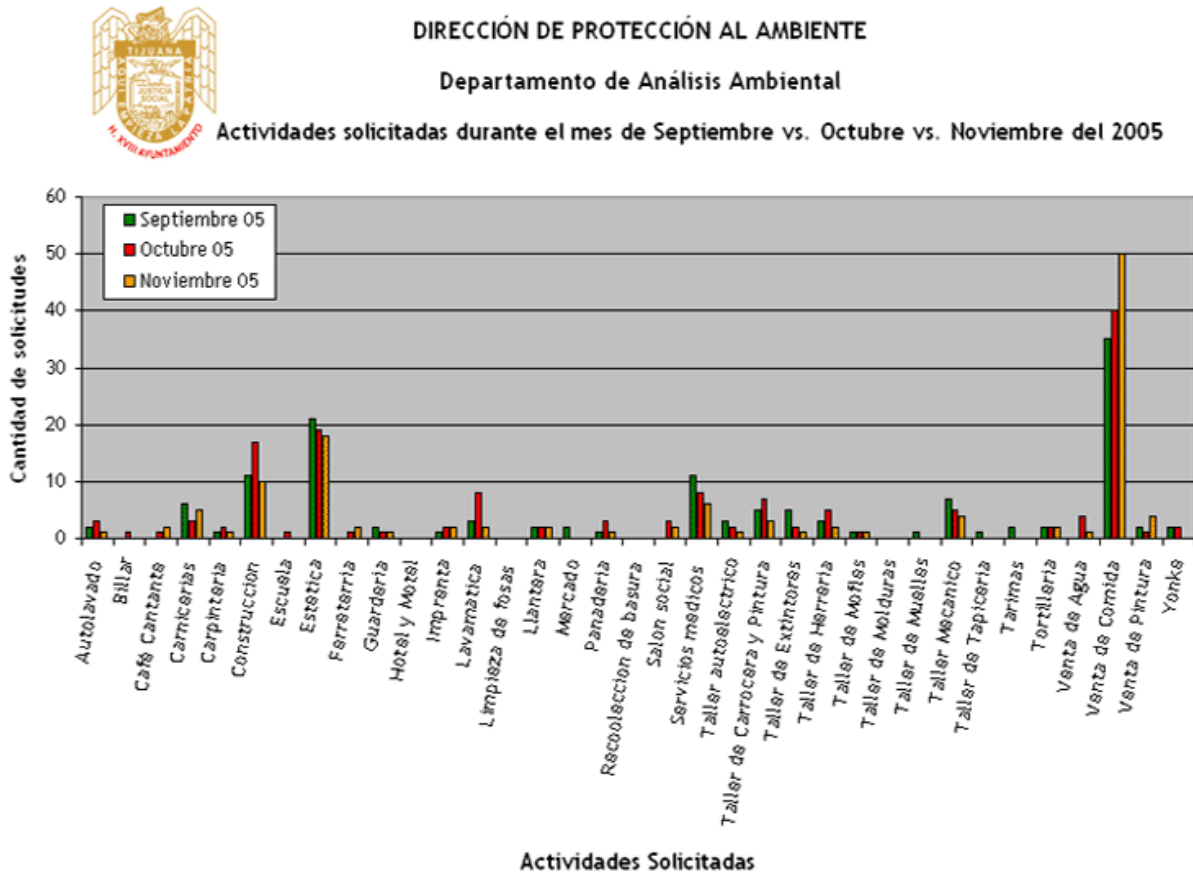
The City Government of Tijuana tries also to reach active community organizations that participate in environmental issues, like the ecologist group Gaviotas, Grupo Ecologista Gaviotas, whose leader Mr. Rodolfo Anguiano is often received by the City Mayor.

The Department of Ecology of the State government of Baja California has jurisdiction over the control of residual water discharges to the local sewage systems. They issue registration and permits for these discharges. The procedures of the Department of Ecology of Baja California have been recognized by the International Organization for Standardization, ISO, with an ISO-9001 certificate.

Figure 4.1

Business Activities Applying for Compliance Procedures to the Municipal Environmental Protection Department. (The most numerous are establishments that sell food, “venta de comida”)

