THE IMPACT OF WATER LAW ENFORCEMENT ON CORPORATIONS:

A Comparison of British Columbia’s Lower Fraser Basin and Washington State’s Puget Sound Area

By

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Abstract

The understanding of the interface between ecological and regulatory systems is necessary for the evaluation of the effectiveness of current environmental management strategies and for the design and implementation of new ones. The aim of this thesis is threefold. First, to compare and contrast the US and the Canadian environmental enforcement systems as they manifest in similar ecological systems, the Lower Fraser Basin - Puget Sound (LFB-PS) watersheds. Secondarily, to assess the tangible and intangible costs and benefits that emerged as a result of experiencing a water quality related enforcement action during the 1997-2000 time period for a random sample of companies located in these watersheds. Thirdly, to examine the feedback and learning effects that resulted from these incidents.

Through case analysis based on literature review and interviews with members of the regulatory community the two enforcement systems are compared. Systematically collected primary data via confidential interviews with companies provided for the quantitative and qualitative analysis of the tangible and intangible costs, as well as for an assessment of and the nature and effectiveness of existing feedback loops and learning processes.

The results have shown that even though the connection between ecosystem inputs and enforcement inputs in the PS area have proven to be tighter and relatively more complex than in the LFB, they did not seem to lead to an improved permitting process. Compliance rates are generally higher in the PS indicating more effectiveness of that system on the input side.

In terms of charges and compliance effects, penalties were not higher in the PS area only when measured by direct and indirect associated costs. Comparing the complexity of the two systems has led to the discovery that the PS system has more components, levels, number of interactions, available feedback mechanisms, and longer history. However, the actual number of adjustments in the system that ultimately determine learning and change was lower since the meaningfulness of the information exchanged and the frequency of the utilization of available feedback mechanisms was less.

Overall, the PS system is better for ensuring organizational compliance with water quality standards in the short term but not on the long term. For improving environmental performance, the LFB system is more equipped and adaptable due to its smaller system size and its focus on constructive feedback.
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**Lower Fraser Basin**
- The process is an obstacle and a waste of time  
- Lack of preparedness and fairness  
- Interpretation of policy  
- Theoretical Implications for Perception of the Regulatory System for Environmental Management and Enforcement in the LFB

**Puget Sound**
- Inconsistency, unfairness, ambiguousness, shift  
- Science is not feeding into the rules  
- Too many agencies and no lead, lack of adaptive capacity  
- Fines vs. true costs and behavioral change  
- Distrust  
- Interpretation of policy  
- Positive remarks  
- Theoretical Implications for Perception of the Regulatory System for Environmental Management and Enforcement in the PS

**UNMET NEEDS**

**Lower Fraser Basin**
- Information and education  
- New legislation, programs and process

**Puget Sound**
- Information and education  
- New legislation, programs and process  
- Compassion
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The essence of the path of the Thunderbird is feeling through the concrete shell the footprints of the ancestors, the caressing of the wind as it timelessly arches up the valley, picking up the floating feathers weaving them into a dream catcher; hearing the sizzling of the rocks the bursting heat of steam as the visions bubble to the surface of the mind the lava of a deep coral ground.

Shells are dancing in the sand to the harmony of the ocean waves, turtles searching for a peaceful place carrying the eggs to lay.

Silence is broken by the beat of the drums, wolves are howling far in the wild. The moon is pregnant, hanging in the beaded sky high above, a stream is born, a salmon run.
CHAPTER I. INTRODUCTION

This thesis compares and evaluates the effectiveness of the regulatory systems to protect water quality and control water pollution in the LFB (in south western British Columbia, Canada) and the PS area (north western Washington, United States). As economic activity expands, the impacts on ecosystem health at the watershed level intensify. In terms of water quality, non-point sources of urban and agricultural runoff are the main concern, while an increasing number of organizations are using the watershed (rivers, streams, lakes, and coastal marine waters) for waste disposal, both purposefully through allowed discharges and inadvertently in the case of accidental spills. Watersheds provide a natural boundary for studying the complex ecological, economic, and social processes that affect the ecosystem’s health.

Researchers have acknowledged that the social system has a huge impact on the ecosystem in these watersheds (Dorcey, 1999; Hawkin, 1995; 1999 Healey, 2000). In addition to consumption and production effects driven by economic activity (i.e. pollution and resource extraction impacts), there are the effects of policy and organizational choices. Often this work relies on a combination of older systems theory and institutional theory from political science and economics to detail the regulatory system and the role of organizations within it (Dorcey, 1989; 1991). Recently, new institutional theorists have begun to document how policy and regulatory systems depend on underlying political cultures and regimes that shape the creation of standards and their application on members of ecosystems (Jennings and Zandbergen, 1995; Hoffman, 1997; 1999). However, neither the older institutionalists nor the newer institutionalists have connected their studies very clearly with impacts on the ecosystem (Espeland, 1998; Hoffman and Vantresca, 2001). At the same time, ecologists and environmentalists have not spent time looking at the institutional sources of important ecological outcomes. In this thesis, which is an extension of a larger project on enforcement conducted under Eco-Research and HSS grants (Jennings, Zandbergen and Martin, 2001), I focus upon the interface of the institutional system and the ecological system by studying the system of compliance, remediation and enforcement of water regulation.

Jennings, Zandbergen and Martin (2001) have argued that enforcement systems are unique sub-domains of regulatory systems, ones that allow researchers to isolate and investigate the linkages of the larger regulatory system with the surrounding ecosystem. In addition, these enforcement systems can be assessed in performance terms, using criteria from the enforcement agency as well as ecological criteria about the local basin’s health. But these researchers have spent more time looking at the process of enforcement and outcomes within the institutional system. They study the determinants of water-related charges against organizations in the LFB over time, but do not spend time examining the inputs from the ecosystem into the enforcement system (the calculation of carrying capacity for the establishment of water quality objectives, the permit system and non-compliance) and incidents that lead to charges. Nor do they spend time to connect each charge to specific ecological outcomes.

By combining institutional and broader systems theories, this thesis examines the ecological inputs into the regulatory system (the permit system and referrals of incidents) as well as the regulatory outputs from enforcement actions (charges) on the ecological system (tangible and intangible costs and benefits of warnings, charges, and fines). This approach may offer a better understanding of the interface between the ecological and regulatory systems and suggest improvements to the existing enforcement systems.
The larger common bioregion of the Lower Fraser Basin and Puget Sound provide an excellent research opportunity in that they are similar ecologically and in terms of regulated bodies (firms in a democratic market economy), while the regulatory and enforcement systems are under different institutional regimes. This study can then compare and contrast two different enforcement systems set in similar ecological systems.

The central research question of this thesis is the following:

Is one regulatory system "better" for ensuring organizational compliance with water quality standards and improving environmental performance according to that system's standards? If so, why?

In one system the institutional arrangement is presumed to be better than the other if it is able to meet its own standards better than the other system is able to meet its own standards. In that sense, the systems are compared only against themselves, but on similar regulatory criteria. In addition, I presume that each regulatory system can and does learn from the other, and hence it is worth comparing the two. In both cases, my main focus will be on water resources and water-related legislation and regulation.

RESEARCH DESIGN

The approach to answering this question is to frame the regulatory environmental enforcement systems in a conceptual model based on systems theory, complexity, and institutional theory. Then, based on this model, to predict the effectiveness of the two systems relative to their own standards, test these predictions based on existing data resources and interviews, and then discuss what each system might learn from the other.

My explication of the conceptual model leads to the proposition that regulatory systems with more tightly coupled, complex linkages and better articulated policy understandings will have clearer processes than systems without such coupling, complexity and understanding. However, less attention to and elaboration of outcome and feedback (learning) effects will undermine a system in the long run, and this will be particularly noticeable in systems with highly elaborated inputs and processes.

My central argument, stated as a set of hypotheses, are that:

In the case of organizational compliance and performance, the effects will be greater in the Puget Sound system relative to its standards than in the LFB relative to its standards, because

- **H1:** In the Puget Sound area, the enforcement processes from inventory to monitoring to enforcement to outcomes are more complex and tightly coupled with the organizational field than they are in the LFB.

- **H2:** In the Puget Sound Area, the sanctions for non-compliance are higher for organizations, particularly if measured by direct and indirect associated costs of non-compliance, than in the LFB.

In the case of prevention and long-term learning,
To test my argument about the differences within and between these two regulatory systems, I collect data in each system on ecological and regulatory inputs, and regulatory and ecological outputs. More specifically, to explore Hypothesis 1, I examine the creation of water quality standards and the permitting process in each system and examine the rates of compliance with these permits. All things being equal (e.g., in terms of system size and growth rates and economic changes), higher rates of compliance in one system with its standards will indicate great effectiveness on the input side within that system. Given that the two systems have some similar standards, this suggests that one system might be more effective on the input side than the other.

To test Hypothesis 2, I examine response and remediation in both systems. I rely on some of the process data, but emphasize analysis of systematic, random sample data that compares outcomes in the Puget Sound and LFB ecosystems. I randomly sample 50 prosecuted firms in each enforcement system and interview those willing to participate about the tangible and intangible costs and the tangible and intangible benefits of the event. In addition, I examine whether or not any site remediation has occurred. Higher benefits for the regulatory system, lower costs for firms, and higher rates of remediation in one system suggest greater effectiveness on the output side.

To test Hypothesis 3, I examine the case data and the qualitative data from my company interviews in each system. This argument is more difficult to test with either case or interview data, because it implies over time effects, many of which have not happened yet for the firms sampled. However, I think there is sufficient information to make some grounded claims about the hypothesis.

Knowing compliance rates and the effects of enforcement leads to several theoretical and practical contributions. First, it adds to the small set of empirical studies that have examined compliance rates and to the almost non-existent set that examine remediation post-prosecution. Second, it speaks to whether or not the enforcement system as a component of the regulatory system can be and should be justly considered a unique subsystem (policy domain and set of organizational units). Third, it addresses larger issues about provincial and federal enforcement in Canada versus enforcement within particular states in the U.S. One important issue is whether a more collaborative system of water quality objectives and permitting and a moderately legalistic enforcement of non-compliance in Canada have some advantages over the agency- and legally-driven, standard setting and enforcement process in the U.S.

Assessment Criteria Issues

The model and main proposition focuses on inputs to outcomes as process, on outcomes and their immediate effects, and on feedback. In essence, these three components are being used to capture or assess the effectiveness of the Puget Sound and LFB regulatory systems.

I must acknowledge that within ecology and environmental management, there already exist a number of existing frameworks for assessing environmental management. Many are more
specific in terms of the indicators and methods of combining indicators than this general one and
its associated propositions.

If we look at the inputs from the ecosystem to the social/regulatory system, we can see a number
of different approaches. In the case of water quality objectives (WQOs), I have found that the
following three criteria are used in BC: 1) risk; 2) use protection strategy; and 3) best available
technology (BAT). The target is zero level of human risk in most cases (but actually calculated
with costs/benefits per toxin in application). In terms of risk, water quality objectives are
established by defining background levels of priority contaminants at the site. This approach
ensures that environmental receptors are not exposed to elevated levels of environmental
contaminants - there is no incremental risk of adverse effects. In the case of the use protection
strategy, water quality objectives are based on the protection of existing and potential uses of
land and water at the site. There is collective development of broad ecosystem management
goals, and assessment of benefits and cost of the various options in the context of these goals.
This approach accommodates the multiple use of aquatic ecosystems and minimizes conflict
between human and non-human competing interest. Further, it necessitates the development of
defensible procedures for deriving WQOs. In terms of the BAT approach, that depends on the
specific discharges, but, in general, discharge limits are uncertain because effects of wastewater
discharges on designated water uses are generally not considered.

Anyone evaluating the US system of water quality would, of course, say that risk, use protection
strategy, and BAT are important criteria for setting up that system. However, the attempt to
blend all three criteria through a negotiation of water quality standards in the BC system does not
look like the use of the three criteria in the different US federal agencies (e.g., the EPA) or the
top-down delivery and interpretation of these standards by state level departments of ecology.
This means that the context for the use of these criteria as well as the structure of the system for
setting water quality objectives need consideration.

If we turn to the relationship of process to outputs in enforcement, I found that in the US the
Washington (WA) Department of Ecology (DOE) follows the US Enforcement System
(Principles, 1992) to measure and evaluate the success of its program. This system focuses on
environmental results, compliance rates, progress in returning significant violators to
compliance, measures of compliance monitoring, number of enforcement responses, timeliness
of enforcement responses, monetary penalties assessed, and measures of technical assistance.
Some of the criteria for effectiveness specific to enforcement-ecosystem connection could be the
following: Do we have the kind of water quality we want? Do we have a common goal in terms
of the kind of water quality we want? Do we have a regulatory mechanism in place that
recognizes and is capable of delivering what we want? Are the actors/stakeholders in the system
(regulators and conservation officers, business, the community) satisfied with the current process
trying to deliver what we want? Do we have adequate feedback systems in place (proper
indicators, monitoring, assessment, evaluation) to know if we are achieving what we want?

Again, just as in the input-side case, the criteria being followed in the US are quite specific to the
US case. Granted, anyone in BC would say that all these steps are important in enforcement; but
in BC, the Provincial agencies have a lot of power to determine these steps—and to intervene at
different stages. Moreover, there is a disjuncture in the enforcement system between Pollution
Prevention and Environmental Enforcement. The former does monitoring and some negotiation
of enforcement outcomes, while the latter picks up referred problems and does stricter, less
negotiated enforcement.
Because these more specific sets of assessment criteria in each regulatory system do not allow for across system comparison, I cannot rely on such existing schemes by themselves to evaluate each regulatory arrangement in WA and BC. However, they do rely on the same underlying logic of inputs to throughputs to outputs & feedback, and they acknowledge that different eco-basins and resources (like water) require more specific criteria for assessing them. Therefore, I will use frameworks like these only along with the assessment of the broader context and interpretation of the systems according to systems and institutional theory. Relying on systems theory and institutional theory is in keeping with the spirit of assessment currently applied in each system. In fact, my broader framework will allow me to make recommendations about these more specific assessment criteria.

In the following Chapter, I elaborate on the conceptual model and theories that frame the study. In subsequent chapters I examine the available data along with data generated for this study, to assess the validity of the outcomes that the theoretical model predicts in terms of the effectiveness of the enforcement systems (the hypotheses above).
CHAPTER II. THEORETICAL BACKGROUND ON ENVIRONMENTAL ENFORCEMENT SYSTEMS: SYSTEMS THEORY AND INSTITUTIONAL THEORY

"Our theories determine what we measure."
Albert Einstein, quoted in Senge (1990, p. 175)

To capture the enforcement process and its effects on local ecosystems I draw relevant ideas from two sets of theories: 1) systems and complexity theory, and 2) old and new institutional theory. Systems and complexity theory have been used a great deal in the ecological sciences to describe how natural and social systems interact. Complexity is the more recent, dynamic, and non-linear version of older systems theory. While they are good at describing the general patterns of how complex systems work, the problem with these two theories is that they are quite abstract and thus distant from easy, direct observation. Furthermore, they may apply more easily to complex systems identifiable in the natural than the social world, partly because of the inherent bias of self-reflection, the ability of members in the social world to modify their interpretation of their own patterns.

Institutional theory is useful because, as a complement to complexity theory, it helps overcome these issues. Institutional theory argues that history and context and social actors are critical for understanding the evolution of any pattern in a social system. Furthermore, institutional theorists (both new and old) have studied the operation and effect of regulatory systems. Some institutional theorists have even begun to examine the interaction of the natural and the social system from the institutional angle (Hoffman, 1997; 1999; Hoffman and Vantresca, 2001; Jennings and Zandbergen, 1995; 2001). Yet almost no one has a combined explanation of regulatory systems or enforcement that draws on both complexity and institutional theory: that is one of my principal contributions.

The figure below contains systems and complexity theory, institutional theory (old and new), and ecological theory (the topic of watershed management). It helps articulate how I relate these three sets of ideas. One additional item that is in this figure that is not in my discussion above is "communicative rationality theory". I rely on this theory not so much in developing and testing my hypotheses, but as an expression of my own values and the direction in which I hope to steer policy recommendations. It is in many ways a hidden box in the theses that guides normative discussions, but I have tried to make it more explicit.

I begin with a discussion of systems and complexity theory from an ecological standpoint, and then move to how institutional theory fits within this framework, just as the social system ultimately fits within the biosphere (Meadows, 1992).

SYSTEMS AND COMPLEXITY THEORY IN ECOLOGY AND ENVIRONMENTAL MANAGEMENT

To substantiate my hypotheses, I need to elaborate on the theoretical underpinnings. In this section, I discuss the definition of a "system", which is the key comparative unit of analysis between the two watersheds, and how a system works. I then discuss the implications of this on
establishing the nature of the systems under study, and the underlying presumption in the hypotheses about which one would be more effective. Finally, I discuss the nature of feedback and learning and how it can be determined. In ecology and environmental management, systems theory is quite useful for defining systems and how they work; complexity theory is quite useful for elaborating the notions of how systems work and discussing feedback. Hence, I use both.

According to complexity theory on feedback and learning, feedback comes in the form of micro adjustments in networked elements (clusters) that occur when one element is disturbed at time 1 (t1), then other networked elements are disturbed at time 2 (t2), which then affect the original element in some direct or indirect way at time 3 (t3). Feedback can also occur when a whole cluster’s pattern or network is changed at t3 by the adjustment and a new pattern is established. Learning is not discussed so much as adaptation or evolution. If a cluster or network adjusts over time in a way that allows its basic pattern to survive but be modified, then the network “adapts.” If a cluster or network’s pattern succeeds where other patterns don’t and allows for higher order networks to adapt, then the pattern is the basis of a system’s “evolution.” Key points are summarized as a series of propositions that support the hypotheses.
What Is A System?

Borrowing from Jones (1994:56-57). I define a system as follows:

Definition 1:

A system is something that:

• consists of a set of structured components designed to meet the conditions required for the survival of the system,

• has some degree of specialization and structural organization among these components, based on the level of phenomena under analysis,

• leads to survival, which may be referred to as functional requirements, and

• involves actions in response to them as processes or as functions of the structures involved.

A fundamental assumption of this perspective is that the structures of a system are interdependent or interrelated. The structures, that is, are systematically rather than randomly associated. The processes associated with these structures are similarly interdependent. Although the degree of interdependence may vary, this assumption means that the actions of structures and processes serving a particular functional requirement can be expected to have consequences for other structures and processes of the system.

The system, whatever its level, is viewed as existing in an environment and as being separated from its environment by a boundary (Jones, 1994). The environment of a system is not well defined in systems theory. It is understood by most systems theorists to NOT be the natural environment, which itself is a system. However, it is presumed that systems and nested systems sit within a larger environment or framework. New systems can be partially built using this external source and this external source determines how closed or open the system and nested set of systems are. If the external environment has a lot of linkages and effects on the system, then the system is an “open system”; if not, it is “closed.”

The maintenance of the boundary between a system and its environment is tantamount to system survival. The disappearance of the boundary is the loss of organization or the demise of the system. Thus, the overall functional requirement of the system is boundary maintenance. Basic functional requirement is typically divided into various sub-categories of functional requirements. For example, defensive action may be required to ward off external threats.

In the case of the Lower Fraser Basin and the Puget Sound, I believe there is enough agreement to argue that:

Proposition 1:

The LFB and Puget Sound region represent ecologically bounded systems, where water quality is concerned.