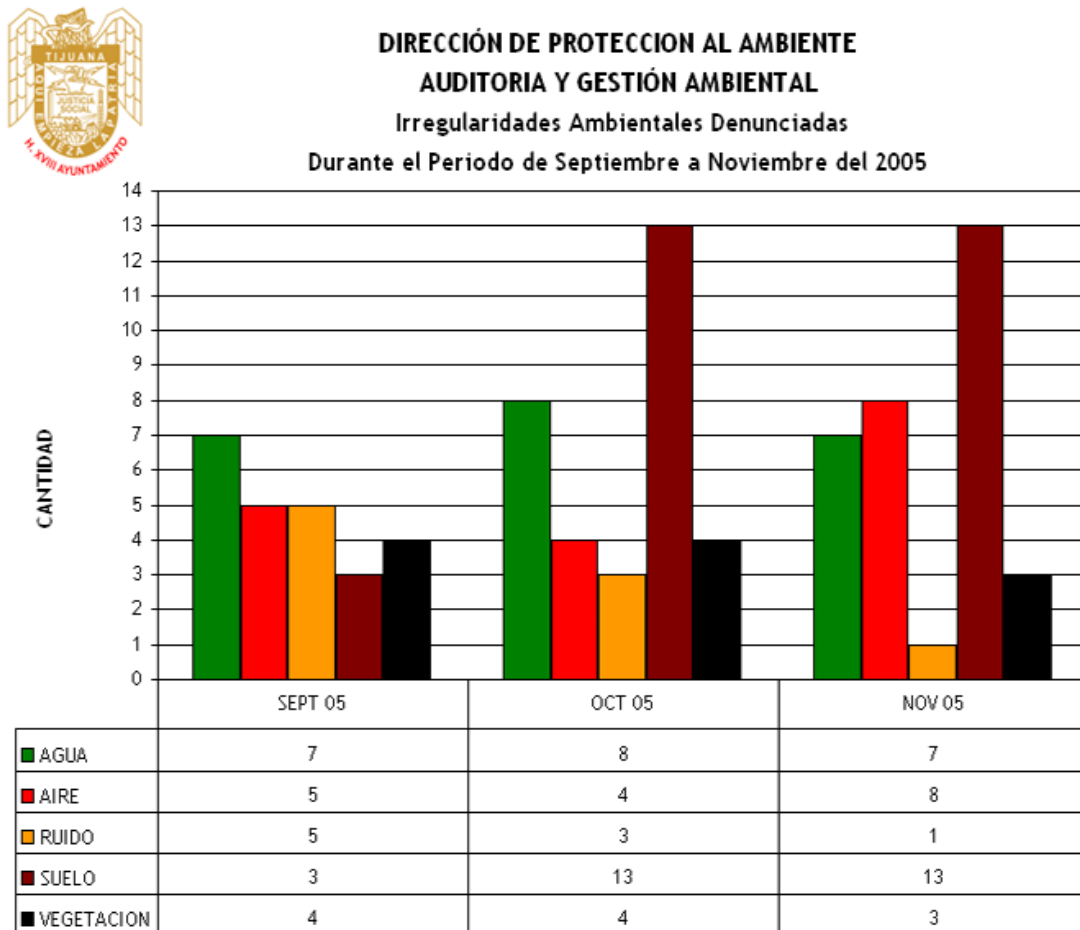
Retrieved from www.tijuana.gob.mx on December 2005.



The Department of Ecology has an area of inspections and audits to verify that existing residual waters comply with the norms that establish the characteristics that these waters should have. These norms are Mexican Official Norms, Normas Oficiales Mexicanas, known for their acronym NOM. They are laws that set many standards in many fields.

Figure 4.2

Environmental Denounces by Type of Contamination (Water related in Green: first bar in each month).