Organizations as Systems

A strong argument has been made by Cummings (1980) for viewing economic and social organizations as dynamic entities continually interacting with their environment, changing and adapting to develop congruence between people, processes, structures, and the external environment. "This dynamic view helps explain why bureaucratic organizations, the dominant form of organization when the environment was stable, are under stress and new organizational
forms are evolving. It also provides a historical and developmental perspective for any one organization and aid in diagnosing the current state and problems within that organization." (Cummings 1980, p.76). His application of systems theory to organizations lead to the following list of general characteristics:

1. Organizations are composed of several components or parts that are in interaction with one another while at the same time part of an identifiable whole. These components may be sub-units or they may be dimensions such as people, process, structure, and culture.

2. Organizations, having more or less permeable boundaries, interact with an external environment from which they obtain energy/matter or information as inputs and to which they export products or services as outputs (by energy/matter is meant people, electricity, money, materials, etc.)

3. Organizations are a network of people, structures, and technical operations that transform the raw materials, such as energy or people, into a product or service desired by users in the environment.

4. Organizations have feedback mechanisms that allow their various parts or components to adjust to its other parts and components. Similarly, there is information flow between the organization and its environment that allows it to adapt and influence. Market research departments are examples of external sensing functions, while various interdepartmental meetings are examples of internal feedback mechanisms.

5. Entropy, or a running down of the system, will occur to the extent that energy is not continuously imported and converted into valued outputs that allow reinvestment and further development. For social systems, the most important maintenance source is human effort and motivation. Thus the motivation of people in the organization becomes just as important a source of energy as financial and other energy/matter resources.

The idea that organizations convert inputs such as energy/matter and information from their environment into outputs that are usable by the environment can be translated into a social system model of organizations (see Scott, 1982; 1994). The model specifies the relationship between the major organizational components that have to fit or be congruent in order for an organization to be effective. These are:

- *People* (qualities they bring with them into the organization)
- *Organizational structures* (reward systems, policies, control and evaluation systems signal the desired and reinforced behaviour, thus shape organizational behaviour and process)
- *Organizational behaviour and process* (mediate the relationship between peoples' needs, expectations, and capacities when they enter the organization and the attitudes and capacities developed as a result of living and working there)
- *Human outputs* (attitudes and psychological states of members after they lived and worked in the organization for some period of time)
- *Culture* (commonly held belief about how the organization is and should be operating, formed by the above four components but also influences and shapes them.)
- *Dominant coalition* (a small number of key decision makers impact all of the above components through their position of power and influence, but they are also influenced by their experience in the organization)
- *Environment* (market, social, and technological)
• **Organizational outcomes** (performance: economic indicators such as profit, quality of work life indicators such as turnover; a function of all the components of the social system working in concert but are particularly well predicted by human outputs).

The social system model does not explicitly recognize tangible assets such as buildings, stock, money, and materials as organizational inputs.

"The environment of [an organizational system] consists of those things that can affect the properties and performance of that system, but over which it has no control. That part of its environment that a system can influence, but not control, is said to be transactional. Consumers and suppliers, for example are part of a corporation's transactional environment. That part of the system's environment that can neither be influenced nor controlled is said to be contextual, for example, the weather and other natural events, such as floods and earthquakes, and in the case of a corporation, at least some competitive behaviour." (Akoff, 1999, p.7)

In the case of the Lower Fraser Basin and the Puget Sound region, systems theory implies that individual organizations are systems, but also that sets of interacting organizations are systems.

**Proposition 2:**

*Several important organizational systems are bounded by the Lower Fraser Basin and the Puget Sound region.*

**The Operation of Systems**

System persistence requires not only the maintenance of boundaries but also the acquisition of resources. These are generally referred to as inputs of forms of energy (physical, chemical, biological, and mental). The inputs are transformed through processes in the different functions called throughputs. These, in turn, lead to outputs, which relate to the objectives or purpose of the organism. For example, analysis at the level of the organism may identify various structures and processes that provide inputs of oxygen, water, and food that will transform these resources to meet organic requirements and that will provide for waste disposal. As well, the organism must be able to distinguish between benign and noxious resources. These various structures and their related processes are usually identified as a subsystem.

The system perspective also includes the concept of feedback, that is, a self-regulating process that monitors the level of system pressures and that, as necessary, sets subsystems in motion to respond to pressures that threaten system equilibrium. For example, a subsystem of the human organism must respond to the changes in ambient temperatures, which threaten a stable internal temperature. Another must provide for the coordination of all subsystems in order to maintain a balance, usually referred to as equilibrium or a steady state. These general concepts, however, must be interpreted as required for the level of system under analysis (Jones, 1994).

In the case of the LFB and Puget Sound, this implies that:

**Proposition 3:**

*The Lower Fraser Basin and the Puget Sound region each contain regulatory systems dedicated to the maintenance of water quality.*
Complex Systems

We know, however, that systems are dynamic in nature. The loops of inputs to throughputs to outputs and back occur across levels and over time, making the systems inherently complex.

The concept of complexity is elusive and there is no widely accepted working definition for it other than a set of characteristics describing it (Morel and Ramanujam, 1999). Complexity entails that in a system there are more possibilities than can be actualised. It is not located at a certain identifiable place in a system but results from the interaction between components of a system, so it manifests at the level of the system itself. Complex systems are usually associated with living things (a bacterium, the brain, social systems, language) and can be characterized by the following parameters:

- Consist of a large number of elements. Large number of elements is necessary but not sufficient.
- The elements have to interact and this interaction must be dynamic. The interactions do not have to be physical; they can also be thought of as the transfer of information.
- Change with time
- Interaction is rich - any element influences and is influenced by some of the other elements. The behaviour of the system however is not determined by the exact amount of interactions associated with specific elements.
- Interactions are non-linear which guarantees that small causes can have large results and vice versa.
- There are loops in the interactions. The effect of any activity can feed back onto itself, sometimes directly, sometimes after a number of intervening stages. The feedback can be positive (enhancing, stimulating) or negative (detracting, inhibiting).
- They are usually open systems, interact with their environment and thus it is difficult to define their border. The scope of the system is often determined by the purpose of the description of the system, and thus it is often influenced by the position of the observer. This process is called framing.
- They operate under conditions far from equilibrium. There has to be a constant flow of energy to maintain the organization of the system and to ensure its survival.
- They have a history, they evolve through time, and their past is co-responsible for their present.
- Each element in the system is ignorant of the behaviour of the system as a whole, it responds to information that is available to it locally. (If each element knew what was happening to the system as a whole, all of the complexity would have to be present in that element. This would either entail a physical impossibility in the sense that a single element does not have the necessary capacity, or constitute a metaphysical move in the sense that 'consciousness' of the whole is contained in one particular unit.)

In complexity or cybernetic theory, feedback is more general: it is the return of information (i) about some past/occurring event (pe) involving an operation (o), where feedback goes to some system or component of a system (Si).

It may or may not directly affect the operations (o) involved in similar future events (fe), but will likely affect some operation (o-other) and some other future event (fe-other).
Learning is feedback about a performance that will affect a future performance. The feedback is normally about positive or negative aspects of the performance and affects future performance in positive or negative way. In sum, I think that complexity can be thought of as:

**Definition 2:**

> Complexity is the result of all the rich interactions among simple elements across levels in a system, where each interaction is based on limited information, yet the sum of interactions creates a unique identity for the whole.

This definition implies that a more complex system is one with many more components, more interactions per components, many types of interaction, history and path dependence in each interaction, and mutual adjustment over-time in the interactions than a less complex system. To say a "system is more complex" then, means that it has a lot more components, levels, interactions per component and level, history, and adjustments.

I argue that:

**Proposition 4:**

> If the regulatory systems in the Puget Sound region are more complex than those in the LFB, they will contain more components, levels, interactions, history, adjustments, and feedback mechanisms.

Of course, rather than focusing on the sum of the individual components, we can also look at the system as a whole—as a global construct and from the outside rather than a construct about components from the inside. Complexity emerges as a result of the patterns of interaction between the elements, but these interactions often take the form of clusters of elements that cooperate with each other, but also compete with other clusters. An element in the system may belong to more than one clustering. The clusters are dynamic and interact with other clusters, both directly as well as through the individual members they share with each other. The evolutionary needs of the overall system may condition which clusters cooperate and which compete with one another. While this is all very useful and interesting, I am primarily concerned with the internal workings of regulatory systems, rather than comparing a large number of regulatory systems from an external point of view. Therefore, I still want to start with my above definition of complexity to understand enforcement.

Equilibrium thermodynamics offers an alternative measure of complexity to this essentially structural one. It is expressed in terms of entropy. The dissipation of energy, the forgetting of initial conditions, and evolution towards disorder, where time implies degradation and death - was the first response of physics to the problem of nature's complexity. Entropy is the measure of disorder in a system. As a system transforms energy less and less of it remains in a usable form, thus disorder increases (i.e. the ability to have reinforcing interactions). Claude Shannon (1949) uses the concept of entropy as a measure of the information content of a message, leading to the development of a mathematical theory of communication, which became the basis of modern information theory.

By replacing the energy with information in the equation of thermodynamics, Shannon (1949) could show that the amount of information in a message is equal to its entropy. The more disorderly a message, the higher its information content, the more highly structured a message, the lower its information content. This theory implies that if information equals entropy, then the message with the highest information content is one that is completely random. Randomness
is no longer understood as unpredictability but in terms of the denseness with which the information is packed (Chaitin, 1987).

I raise this alternative definition of complexity, because the content of interactions (enforcement policy, penalties, remediation, angry responses, mutual adjustment) all represent what I think of as information. It is usually the case that a small, highly structured system, with few components, and little interaction (i.e., one with low complexity) will also be one that delivers low complexity content messages; but that is not always the case (Frank and Fahrback, 1999). The information from the top of the system (i.e., from policy makers) might be highly complex, but less complex as it filters down. Alternatively, the information content in a highly complex (structurally) system, on a linkage by linkage basis, will be less complex than on a linkage by linkage basis in a structurally less complex system. While I stick with the structural complexity measure of systems for the elaboration and testing of my hypotheses, I return to this important, alternative measure of complexity in my discussion and conclusions.

**Summary of Systems and Complexity Arguments**

Figure 2 below illustrates the relationship between regulatory systems for environmental management and enforcement, organizations, and the larger ecosystem. First, the local social system is bounded within the larger ecosystem. This is, of course, a critical assumption and a large one. Both social and ecosystems are known to be more “open” systems than this and often to be components of larger systems.

![Nesting Organizations in Environmental Systems](image)

Second, some particular element of the ecosystem and social system can be examined. In this case I am thinking about watersheds and water quality as a somewhat separable dimension from air and other terrestrial resources. In addition, I am focusing on the regulatory system and the subsystem of environmental enforcement within this system, and less on the complete social system.

**INSTITUTIONAL THEORY: PROVIDING CONTEXT FOR COMPLEX SYSTEMS**

The simple model of ecosystems and organizations interaction in Figure 2 could be used to assess the main hypothesis; that is, enforcement in one ecosystem against organizations is more effective than in another system based on its inherent structural complexity and dynamics. The
specific ecosystems might be designated in BC and WA, and the system of enforcement linking organizations and regulators might then be specified. Finally, the impact and feedback effects from enforcement could be assessed in a model.

However, that would be ignoring a large amount of prior research on organizations and regulatory institutions that has already been done, and it would also be too abstract to capture some of the important social processes that drive the system. Institutional theory from sociology and political science (Powell and DiMaggio, 1991; Scott, 1995) provides the context, description, and background research to link the social and ecosystem elements in Figure 2 more tightly.

In institutional theory, an institution, such as a regulatory system, is defined as follows:

Definition 3:

“Institutions are multifaceted systems incorporating symbolic systems - cognitive constructions and normative rules - and regulative processes carried out through and shaping of social behaviour” (Scott, 1995:33).

According to Scott (1995, ibid), “institutions are transported by various carriers - cultures, structures, and routines - and they operate at multiple levels of jurisdiction. Meaning systems, monitoring processes, and actions are interwoven. Although constructed and maintained by individual actors, institutions assume the guise of an impersonal and objective reality.”

This implies that every regulatory system and the organizations that compose it (agencies, intermediaries, regulates), be thought of as institutions, that is:

Proposition 5:

Regulatory systems and the organizations and fields involved with them can be thought of as an “institution”.

As institutions, these systems can be understood from three different angles or as resting on three “pillars”. The first is the regulatory (operational choice rules) - it addresses questions about what actions are to be prohibited and permitted, and what sanctions are to be used. The second is the normative (collective choice rules) - about who has the right to exercise authority over what decisions and actors in what situations. The third is the cognitive (constitutional choice rules) - about what types of problems fall under who’s jurisdiction, and how these problems are to be categorized and processed. The diagram on operational, collective and constitutional choice rules has been included in Appendix A1.

In the development of an institution (established values, norms, practices, or organizational systems), institutional theory maintains that, first, cognitive processes normally dominate the field where action occurs. Second, regulative processes dominate, as the cognitive become objectified in rules and laws. Finally, the normative processes dominate, where the cognitive and regulative become second nature, unwritten, taken-for-granted rules of behaviour.

Enforcement falls, first and foremost, under the regulatory pillar. The regulatory system in which compliance and enforcement occur contains actors, routines, organizational and political structures, negotiated rules, laws, and policies (Downs, 1967; Krasner, 1983; North, 1990; Wilson, 1989). The tangible elements of the system are most often studied. These include the
written rules, laws, and formal policies; the actors involved in the creation and enforcement of these laws; and the resources needed to maintain the system’s operation. Older institutionalism argues that configuration of a particular regulatory system—including the enforcement process within it—depends on the efficiency of its operations (North and Thomas, 1973; Williamson, 1975) or on its functions for society (e.g., see Gouldner, 1954; Selznick, 1949; 1969).

Compliance refers to a regulated actor following the explicit and implicit laws, rules, and standards in a regulatory system (Environment Canada, 1998; Wilson, 1989). Non-compliance with these standards activates mechanisms for enforcement. Enforcement refers to the monitoring and detection of behaviour that does not meet the targets, and the subsequent application of sanctions to correct behaviour (Barnett, 1986; Scott, 1995). The targets of enforcement refer to explicit standards set in advance of behaviour, with measurable processes and outcomes, as well as to implicit standards that are not well-articulated, but exist in a larger framework, such as case or contract law (North, 1989; Williamson, 1985). Monitoring normally includes a system of measurement and observation of standards, one that uses resources from existing formal systems and inputs from a wider public. Sanctions refer to the threat of using sanctions, embarking on sanction procedures, or to the application of some specific punishments; explicit rewards are rarely offered for compliance within most enforcement systems (March, 1989; Scott, 1995; Dornbusch and Scott, 1975).” (Jennings et.al, 2000)

Several government institutions can have significant impact on the design and operation of enforcement programs. Most significant are the legislative (lawmaking), executive (management and budget), and judicial (legal) institutions, as well as any agencies that have programs in areas related to the environment. The particular institutions and the nature of their impact will depend on the government infrastructure of the country. Institutions with an impact will be those that:

- Identify the need for legislation
- Create environmental laws
- Determine budgets
- Track program progress and success
- Bring legal action
- Oversee activities related to environmental management
- Identify violators of the laws

Legislative Institutions probably have the greatest impact on program development, since they create the laws that define the environmental goals to be met, the authority and flexibility to meet those goals, and the level of funding. They can become involved in policy and implementation decisions by issuing amendments to laws that impose certain duties on the executive institutions. They can also impose deadlines that executive institutions must meet.

Executive Institutions - usually the environmental agency of the country or region - are often responsible for identifying the need for legislation and enforcing the legislation once it has been enacted. This agency may have its own administrative law judges providing an internal mechanism for enforcing administrative orders and appealing agency actions. An executive institution may also supply the lawyers responsible for taking legal action against violators. If this institution is not the environmental agency itself, an interagency agreement can be important to define the conditions for services between the two executive institutions.

Judicial Institutions in some countries (e.g. the U.S.) are responsible for interpreting the laws. They may also impose requirements on the executive institutions by requiring that they use
certain rulemaking procedures if they want those rules to be upheld in court. Courts may provide a forum for taking enforcement action, for prosecution, and for enforcing administrative orders (if the court is authorized). Courts can also play a significant role in assessing sanctions.

**Proposition 6:**

As institutions, regulatory systems require some description of the enforcement cycle as conducted by various actors from the executive, legislative, and judicial branches.

**The Interpretation of Institutions**

New institutionalism argues that most systems are neither efficient nor functional, nor measurable in such terms (March, 1989; March and Olsen, 1976; Meyer and Scott, 1983); instead, systems are better understood as reflections of underlying policy regimes and political cultures. These regimes set up and shape regulatory systems. New institutionalists make a persuasive argument that understanding these regimes requires an interpretive framework.

First, it is necessary to define the relevant organizational field of action, past understandings of compliance and enforcement in those fields. Next, it is important to examine the current interpretation of the rules governing these processes. The interpretation of formal systems of compliance and enforcement lead to the actual behaviour in the system and the observed outcomes. Finally, it is important to see if there is an overall pattern or mode or regime to how the system works, is interpreted, and affects behaviour.

Unfortunately, much less work has been done on implementation and interpretation of policy (i.e., "enforcement") in organizational fields (Suchman and Edelman, 1996); that is, the ways in which laws are implemented, variance over time in their adoption by companies responding to these laws, and the factors leading to certain variances. Hukkinen (1999) has examined the creation of water policy in the US (e.g., California). Her analysis of the mental models with which individual decision makers and experts make sense of environmental problems documents the importance of informal constraints on their thinking. Informal rules are obtained by deciphering them from the mental constructs they reveal in their stories via confidential interviews. The institutional framework determines what organizations come into existence and how they evolve, but the perceptions of individuals working in the organizations also influence how the institutional framework evolves” (Hukkinen, 1999).

Given the importance of interpretation, I maintain that:

**Proposition 7:**

Regulatory systems, like all institutions, rest on interpretation by the actors, and require some interpretive research to understand their operation.

**INTEGRATING SYSTEMS AND INSTITUTIONAL VIEWS OF ENFORCEMENT**

The theoretical views of regulation and enforcement in systems theory can be combined with those from institutional theory. The combination allows for elements of the natural environment, the institutional environment, and the regulatory institutions and events themselves to be mapped
out. The figure below builds on the previous two sections and my original figure at the outset of this theory section, and shows how the regulatory institutions fit within the natural environment.

**Figure 3 Process, Outcome and Feedback**

![Diagram showing the interaction between ecological, social, regulatory, and enforcement systems with process, outcome, and feedback.]  

Figure 3 shows how, in even a simple framework, there are complex sets of processes that lead to corporate and environmental outcomes. Part of the complexity is that interpretation of the rules in the system guides actors, so they must be understood if the operations are to be understood. The figure also shows that processes do lead to outcomes and these outcomes have feedback effects. The outcomes are social and ecological, and feedback into the regulatory and ecosystem. Together the processes and outcomes lead to the general claim or proposition from combining institutional and system/complexity theory:

**Main Proposition:**

*Regulatory systems with more tightly coupled, complex linkages and better articulated policy understandings will have clearer processes than systems without such coupling, complexity and understanding. However, less attention to and elaboration of outcome and feedback (learning) effects will undermine a system in the long run, and this will be particularly noticeable in systems with highly elaborated inputs and processes.*

The following chapters take each of the hypotheses or predictions deriving from this proposition (as discussed in the introduction), and test their validity based on available data and interviews.
CHAPTER III. RESEARCH DESIGN AND METHODS

My hypotheses about the Puget Sound and LFB system are based on a fundamental premise, one embedded in the research design for this thesis: the PS and LFB systems are ecologically similar, but also quite independent in terms of water quality; and the PS and LFB systems are socially distinct, because of political boundaries and living areas, even if they are beginning to draw on similar policies and enforcement tools. Because the Puget Sound and LFB cases are similar, yet distinct, in both ecological and social terms, they make good cases for comparison.

HYPOTHESIS 1 TESTING WITH CASE ANALYSIS

Hypothesis 1 argues that the Puget Sound regulatory system on the input side—particularly on the creation of water quality objectives—is more complex and yet tightly coupled than the regulatory system in the LFB. My theory section detailed the definition of complexity and made it clear that to assess complexity, the components of systems, their interactions, adjustments, and feedback effect need documentation. This implies a fairly sweeping, yet in-depth, study of a system. Case analysis is designed for such situations (see Capra, 1996; Zandbergen, 1999).

Case analysis, as a research method, requires several steps: 1) the creation of explicit rationale and criteria for selecting a case; 2) a strategy about how to assess only relevant portions of the case based on theory; 3) application of case analysis standards when analysing that case; and 4) connection of the case to the theory and hypotheses. Case analysis standards vary by field, but common to all case analyses is the need to “tell a story” (Glaser and Straus, 1968; Ragin and Becker, 1992; Wasserman, 1994). The context, actors, plot, story line, and outcomes are all part of a narrative that connects the pieces of a document.

Below, I attempt to document the input side of the Puget Sound and LFB water regulation systems and “tell a story” about the creation of WQ objectives in a way that illuminates the complexity of each system. Ironically, I think that the diagrams summarizing the linkages in each system are one of the most critical components of the “story”. Qualitative researchers have relied increasingly on diagrams as a means of summarizing text (Miles and Huberman, 1994), so this tool is still considered legitimate within case analysis.

However, I do recognize that I cannot systematically “test” hypothesis one with some definitive criteria, and that, at best, my results are exploratory and suggestive.

HYPOTHESIS 2 TESTING WITH SYSTEMATIC QUANTITATIVE & QUALITATIVE DATA

Hypothesis 2 says that sanctions for non-compliance are higher for organizations in the Puget Sound region, particularly if measured by direct and indirect associated costs of non-compliance, than in the LFB. This is a much more focused hypothesis, than hypothesis one, because non-compliance can be measured in terms of violations of water quality standards and data on violations are kept by governments (see Jennings, Zandbergen, and Martins, 2001). However,
while data on warnings, orders, and fines are kept, the hidden costs and benefits of these sanctions are not examined. As discussed in my theory section, the hidden costs are often the “real costs” (and benefits) experienced by firms and lead to their actual response and feedback. So I have to supplement the governmental data on sanctions with survey and interview data on costs and benefits (Boardman, 2000).

To do so, I interview a random sample of 50 companies in the LFB and 50 companies in the Puget Sound region that have experienced water quality-related violations (NOV/warnings, orders, penalties/fines) over the 1997-2000 time period. In order to obtain the violations data for the LFB I contact Environment Canada Investigations Section, BCMOELP Conservation Officers Services Surrey and Nanaimo offices, and the Department of Fisheries and Oceans Enforcement Officers. The PS violations data is available from the Washington State Department of Ecology in Olympia and Bellevue. The overall sample of companies is stratified by size prior to random sampling to make sure that an even distribution of small, medium, and large firms is included. Small, medium and large firms are defined by ranges 5-50, 100-250, 500 and greater number of employees, respectively, and only the size of local plants or divisions are considered.

I created an interview questionnaire to find out about the tangible and intangible costs and benefits and the response of organizations to enforcement. The cover letter and interview questions can be found in Appendix B1. The survey consists of four open-ended questions and a table with an array of tangible and intangible cost and benefit categories. Participants who agree to an interview are asked all the questions to which I write down all the answers, and then with their help based on their responses I complete the table. The majority of interviews are aimed at being conducted in person, but I am expecting some to be done over the phone and some to be faxed back to me completed.

The tangible and intangible costs and benefits table provides both quantitative and qualitative data for the analysis. Companies are asked to provide me with approximate figures on tangible costs such as clean up, capital investments, monitoring and reporting, etc. To the intangible cost and benefit categories I ask them to respond with a "yes" and "no" answer.

The open-ended questions are to achieve the following objectives:

- to get a more clear picture of the types of new environmental management systems, plans and practices that have been implemented after the incident and in response to the experience of an environmental enforcement action;
- to explore whether the incident and the enforcement action has had any effect on other firms and industries, whether it led to deterrence in any way;
- to find out how the firms' relationship with regulators and the local community has changed;
- to collect feedback and recommendations on elements or aspects of the system that are lacking;
- to reveal the needs that haven't been met and must be addressed, and
- to find ways to improve existing feedback systems both between industries as well between the regulatory community and the regulated firms.
HYPOTHESIS 3 TESTING WITH QUALITATIVE DATA, INFORMAL INTERVIEWS & PERSONAL OBSERVATION

To test Hypothesis 3, that in the Puget Sound Area, the more complex and ambiguous feedback leads to less positive long-term learning and prevention on the part of organizations than in the LFB, I examine the case data on the two systems and the qualitative data from my interviews with companies in each system. In particular, I rely on the comments of participants from their interviews about what they learned within each system. I also conducted interviews with Ministry of Environment and Department of Ecology members about the feedback and learning in each system, which I use as supplementary data.

I focus on examining feedback from an environmental incident through the regulatory agency to the offending actor that should decrease the likelihood of the actor having a second incident in the future: that is, it involves feedback and learning. The feedback and learning is for both the regulator and the regulated actor. I also attempt to provide a missing feedback through the offenders' experience of the process itself and their response to it. This type of feedback is often lacking yet very important in revealing the strength and weaknesses of the environmental enforcement system.

The figure below is my representation of that generic model, informed by background reading, interviews with members of the regulatory community, and current research.

Figure 4 Feedback and Learning

The model shows that incident, monitoring agencies, conservation officers, and the specific decision processes in the monitoring, sanctioning and feedback cycle all must be attached to each other in any working model of enforcement. In addition, the formal and informal rules, combined with standardized versus negotiated outcomes give the model more texture and allow it to fit into different context, depending on where enforcement in a particular system is flexible and where it is not.

In behavioural theory, feedback means giving information about an outcome back to an actor, normally in order for the actor to adjust his/her behaviour. The focus in this research is on feedback from an environmental incident through the regulatory agency to the offending actor that should decrease the likelihood of the actor having a second incident in the future: that is, it involves feedback and learning. The feedback and learning is for the regulator and the regulated actor. I have also tried to reveal the nature of this feedback through the offenders' experience of the process itself and their response to it.
The institutional view of feedback and learning is that feedback is convergent, towards a target or similar behaviour. So if there is a lot of variability at the outset, then the variability decreases to meet a target level, whether good or bad. For example, a certain TMDL might be the target, which is good from the EPA’s point of view, but bad from a naturalist’s. The reasons for feedback and its effect is that firms try to mimic other firms and do the right thing symbolically in order to be considered legitimate in the eyes of the government and society. Otherwise, they might be put out of business. The technical/rational logic of feedback along with its monetary value is important, but less important than isomorphism and legitimacy.

Learning for institutional theory can occur, but it is not apparent or intended learning that happens most often—but unintended learning or indirect learning. Therefore, learning occurs about things other than performance and learning often happens just to make things look good, rather than change any real process. For example, a firm may learn to fill out paperwork and evade the rules on site, but keep the government happy.

Of course, Hypothesis 3 cannot really be tested very thoroughly with either case or survey or interview data, because it implies over time effects, and because many of these over time effects have not yet been experienced by the firms or government agencies in the sample. Nevertheless, I think the limited information I collected is quite rich, and in light of the information on Hypothesis 1 and 2, allows for some conclusions about feedback and learning effects—and more importantly recommendations for each system. A similar strategy was used by both Hukkinen (1999) in her study of the creation of water quality objectives and their management in California and by Espeland (1998) in her examination of the politics around the creation of water quality agreements in the American Southwest.
CHAPTER IV. CASE COMPARISONS OF PUGET SOUND AND THE LOWER FRASER BASIN - HYPOTHESIS 1

THE PS ENVIRONMENTAL ENFORCEMENT MANAGEMENT SYSTEM

The Puget Sound Region refers to the area north of Seattle bounded by the US border, the area east of Seattle bounded by two major river valleys, and the area south of Seattle bounded by the mountains past Tacoma. The west is bounded by the Pacific Ocean (see map of PS below).

Figure 5 The map of the Puget Sound Region
The regulatory system for water quality in the Puget Sound can only be understood within the context of the larger US and the Washington State system. Numerous authors assessing water management systems in the US have noted its top-down nature, in spite of recent attempts to localize control (Day and Georgison, 1994; Hoffman, 1997; Hukkinen, 1999). Therefore, I spend a lot of my case analysis discussing the US system, then turn to the Washington State system, and finally examine the implications for local regulation and enforcement of water quality.

The Federal System

The management of water quality in the regulatory system in the United States can be depicted by the flow diagram on the next page (Figure 6).

The enforcement system in the US currently has several objectives:

- Translates compliance information into timely and appropriate enforcement action
- Identifies priorities and directs the flow of enforcement actions based on these priorities and available resources
- Provides flexibility to develop management procedures best suited to operations and resources
- Defines the principles necessary to the operation of an effective compliance/enforcement program
- Provides the basis for evaluation of the performance of agencies.

This system of parallel responsibility, with the primary role delegated from the federal level to the state and local governments, has several advantages:

- Program quality (minimum program standards are met across the country regardless of the resources and capabilities of individual states)
- Technical capabilities (provided when they are not available at state level)
- National consistency (enforcement is practiced fairly and consistently)
- Deterrence
- Fostering competition (measures progress and success across states by comparing them which resulted in a healthy competition among states and improved program success)
- Improved program effectiveness (shifting responsibility for compliance monitoring and enforcement to local level - those closest to a problem are most likely to spot the problem and correct it in a timely manner)
- Sharing the financial burden (delegating to state and local governments relieves the national government of substantial financial burden for enforcement programs)

In terms of feedback, EPA identifies and publicizes information about successful state programs so that other state programs can learn from their approach.

As far as disadvantages, parallel authority may lead to duplication of effort and confusion of roles.
Figure 6 THE WATERSHED WQ MANAGEMENT SYSTEM SOUTH OF THE BORDER

TOTAL MAXIMUM DAILY LOAD (TMDL)
1. Loading capacity: the amount of pollutants a water body can receive without violating WQS. A reference for calculating the amount of reduction needed to bring a water body in compliance with WQS.
2. Waste load allocation: the portion of a receiving water's loading capacity that is allocated to one of the existing or future point sources of pollution
3. Load allocation: the portion of a receiving water's capacity that is attributed either to one of its existing or potential non-point sources of pollution or to natural background sources
4. Margin of safety: implicit assumptions in the loading capacity calculations that provide a margin of safety. The sum of the tributary, upper basin and Waste Water Treatment Plant reductions are greater than needed to meet the main stem reduction target
5. Seasonal variations: correlation between rainfall and bacteria loads

FEDERAL: US EPA
Clean Water Act - section 303
NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES)
- Permit Compliance System (PCS)
- National Database of Environmental Management Systems

PERMITS
NEGOTIATED AGREEMENTS
ORGANIZATIONS, FACILITIES, ENVIRONMENTAL MANAGEMENT SYSTEMS
- Monitoring and Reporting, etc.

FINAL ALLOCATION scheme and a description of HOW the allocations were developed

NON-COMPLIANCE
- Enforcement Action:
  - Negotiation
  - Notice of Violation
  - Order
  - Penalty Matrix
  - Remediation

STATE, LEVEL INSTITUTIONAL ACTORS:
Washington Department of Ecology, (enforcement and non-enforcement staff not separated); Health Boards on outlying areas.

MOA

ENFORCEMENT ACTION:
- Negotiation
- Notice of Violation
- Order
- Penalty Matrix
- Remediation

DEPARTMENT OF WASHINGTON
Environmental Management Program

COMPLIANCE
- Best Management Practices Leadership case studies Environmental Excellence Program

DESCRIPTION OF ALTERNATIVE ALLOCATION strategies explored

ANALYSIS OF POLLUTION SOURCES contributing to the problem

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- Monitoring and Reporting, etc.
EPA's use of science for regulatory decision making

The scientific culture within the agency and in the environmental regulatory science community at large is dominated by the disciplinary norms and training of toxicology that greatly influences the extent and nature of EPA's use of science.

"This is an outcome of the fact that to assess the environmental effects of substances before they are released into the environment, many EPA regulatory decisions (i.e. Toxic Substances Control Act pre-manufacturing notices) are based on predicted, rather than observed outcomes. In the meantime the quantity and quality of data available vary greatly among chemicals, but for most chemicals, data for toxic mode of action, metabolism and toxic potency, exposure, and differential susceptibility are lacking. The National Research Council (1984) found no toxicity data on more than 80% of the roughly 50,000 industrial chemicals (a category that excludes pesticides, food additives, cosmetics, and drugs) used in the United States and concluded that data were incomplete for the remaining 20%. The share of pesticides - which are expected to be biologically active - without minimal toxicity information was estimated at 64%. For industrial chemicals produced in amounts exceeding one million pounds a year, they found that virtually no neurological, reproductive, or developmental toxicity testing had been done. "Good" toxicity data testing data are available for only 10% of all chemicals, while human epidemiological data are available for less than 1% of chemicals in use" (Powell, 1999).

"The nature of the decision (for example, whether to request additional information, where to set a national standard, what technology to employ, what contaminated site remedy to choose) affects the level of scientific effort but may shed little light on whether science drives decision-making." (Powell, 1999, p.124).

"Much of what passes for "environmental science" is in fact, a negotiated consensus among experts. Different experts weight data differently, and as a result consensus can be difficult to achieve. However, in the cases in which expert consensus has been achieved, or when some credentialed group deems it so, it is easy to lose sight of the fact that what is perceived as a "scientific fact" remains an un-validated sometimes un-testable, negotiated scientific judgment." (Powell, 1999, p.127)

In the case of developing effluent guidelines for industrial sectors for example, in addition to technology-based standards EPA also formulates ambient water quality standards. The administrative complexity is introduced at the stage of establishing and allocating pollutant discharge limits that will ensure attainment of the ambient standard (see Figure 7 below). Basing regulatory controls of wastewater discharges on risk-based standards requires consideration of site-specific characteristics of the receiving water body and of the exposed population. Under the current Clean Water Act (CWA) program states are required to identify waters that do not meet ambient WQ standards after implementation of technology-based controls and to develop total maximum daily loads (TMDLs), which specify the maximum amount of pollution a water body can receive daily without violating WQ standards. The TMDL is then to be allocated among the various sources contributing to the problem (though only point source discharges are subject to enforceable limits). If a state fails to fulfil these requirements, EPA is required to do so. (Powell, 1999, p.99).
A study has requested forty respondents to rate the EPA's overall use of science in regulatory decision making currently, ten years ago and twenty years ago. 47% respondents rated it as good.

Figure 7 Institutional Actors - Development of WQ Standards for PS
to very good, compared with 31% 10 years ago. "Several general trends emerge from the response. Although the trends are not even across programs or consistent over time, and respondents were not in complete agreement. Most agreed that science at EPA has become more institutionalised, decentralized, consistent, rigorous and comprehensive. In particular, the use of risk assessment in decision making has become more formalized, (gained legitimacy within the agency) refined and ingrained at EPA." (Powell, 1999)

Enforcement in the Federal System

An overview of the enforcement system is contained in Table 1 which a new synthesis of the components of the EPA's original (1985) enforcement system - the basis for the current enforcement system in the US. It is built on seven principles:

1) source inventory,
2) flow of information,
3) pre-enforcement screening,
4) enforcement evaluation,
5) enforcement action/follow up,
6) field investigations, and
7) internal management control.

I have tied those seven elements to the larger regulatory system in terms of:

- goals in the system,
- who is responsible,
- the multi-criteria and multi-objective optimisation tools they use
- models, data and knowledge base
- the information flow and feedback to the larger system, results domain.

They help in the situation of the system and show where the inputs and outputs might need adjustment. The table below captures these seven elements and five design considerations.

<table>
<thead>
<tr>
<th>SYSTEM COMPONENTS, PRINCIPLES</th>
<th>GOAL FUNCTIONS, WHAT IS IT? PURPOSE</th>
<th>WHO IS RESPONSIBLE FOR? WHO HAS ACCESS TO DATA? PROBLEM SOLVING? Actual decision making process, individual weighting of the goal functions by the decision maker.</th>
<th>ORIENTORS, MULTI-CRITERIA AND MULTI-OBJECTIVE OPTIMIZATION, TOOLS IN HELPING ECOLOGICAL AND ENVIRONMENTAL DECISION MAKING, DECISION VARIABLES</th>
<th>DATA, MODEL AND/OR KNOWLEDGE BASE</th>
<th>INFORMATION FLOW, FEEDBACK, COMMUNICATIONS, FINAL STATE, RESULTS DOMAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE INVENTORY</td>
<td>Process for determining who hasn't applied for a permit. Historical reference of previous enforcement action.</td>
<td>Maintenance responsibility. Routine schedule for updating inventory.</td>
<td>Permit Compliance System (PCS) Automated National Pollution Discharge Elimination System Database</td>
<td>Data access to all parties</td>
<td></td>
</tr>
</tbody>
</table>
**FLOW OF INFORMATION**

**PRE-ENFORCEMENT SCREENING**

- Substantive technical evaluation for dischargers:
  - Initial review of incoming information:
    - Who is responsible for each screening function?
    - Identify who is responsible for completing each phase of the evaluation?
    - Who must make each decision as the apparent non-compliance is processed?