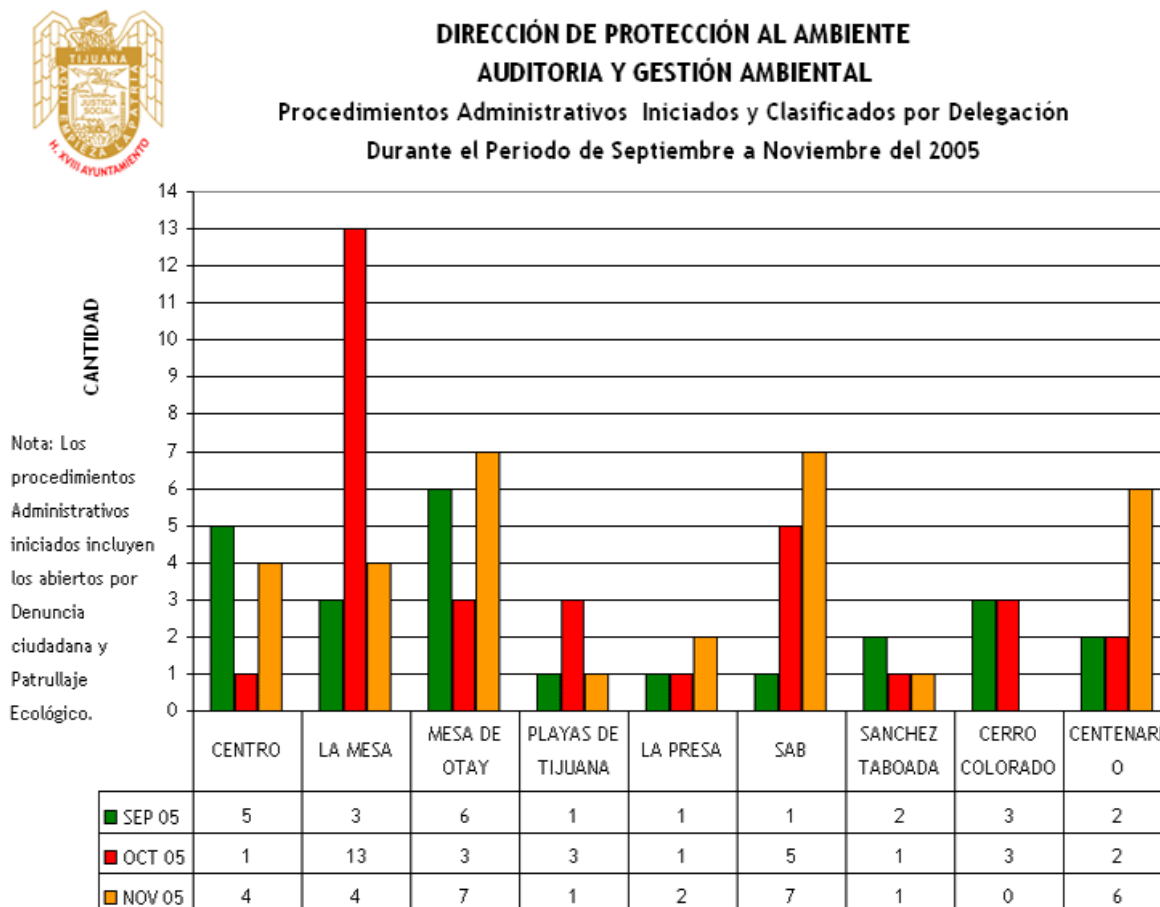


NOM-001-SEMARNAT-1996, NOM-002-SEMARNAT-1996 and NOM-003 are the norms pertaining to water discharges standards, and include regulations on the levels of biological and chemical elements present in those waters, hazardous substances among them. An important inspection and monitoring program that the Baja California Department of Ecology has in regards to water pollution control and water quality, is the joint program for monitoring the waters of the sewage system of Tijuana that is carried out working

together with the local water utility of Tijuana, the Comision Estatal de Servicios Publicos de Tijuana, CESPT, which manages the sewage system, and provides its own resources, expertise and equipment to accomplish the monitoring tasks of this verification program.

Figure 4.3

Enforcements Actions Undertaken by City Jurisdiction (Delegacion).



Data source:

www.tijuana.gob.mx

Chemical specialist Ms. Guadalupe Navarro, from the Department of Ecology Audit section, points out that one of the main goals of this program is to keep the standards mandated by the NOM-001, NOM-002 and NOM-003 in the waters of the Tijuana sewage system.

They keep a closer look in certain zones of Tijuana where it is more probable to find activities that represent higher risks, like the industrial park located in Mesa de Otay, just above the Alamar river, an urban river in the middle of populated neighborhoods. Industries are expected to comply with the regulations that prohibit discharging water that is polluted with hazardous substances to the sanitary or storm sewage system of the city, and if they produce this kind of discharges they are required to treat them before they go to the drain pipes. The issuance process of water discharge permits addresses this compliance requirement and others. Department of Ecology's Biochemical Engineer Cristhabel Verdugo from the Audits and Analysis section points out that when there is an annual revalidation of a water discharges permit, laboratory analysis data is used to look at the applicant's compliance with the standards of NOM-001, NOM-002 or NOM-003 that correspond to the case. The chief of this Department of Ecology's Analysis section, Ms. Xochitl Eguiarte, who has a degree in Geography, denotes also that her agency can regularize or intervene in cases of clandestine water discharges when there is a denounce by a citizen or a community group. As a note related to the sewer system, CESPT is in charge of taking care of the muds produced in the binational treatment plant located in the San Diego-Tijuana international border. To carry out its tasks on water quality monitoring, CESPT has laboratories both in its potable water plants and in its sewage treatment plants. CESPT's Industrial Chemical specialist Edgar N. Flores points out that this water utility supports new neighborhoods that do not have a sewer system in place, offering technical advise for handling septic fosses and providing recollecting tank trucks if they are requested. These kind of agendas also have an impact in water pollution prevention and control, because they provide for alternative measures to manage residual waters where there are fewer resources.

The State government of Baja California through its Department of Ecology has a number of monitoring stations to observe the condition of the air quality in different geographical areas of the city of Tijuana. Pharmaceutical-Biologist Chemical specialist Ms. Monica E. Tamayo, coordinator of the emissions recording area of the Department of Ecology, comments that beginning in 2005, the Department launched a web-site to publish the reports that contain the air quality information collected from its network of monitoring

stations in order to make this data available to every citizen that is interested in having access to it. The Internet address of this web-page is <http://aire.bajacalifornia.gob.mx>

The main characteristics being measured in this air quality monitoring network are carbon monoxide, CO, ozone, O₃, and suspended particles, PM₁₀, most of them product of inadequate combustions. Now that some water pollutant materials, like motor oil, are being used as alternative controlled combustibles, the monitoring of air quality is as relevant as ever, and the issues of water pollution and air pollution as part of the general pollution situation of our transborder region become more clearly interlinked.

The cement products corporation Cementos Mexicanos, CEMEX, provided a compact disc presentation of their annual general performance report. It has a section that introduces the concept of sustainability report, which is a report that not only speaks about the economical results of the company, but also about its environmental and social performance. Sustainability reports constitute a valuable instrument for the management teams of corporations; they can give them for example, a broader scope of their future. For stakeholders of the organization in general, it gives them for example, a more complete view of how the company is conducting itself and what set of actions it is taking. CEMEX prepares its report following the guidelines for sustainability reports of the General Reporting Initiative, GRI, which is a multi-stakeholder enterprise devoted to the dissemination of these guidelines and "an official collaborating centre of the United Nations Environment Programme (UNEP)" (GRI, 2005). General accepted guidelines, as it happens in financial accounting, give reports important attributes to make them extensively serviceable: credibility, consistency, and comparability (GRI, 2005).

The Ensenada cement production facilities of Cementos Mexicanos, CEMEX, which is probably the biggest of its kind in Baja California, utilizes disposed vehicle tires as combustible for its cement production process. It also employs used motor oil as backup combustible. These actions eliminate huge amounts of hazardous residual materials that represent a threat of contamination to our local bodies of water.

Figure 4.4

Statistics on Tasks Carried Out by the Department of Ecology of the State of Baja California.

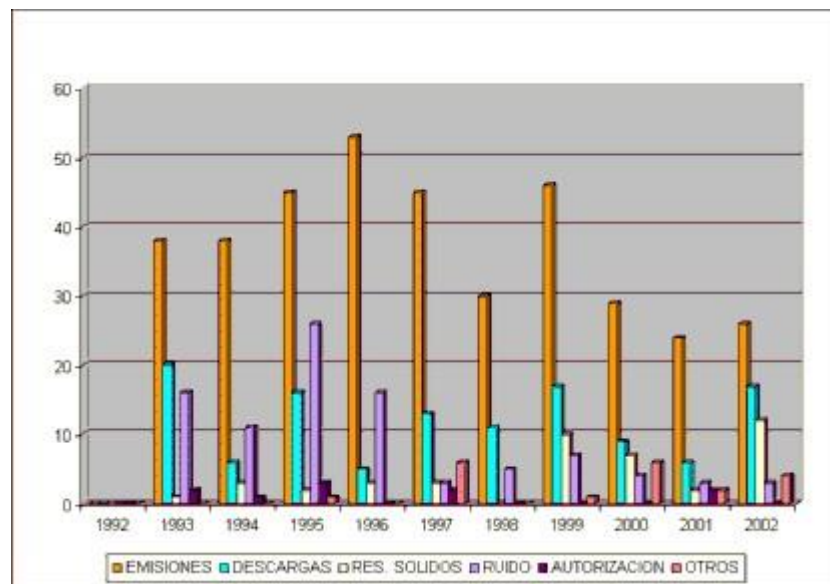
(Retrieved from <http://www.bajacalifornia.gob.mx/ecologia/problematicas/estadisticas.htm> on December 2005).



Inspection Visits by Municipality in 2002. (Tijuana in blue, first bar)



Next: Denounces Against Micro Industry (Bars representing Emissions, Discharges, Solid Waste, Noise, Authorization, Others, in this order.)



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miembr
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Aquí en
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calenda



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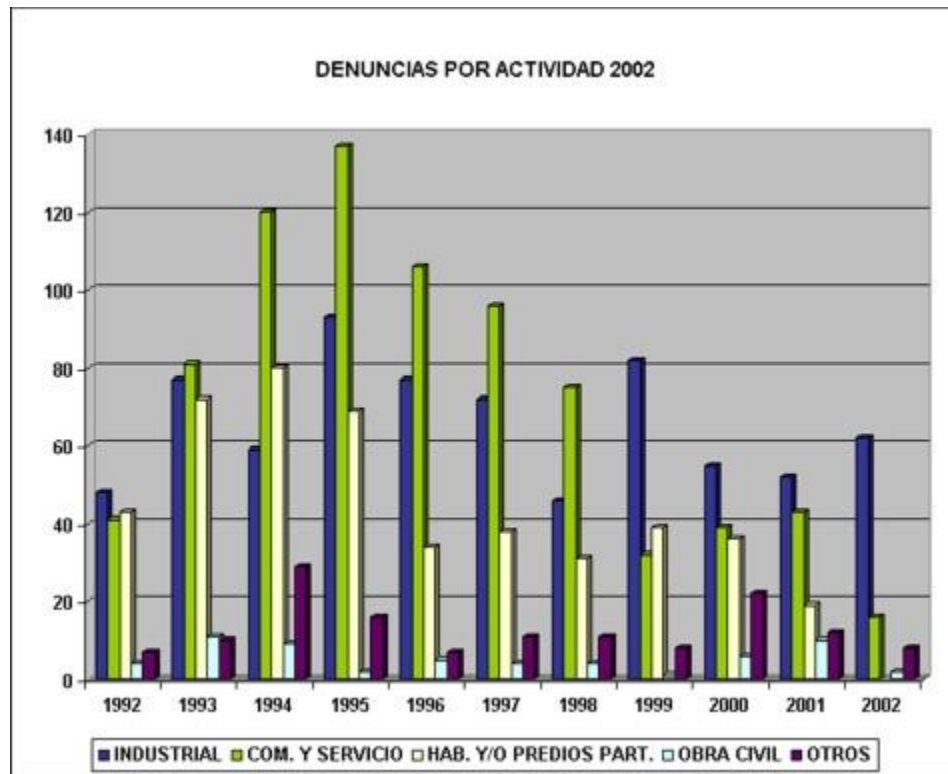
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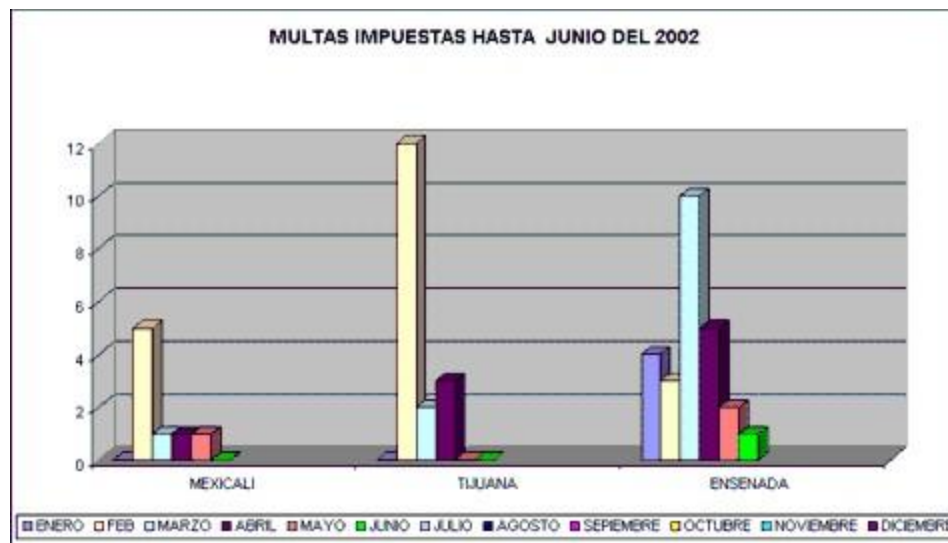
SEMAR
INE
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Below: Denounces by Economic Activity and Municipality