- Detailed procedures & timeframes for conducting technical evaluation to determine level and frequency of violation and determine appropriate response,

- Document action taken/not taken when violation falls below level of immediate action (for future reference)

- Identify timeframes for action

- Procedure for describing follow up action: If obvious compliance, no further review, update source inventory

- Method for

**Integrate info from various sources into effective information flow channel into decision and control points in the system.**

**Potential sources: Compliance reports, Industrial User Reports, Construction-Completed Reports, Bypass/overflow Reports, Construction Grant related information, Discharge Monitoring Reports, Inspection reports/field surveys, Operation and maintenance reports, Information from other agencies: health, fish kills, Reports/complaints from citizens, Evidentiary Hearing Information, Permit modification requests, Information from other Programs Pre-treatment Program Reports**

**Appropriate time frames for info flow - allowable elapsed time from receipt to availability for review (less than a week)**

**Install and maintain tracking system (violation summary) to locate an enforcement action at any time in this process**

**Internal transmittal of compliance information pre-enforcement screening of Discharge Monitoring Reports to determine whether the Violation Review Criteria have been exceeded.**

**Require forecast of Reports (due in 30 days)**

**SOURCE INVENTORY**

- Have standard procedure for compiling material to use in the next evaluation step:
  - set out type of information in document sent to the assigned author of the proposed action

- Method for
<table>
<thead>
<tr>
<th>Determining exceedence of permit effluent limits?</th>
<th>Develop chronological summary of violations</th>
<th>Guidelines and procedures which assist in determining the appropriate level of action to be taken for a specific violation:</th>
<th>Delineate role of technical vs. legal staff</th>
<th>Procedure for compiling enforcement action background information</th>
<th>Procedures for closing out and updating the file and returning the compliance information to the database.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enforcement Response Guide (international?)</td>
<td>Establish procedures for coordination</td>
<td>Technical staff should have the lead responsibility for preparing enforcement action</td>
<td>Procedure for escalating enforcement action</td>
<td>When it is decided that an enforcement action will not be taken, clearly document why the alternative action is more appropriate</td>
<td>Timeframe for completing a determination as to whether the violation is actionable and initiation of the appropriate response (should not exceed 45 days).</td>
</tr>
<tr>
<td>Determine appropriate follow-up action made by technical personnel with legal consultation.</td>
<td>Legal staff are responsible for certain aspects of case development.</td>
<td>Procedures for interaction &amp; coordination with other affected programs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Enforcement Evaluation

**ENFORCEMENT ACTION**

<table>
<thead>
<tr>
<th>The cutting edge of the EMS and begins when the decision has been made to issue a “formal” enforcement action under specific sections of Federal and State/Provincial statutes and/or regulations</th>
<th>Specific designation of responsibility for writing the enforcement action</th>
<th>Procedures and guidelines for escalating the action if compliance is not achieved expeditiously</th>
<th>A tracking system for following the progress of formal enforcement actions and for determining compliance capable of supporting the flow of required information into the Permit Compliance System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidance for the form and substance of the formal action for use by the legal and technical staff. The basic elements of the action should be summarized in this form</td>
<td></td>
<td>Procedures for establishing the basis for closing an enforcement action</td>
<td>Routing the appropriate compliance information to the SOURCE INVENTORY.</td>
</tr>
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<td></td>
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</table>

### Enforcement Action and Follow-Up

<table>
<thead>
<tr>
<th>The enforcement action is often dictated by the ability of field inspection programs to respond to enforcement needs</th>
<th>Designation of responsibility to the Enforcement Program Manager for requesting field investigations</th>
<th>Criteria and procedures for detecting candidates for field investigations accomplished by development of annual compliance inspection plan.</th>
<th>Timeframes for reporting findings, full report within 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Procedures for coordinating field investigations between administering agencies.</td>
<td>Clear criteria for</td>
<td>A mechanism for informing investigation personnel of the utilization of field</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
30

Enforcement program responsible for selecting inspection candidates for both routine and special efforts of the field units in support of the program. | selecting candidates for appropriate mix of routine and special compliance inspections | surveys

A system for assessing how the compliance data, as indicators of environmental results, helps meet the goals of the Clean Water Act
A system for evaluating specific activities in terms of their quality, timeliness, results, and accomplishing of program objectives.
To be able to assess the effectiveness of the program and to identify progress or deficiencies

The EMS must provide for maintenance of a record of specific formal enforcement actions
The organization's enforcement procedure must provide feedback to give management the information it needs to ensure that the program makes timely decisions and meets commitments
Must allow for self-evaluation based on reasonable timeframes
Must identify the focus or responsibility for each element of the EMS

INTERNAL MANAGEMENT CONTROL

Voluntary Measures in the US System

So, in the US, do "environmental management systems" used by businesses and governments to improve their environmental performance work in the real world?

Nobody knows for sure. Because widespread adoption of EMSs by industrial and governmental facilities has the potential to change the nature of environmental regulation, the Environmental Law Institute and the University of North Carolina at Chapel Hill are engaged in a multi-year project to help answer that question through the creation of the National Database on Environmental Management Systems. NDEMS includes more than 50 pilot facilities that are implementing EMSs. The joint ELI-UNC project is supported by the EPA and a consortium of states known as the Multi-State Working Group. ELI and UNC have released the NDEMS database as well as a landmark study that contains a thorough analysis of the initial baseline data from the 50 facilities. The report, The Effects of Environmental Management Systems on the Environmental and Economic Performance of Facilities, covers the three years prior to the implementation of an EMS at each facility, along with extensive data on each facility's past environmental performance, compliance history, pollution prevention efforts, and involvement of external interested parties. The facilities, including some that are implementing EMSs based on
the ISO 14001 international EMS standard, are located in 10 states and represent a variety of sizes, industries, and government agencies.

"The creation of NDEMS and our research based on it are designed to answer the fundamental question of whether implementation of an EMS changes a facility's behaviour in ways beyond those that are the result of standard environmental regulations," said Suellen Keiner, Director of ELI's Program on Environmental Governance and Management. EPA's project manager for NDEMS, Jim Horne of the agency's Office of Water, added: "We want the public and other researchers to have access to these data so they can build upon our analysis and determine for themselves the effects of EMSs." In addition to analysing the baseline data, The Effects of Environmental Management Systems includes a summary of the major project milestones and updated information on the demographics for the 50 pilot facilities. The report also describes upcoming project highlights, including preliminary details regarding the facilities' EMS design activities.

Beyond analysing information from the national database, the ELI-UNC researchers have conducted a number of site visits and in-person interviews with pilot facility managers and employees. Two facilities are the subject of detailed case studies in the report, and more case studies will be published later this year. "The case studies are crucial to the project because they provide a more complete understanding of EMS implementation," said Horne. "The two case studies describe each facility's EMS design process, motivations for developing its EMS, and the perceived costs and benefits of implementing an EMS." In the next phase of the NDEMS project, the ELI-UNC research team will be compiling data on the pilot facilities' EMS designs, as well as the processes by which their EMSs are implemented. These data will be added to NDEMS, which will be updated every six months so that changes over time can be analysed by the ELI-UNC team and other researchers. The database and the report are available to the public for free at www.eli.org/isopilots.htm. The project Web site also includes background information on NDEMS, including the data collection protocols.

**Washington State**

The EPA and the State of Washington have signed a Memorandum of Agreement for the implementation of section 303 of the Federal CWA in order to provide a framework, schedule and strategy to restore the quality of impaired waters in WA: (a) achieve WQ standards and (b) to describe methods and processes that the Department of Ecology will use to develop and implement the requisite TMDL for the 1996 303(d) list of WQ limited segments. As a result, Ecology's responsibilities include the:

- Identification of waters for which applicable technology-based effluent limitations or other controls are not stringent enough to implement WQS
- Establishment of priority ranking for such waters
- Establishment of TMDL for those waters that are not in attainment with WQS.

The TMDL development (the sum of the allocations) consists of the following steps:

- description of the applicable WQS, including the uses to be protected, problems to be corrected
- an analysis of pollution sources contributing to the problem
- description of alternative allocation strategies explored
• final allocation scheme and a description of how the allocations were developed, including:

1. **Loading capacity**: the amount of pollutants a water body can receive without violating WQS. A reference for calculating the amount of reduction needed to bring a water body in compliance with WQS.

2. **Waste load allocation**: the portion of a receiving water's loading capacity that is allocated to one of the existing or future point sources of pollution.

3. **Load allocation**: the portion of a receiving water's capacity that is attributed either to one of its existing or potential non-point sources of pollution or to natural background sources.

4. **Margin of safety**: implicit assumptions in the loading capacity calculations that provide a margin of safety. The sum of the tributary, upper basin and Waste Water Treatment Plant reductions are greater than needed to meet the main stem reduction target.

5. **Seasonal variations**: correlation between rainfall and bacteria loads.

The logical and strategic explanations of the trend towards decentralized science may be that risk analysis and other means of using science have gained such institutional momentum at EPA that less attention from the political level is required to sustain the trend (Powell, 1999). Science:

- Can't be managed centrally
- Has to be tailored to specific program needs
- It's a control issue (the programs want control of the science)
- Control over the regulatory analysis function promotes scientific support for policy decisions.
- It must ensure that regulatory decision makers' information needs are satisfied.
- Increased use of external review and willingness to acknowledge scientific uncertainty.
- The development and use of science inevitably present policy choices.

A good example of this decentralization process and the proceeding institutional arrangements for implementation is the development of the Puget Sound Action Team and its activities.

**The Puget Sound**

Washington State has adopted a governmental approach to comprehensive environmental protection for Puget Sound dating back to 1983. In 1985 the Puget Sound Water Quality Authority was established with the assignment of developing a comprehensive plan for Puget Sound. In 1996 the statute for the Authority has expired and it was rewritten into a new structure, as well as given a new name: The Puget Sound Action Team (PSAT). The PSAT is a branch of the State Government with a rather unique governance structure. Their main assignment is to oversee, implement, periodically revise and amend the Puget Sound Action Plan.

The governance structure constitutes two governing boards: the PSAT and the Puget Sound Council. The PSAT itself has representatives from three federal agencies, ten state agency directors, and representatives of tribal, city and county governments. A full time director of the 25 member staff, the chair of the action team is pointed by the Governor of the state. The Puget Sound Council has formed out of the legislature. It also has representatives from the tribal government, the city, the county, and interest groups (businesses, farmers, shellfish growers, environmental groups, etc.).
There is a peer review and some public review in the process of selecting the series of environmental indicators that they are trying to report on. These indicators are all linked to the management plan and they are published in (a newspaper format) the "Puget Sound Health 2000: Status and Trends of Key Indicators", as well as online at www.wa.gov/puget_sound. In addition, a comprehensive monitoring plan and technical report on the Puget Sound ambient monitoring program is produced every two years: "The Puget Sound Update" which is also on their website.

The drivers and main indicators for the PSAT team are: population growth; spills; biological behaviours (e.g., of shellfish), sediments, and coliform levels. For instance, in the case of population growth, the question is whether or not there is a systems in place to approach a doubling of population in a short time period. This is an indicator of the stressor - people are the problem, and the challenge is how we modify our standard of living, our manner of living so it is sustainable. There are official projections and census numbers across the border because data is available.

In the case of biological indicators, the question is what's the effect of our human operations on the biological populations? Pacific herring, large copper rockfish, and scoter densities have been used to gather multi-indicator data. In addition, the dramatic increase in the number of shellfish growing areas closed was one of the public driving forces for rehabilitating Puget Sound. Commercial shellfish growers declare a growing area for which they apply for and thus are subject to state regulation.

The case of contaminated sediment is an example of applying a regulation to an environmental indicator. Washington State has adopted regulatory clean standards - the difference between clean and dirty marine sediments in Puget Sound. In Bellingham bay almost 2000 acres have been assessed and of the 2000 acres, 1000 acres are violating state standards. In Eastern Kitsap Inlets & Bays less than half of the assessed sites are contaminated. In Puget Sound there is a total of 5000 acres of surface sediments that violate state standards. This is a good measure in terms of the cumulative harm done, and the fact that sites violate the standard is considered to be a declaration of the level that causes harm. On the other hand, this indicator shows virtually no trend. When new dirty sediments get deposited on old dirty sediments it takes a long time to see recovery because of the accumulation effect. The only changes that are measurable are when we actually clean up sediments. So far 160 acres have been remediated. As more data is collected, more errors can be assessed, and as a result the total area of contaminated sites goes up - not because it became contaminated, but because of the time lag the data has been received. It would be difficult to extend this indicator across the border for the following reasons: 1) there is no parallel standard in Canada, 2) the standard requires the application of chemistry and bioassay test which is expensive and right now there is no comparable chemistry testing data available from Canada.

My Assessment of the Effectiveness of the PS System

My assessment of the input side using complexity and institutional theory lead me to the following observations:

- The US system has a large number of components as regulatory systems go.
- Within the US system, components are still organized by levels in a decision-making hierarchy.
• The state systems have moderate priority, while the local systems do not have too much priority in that hierarchy. (From some of the interviews I found out that county governments however, have attempted to override state level regulations and decisions in several occasions.)
• The amount of interaction between components in the system seems lower than I might have imagined, partly because the interaction is specified by decision rules and programs.
• The most adjustment occurs around the application of science to water quality standards.
• There is also a lot of adjustment around the creation of TMDLs, but only for the limited number of participants that are covered by TMDL permits.
• The water quality objectives and standards that are sweeping have a lot of inherent ambiguities. That is, they are rich.

THE LFB ENVIRONMENTAL ENFORCEMENT MANAGEMENT SYSTEM

The Lower Fraser Basin is the region that is bounded on the west by the Pacific Ocean, on the south by the US border, on the east by the end of the natural valley at the town of Hope; and on the north by the Cascade Mountains (see LFB map below).

Figure 8 The Map of the Lower Fraser Basin

The Federal System

As Jennings, Martin and Zandbergen note (2001), the fragmentation and tension in the state structure had three interesting outcomes in terms of environmental regulation and enforcement, particularly when compared to the U.S.’s environmental system.

First, there is no overarching legislation and regulatory system in Canada that parallels the U.S.’s National Environmental Protection Act (NEPA, 1969) and the Environmental Protection Agency (EPA, 1970). In contrast, the Canadian Environmental Protection Act (CEPA) was passed only in 1989 and simply reinforced existing laws and strengthened enforcement, partly by coordinating interagency efforts. It did not change the federal government’s or provinces’ roles greatly (Dorsey, 1991a; Rankin, 1991; Thompson, McConnell, and Huestis, 1993).

Second, in Canada as a whole, until the mid-1980s, the approach to monitoring and enforcement was more conciliatory and negotiation-based (Huestis, 1993; Rankin and Finkle, 1983). It was
up to the ministries and their functionaries to determine the nature of compliance. Environment Canada was known for studying problems endlessly and joining large task forces without making a difference. In the late 1980s, social movements and legal pressures from outside the system began to mount in several regions. During the same time period, the federal government was engaged in signing environmental protocols and treaties, such as the Bruntland protocol and the Rio Treaty (see Frank, 1997). CEPA was passed at the same time. The result was more pressure for compliance and the use of legal mechanisms to ensure it (Environment Canada, 1999; Huestis, 1993; Nemetz, 1986; Paisley, 2000).

Third, because the provinces have a great deal more power in Canada than states do in the US to set up, monitor and enforce environmental laws, provincial and local politics also have a greater role in the creation and enforcement of environmental laws and regulations. Each province has its own set of laws and regulations dealing with different areas of the natural environment—land, air, and water. These overlap federal laws and regulations. In several cases, the provincial laws and regulations are actually more stringent and have precedent, based on the separation of federal and provincial rights and powers. For instance, the Waste Management Act (WMA) of British Columbia contains more restrictions and higher penalties for water-related pollution than the strongest of the federal, water-related acts, the Fisheries Act (Dorcey and Ruggeberg, 1991; Rankin, 1991).

The arrangement of the environmental regulatory system in Canada, as documented in this and other research (e.g., see Dorcey, 1991), indicates that a great deal of attention needs to be paid to the provincial as opposed to the federal level where water quality is concerned. However, in order to make an easier comparison with the US case, I will first discuss water quality and the input side of the regulatory system at the federal level and then move to the provincial level.

The diagram below (Figure 9) shows how the federal system is set up where water quality is concerned. It is immediately apparent that a consideration of both the federal and provincial actors is critical for setting the objectives, especially when there is an inherent conflict of philosophy between the two levels of government about the waste assimilative function of the natural environment. While I will start by discussing the federal system, bear in mind that the provinces have at least as much power.

Each year Environment Canada inspectors conduct from 400 to 700 inspections in British Columbia and the Yukon. The annual plan involves national priorities such as ozone depleting substances, transboundary movement of hazardous wastes or local issues related to agriculture, urban development, and industries such as pulp and paper, wood, preservation, ship repair and mining. Inspectors may become involved in emergency responses to spills, leaks or fires involving hazardous materials. These responses often involve co-ordination with the federal Department of Fisheries and Oceans, Canadian and American Coast Guards, Royal Canadian Mounted Police and the provincial or territorial Ministries of the Environment.

The annual compliance reports provide details of the routine inspections carried out by Environment Canada’s Inspection Section. New programs and additional inspection activities sponsored by the Fraser River Action Plan and the Georgia Basin initiative are featured in these reports. The 23 Annual Compliance Reports provide an overview of the level of compliance with the environmental statutes and codes of practice under the Canadian Environmental Protection Act (CEPA 1999) and the Fisheries Act (FA). In 1998, 847 inspections were completed under the CEPA and 282 under the Fisheries Act.
**Figure 9 THE PROCESS IN CANADA AND THE LFB**

**PROVINCE, BASIN LEVEL, REGIONAL INSTITUTIONAL ACTORS**

BCMOELP, Water Management and Pollution Prevention Branch: Guidelines and Standards Policy & Procedures - framework for setting WQO and Standards

**FEDERAL: EC, DFO, CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT**

CEPA section (8)(1), Fisheries Act. Federal Water Policy, Joint policy statement by EC and DFO on use and application of WQO

**PHILOSOPHY:**

**WASTE ASSIMILATION** is a VALID WATER USE, INITIAL DILUTION ZONE

**Water Quality Objectives**

**WHAT ARE Water Quality Objectives?**
Numerical concentrations or narrative statements that have been established to support, conserve and protect

**DESIGNATED USES** at a specified site:
- Drinking, public water supply and food-processing (for raw water sources prior to treatment
- Aquatic life & wildlife
- Agriculture (irrigation and livestock watering
- Recreation & aesthetics
- Industry
- Power storage
- Water storage
- Waste assimilation

**HOW THEY ARE DERIVED?**
- Background concentration procedure
- Recalculation procedure
- Water effect ratio
- Resident species

Implementation of a regional/basin assessment in consultation with stakeholder groups. For the attainment of WQO the WATER INDEX is used

**PHILOSOPHY:**

**NON-DEGRADATION POLICY**
All reasonable and preventative measure should be taken to maintain existing conditions when they are better than the conditions specified by the WQO. Existing conditions should be adopted as the objective for waters of superior quality. Objectives cannot be used to derive allowable effluent contaminant concentrations if they would result in relaxation of effluent treatment requirements such that legislated effluent standards are no longer met. (E.g. Metal Mining Liquid Effluent Regulations)

**RECOGNIZED WATER USES:**
- Raw water for drinking water supply
- Recreation & aesthetics
- Freshwater, estuarine, and marine fish
- Migratory birds and other aquatic life
- Agriculture (irrigation and livestock watering
- Industrial water supply

**HOW THEY ARE USED?**
One component of an Integrated Process for Ecosystem Based Natural Resource Management in Canada. Used in conjunction with PERMITTING PROCESS, TECHNOLOGY DEVELOPMENT AND ENFORCEMENT
- For Rating
- For Reporting Status and Trends Reports

**ORGANIZATIONS', FACILITIES' ENVIRONMENTAL MANAGEMENT SYSTEMS**
- Monitoring and Reporting
- Non-Compliance lists
- Referred Incidents to Conservation Officers Services, etc...
Industries regulated under the federal Fisheries Act or the Canadian Environmental Protection Act in British Columbia had an average compliance rate of 93% in 1998. Non-federally regulated industries implemented an average of 65% of the recommended environmental best management practices.