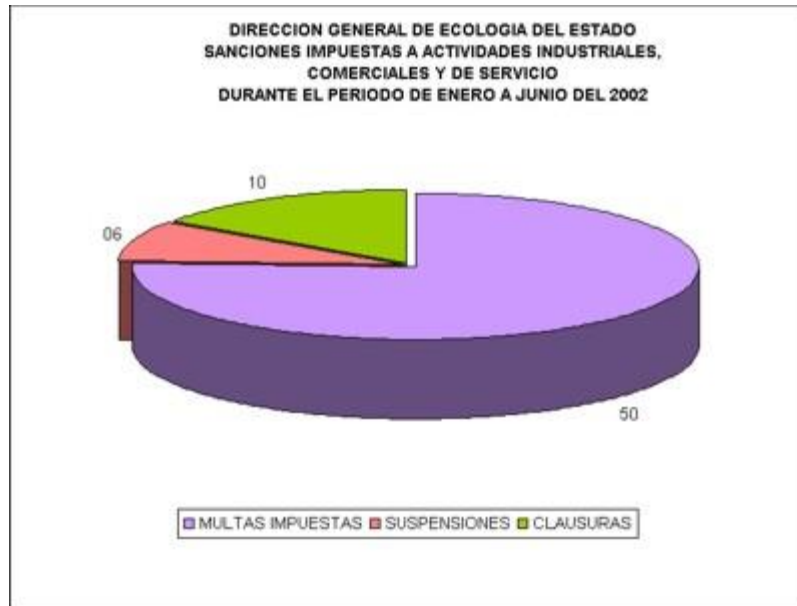




Next graphic: Fines Imposed



Sanctions Imposed (Fines 50, Suspensions 06, Closures 10)



Note: Most Activity of the Department of Ecology Takes Place in Tijuana and is Related to Many of this City's Industrial Establishments.

In regards to the efforts of environmental agencies to educate the public in water protection issues, most agencies in the United States have web pages with guidance and advice for businesses and households. In Mexico, the use of computers is not widespread yet, so the environmental agencies publish handbills or booklets to distribute them among the public mainly through their branch offices.

Many industries, as noted by Ms. Ivonne Vaquez from G.A.N. recycling company in Tijuana, are recurring to motor oil as an alternative and viable combustible for their operations, sometimes just keeping it as a backup source of energy. Other recycling companies receive car batteries for smelting and remanufacture or disposal.

It looks like there is neither a comprehensive recycling system nor a widespread recycling culture in Mexico yet. Nevertheless, there is data that suggest noteworthy accomplishments. It has been said that a significant amount of the paper in Mexico is recycled, about 80% of it, but also glass seems to be recycled in big amounts, about 100 000 tons (SEMARNAT, 2004). This numbers could be speaking about the feasibility of an optimistic prospect in regards to the better handling of the materials and substances that constitute the main potential pollutants of non-point sources of water contamination.

4.2 Key points from literature.

Many ideas exposed in the articles mentioned in section 2 are being applied in some way. New ideas are more relevant for application especially to the Tijuana case, like the self regulatory programs...

5. Conclusions.

5.1 Analysis.

Most societies have acknowledged the importance of moving towards Sustainable Development, to achieve desired economic progress and to guarantee, by caring about the environment, natural resources and biodiversity, a horizon of ample possibilities to future generations. Environmental and ecological considerations have to be included in municipal policy design. They should also be part of the guidelines of the daily and common practices of the different city agencies that constitute the public administration machinery of big cities like Tijuana and San Diego that share a natural area.

Figure 5.1

Human Development Index by Municipality of Baja California. 2000.

Estadístico. Índice de desarrollo humano por municipio, 2000

| Nombre | Tasa de mortalidad infantil | Índice de sobrevivencia infantil | Índice de nivel de escolaridad | Índice de desarrollo humano (IDH) | Grado de desarrollo humano | Lugar Nat'l Rank |
|------------------------|------------------------------------|---|---------------------------------------|--|-----------------------------------|-------------------------|
| | Infant Mortality Rate | Infant Survival Index | Education Index | Human Development Index | Grade of Human Devel | |
| Baja California | 22.0 | 0.858 | 0.849 | 0.823 | (High) | 4 |
| Ensenada | 25.9 | 0.828 | 0.839 | 0.778 | Medio alto | 358 |
| Mexicali | 20.9 | 0.867 | 0.862 | 0.842 | Alto | 41 |
| Tecate | 23.8 | 0.844 | 0.842 | 0.796 | Medio alto | 223 |
| Tijuana | 21.3 | 0.864 | 0.845 | 0.825 | Alto | 88 |
| Playas de Rosarito | 22.6 | 0.854 | 0.837 | 0.785 | Medio alto | 304 |

Data on this Human Development Index can be found at

<http://www.conapo.gob.mx/00cifras/6e.htm>

Note: As Societies Achieve a More Sustainable Development and Better Environmental Conditions, their Human Development Indexes are Positively Impacted.

One face of the problem of water pollution by non-point sources in the cities of San Diego and Tijuana is the impact of the physical urban layout in each of these two neighbor cities. Due to the strict zoning regulations that exist in San Diego in regards to land use, non point sources of pollution are less dispersed in the urban landscape than in Tijuana. This circumstance works in favor of monitoring and control programs by the authorities. On the other hand, land use in Tijuana is mainly of mixed use nature, which can work in favor of community involvement and voluntary control. One reason: the non-point sources of pollution can be in everybody's "back yard".

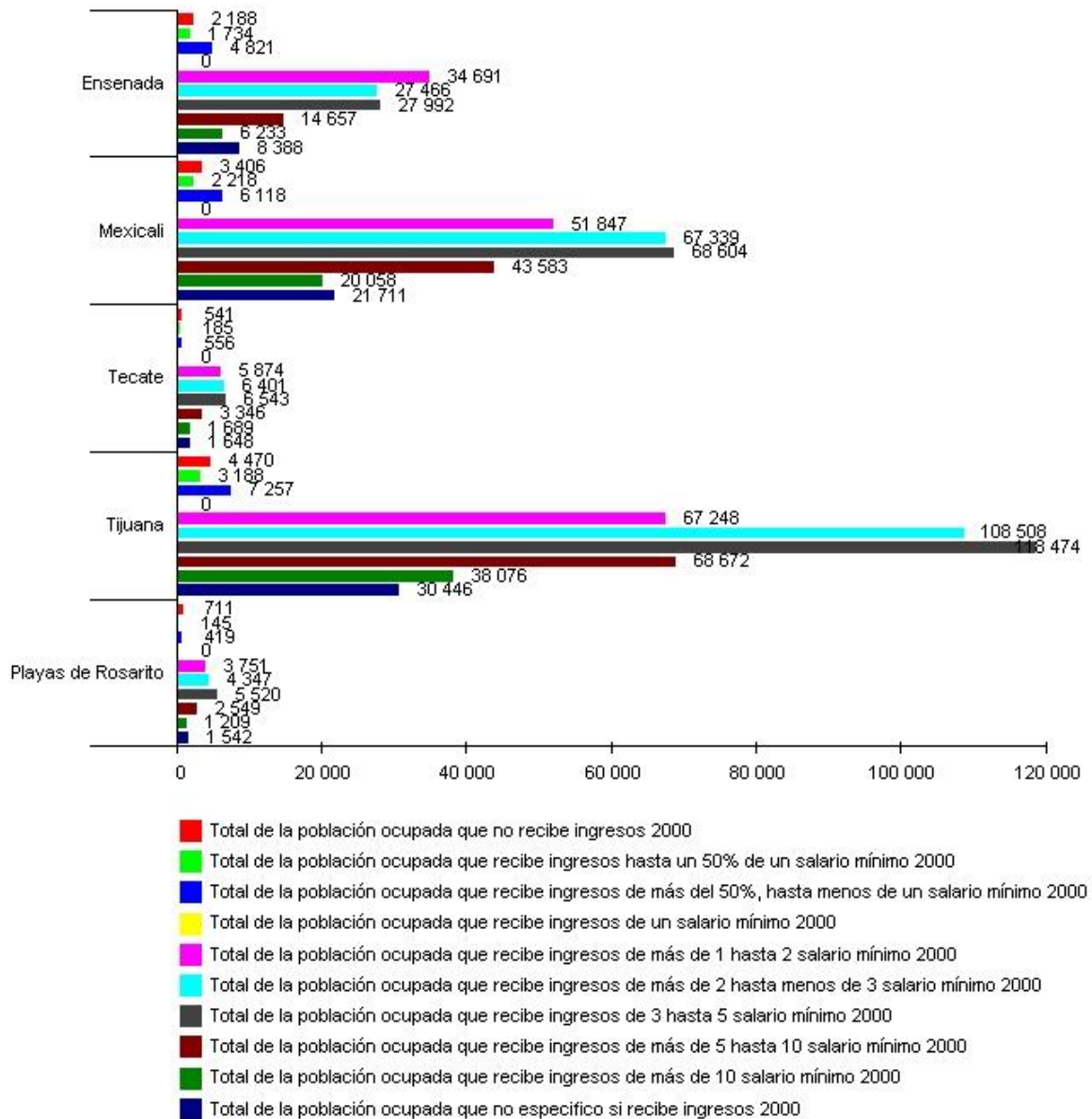
It has been said that San Diego has a "sprawl" kind of urban expansion, making it a very extended city. Fortunately, much of this growth that could be classified as low density growth, has respected a number of local wetlands, specifically riparian habitats. The San Diego Multiple Species Conservation Program has an impact in this outcome. These events have work in favor of avoiding what could have been a bigger reduction in aquifer recharging zones and bodies of water in general in the city of San Diego.