Other 1998 regulatory compliance rates included:
- 99% Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations
- 96% Export and Import of Hazardous Waste Regulations
- 99% Ocean Dumping Regulations
- 88% Ozone Depleting Substances Regulations
- 94% Storage of PCB Materials
- 100% Pulp and Paper Mill Defoamer and Woodchip Regulations
- 100% Diesel Fuel Regulations

The implementation rates for Best Management Practices by various industrial sectors included:
- 84% antisapstain wood preservation
- 91% heavy duty wood preservation
- 71% ready-mix concrete
- 57% ship building and repair

**Enforcement in the Federal System**

Environment Canada believes that promotion of compliance through information, education and other means is an effective tool in securing conformity with the law. Measures to promote compliance include:

- **Education and information** includes creation of the environmental registry, media releases, publicizing the laying of charges and the results of prosecutions as an effective means of deterring potential offenders.
- Providing **technical information** regarding pollution prevention, pollution control, methods for analysis and monitoring, etc, in the form of publications, newsletters, seminars, conferences, training materials, licensing of research developments.
- **Consultation on regulation development and review** with provincial ministers of environment and health, aboriginal governments and the public.
- **Environmental codes of practice and guidelines** don't have the force of law but they can help achieve the objectives of CEPA 1999, namely the protection of the environment. They are developed in consultation with interested parties, including provinces, territories, aboriginal governments and aboriginal people, industry and environmental groups. Codes of practice as well as environmental quality and release guidelines help in the establishment of effective management practices. Codes focus on substances and the processes and techniques related to their production and use, including activities such as handling, packaging, distribution, transport, and disposal. They may detail procedures, practices or release limits relating to works and undertakings during any phase of development or operation, including sighting, design, construction, start-up, closure, and dismantling. Environmental quality guidelines and release guidelines focus on the ambient environment. They recommend acceptable levels of a particular substance in air, water or soil, to protect a specific use of that component of the environment. They serve as a yardstick to determine whether the environment and human health are being
sufficiently protected; and as targets for pollution prevention and control programs by industry and government agencies.

- **Promotion of environmental audits** - internal evaluations by companies and government agencies to verify their compliance with legal requirements as well as their own internal policies and standards. They can identify compliance problems, weaknesses in management systems, or areas of risk.

Enforcement officers are appointed under the CEPA (1999) and they carry out two categories of enforcement activity: inspections and investigations. The inspection program is complemented by spot checks. Responses to alleged violations include:

- Warnings
- Directions by enforcement officers
- Ministerial orders
- Detention orders for ships
- Tickets
- Ministerial orders
- Environmental protection compliance orders
- Injunctions
- Prosecution
- Environmental alternative measures
- Penalties and court orders upon conviction
- Use of court orders upon conviction
- Civil suit by the Crown to recover costs

Investigation involves gathering, from a variety of sources, evidence and information relevant to a suspected violation.

**Voluntary Measures in the Canadian System**

Canada is committed to pollution prevention as part of sustainable development. The use of regulatory and non-regulatory approaches are essential to meet this goal as part of the national commitment to protect human health and the environment. The Accelerated Reduction/Elimination of Toxics (ARET, 2000) program is an example of non-regulatory efforts to secure a safe and healthy environment while contributing to a prosperous economy. ARET seeks, through voluntary actions, the virtual elimination of 30 persistent, bioaccumulative and toxic substances and significant reductions in emissions of another 87 toxic substances. Participants from nine major industry sectors and government use the ARET program to prioritise emission reductions and determine appropriate reduction and elimination methods.

In the early 90's, the concept of voluntary measures was uncharted territory. There was no model when ARET was developed which made it a leading-edge initiative. Voluntary measures can be an effective means of accelerating the reduction in the release of toxic substances to the environment. The government is prepared to take regulatory action to reduce emissions of toxic substances if voluntary measures do not produce the desired results. Environment Canada undertook an evaluation of ARET to determine its level of support for the initiative in the future. The evaluation indicates that, in general, ARET participants made a greater effort to reduce releases of toxic substances than non-participants. The short-term targets were to reduce the emissions of 30 toxic substances that are persistent, bioaccumulative and toxic by 90% and emissions of 87 other substances by 50% by the year 2000.
The report by Environment Canada Report on Voluntary Corporate Initiative (July 24, 2000) shows that toxic emissions from 169 companies, who are submitting plans, were down by 67 percent in 1998, and 43 percent have already achieved year 2000 targets established in 1994 for all categories of substances on which they report. Year 2000 targets have been exceeded for three of the five ARET substance categories, and for 62 percent of ARET substances being reported. These facilities, representing 169 companies and government organizations, are using ARET to publicly demonstrate their environmental responsibility. ARET participants will continue to monitor, implement and evaluate their emission reduction efforts. As they develop new technologies and implement innovative pollution prevention measures, participants will update their action plans and report on their progress through annual reports submitted to the ARET Secretariat. Environmental Leaders 4 will be produced in early 2001, and will include results achieved up to December 1999. Additional information on ARET can be found on Environment Canada's Green Lane at www.ec.gc.ca/ARET/.

The Green Industrial Analysis (GIA), is another voluntary initiative for industrial companies designed to cut costs by improving efficiency. GIA encourages the adoption of environmentally attractive and economically sound practices by industry. In making a case for GIA, pilot green analyses were undertaken to develop the methodologies for the analyses and to assess the economic benefits. In addition the pilots were to indicate the potential for energy conservation, water conservation and environmental improvements that such analyses could identify. Industrial plants in various sectors and of various sizes were selected for these pilots to reflect a cross section of Ontario industries. The pilot analyses, with very successful results, were conducted by private sector consulting engineers jointly with MOE engineers (MOE, 1998).

**British Columbia**

According to the BCMOELP's website, two distinct strategies are commonly used to establish WQ objectives (WQO). For water bodies of aquatic resources of national and regional significance, the WQOs are established to avoid degradation of existing water quality. For all other water bodies, the WQOs are established to protect the designated uses of aquatic ecosystem. As long as the designated water uses are protected, some degradation of existing WQ is considered to be acceptable. Using this strategy, ambient WQ objectives can be derived using three separate approaches:

1. Direct adoption of generic water quality guidelines (WQG) and criteria (WQC)
2. Derivation of site-specific WQOs (e.g. using recalculation of water effect ratio procedure)
3. Development of de novo WQOs (e.g. using the resident species procedures)

At most sites, the generic WQG or WQC that have been established by BCMOELP or the CCME will provide an appropriate basis for establishing WQO, however they may require modification before they are directly applicable to sites with atypical WQ conditions or resident species assemblages. Development of numerical WQ objectives from generic WQC and WQG involves a number of steps:

- Identification of the designated uses of the aquatic ecosystem
- Preparation of a list of water quality variables of concern using information on the existing and proposed developments in the basin
- Screening the data on wastewater and receiving WQ using the generic WQG and WQC also supports the identification of contaminants of concern
• In case of complex mixtures of contaminants, toxicity identification evaluation procedures are followed for the identification of significant hazards
• Once contaminants are identified, the available WQC or WQG for each substance and each water use are complied and modified to account for the ambient WQ characteristics of the water body (i.e. pH, hardness, etc)
• For each substance, the WQG for the most sensitive water use is selected as the preliminary WQ objective which is then compared to the natural background concentrations of each substance, and the higher of the two values is selected as the WQ objective for that substance
• Most toxicological data for the derivation of WQC or WQG are from water at laboratory temperatures, as a result it is difficult to see if hardness for example will act independently, in modifying toxicity, at temperatures around zero degrees for over-wintering fish
• Development of manufacturing processes that reduce the production of waste products and improve the performance of wastewater treatment systems are normal R&D activities pursued by all responsible corporations and organizations. Nonetheless, it is possible that the costs associated with implementing the remedial measures necessary to comply with the WQ objectives could be substantial in certain situations. In such cases, more certainty in the WQ objectives may be required to assure that such expenditures are justified.

In terms of reporting, EC and BCMOELP together publish status reports, the WQ index and trend reports.

**Status Reports** are based on the attainment of WQOs during a critical month (when the objectives are most likely to be exceeded) for at least 3 consecutive years. They present an overview of the state of water quality at critical times over the three years. They list the objectives set for each body of water and describe how they are met. The status reports present an overall index for each body of water and a breakdown in graphical form showing the suitability of water for specific uses.

The **water quality index** is based on the attainment of WQ objectives. It takes into account the number of objectives not met, the frequency with which and the amount with which they are not met. The index ranks WQ into five different categories relative to the natural or desirable state, and thus measures the degree to which the quality of water is affected by human activity. The five categories consist of: excellent, good, fair, borderline, poor. The index ranges from 0 for the best to 100 for the poorest.

- Excellent (0-3) means all uses of water are protected and none are threatened or impaired.
- Good (4-17) means all uses of water are protected with only minor degree of threat and impairment.
- Fair (18-43) means most uses are protected but few are threatened or impaired.
- Borderline (44-59) means several uses are threatened or impaired
- Poor (60-100) means most uses are threatened, impaired, or even lost.

**Trend Reports** are based on the results of regular and consistent long-term monitoring (5-10 years), and they state what is being done or will be done to improve WQ where there are deteriorating trends or other WQ concerns, or to maintain WQ where there is no concern.
Regulation and Enforcement of Water Quality

Three types of agencies are involved in management and enforcement of the water quality regulation: 1) the Water Management Branch; 2) the Pollution Prevention Branch (P2); and 3) the Enforcement Branch of the Ministry.

The Water Management Branch:
- Implements standards, programs and strategies in areas of water allocation, water quality, groundwater, public safety, water utility regulation, and water use planning.
- Modernizes water laws, improves policies and procedures
- Is responsible for water licensing
- Develops protocols for non-point source pollution and ambient water quality guidelines and objectives. Limits are set for WQ indicators to protect all designated uses of a specific body of water, that take into account the local WQ conditions and uses and they establish a reference against which the state of WQ in the water body can be checked. WQ objectives however, are not enforceable.
- Provides technical advice to protect ambient water quality
- Prepares remediation plans and assessments under the Environmental Assessment Act
- Provides specialized toxicological services
- Reports on water quality monitoring programs, and on the results of the observation well network (groundwater monitoring)
- Assesses and monitors dams and dikes
- Oversees the water use planning process

While in the US the TMDL approach relies heavily on the permitting process, in BC the Pollution Prevention branch is:
- aiming at de-permitting, market-based approaches (eg. non-compliance list and waste discharge fees) education, cost recovery initiatives and industry stewardship through environmental codes of practice and product and packaging stewardship programs.
- responsible for developing and implementing environmental management system within the municipal, industrial and small business sectors to prevent pollution and remediate sites where pollution is occurring.
- responsible for developing the water quality guidelines: safe levels of WQ indicators that apply province wide or nationally to protect sensitive uses (drinking, aquatic life, irrigation, livestock watering, recreation, wildlife). These guidelines are used when WQ objectives have not been established for a water body - provides general reference against which the state of WQ can be checked.

The aim of regulators with initiating P2 planning is primarily to promote environmental innovation at the facility level and to increase resource efficiencies by simplifying the permitting and inspection system. It enables them to direct scarce resources to more urgent needs. Industry, on the other hand, is participating in the hope of creating regulatory flexibility and simplifying the permitting system by rolling all permits into a single permit or plan. These are the potential strength of the program. The primary weaknesses are the resource intensity and time-consuming nature of the process as well as the added burden of additional reporting requirements.
It is an attempt at an over-arching authorization approach that would incorporate both mandatory
and voluntary components for all discharges from a facility. It would take into consideration the
requirements of all applicable provincial and federal environmental laws to identify a unified set
of priorities for the applicable facility in order to effectively allocate resources and to maximize
environmental and human health benefits. Mandatory components would be those that would
normally be found in a permit or regulation together with plans associated with bringing into
compliance circumstances of non-compliance identified over the course of an environmental
review carried out pursuant to P2 planning. P2 opportunities which go beyond compliance
would continue to be voluntary and not subject to enforcement. This would allow both
government and private sector to agree to a process for planning, management and
accountability. This approach offers significant reinforcement for principles of cooperation and
mutual commitment to identified goals.

Real and perceived benefits of the P2 model:
• cooperation, trust - commitment to common goals between government and industry and
  shared with the public through advisory committees and other forms of consultation
• transparency and communication with stakeholders – government has a better understanding
  of operational issues and P2 opportunities within facilities while industry has a better
  understanding of public expectations and a greater appreciation of the responsibilities of
government, and the fact that being open and communicative is not necessarily threatening
  and generally results in greater support for the activities of the facility
• self-examination and accountability – involving operational personnel at all levels within the
  organization, management were able to tap into collective experiences to identify P2
  opportunities that had not previously been considered
• future environmental improvements and industrial efficiency – an open and broad based
  review has made possible a greater awareness of what can be accomplished
• flexibility and creativity – allowed participants to look at environmental management and P2
  without the confines of a narrowly constructed regulatory framework, without the paranoia
  associated with the threat of prosecution, to openly discuss issues and search for solutions in
  a non-confrontational and non-adversarial environment
• efficiency and effectiveness as a result of priority setting – being able to address
  environmental issues in some orderly fashion through the prioritisation of proposed
  initiatives, while gaining public support and taking into account economic constraints
• coordinating with other environmental management tools (ISO 14001) – builds on generally
  accepted industry standard and expands an internationally accepted framework that is
  relatively easy to apply at an operational level.
• ongoing review and renewal - P2 plans would operate over a 3-5 year period, with continual
  improvement and focus on pollution prevention, and with sustained transparency, trust, and
  open communication.
• credibility and integrity of environmental management – the aim of both government and
  industry is to establish a system that is credible and supported by the public at large, gaining
  their respect and support

The Enforcement "Branch"

The Ministry's Enforcement Program (Conservation Officer Service) provides direction, policy
and procedural guidance to regional conservation officers. The program provides support to
other Ministry programs in the development of new legislative initiatives or amendments to
existing regimes to ensure the enforceability of new environmental protection laws, and participates in interagency and intergovernmental discussions concerning partnership and joint enforcement efforts. In addition, the Special Investigations Unit (undercover) continues to successfully conclude investigations and lay charges for violations that may not be achievable by the Ministry’s high profile uniformed staff. The SIU objective is to focus on illegal activities that have the greatest impact on the environment, fish, wildlife, forest and water resources.

The enforcement program is responsible for the enforcement of the following legislations:
- Wildlife Act
- Migratory Birds Convention Act (Canada)
- Waste Management Act
- Litter Act
- Pesticide Control Act
- Fish Protection Act
- Firearm Act
- Fisheries Act (Canada)
- Environment Management Act
- Water Act
- Commercial River Rafting
- Safety Act
- Forest Practices Code Act
- and, through their Special Constable appointment, enforcement of certain sections of the Criminal Code and other provincial statutes.

The Conservation Officer Service (COS) is the delivery arm of the Enforcement program in the Ministry. Working with other professional staff in the Ministry to achieve compliance with provincial and federal environmental legislation, the COS is made up of field officers, senior conservation officers, Regional Enforcement Managers and Victoria headquarters staff which includes the Chief of Enforcement program analysts and the SIU.

The Environmental Emergencies Program provides assessment and coordination of environmental emergency response units located in regional offices. The Program prepares provincial-level contingency plans for oil and hazardous materials spills, fosters consistent emergency planning and response management, and works with local, national and international agencies and industry.

**My Assessment of the Effectiveness of the LFB System**

*So does the setting of Canadian and BC water quality objectives lead to better environmental management systems and organizational performance in the Lower Fraser Basin?*

As in the US case, nobody knows for sure. But unlike the US case, I could not find large-scale studies of the effectiveness of setting water quality objectives and their eventual impact on organizations. Hence, I will rely on some of my own observations from this case to assess Hypothesis 1, the claim that the enforcement processes from inventory to monitoring to enforcement to outcomes are less complex and tightly coupled with the organizational field in the LFB than in the Puget Sound.
Based on my observations I found that:

- Where water quality is concerned the Canadian system has many of the same components as the regulatory system in the US, except for the presence of an integrated governance structure such as the Puget Sound Action Team.
- Within the Canadian system components are still organized by region and types of water issues, rather than levels in the decision-making hierarchy. Of course, there are a lot fewer regions in Canada than states in the US.
- The regional/provincial systems have a lot of priority in that hierarchy.
- The amount of interaction between components in the system seems higher than I would have imagined, partly because the interaction is under-specified by decision rules and programs.
- Less adjustment occurs around the application of science to water quality standards, because a great deal of direct adoption of methods from the US occurs.
- There is no equivalent of the US TMDL process.
- Nevertheless, as in the US, the water quality objectives and standards that are sweeping have a lot of inherent ambiguities. That is, they are informationally rich.

If I compare the two systems in terms of these dimensions of complexity on the input side, as required by Hypothesis 1, on balance, the regulation of water in the Puget Sound looks structurally more complex than the regulation of water in the LFB. This is because the US system has more levels to deal with around the Puget Sound Action Team and the Department of Ecology. The number of actors at the federal level is large, the role of the different programs and reporting agencies is not very clear, yet requires a lot of different types of interaction. In the LFB the number of levels around the system is smaller and the Canadian levels have less impact and less diversity in terms of number of interactions (reporting requirements).

Having said this, I think that the information content of many of the US linkages is actually less rich than in the Canadian linkages. Because there are fewer interactions, more gets done in each interaction, and because there are fewer decision rules, more adjustment occurs at each decision point. So the irony is that the Canadian system informationally is actually more complex than the US one. I will return to this point in the discussion, conclusions and the recommendations at the end of the document.
CHAPTER V. THE ANALYSIS OF OUTCOMES OF ENFORCEMENT-HYPOTHESIS 2

SAMPLE OF COMPANIES

The research sample consisted of a 100 randomly selected companies that are located in the Lower Fraser Puget Sound Basin (for a map and a more detailed description of the basin see Appendix C) and have experienced a water quality related enforcement action (NOV/warning, order, penalty/fine) between January 1997 and December 2000. The Lower Fraser Basin charges data sample was limited to information supplied by Environment Canada Investigations Section and the BCMOELP Conservation Officers Services Surrey office. The total number of charges for the three year time period were 43, out of which 5 were non-concluded and the other 5 could not be followed up on due to either lack of contact number or the company has gone out of business. The BCMOELP Conservation Officers Services have also provided 10 warning letters that we included in our overall sample. Data from the Department of Fisheries and Oceans and from the BCMOELP Nanaimo office have been requested but were never received. According to one of the DFO officers however, approximately 1200 charges occurred under section 36(3) of the Fisheries Act that would have been relevant to include in the overall data set for the selection of the random samples. Due to the lack of data supply from all the relevant agencies involved in water quality related enforcement, I was unable to determine the total number of enforcement actions conducted during the given three year time period. Further, my request for information has led to the discovery by one of the senior conservation officers that 50% of their cases were missing from the ministry's database. Finally, there were no contact telephone numbers, industry type or company size included with the case information, so they had to be searched for individually within the Canadian Business Database accessible at the Vancouver Public Library.

The Puget Sound data were supplied by the Department of Ecology's Olympia office. From the enforcement database manager I have received 309 Notices of Violations, 535 Orders and 325 penalties, amounting to a total of 1169 cases for the January 1997 to December 2001 time period. Since the enforcement actions have taken place all over Washington State and I was only interested in the Puget Sound area, it was necessary to exclude the companies that were not within my area of interest. The final sample size was further limited by the amount of available contact telephone numbers that I could find in the US Business Database and the online Yellow Pages. The overall sample of companies was stratified by size prior to random sampling to make sure that an even distribution of small, medium, and large firms were included.

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<tr>
<th>TYPES OF RESPONSES</th>
<th>LFB</th>
<th>PS</th>
<th>TOTALS</th>
<th>PARTICIPATION%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Successful interviews</td>
<td>16</td>
<td>17</td>
<td>33</td>
<td>43.42%</td>
</tr>
<tr>
<td>Some response</td>
<td>15</td>
<td>16</td>
<td>31</td>
<td>40.78%</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td>10</td>
<td>12</td>
<td>15.80%</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>33</td>
<td>43</td>
<td>76</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Out of the 100 firms 76 were contacted for an interview, and 33 decided to participate in the research study. Those who decided not to participate have been categorized into "some response" and "no response". A good example of "some response" from the president of one of the Puget Sound firms is the following reply:
"Dear Ms. Kiss,
We received your survey form. We continue to sustain substantial water related cost impacts which unfortunately are effecting our viability and yet cannot be shown to have any significant impact on improving or protecting the environment. We must decline to respond to your survey at this time as more important business matters resulting from the energy crisis and our parents corporations Chapter 11 bankruptcy filing demand our immediate attention. Sincerely...."