Another face of this problem has to do with social and economic conditions. Personal and household income is much higher in San Diego than in Tijuana. Since the median income in Tijuana is one of a developing country, it is paramount for its inhabitants to try to reduce expenses as much as possible, including those on some needed automobile repairs and simple maintenance services:

Instead of paying to have these services done in an automotive workshop, many persons prefer to do them by themselves in the streets, parking lots and sometimes even in their homes. If what they do are motor oil changes or battery changes, then there is the potential risk that these hazardous materials will not be disposed of properly, in part because most hazardous materials programs are conceived mainly for businesses.

One feature that exists in Mexico that could explain its high figures of recycled paper and glass is the presence of "pepenadores", persons that make a living out of recollecting items in municipal garbage sites. It is not unusual to find them organized in unions, and sometimes it could be said that they even inhabit the landfills. There are cases in which these unions handle huge amounts of materials that represent a considerable amount of money.

Figure 5.1.1



Fuente: INEGI

Figure 5.1.1 Ranks of Income of the Economically Active Population of Baja California Measured in Minimum Salaries. (2000 Census). Note: Minimum Salary in Mexico is approx. about MXP \$50.00 pesos per day (Approx. USD \$5.00). Most persons counted in this statistic earn between one and five minimum salaries per day.

Data Source: www.inegi.gob.mx

The "pepenadores" phenomenon could be underestimated as a booster factor for recycling, and it can be a subject of study for researchers interested in this area. But there are other characteristics of developing countries that can favor the conditions of the environment and the adoption of recycling habits. For example, less income translates into less consumption of materials and fossil combustibles.

Figure 5.2

Some Numbers on Municipal Waste in Tijuana and San Diego

| San Diego | Household Disposal by Overall Materials (Based on 1999 Statewide Estimates) | | | Tijuana | | 838 tons/day |
|-----------|--|----------|------------------|----------------|----------|------------------|
| | <i>Material</i> | <i>%</i> | <i>Tons</i> | <i>tons</i> | <i>%</i> | 305870 tons/year |
| | General Category | | | | | |
| | Other Organic | 45.00% | 537,127 | 141,006 | 46.10% | |
| | Paper | 27.50% | 327,669 | 61,480 | 20.10% | |
| | Plastic | 8.80% | 105,594 | 39,457 | 12.90% | |
| | Metal | 4.60% | 55,232 | 15,294 | 5.00% | |
| | Construction and Demolition | 4.50% | 53,466 | | | |
| | Glass | 4.00% | 48,178 | 7,647 | 2.50% | |
| | Mixed Residue | 4.00% | 47,760 | 39,763 | 13.00% | |
| | Household Hazardous Waste | 0.30% | 3,856 | | | |
| | Special Waste | 1.20% | 14,802 | | | |
| | | 99.90% | 1,193,684 | 304,647 | 99.60% | |

The following data source was found in relation to municipal waste in San Diego.

www.ciwmb.ca.gov/profiles/county/CoProfile1.asp

The following data source was found in relation to municipal waste in Tijuana.

www.ine.gob.mx/ueajei/publicaciones/libros/109/cap8.html?id_pub=109

On the other hand, characteristics of developed countries like education, high levels of income and the activism of NGOs also favor the environment and recycling activities. That is why even though different conditions may exist in a developing country in comparison with a developed country, and different ways to address environmental issues may be appropriate for those different conditions, progress towards a better environment can be achieved most of the time under both circumstances. This convergence of results, that improvements happening in developed as well as developing countries would indicate, can gradually connote homologation in terms of environmental goals.

Neighboring cities like Tijuana and San Diego, representing themselves two neighboring nations, with different social and economic conditions, can try to achieve this kind of homologation. Homologation is desirable for neighboring cities that form part of the same natural region and transborder zone. It is mutually beneficial, in great part due to the immediate spillover effect that can take place in a transborder region. It also gives confidence and strengthens a basis for communication and collaboration.

The case of the cement factory in Ensenada that employs disposed vehicle tires illustrates one form of eliminating this residual material. Vehicle tires, due to their potentially pollutant capacity could affect the local bodies of water if they are not disposed of properly. Tires are not originally designed as combustible and are not supposed to be burned in open spaces because their fumes are toxic. But if this combustion is carried out properly and under controlled conditions, the environmental impact can be minimized.

Figure 5.3

Data on Household Median Income in the Localities of the San Diego Area.

Retrieved from the SANDAG Web Site on 2005. Based on the 2000 Census.

| Area | total pop | med age | med hh inc | % of tot pop | weighted med hh inc | |
|----------------|------------------|----------------|-------------------|---------------------|----------------------------|----|
| Carlsbad | 78,247 | 38.9 | 65,854 | 2.78% | 1,831 | 1 |
| Chula Vista | 173,556 | 33 | 44,834 | 6.17% | 2,765 | 2 |
| Coronado | 24,100 | 34.1 | 67,335 | 0.86% | 577 | 3 |
| Del Mar | 4,389 | 43.6 | 81,941 | 0.16% | 128 | 4 |
| El Cajon | 94,869 | 32 | 35,530 | 3.37% | 1,198 | 5 |
| Encinitas | 58,014 | 37.8 | 64,821 | 2.06% | 1,336 | 6 |
| Escondido | 133,559 | 31.3 | 43,208 | 4.75% | 2,051 | 7 |
| Imperial Beach | 26,992 | 28.6 | 35,950 | 0.96% | 345 | 8 |
| La Mesa | 54,749 | 37.3 | 41,804 | 1.95% | 813 | 9 |
| Lemon Grove | 24,918 | 34.7 | 39,833 | 0.89% | 353 | 10 |
| National City | 54,260 | 28.8 | 29,980 | 1.93% | 578 | 11 |
| Oceanside | 161,029 | 33.3 | 46,145 | 5.72% | 2,641 | 12 |
| Poway | 48,044 | 36.6 | 71,716 | 1.71% | 1,224 | 13 |
| San Diego | 1,223,400 | 32.6 | 45,826 | 43.48% | 19,924 | 14 |
| San Marcos | 54,977 | 32.2 | 45,854 | 1.95% | 896 | 15 |
| Santee | 52,975 | 34.8 | 54,161 | 1.88% | 1,020 | 16 |
| Solana Beach | 12,979 | 41.6 | 73,524 | 0.46% | 339 | 17 |
| Vista | 89,857 | 30.3 | 43,161 | 3.19% | 1,378 | 18 |
| Unincorporated | 442,919 | 34.7 | 53,521 | 15.74% | 8,425 | 19 |
| | 2,813,833 | | | 100.00% | USD \$ 47,823 | |

With actions like these, non-point sources can be converted to point sources...which are easier to control...or at least to monitor. There are more instruments at present time to monitor air pollution than instruments to track down non-point sources of pollution. Also, punctual sources like big industrial establishments tend to attract more attention from the public and from environmental agencies, and thus, they tend to be more supervised.

A transition from non-point to point sources should be supervised...There are voices in many countries that warn about the risks of incinerators of waste. The horizon that appears from this panorama should be studied and researched much furthered in order to have better alternatives in the future and better public policy.

The limits that exist in Tijuana in regards to fiscal and other resources constrain the action capacity of its public sector. This factor has encouraged government agencies to seek new alternatives to tackle urban environmental challenges.

In order to have better ways to measure the results of the new initiatives particularly taken by the Municipal Government of Tijuana, all the agencies involved in environmental issues must work together and closely coordinated. The key point here is information sharing. Everybody can share for example, the denounces from the public to be aware of the problems perceived by citizens, the cases found by different agencies' inspectors, and certainly, the water quality measures taken for example by CESPT-Ecologia del Estado in the sewer system and CESPT-CONAGUA in the local bodies of water of Tijuana. The results from particular environmental audits can be disclosed following an administrative procedure that can be improved to become more agile. City Governments could also engage in programs to carry out random monitoring in critical points that reflect water pollution by non-point sources in the urban or adjacent areas.

The adoption of a Watershed Sanitary Survey in Tijuana would constitute an important tool to manage local water pollution issues, probably also in the urban area, and advance towards homologation of environmental results with San Diego. It allows focusing attention on critical threats to the local bodies of water happening in a relevant and directly influencing territory and also back ups the public actions taken to address them.

5.2 Policy implication for the border region.

When in both sides of the border local authorities acknowledge that the neighboring counterpart is working and trying to do a better job, better conditions exist for more communication. Increased levels of communication can lead to mutual confidence, which is a key part of increasing transboundary collaboration, consequently opening new opportunities in this area.

5.3 Thesis put to test.

It can be said that the information presented in this paper has been supportive of the thesis proposed here. Innovative actions are being undertaken in Tijuana, in part due to necessity...The application of these initiatives has activated many stakeholders and various sectors of society in Tijuana. Due to this momentum and synergic drive it is reasonable to expect environmental achievements in the near future. A homologation process with San Diego in terms of environmental conditions and impact of local environmental public action can be in progress...

5.4 Opinion on the impact of this project.

This thesis paper can give a look on the environmental efforts taking place on the other side of the border...Thus contributing to mutual understanding and collaboration.

6. Further research.

There is much research to do in this and other related fields...Fortunately, there are sources of information that can be further explored; like the stakeholders for example, that can provide more elements about their views on these issues...There are also groups and institutions generating more data each year... An additional effort should be undertaken to

6.1 Improvements and Expansion.

More time should be dedicated to researches like this...Projects like this can be expanded to include more information on local transborder collaboration and environmental issues...There is much information in many web sites that has not been included in this paper. It can be expected that the amount of information available in the Internet both in the United States and Mexico will increase significantly in the years to come.

6.2 Future benefits of further research.

With further research on transborder environmental issues, more knowledge will come out to enlighten better policy design in both sides of the border, better enforcement instruments and certainly better informed decision making...

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