The company size distribution of the final sample of successful interviews is summarized in the table below. Small, medium and large firms were defined by # of employees in the ranges of 5-50, 100-250, 500 and greater, respectively, and only the size of local plants or divisions were considered.

### Table 3 Firm sizes - overall sample

<table>
<thead>
<tr>
<th>Min. size</th>
<th>PS</th>
<th>%</th>
<th>LFB.</th>
<th>%</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
<td>5.88</td>
<td>2</td>
<td>12.5</td>
<td>3</td>
<td>9.09%</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>11.76</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6.06%</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td>11.76</td>
<td>4</td>
<td>25</td>
<td>6</td>
<td>18.18%</td>
</tr>
<tr>
<td>50</td>
<td>5</td>
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<tr>
<td>100</td>
<td>3</td>
<td>17.64</td>
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<td>18.75</td>
<td>6</td>
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<tr>
<td>250</td>
<td>2</td>
<td>11.76</td>
<td>1</td>
<td>6.25</td>
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<td>0</td>
<td>2</td>
<td>12.5</td>
<td>2</td>
<td>6.06%</td>
</tr>
<tr>
<td>1000 or &lt;</td>
<td>2</td>
<td>11.76</td>
<td>2</td>
<td>12.5</td>
<td>4</td>
<td>12.12%</td>
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<td>Totals:</td>
<td>17</td>
<td>100</td>
<td>16</td>
<td>100</td>
<td>33</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Over 58.8% of the 17 firms in Puget Sound were small, 29.4% were medium and 11.76% were considered large. In the LFB, the size distribution of the 16 companies consisted of 50% small, 25% medium and 25% large firms (see Figure 10 below).

![Figure 10 Firm sizes - PS and LFB successful interviews](image)

Based on the North American Industry Classification System the LFB companies belong to the following industrial sectors:

1) Goods Sector:
- Agriculture, fishing and forestry
- Mining, oil and gas
- Utilities
- Construction
- Manufacturing

2) Services sector:
- Transportation and warehousing
- Waste management, remediation services, and administrative support
- Recreation, arts and entertainment.

On the other hand, fewer industry sectors were represented in the PS sample:
1) Goods Sector:
- Utilities
- Construction
- Manufacturing

2) Services sector:
- Transportation and warehousing
- Waste management, remediation services, and administrative support

It is important to note that I did receive qualitative but not quantitative data feedback from the PS Agriculture industry, more specifically from a retired member of the dairy industry, however he is not included in the sample of companies for the purpose of quantitative analysis.

QUANTITATIVE DATA ANALYSIS

One of the main objectives of this research has been to uncover the type and magnitude of the tangible and intangible costs and benefits that have emerged as a result of experiencing a water quality related enforcement action. The results of the primary data that were gathered from the previously described sample of charged companies via confidential interviews are summarized and analyzed below. All the graphs illustrating the results of each interview question that is discussed and listed here can be found in Appendix B2.

The majority (over 50%) of the cases in my sample ended up being Fines/Penalties followed by an equal number of Warnings/NOVs and compliance Orders. One of the many differences between the Puget Sound and the Lower Fraser Basin environmental enforcement systems, as it has been previously described in the case comparisons, is in the context of compliance orders. In PS there is no specific cost attached to an order issued by the Department of Ecology. It is merely a list of tasks given to be accomplished within a certain timeframe without any consideration to the associated costs. In the LFB compliance orders are only issued by Environment Canada enforcement officers and they are usually issued in addition to the cost of a fine for a certain amount of money much larger than the fine. This sum is payable to either a Habitat Conservation and Restoration Trust Fund, or distributed directly between local communities involved in restoration activities.

The assumption of Hypothesis 2 was that the penalties for non-compliance are higher in PS than in the LFB, particularly if measured by direct and indirect associated costs of non-compliance. The results have shown this to be partially true, partially not. The cost of the penalties in PS ranged from $4000-$20,000 with an average of $8,357 while the range of the fines in the LFB were much larger, $200-$200,000, with an average of $20,670. A more detailed break down of the results can be found in Figure 11-12 in Appendix B2.

Figure 11 PS Penalties by firm size
Figure 12 LFB Fines and orders by firm size
The extreme value of the $200,000 fine in the LFB has really distorted the results from what I originally expected. If it were not part of the data set the average fine in the basin would have been $744 that confirms the hypotheses, since most of the fines were $575 tickets.

**Figure 13 Penalties/fines vs. total tangible costs** (using averages)

Penalties/fines are only a small fraction of the overall costs that emerge with the experience of an enforcement action (see Figures 14-15 in Appendix B2)

**Figure 14 PS and LFB Total TC vs. penalties by firm size** (high resolution)

**Figure 15 PS and LFB Total TC vs. penalties by firm size** (low resolution)

Before I focus on the breakdown of the different types of tangible costs that firms encounter, I would like to discuss the relationship I found between company size and the cost of penalties/fines, as well as firm size relationship to total tangible costs. In PS the largest and the smallest firm had the highest penalty. Similarly in the LFB the highest fine was given to the second largest company in the sample, while smaller companies were more likely to receive higher cost orders than medium and large firms. The variation of total tangible costs has shown an exact same pattern of behaviour: the largest firms have spent the most along with small size companies. In terms of the difference in magnitude of these costs between the two regions, the second part of our hypothesis 2 has proven to be true: the associated costs of compliance in PS were almost five times higher than those in the LFB.

**Tangible Costs**

I decided to address the following tangible costs in the interview questions:

- Cleanup costs
- New permit costs
- Capital investments
- New environmental management practices
- Withdrawal of investments
- Monitoring and reporting related to the incident
- Market competitiveness, and
- Other (legal and training)

Now I will discuss the findings for each of these costs in term of the variations in ranges, averages, and association with firm size, in the two regions.

**Cleanup Costs**

Unfortunately, the frequency of information gaps within the Department of Ecology's enforcement database, especially as far as incident description is concerned, was very high, so most often I had to rely on the companies to tell me what happened and what the responses to the events were. Not all the cases I examined were spill related incidents, but the ones that were, have been immediately cleaned up. In fact, I had the opportunity to experience an emergency response and cleanup process in action, since one of the pulp mills had an over 3 feet diameter pipe carrying untreated waste water to the waste retention ponds rupture a few hours before I got to the site for the interview. The mill was shut down. Being shut down even for just a few days is a much higher cost to the company than any penalties they will ever get.

Cleanup costs in PS ranged between $750-$100,000 with the highest costs experienced by small firms.
49

Figure 16 PS Cleanup costs
In the LFB cleanup costs were slightly lower, ranging between $800-$65,000, with the largest amounts paid by small and medium size companies.

Figure 17 LFB Cleanup costs
Out of the 33 successfully interviewed firms 22 have reported cleanup related costs with an average of $24,320 in the two regions combined.

New Permit Costs
Approximately 50% of the PS cases were incidences of existing NPDES permit violations, while one of the companies was in the process of getting a new permit that incorporated new temperature and mixing zone parameters due to the implementation of the Endangered Species Act (ESA). In fact, a lot of permits will have to be rewritten in the near future as an implication of enforcing this new legislation. (More information about the institutional actors and the permit approval process under the ESA can be found in Appendix A4.) In the LFB 1/3 of the cases were permit violation related incidences and very few of the firms were required to obtain a permit after the incident for continued discharge. In both regions combined, overall 16 firms reported permit related information during the interview with an average of $494,549 per company. In the LFB permit costs ranged from $700-$141,028 with medium size firms baring the large portion of the costs.

Figure 18 LFB Permit costs
In PS the permit cost ranges were much higher, $700-$6,000,000, with the largest firm paying the highest price, followed by small size companies.

Figure 19 PS Permit costs
My impression was that the complexity of the institutional framework and the many overlapping and sometimes conflicting jurisdictions in PS required a much longer time period for the development and approval of permits than it did in the LFB. This observation was further supported by a lot of complaints from the PS firms about the lengthy nature of the permitting process.

Capital Investments
In both regions combined a total of 19 firms have reported investing large amounts of capital into state of the art technologies and new equipment, for the purpose of minimizing the human and ecosystem health impacts of their processes and products, for demonstrating leadership, and/or for coming into compliance with regulatory requirements. The overall average investment per firm was $86,738. Capital investments in the LFB ranged between $300-$500,000 with medium sized firms followed by large firms paying the most for improvements.

Figure 20 LFB Capital investments
Capital investments in the PS similarly ranged between $100-$500,000 with medium sized companies spending the most on upgrading their operations.

Figure 21 PS Capital investments
Some examples of investments into retrofits were the following:
- "We changed the way we deal with storm water, we don't discharge anymore into waterways but collect it and discharge into a sewer system" ($500,000)
- "Rerouting of discharge pipe and building of containment area" ($5000)
"We installed a cooling tank and obtained a permit for the releasing of that water into the sanitary sewer" ($1200)
"We invested into a new turbidity meter that automatically shuts off the sewer access at 600 MTU, so we don't have to worry about human error anymore" ($6,600)
"Replaced piping" ($12,000)
"We invested in a filtration system to settle the silt and in a straw blower" ($35,000)
"We had to create a stream restoration plan which still hasn't been approved " ($50,000)
"Installed polymer into secondary treatment" ($20,000)
"We put in valves for all storm drain pipes, extended storage capacity and added tanks with containment walls around them, installed new pumping equipments and radio control devices for people pumping, booms etc "($500,000)
"We put in place a pH control system and constant monitoring"
"Invested $300,000 into treatment of runoff (the storm receptor, a huge manhole for the settling of water wasn't working)
"Invested $100,000-200,000 ($1000/truck) into truck retrofitting plus labor and driver training programs; we are in the process of retrofitting every site in …"($2-$3 million)

New Environmental Management Practices
From the information provided by the firms, sometimes it was difficult to differentiate between a new capital investment and a new environmental management plan or practice, but I decided to categorize those costs based on their perception of what constituted one or the other. Overall, 10 firms out of the 33 have reported on the existence of new plans and practices in place to improve their environmental performance at an average cost of $15,360. The cost of EMSs in the LFB ranged from $900-$11,000 where small, medium and large companies have equally participated in their implementation, but medium size companies have spent the most.

Figure 22 LFB New EMSs
In the PS only two small companies have reported on the development of new EMSs and their costs ranged from $50,000-$75,000.

Figure 23 PS New EMSs
I have included a few examples of these new management systems below:
- "Modified standard operating procedures to include tank monitoring and high level alarm testing schedule (monthly or quarterly)"
- "Reconfigured the process so the oil saturated exhaust doesn't get onto the ground any more - we capture the condensation in a barrel"
- "We put in place a pollution prevention plan:
  - Bought cleanup supply
  - Enhanced waste oil storage recycling
  - We have double containers for all the paints
  - Implemented best management practices for:
    1. bilge water management
    2. fueling practices,
    3. handling of hazardous chemicals,
    4. used oil,
    5. cleaners and waste
    6. spill prevention and response
    7. solid waste
    8. sewage treatment and gray water
9. boat repair activity - containing scrapping and painting
   • Clarified moorage agreements - to put responsibility onto tenants
   • Continuing surveillance and education program ("See it stop it")
   • Pollution prevention plan developed
   • Training and education of fishermen"
   • "We altered ammonia feeding to the waste water system"
   • "Put in place audit by third party"
   • "We have best practices in place - documented procedures developed together with other industries in the harbour, with help of consultants"
   • "Implemented zero discharge policy for the entire site."
   • "We recycle 100% of our water"
   • "We are using a biodegradable chemical to prevent concrete from setting"
   • "Built a burm to capture spills"
   • "We recycle used tires, metal scraps, auto parts, oil, and we change less oil"
   • "We put in place a Chemical Spill Prevention and Emergency Response Program and 25 spill kits for solvents and oils which are somewhat positively used".

Withdrawal of Investments

Only two firms have reported a withdrawal of investments as a result of experiencing an enforcement action, but both of those incidences entailed significant capital losses. In the PS the withdrawal of capital investment was from a small firm, and it amounted to $2,000,000, while in the LFB similarly from a small firm the withdrawal was $500,000. Both companies are involved in construction related activities but the nature of their incidences was different. The fascinating story of the first incident was told the following way:

"The only violation I can think of was on ... and the court case for it was in .... Ecology didn't see a problem, however the county did. They constructed a 1 mile long boardwalk/seawall, put steel posts into the ground but the elevation was incorrect. We were called in to create a 10 feet deep excavation on the inter-tidal zone. While dragging in the sand we hit a blue clay zone and created a silt plume. The people from the county were quite inexperienced, thought it was a complete disaster and they wanted us to dig it up and remove it. We told them that we had to wait for the tide to go out. We tried to load it onto the trucks but it got stuck, we could hardly scrap it off - the guys refused to go back for more. The county took us to court for the silt plume and that we didn't clean it up. We were in court for 3 days and they lost the case. So they attacked me for 5 months and ran me into a $3.7 million debt. It was a 5 year process where I spent 1.4 million on legal fees, I liquidated 2 million, lost a 72 member company with an annual sales of 8.5 million, and I was in deposition for four months. We finally got them into a forum where they had to listen to the experts. The case was finally settled in a non-binding mediation where the county admitted being wrong, and gave us a $3.8 million settlement. So I came out of this nightmare with a $100,000 and restarted from scratch."

The other incident is related to issues many creek and river-side property owners are dealing with:

"They are putting my development proposal on hold, and I lost 2 lots out of 8. There is a hatchery down the road a mile away. The property is within the headwater area of the ...river. There is a ravine behind our home, which at some places is quite steep, and my neighbor asked me to move some excavation material onto the embankment
of his portion of the ravine (50 truck loads). The creek is about 200 feet away, so I didn’t think it posed any danger to it. Somebody saw it and reported it. The enforcement officers came and gave me a warning letter not to do that again and I was required to remove it. They came back to inspect it. They are very heavy handed, without any intention of compensating people for their loss. You invest a lot of money into a 4 acre property and then all the rules change on you after 6 months. They not only want the 200 feet but another 45 feet on the top of the embankment due to slope steepness. They also want me to jail myself in by putting a fence up and not have access to that part of my property. I'm all for conservation, but give property owners the chance to protect their ravines, do proper landscaping on their back yard. If we are not trusted to look after our environment than buy out the property for a fair price and look after it yourself. The real-estate board should be alerted and made more aware of what changes apply if you are buying property near a creek."

**Incident Related Monitoring & Reporting**

In general, continuous monitoring and monthly reporting activities are much more systematic, complex and engrained in the PS enforcement system than in the LFB due to the requirements of the National Pollution Discharge Elimination System from permitted facilities. Based on company responses the level of dissatisfaction with the current system however is extremely high due to its overly bureaucratic nature and the impact of that on the viability and performance of firms. One of the interviewees has described this problem the following way:

"..with every legislative cycle, with every incident, we end up with increasingly confusing lines of communication. We have six full time people plus external consultants doing compliance paper work who have little to do with actually trying to mitigate water and air impacts. Instead of focusing on mitigation and improving, we spend most of our time calling all the regulators on the phone. If there is a spill we have to report it to the US coast guard, to Fisheries, to Ecology, to EPA region 10, to the shellfish people, to the fire district, to the Navel Base and Science center across from us, etc. Layers upon layers of regulators and there are major arguments as to who to call first within the limited time we are given to do that. They are very territorial. I wish they could choose a lead agent for us to speak to."

The LFB system is more focused on getting away from permitting and is leaning more towards technical assistance and helping companies in the design and implementation of EMSs with monitoring and reporting nested within that. Overall, in both regions combined, 10 companies have mentioned incident related monitoring and reporting activities with an average cost of $17,300. In the LFB the costs ranged from $5000-$100,000 and originated mainly from medium size firms.

**Figure 24 LFB Monitoring & reporting**

In the PS the costs were much lower, ranging from $1,500-$20,000, with, small, medium and large companies equally participating in the process, however, small firms bore the highest costs.

**Figure 25 PS Monitoring & reporting**

From all the tangible costs examined, in addition to the difference in the level of fines, this category is the only one where the costs in the LFB were higher than in the PS.
Market Competitiveness
Market competitiveness was negatively impacted by the experience of a WQ related enforcement action in the case of only one small PS company. The reported loss was $15,000.

Other Costs (legal and training)
I have created an unspecified tangible cost category for miscellaneous expenses that didn't fit neatly in any of the above groups. Respondents ended up including both legal and sometimes training costs into this category, but the majority were legal costs. Overall, 11 firms have reported miscellaneous expenses averaging $149,818 per firm. In the LFB costs ranged from $1,000-$100,000 and mainly affected large companies.

Figure 26 Other costs (legal, training)
In the PS the cost ranges were much higher, between $2,500-$1,400,000 and were paid by small firms.

Figure 27 PS Other costs (legal, training)

Summary of Tangible Costs
The following two figures are a summary of what has been previously described. Figure 28 illustrates total tangible costs in the two regions combined, while Figure 29 illustrates the average tangible costs in the two regions combined.

Figure 28 Total Tangible Costs by Firm Size (LFB+PS combined)
Figure 29 LFB&PS Average Tangible Costs (LFB+PS combined)

These two graphs merely help us rank the different tangible costs. "Withdrawal of investments" represented the most significant tangible cost followed by "new permit costs", then followed by "legal and training costs". "Capital investments" were only fourth in line, followed by "cleanup costs", then "monitoring and
reporting", then "new environmental management systems", and lastly "reduced market competitiveness". The problem with using average values, however is that extreme maximums and minimums can really skew the distribution.

QUALITATIVE DATA ANALYSIS

Intangible Costs
The following intangible costs were addressed in our interview questions:

- Damaged industry reputation
- Damaged reputation with investors
- Damaged relationship with regulators
- Damaged relationship with local community
- Other

The answers to these questions were in the form of "Yes" or "No" responses. The results have been summarized and are illustrated in the Figures included in Appendix B2 in the form of bar graphs. The graphs have been constructed by applying within the large data table 0 to all the answers that were "No", "N/A" or "Missing", and 1 to all answers corresponding to "Yes". As a result, all the graphs have been based on the assumption of having a total of 33 responses to all these questions, 17 from PS and 16 from the LFB that was not always the case. The regional totals are expressed in percentage terms. Much more interesting result could be shown if the data was fine tuned to illustrate variations of the intangible costs as well as the tangible and intangible benefits of environmental enforcement across industry sectors and company size, but that is beyond the scope of this document.

Damaged Industry reputation
The trends were almost identical in the two regions in terms of the impacts of environmental enforcement on industry reputation. The results showed fairly low negative impacts in both places. In the PS only 24% of firms have felt that the reputation of their industry was affected, and 76% has claimed no damage at all. In the LFB 25% of the companies felt that industry reputation was at stake, 75% thought there was no impact at all.

Figure 30 Damaged industry reputation

Damaged Reputation with Investors
Unfortunately I do not know precisely which companies were privately or publicly owned, that question was not part of our survey. None of the LFB firms have experienced damaged reputation with their investors and only 6% of the PS firms mentioned their reputation with their investors being negatively impacted by environmental enforcement.

Figure 31 Damaged reputation with investors

Damaged Relationship with Regulators
In the PS 24% of the companies felt that their relationship with regulators has been negatively affected by the experience of an enforcement action, while the remaining 76% didn't share the same perception. In the LFB the damage seemed even less severe, only 19% of the firms felt the affect, while the remaining 81% did not feel their relationship with regulators deteriorating in any way.

Figure 32 Damaged relationship with regulators
Damaged Relationship with Local Community
Firms' experience of environmental enforcement actions seemed to have fairly insignificant affect on their relationships with their local communities. Only 18% of the PS and 19% of the LFB companies have felt their community relationships negatively impacted, while the remaining 82% and 81% respectively didn't feel any damage occurring.

Summary of Intangible Costs
Intangible costs are summarized in Figure 34 below. The results from both regions illustrate that from all the different types of intangible costs that have been considered for the purpose of this study the "damage to industry reputation" was the most significant impact that emerged from the experience of an enforcement action. On the other hand, "damage to reputation with investors" had the least significant affect.

Figure 34 LFB&PS Total intangible costs

Tangible Benefits
A number of tangible benefits were addressed during the interviews with which I was hoping to explore some potential first and second order effects that might have emerged as a result of experiencing an enforcement action. The questions that were asked have been listed below:

- New processes and production
- New planning and management practices
- Increased competitiveness and innovation
- Better monitoring and reporting
- More efficient on-site treatment options
- Reduced energy and material throughput
- Savings in annual energy, water, solid waste
- Increased shareholder value

I was hoping to receive some numerical responses to the questions related to the tangible benefits, but similarly to the replies to the questions regarding intangible benefits, the interviewees only gave us "Yes" and "No" responses. Unfortunately, not one firm was able to quantify or even approximate any benefits in dollar terms. Let's explore the responses to each individually.

New processes and production
The experience of an enforcement action has definitely had positive outcomes in terms of the emergence of new processes and productions. In the PS region 35% of the firms have reported the presence of such positive changes, while the remaining 65% didn't experience the same. In
the LFB the positive outcomes were even higher. There 44% of the companies interviewed have noted new processes and productions, while the rest of the 56% hadn't.

**Figure 35 New processes and production**

**New planning and management practices**
Probably the most benefit from the experience of an environmental enforcement action arose in the form of new planning and management practices. This positive outcome was fairly high in both regions, especially in PS where 71% of the companies have reported a significant gain in this area. Only 29% of the firms haven't felt that new planning and management practices came about that they benefited from. In the LFB 69% of the companies have reported successful and positive changes in their planning and management performance, while 31% didn't share the same experience.

**Figure 36 New planning & management practices**

**Increased competitiveness and innovation**
The results from the LFB have shown greater increases in terms of competitiveness and innovation than those from the PS, as a result of environmental enforcement. In the LFB 38% of the companies have witnessed such positive benefiting changes while in the PS only 24% of firms have reported similar outcomes. Unfortunately, the remaining 62% of the companies in the LFB and 76% of the companies in the PS haven't experienced the same benefits.

**Figure 37 Increased competitiveness & innovation**

**Better monitoring and reporting**
Similarly to the success of new planning and management practices, environmental enforcement actions seemed to have brought about better monitoring and reporting activities as well in both regions. This positive change was especially evident in PS where 53% of the companies have reported significant improvements. The remaining 47% of the firms experienced no change in the way in which they monitor and report on the impacts of their operations. In the LFB 44% of the companies have gained better monitoring and reporting practices, while 56% experienced no change.

**Figure 38 Better monitoring & reporting**

**More efficient on-site treatment options**
The development of more efficient on-site treatment options, as an outcome of an environmental enforcement action, seemed to have played more significant role in the life of the LFB companies than in those located in the PS. In the LFB 38% of firms have experienced such beneficial response, while the remaining 62% hadn't. In the PS only 24% of the companies have noted the emergence of more efficient on-site treatment options, the rest of the 76% didn't share in the opinion.

**Figure 39 More efficient on-site treatment options**

**Reduced energy and material throughput**
It was surprising to me that not one company has reported benefiting from the second order effect of reduced energy and material throughput in the PS when the frequency of new management, planning and enhanced monitoring practices was so high. This is probably due to the fact that current compliance reporting doesn't require material and energy lifecycle analysis,
thus doesn't seem to contribute to increased overall process efficiency and reduced waste production. In the LFB on the other hand, 19% of firms have benefited from reduced energy and material throughput as a consequence of experiencing an enforcement action.

**Figure 40 Reduced energy and material throughput**

**Savings in annually energy, water, solid waste**

Similarly to the question of "reduced energy and material throughput", with "savings in annually energy, water, solid waste" I was hoping to explore the possibility of yet another second order effect due to improved planning, management and monitoring practices. Unfortunately, none of the companies in either the PS nor the LFB have reported benefiting from an enforcement action in this way.

**Figure 41 Savings in annual energy, water, solid waste**

**Increased shareholder value**

The last tangible benefit potential I explored was increased shareholder value - limited in terms of relevancy to privately owned firms. The results show that it played an equally insignificant role in both PS and LFB companies. Only 6% of the firms in PS and 6% of the firms in the LFB have reported their shareholder values benefiting from the experience of an enforcement action in this way.

**Figure 42 Increased shareholder value**

**Summary of Tangible Benefits**

The aim of the following figure is to summarize in one graph all the tangible benefits that have emerged, in the two regions combined, as a result of experiencing a water quality related enforcement action. The development of "new management and planning practices" played the most significant role (70%) followed by "enhanced monitoring and reporting" (48%), and "new processes of production" (39%).

**Figure 43 LFB&PS Total tangible benefits**

The fourth highest benefit category was "more efficient on-site treatment options" (30%), followed by "increased competitiveness and innovation", and "reduced energy and material throughput". Finally, "increased shareholder value" and "savings in energy, water and solid waste" were the least frequently reported benefits.
**Intangible Benefits**

For the purpose of exploring the potential intangible benefits of environmental enforcement I addressed the following questions during the confidential interviews:

- Improved industry reputation
- Improved reputation with investors
- Improved reputation with regulators
- Improved relationship with local community
- More consensus on environmental issues
- Value the environment more

The "yes/no" responses to these questions have been summarized and results are presented and discussed below.

**Improved industry reputation**

Improved industry reputation wasn't a very frequently reported phenomena in either region. It was slightly higher in the PS where 29% of the firms have felt that they benefited from the experience, while 71% haven't shared the same view. In the LFB only 25% of the companies have mentioned that the reputation of their industry has improved as a result of environmental enforcement, while the remaining 75% did not seem to have that same impression.

*Figure 44 Improved industry reputation*

**Improved reputation with investors**

Insignificant percentage of firms has claimed having an improved reputation with their investors after experiencing an enforcement action. In the PS only 13% of companies have experienced any enhancement, while in the LFB only 6% of firms mentioned any positive change.

*Figure 45 Improved reputation with investors*

**Improved relationship with regulators**

The results show that the most important intangible benefit of environmental enforcement was the significantly improved relationships with the regulatory community. It has provided an opportunity for more frequent and extended face-to-face communication, and a chance for asking questions and allowing for constructive feedback. It has resulted in a two-way learning experience not only about the different systems and their complex processes but also about the individuals behind the scenes in charge of their operations and management. In the PS 53% of the firms have really appreciated the ways in which their relationships with regulators have changed, while the remaining 47% have not noticed any improvement at all. In the LFB the beneficial effect was less intense, only 38% of the companies have mentioned its existence, while the remaining 62% haven't noticed it at all.

*Figure 46 Improved relationship with regulators*

**Improved relationship with local community**

Firms' relationships with their local communities varied extensively across industrial sectors, some were received and supported better than others. The majority of the non-permit and spill related environmental incidents were reported by nearby residents. Especially in the state of Washington local communities are very active participants in third party lawsuits, but they also play significant roles in habitat restoration, protection and conservation projects. Thus, excellent community relation is a very important aspect of company performance. In the PS area 41% of
the firms have reported improvement in their relationships with their local communities as result of an enforcement action. In the LFB on the other hand, only 19% of the companies have experienced similar benefits, while the remaining 81% has not.

**Figure 47 Improved relationship with local community**

**More consensus on environmental issues**

Increased consensus on environmental issues, both inside and outside the organizations, was an important outcome of environmental enforcement that firms in the two regions have reported benefiting from. In the PS 41% of the companies have mentioned increased understanding and appreciation of the issues at hand, and the significance of the role they play in terms of contributing to solutions. In the LFB the benefits were even higher where 56% of the firms believed that consensus on environmental issues has greatly improved as a result of having an environmental incident and having to respond to it.

**Figure 48 More consensus on environmental issues**

**Value the environment more**

Environmental incidents and their consequences certainly bring increased awareness into companies' lives. The sometimes unexpected and detrimental impacts of our actions bring us closer to the understanding and appreciation of just how fragile the natural environment around us can really be. A fairly significant number of firms in both regions have felt that their experience of an environmental enforcement action has led to an increased value of the environment. In the PS 35% of firms have reported such benefits, while in the LFB 56% of the companies perceived the environment at a higher value.

**Figure 49 Value the environment more**

The majority of the rest of the firms have mentioned that they have always valued the environment, and enforcement hasn't contributed to any change of that perception.

**Summary of Intangible Benefits**

This summary graph illustrates the relationship between the different types of intangible benefits in terms of their ranking and importance in the two regions combined. "More consensus on environmental issues" was the most significant intangible benefit companies have recognized (48%). That was followed by an equal number of respondents (45%) agreeing to have benefited from "improved relationship with regulators" and from "valuing the environment more". The third most important benefit was "improved relationship
with local community" (30%), which was followed by "improved industry reputation" (27%). Finally, "improved relationship with investors" was the least important intangible benefit firms identified (9%).

In addition to the interview questions included in our survey table, specifically related to tangible and intangible costs, our open-ended questions have also revealed second and third order costs and benefits.

**Open-ended Questions**
The purpose of the open-ended questions was fourfold. First, to get a more detailed description of the types of new environmental management systems, plans and practices which have been implemented after the incident. The majority of these have previously been described in the context of tangible costs related to new environmental management practices.

Second, I tried to find out whether the incident and the enforcement action has had any effect on other firms and industries, whether it led to deterrence in any way. The responses to this question have been summarized in the graph below and the results reflect low overall deterrence levels. Only 38% of the firms in the LFB thought that the incident and the enforcement action had any impact on other companies or industries, while the figures in the PS were even lower, only 24% of the respondents thought that to be the case.

*Figure 51 Deterrence*
The third question was aiming at exploring how the firms' relationship with regulators and the local community has changed. Based on the results 71% of incidents in the PS hasn't had any effect on already established relationships. Only 6% of the companies have reported deterioration, and 23% of firms' relationships with regulators and the local community has in fact improved. In the LFB 31% of firms have reported improvement, similarly 31% has reported deterioration, and 38% of the companies didn't experience any change in their relationship with regulators or the local community as a result of the enforcement action.

*Figure 52 Change in relationships*
I would like to quote of few comments related to relationships to enhance the sense of what the participants meant:
"Prior to the spill we had no relationship with the local community or regulators. Since the spill, I've met with city works personnel, BC Government Agencies, and Environment Engineering companies. On the whole I feel that we've had good working relationship with all parties concerned."

"Because of good response and open, transparent dealings, reputation with regulators enhanced which makes future dealings easier."

"An incident occurs, a complaint is filed and you have to prove yourself innocent. We felt it was vague and incomplete reporting from the Ministry. They didn't specify what they found in the creek or their levels. They were making an accusation that they had no way to substantiate. I think the regulatory system is losing sight of what the common objectives such as providing environmentally safe opportunities and to improve environmental circumstances are. The system is set up as a confrontational approach instead of one of problem solving. They took a hard line approach - maintaining complete objectivity, not to get too close. In person-to-person interaction you lose power. Rules of conduct become rules of control. They have to be clear on rules of engagement. Finally, they did listen to us and we tried to make it into a positive experience. We put in place the containment they suggested; it didn't work."

"Ecology was very helpful and they responded in a proactive manner to help solve the problem. The process was easy. There was cooperation between agencies. Our experience with them was a positive one. I think it depends on the agent/officer you deal with. We are in reasonably good shape and up to date with the requirements through newsletters from the EPA and Ecology."

Finally, the fourth question helped me to gather some feedback and recommendations on what is lacking, what are some of the unmet needs that should be addressed, and how to improve existing feedback systems both between industries as well between the regulatory community and the regulated firms. I was hoping to get a sense of their perception of the compliance system, to find out how they felt about it both in terms of what is that they didn't like and wanted to see changed, and those aspects that worked for them and they appreciated. Further, I wanted to know what was that they have learnt in the process of experiencing an enforcement action, and whether or not they were satisfied with the current feedback system in place. In addition to providing a lot of detailed recommendations for change and improvement, they have highlighted important strengths and weaknesses of the current system that were in some way affecting their operations. These points are outlined in the next chapter.
CHAPTER VI. FEEDBACK AND LEARNING EFFECTS - HYPOTHESIS 3

As was discussed in Chapter One and Chapter Two, to explore feedback and learning effects and assess Hypothesis 3, I interviewed 33 people from companies that had been charged with a water-related offence in the LFB, and 43 people from companies that had been charged in the PS. I asked each interviewee: "How could we improve feedback effects to companies from environmental incidents such as the one you have experienced?"

I also asked each interviewee to elaborate on his or her perception of the environmental enforcement system, to identify elements or aspects that were lacking, things s/he didn't like and wanted to see changed, to highlight those that worked for the person and were appreciated. I requested feedback and recommendations from each person on how to improve existing feedback systems both between industries as well between the regulatory community and the regulated firms. Further, I asked them what s/he had learned through the process of experiencing an enforcement action.

In keeping with grounded theorizing (Glaser and Strauss, 1967; Miles and Huberman, 1996; Ragin and Becker, 1992), I went through all the comments several times and developed categories of like comments. In addition to providing detailed recommendations for change and improvement, the interviewees commented on important strengths and weaknesses of the current system that were in some way affecting their operations. I categorized the quotes, based on their themes and content, into the following main categories:

- Those quotes that describe their perception of the current environmental enforcement system
- Those that talk about needs that aren't being met
- Those that evaluate existing feedback systems, or the lack of them and the consequences
- Those that talk about learning experiences
- Those that mention specific policies, legislation and their impacts
- Those that are simply useful advices

The remainder of this chapter focuses on comparing and contrasting quotes about the LFB and PS systems in each category that I devised. Specific quotes are offered and their critical phrases are bolded. Then the meaning of these quotes and their theoretical implications for learning and feedback are discussed. The policy related quotes and issues are examined in Chapter 7.

CORPORATIONS' PERCEPTION OF THE ENVIRONMENTAL ENFORCEMENT SYSTEM

Perception of the system is the view of the offender looking back on the whole chain of linkages about how the links work from the event to the regulator's response to the "impact" of the penalty. Part of the impact is in terms of perceived fairness. Fairness means that somehow learning will be absorbed in a positive way; unfairness means it will be absorbed in a negative way.

This category had the most quotes (9 LFB, 34 PS) with some of the comments from the PS showing some convergence.
Lower Fraser Basin

As will be seen from the actual quotes from interviewees, the comments coming out of the LFB with regard to the nature and effectiveness of the environmental enforcement system were mainly negative, only with a few positive remarks. The main positive remark was directed towards the Port of Vancouver having an efficient streamlining of approvals. Negative remarks were focused on three core issues:

1. the process is an obstacle and a waste of time,
2. the conservation officers' lack of preparedness and fairness, and
3. unclear interpretation of policy

The process is an obstacle and a waste of time

(1) "We are in the process of getting a discharge permit from the government for another one of our plants. Dealing with them is a major obstacle and an education process - they are terrified of making decisions, drag their feet, keep changing personnel, and act wishy-washy."

(1) "There are way too many forms to fill out which is a waste of time and money that could be utilized much better and make it go way further."

Meaning: Several participants believed that the time and money required to complete all the different forms to satisfy the requests of the agencies is not only an obstacle but also a very inefficient use of valuable resources that could be utilized in more beneficial ways.

Lack of preparedness and fairness

(2) "The conservation officer wasn't aware of DFO's Agricultural Ditch Maintenance policy which is currently in revision. It was a simple miscommunication that could have been solved with a 5 minute phone call. Instead, everything was held up and we spent a lot of money. We had to hire a consultant ($120/h) who told us that we were in fact in compliance with the regulations."

(2) "The prosecutors of the case were totally unprepared, didn't know much about the case at all. There was pressure and impact from threat of arrest and charge, so it became a personal concern. The accusatory investigation was hard to take when malicious intent was not the case."

Meaning: Environmental officers have been described as slow to respond, indecisive, uncertain, not fully aware of all the different policies or sometime important details relevant to the cases. They have been portrayed as unprepared, threatening, accusatory, not willing to communicate very effectively, lacking consistency in the interpretation of the rules while abusing their discretionary powers. On the contrary, they have also been described as very nice and helpful.

Interpretation of policy

(3) "They adjust, adapt and interpret their rules based on the site. They have a lot of guidelines, lots of room for maneuvering. They have differential treatment between parties (elderly couple vs. other property owners). The interpretation of regulations and guidelines is a real issue. Even if DFO and BCMOELP officers interpret it one way, the Judge will most likely interpret it differently, and nobody seems to have a good understanding of the consequences. The ministry has to clarify guidelines as to what exactly they mean. They should enforce their policies"
without any differentiation between violators. Don't enforce based on site specific variables such as an elderly couple gets away with something the township or a company would never get away with. 

Create a level playing field.

Meaning: One of the main objectives of environmental enforcement, the creation of a level playing field, was felt unfulfilled due to the differential treatment of certain parties. Some even "felt red circled". The fact that the Ministry likes to mark up all invoices 25% when they recover the costs associated with cleanup of fuel spills wasn't very well received either. Finally, the impression was that the allocation of funds for creek rehabilitation wasn't very well planned in terms of maximizing the potential size of returning salmon runs. However, the lack of clarification of guidelines and the difference in interpretations, not only between officers but also between the different enforcement agencies and judicial institutions, along with the lack of understanding of the consequences rising from those differences, seemed to be the biggest concern.

Theoretical Implications for Perception of the Regulatory System for Environmental Management and Enforcement in the LFB

Meaning arises in interaction, which requires effective feedback systems/communication strategies to be in place (Oliver, 1991; Scott and Meyer, 1994). There will be variation in policy interpretation depending on the government agent's background, training, age, characteristics, etc.

Older institutionalism argues that configuration of a particular regulatory system, including the enforcement process within it, depends on the efficiency of its operation or its function for society (North and Thomas, 1973). New institutional theory (NIT) argues that most systems are neither efficient nor functional, nor measurable in those terms; instead they are better understood as reflections of underlying policy regimes and political cultures. These regimes set up and shape regulatory systems and to understand them requires an interpretive framework (Friedland and Alford, 1991). There has to be a clear definition of the organizational field of action, including past understandings of compliance and enforcement in those fields. There also has to be clear understanding of the rules governing those processes, which lead to the actual behaviour in the system and the observable outcomes. In this particular case, the permitting and compliance process was perceived to be inefficient in terms of time and money, in addition to its function for society being perceived as an obstacle.

Furthermore, from an older institutional theory point of view the rational for the system not functioning very effectively is thus due to this lack of efficiency and appropriate function. From a NIT point of view the perception of the regulated actors is valid and normal, and they shouldn't measure the effectiveness of the system in these terms, but rather look at the policies within the system and how they are being interpreted. (Policy interpretation is discussed later in this chapter.)

Finally, the feedback being examined here is not from an environmental incident through the regulatory agency to an actor about his/her performance that was supposed to change his or her behaviour. It is feedback from the regulated actor about the regulatory agency's performance and the nature of the system in which they operate. From a NIT point of view, filling out x number of forms is a reflection of the underlying policy regime since it is a policy requirement. But what
is really lacking in terms of feedback is the interpretation of the data in those forms, their value and use. In terms of time and money is it worth the company effort to generate this information when the outcome is uncertain and not reported. What is really the purpose and outcome in terms of what gets done and what doesn't get done by having to go through the process of filling it out, sending it in, somebody sorting it, reviewing it and processing it. Does this really lead to fewer environmental incidents? I think the question should be: How can we minimize environmental incidences and maximize environmental performance?

**Puget Sound**

The issues with regard to the nature and effectiveness of the environmental enforcement system that surfaced from the PS area participants were also mainly negative, only with a few positive remarks. Their issues were subcategorized as:

1. Inconsistency, unfairness, ambiguousness, shift
2. Science is not feeding into the rules
3. Too many agencies without a lead, lack of adaptive capacity
4. Fines vs. true costs and behavioral change
5. Distrust
6. Interpretation of policy
7. Positive remarks

**Inconsistency, unfairness, ambiguousness, shift**

(1,7) "The State and EPA have two different matrices for determining penalty levels. Even though they are subjective and inconsistent, the matrix is a good guideline for letting us know the minimum and the maximum as to what they can do."

(1)"This is a good example to illustrate what some of the issues are: We built a house for my mother who is an elderly and we decided to build her a pond next to the house. They came and told us, you cannot have a house so close to a pond, you have to move the house. So we moved it. They came again and said the distance we gave you before wasn't enough, you have to move it a bit more. There are no fish in the pond but we had to move that house three times. As a result nobody wants to build ponds or to do anything with water because they immediately lose their rights."

(1)"Ecology doesn't really have an enforcement capacity, Fishery does. The reasons behind variations in the pattern of enforcement are political. Over the last 10 years their attention has been shifting from one industry sector to the next. Now and the last 2 years Ecology has been cracking down on dairy farms."

(1)"It wasn't appropriate what they did and how they handled the whole thing. They basically just called the local health department (which has enforcement capabilities) to get the information, didn't do any of the job themselves in terms of testing and field work, etc. but still wanted $16,000 from us, when it wasn't even our fault in the first place."

(1,7)"Lately (in the last 2 years) they have been more punitive, before that they have been more helpful and assisting. The guys at Ecology in the Industrial Inspection section are very good, there is clear communication with them but lately they had 4 different supervisors looking after our plant, and they have new officers."
"They send me inches of thick paper piles with a note to fill it out otherwise we come and get you. (Compliance and energy audit). Their current approach doesn't yield the system we want, we don't seem to have the same goals."

"They are acting as policemen instead of giving suggestions or help. There is no communication, they don't say: given this issue this is what I would do."

"Politically we are easy target. The politicians will not attack the families with SUVs. Those are numbers of votes. The problem in terms of air pollution for example is 70% due to driving and 11% due to industry, and still, we are paying for it."

"In the last few years it has been shifting from enforcement to compliance and technical assistance. WQ and technology standards are set on a case by case basis and it doesn't adapt to changes very well. For example 20 years ago we had led in our process and a standard for it, not any more but they still require us to test for it. It's a waste of time."

"There is major conflict between Ecology and Fisheries in terms of treatment of storm water - they are not agreeing or working together. The permitting process is not harmonized. It takes 6 years instead of six months to get something approved and done. Ecology does not comply with federal regulations, the county does. Had the county approved the project the tax revenue for them over the last two years would have exceeded 1 million."

"You often get stuck with a penalty before you understand the rules. It all depends on who you get as an enforcement officer since they have very different experiences, a very wide range of skills and background. Regulations are not clear as to what you can do with a property. We don't get much technical assistance from government, they are not very supportive and always busy. They give a bunch of rules to follow."

"We had the EPA here 5 times and 9 people were trying to decide if this area was a wetland."

"Regulators looking after the different sites are very different in terms of personality and attitudes and thus the way in which we relate to each other. On some sites they think we are the "evil empire" and we are treated as such. On other sites it's the opposite, for example we have received an award from Ecology at one of them."

"The county people who gave the permit for the development get into conflict with Fisheries and Wildlife and the State. The restoration plan has been pending for two months and they still have disagreement about fish being there. They need agreement before you can proceed."

"The EPA and Ecology can't agree on how to run a database. They are reacting to everything instead of being proactive. Science is not feeding into the rules. In addition to all the regular compliance paper work, we have to fill out environmental expenditure reports three times a year for three different agencies and everybody is doing it differently. It gets in the way of compliance."

"The money (for the penalty) is not important, what is important is the violation of the permit. The non-compliance list creates a differentiation in values - not a fair representation of what is happening."
Meaning: A sense of injustice and frustration dominated the attitude of the PS respondents. Similarly to the people in the LFB, they have described regulators as lacking common sense, flexibility, adaptive capacity, practical experience, and understanding of the nature of biological processes. Government agents were characterized as being uncertain, more like advocates than problem solvers, not very supportive and always busy, not doing their job, unfair, and reactive instead of proactive. Several individuals have mentioned that it actually all depends on whom you get as an enforcement officer, because they have very different experiences, a very wide range of skills and backgrounds, different personalities and attitudes and thus different ways of relating.

Some of the weaknesses of the overall system were characterized as subjective and inconsistent, especially in the context of methods on the state and federal levels for determining the size of penalties. It was highlighted that EPA and Ecology can't agree on basic storm water management issues, or on how to run a database. As a result there are way too many forms to fill out. It seems as though the Department of Ecology doesn't really have an enforcement capacity, but the Department of Fisheries and Wildlife and the city does. Further, the reasons behind variations in the pattern of enforcement are political.

The current shift in the system has been described in two ways: 1) as shifting from assisting to more punitive as well as 2) shifting from enforcement to compliance and technical assistance (also see Hoffman, 1997; Hoffman and Vantresca, 2002). In either case, small businesses felt at a disadvantage with the permitting process by having to deal with it as though they were a large firm. The non-compliance list creates a differentiation in values that was perceived to be an unfair representation of what was happening.

Science is not feeding into the rules

(2)"Regulators don't understand that waste treatment plants and micro-organisms cannot be very easily controlled from one day to the next - they need time to change"

(2)"We were going to build a building here for storage and to deal with water treatment, but they required the establishment of two parking spaces that we don't need and it would just lead to more runoff."

(2)"In terms of the stripping away the mixing zones and the demand for zero discharge is policy driven. The people doing the TMDLs and the special interest groups don't understand the pragmatic science. They ignore the requirements for extra treatment and premixing. The standard setting was technology driven but now there is a confusion of science and policy and a big disconnection between science and policy. It would be paramount to political death if a politician asked "what good will this environmental legislation do?" There is a perception that if it is environmental it must be good. There is a major shift away from science to policy, from the common good to special interest groups."

(2)"We only use about 1/3 of the permitted limit. We are waiting for a new permit and expect a lot of changes coming down."

(2,3)"Twenty years ago responding to enforcement was easy: if we had a spill we reported it once to one agency and that's it. Not anymore. The main problem now is that too many
**agencies want to be "lead".** Agencies are not funded well and as a result they are fighting for the justification of their programs while creating a false economy. Back in the 70s enforcement of the original CWA was heavily based on science, they had doable regulations. The environmental movement created the perception that it cannot be done through regulations. Lawyers ended up writing unclear legislation, based on not very well thought out methods to implement them. For example they tried the cluster rules, but by the time it got through the approval process it became useless. As a consequence, we got to the point where we had to make millions of dollars worth of capital investment decisions based on guessing if we are doing what was required since they haven't decided."

**Meaning:** Based on the perception of the PS interviewees science is not feeding into the rules and compliance standards are policy driven by special interest groups. Methods of evaluation are lacking the scientific rigor that used to provide a common ground for understanding, problem solving, and response.

**Too many agencies and no lead, lack of adaptive capacity**

(3) "There are too many agencies in the permitting process. If they are spending all of their time on emergency response they have no time to plan."

(3) "There are 30 different agencies that we have to get permits from and report to, and we have 5 different timetables for compliance."

**Meaning:** An overwhelming number of agencies seem to be collecting the same information in different ways, which is perceived not only as a waste of time and energy but as a process that is in fact getting in the way of compliance, planning and innovation. The main problem was identified as too many agencies wanting to be "lead", trying to fight for the justification of their under-funded programs while creating a false economy, that only leads to the inability to come to any sort of agreement. Some felt that the ways in which WQ and technology standards are being developed are not very adaptable and flexible to changes.

**Fines vs. true costs and behavioral change**

(4) "The size of the fines and its impact is not reflecting true costs."

(4) "Now they are coming down on cattle farms. The cows are used to be drinking water out of the creek now they have to be away from it 200 feet. People are losing a lot of land if it is near a water body and farms become worthless. For 20 acres of land I paid $3000 for in 1972, I was offered last week $1500."

(4) "We participated in the TMDL calculations by measuring temperature and conductivity. Now they want to measure at a different height in the river and they want more money from us to do that - it is very expensive."

(4) "Fines are not driving behavior. 99% of the time we are in compliance because that's our policy, we want to stay in compliance and exceed it. We are striving for leadership so we have invested millions into voluntary measures before the fine happened."


Meaning: As this research has illustrated, several tangible and intangible costs occur that are not accounted for by the enforcement system. The bottom line is that fines not only fail to reflect the true costs but they are not driving behaviour either. Nobody wants to construct a pond, or get any properties near water bodies anymore, especially farm land due to the risk of losing property rights.

Distrust

(5) "The graduates getting out of school and into the permitting process have no practical experience - they are advocates. There is a fundamental distrust between the regulatory agencies and the people in the field who are trying to do their work. They think we are raping and pillaging the environment. They have a certain perception and image as to how things should look and if it doesn't then they feel a betrayal of trust and attack."

(5) "We often feel blackmailed by them."

Meaning: A sense of distrust of the enforcement system, and government in general, was very evident in the PS region. Several companies were reluctant to carry on a conversation with me as soon as I mentioned the word environmental enforcement.

Interpretation of policy

(6) "Often the problem is the interpretation of policy, it's not a law or a regulation and it is still included in the permit requirements. Policy is not the law and our procedures are adopted to the law so this becomes an issue in court."

(6) "Common sense is lacking in Ecology and they have no flexibility and adaptive capacity. This is what the book says, this is what we are going to follow. They get no input from contractors. We try to explain to them how to spend the money effectively. They take too long to adjust to new technology or they reject it all together. They are reactive not proactive - fall back on old ways of doing things.

Meaning: Interpretation of policy is the way in which laws are implemented. There is variance over time in their adoption by companies responding to the laws, and many different factors lead to variance. Difference in skills, background, experience, values and attitudes are just a few of those factors leading to variance in policy interpretation.

Positive remarks

(7) "The city has significant enforcement powers."

(7) "Regulators are good at educating us in terms of compliance, they tell you specifically what needs to get done. If you are proactive it is easy to follow their requirements."

(7) "The officers are personable and reasonable people but the problem is that we still need to deal with the whole permitting process as though we were a huge firm."

Meaning: The majority of the comments I have received about the environmental enforcement system were very negative. Very few individuals thought that regulators were good, personable
and reasonable people, who are also good at educating the firm about compliance, without any confusion in the process. Being proactive was an important requirement for effective communication and cooperation.

**Theoretical Implications for Perception of the Regulatory System for Environmental Management and Enforcement in the PS**

Jurisdictional conflicts and the lack of harmonization of the permitting process creates extremely long delays in getting anything approved and done, as well as unexpected and unfair costs for the regulated community. Especially around issues related to construction and site development there is a lot of disagreement between the federal, state and county governments, resulting in high costs and inconveniences for project proponents. Institutional theory is just beginning to recognize, once again, that power, conflict and negotiation shape the degree to which even legitimate regulatory systems can function well (e.g., see Clegg and Westwood, 2002; Lawrence, Winn, and Jennings, 2001).

Apart from power and conflict, it is important to focus on the role of values and cognition (Scott, 1995). Participants and social scientists must both recognize that science can only give us limited amount of answers and guidance for action. As it has been discussed in previous chapters, environmental science is in fact a negotiated consensus among experts who weight data differently and often don't reach consensus (Garud and Rappa, 1994). Even if they do in some cases, it is easy to lose sight of the fact that what is perceived, as a "scientific fact" remains an un-validated sometimes un-testable, negotiated scientific judgment.

Since institutional structure has a major influence on cognitive learning of environments, and the majority of interviewees felt that they were not learning anything from regulators about problem solving and enhancing their operations, the structural adequacy of the multitude of agencies involved in enforcement is rightfully questionable.

The purpose of any environmental enforcement system is to influence, modify, or control with such tools as NOVs, orders and fines those actors' behaviour that is not in conformity with a certain set of rules, objectives and standards aimed at protecting the environment and human health. Some of the prosecuted firms, however, have clearly emphasized that fines are not an effective means for trying to change behaviour. As it has already been mentioned in previous chapters, values must be institutionalised before they can affect behaviour, meaning they must be articulated socially in ways that motivate conformity. Getting a fine is not perceived as something gainful for the individual or group, even though it has been demonstrated that enforcement can have tangible and intangible benefits. Further, it is not perceived as a psychologically satisfying event, it doesn't maintain self-esteem and group identification, other than identification with other violators on the charges list.

A key finding, and one that is not a large part of either institutional or complexity theory, is the roles played by trust. I think this lack of trust is the main source of confusion, lack of communication, progress and learning, conflict, unnecessary and expensive court battles, and unhealthy hostility. The system doesn't need any more advocates but compassionate, genuine and intelligent problem solvers who are equipped with flexibility, adaptability, an open mind, willingness to learn, excellent communication and people skills; individuals who understand and appreciate the permitting process as well as the industrial processes to which those are being applied.
UNMET NEEDS

The questions about unmet needs identify gaps (weak links) in the chain and in the feedback mechanisms.

Fewer comments were made during the interviews about the nature of unmet needs (5LFB, 13PS) than about the general perception of the system described above. The issues that have been brought forth can be subcategorised into needs for:

1. Information and education
2. New legislation, programs and process
3. Compassion

Lower Fraser Basin

Information and education

(1)"It would have been good to know who to contact for cleanup, monitoring and remediation in the case of an environmental event. We, and I'm sure others, were caught totally off-guard as to what to do, and who to call. I think a brochure of some kind could be made up and distributed to companies and manufacturers."

(1)"Fliers about lessons learnt from (rare) incidences would be very useful. Especially if we are surrounded by fish bearing streams, it is needed to know ahead of time and incorporated into building design permits. So people know: what you are going to use that property for and if you could contain it. The city should have more power in decision-making and tell customers upfront what are the requirements to operate a business in this area and not just give permission and then walk in and fine them later. Plants get shut down that way. The way they test a building architecturally they should test it for waste too. Site portfolio, characteristics, potential uses and consideration of all these issues. Guidelines on what kind of facility is this, how much waste are you allowed to put into it, or water out. Tell us ahead of time not after. We are on a five year plan. Phasing in costs is important. Competition is severe out there. Cascading energy flows isn't just about the environment, financially makes a lot of sense, and that's where you see a lot of companies do things."

(1)"We would like to know whether every single new beaver dam automatically becomes a new protected habitat area? Does it change the use protection of the site? When do we need approval for their removal?"

(1)"Proactive education would be more effective than enforcement: in-house studies, Industry association activities, simple summary of incidents printed in newsletter."

Meaning: Companies expressed a genuine need for proactive education, in-house studies, industry association activities and access to information about lessons learnt from incidences, cleanup, monitoring and remediation. They wanted to know who to contact in the case of an environmental incident for such services. They requested the explicit clarification of constraints related to a particular site, especially those near a fish bearing streams, in order to have a clear understanding of the consequences of operating on that site prior to purchasing and using it. They also suggested granting increased enforcement powers to the city in these areas. They
would like some clarification about the status of new beaver dams and their removal in terms of protected habitat.

**New legislation, programs and process**

(2) "Our drivers' handbook deals with incidents occurring at fuelling locations, but not with ones occurring on the road. Any direction given on this should be on a national basis."

**Meaning:** Transportation related fuel spills occur frequently at fuelling stations and on the roads, yet there are no nationally or internationally consistent requirements for preventing and addressing the consequences of such incidents.

**Puget Sound**

**Information and education**

(1) "There is a need for more education programs first. Farms have been here for a 100 years. Our buildings and facilities are designed and built based on the standards of those times and our practices are old. All of a sudden they come and change rules. We need training. We don't know what we are doing wrong. If I had to build a lagoon and buy tractors with it I would have had to spend $200,000. We need a financial system in place to be able to comply."

(1) "It would be nice to have a clearing house in the industry to go to get information from."

(1) "If you send information make it clear, simple, easy to understand. There doesn't seem to be helpful information on supply of lubricants, coolants, clear disposal recommendations for all products. When you are training someone you shouldn't tell them what they can't do, but give solutions. A materials flow inventory and exchange program would be very helpful."

(1) "In terms of turbidity issues it would have been useful to know where to go, who to talk to solve the problem, to find literature on it."

(1) "Suggestions for dealing with the issue would be helpful."

(1,2,3) "There is a need for a compliance assistance program to facilitate the process and improve communication. It would be so nice if they showed some interest in the understanding of our operations and processes and try to help us with suggestions and advice instead of penalizing. A little evidence of "care" would go a lot further than their current approach. It is not effective at all in terms of achieving environmental protection and doesn't create a positive cooperative atmosphere. Feedback and communication is the major missing link, for example the lack of verification of an incident reporting. We outlined the improvements we wanted to make and we were hoping them suggesting corrections on what we are going to do. It's a people thing really, and we are not treated as such."

**Meaning:** Several firms have expressed the urgent need for access to meaningful information on an array of topics such as materials flow inventories, exchange programs, supplies, clear disposal recommendations, turbidity issues, problems solving, cleanup and remediation services. It has been emphasized that for information to be meaningful and useful it must to be more clear,
simple, and easy to understand. Compliance assistance programs designed for the facilitation of the process (education, financial assistance, feedback and communication) are currently lacking in many industrial sectors.

**New legislation, programs and process**

(2) "They provide **no technical assistance** - but we did get a See grant from UW."

(2) "Everybody has the **same problem in terms of storage of manure**. Milk prices are still the same as they were in the 60s, stores are selling milk at a loss. **Federal regulation of milk prices is killing the industry.** By 2003 we have to implement a **Farm Plan** that will cost us $2-3 million. You can't farm here due to overpopulation, the water table is too high, and the weather is unpredictable and wet. The **regulatory** agencies (EPA, Fisheries, County, etc.) are in **conflict** with each other and they are trying to deal with issues from 10 years ago. The farmers who have managed to survived are paying for the ones that are out of business. It is true that they did some crazy stuff in the past, released their lagoons into water ways, etc. **Nobody can comply.** It's a big fight to stay alive, too much work so the young ones are not interested in taking over, however they **can't sell the farms** either because they can't be broken up. So they are leased for cropping."

(2) "Current legislation should be revised, and an initiative put in place that requires any new legislation to have a **lead agency** before it gets passed. In your research please come up with a lead agency. This must be done."

(2) "We should be able to pick up a **set of rules that apply to a site** and take max 1 year to get a permit. Instead of having to reproduce zillion copies of our plans and keep circulating them between all these different agencies, and having them come back with red lines all over, and if somebody gets sick or is having the baby the whole process gets held up because there is nobody else to review it. Why can't we have 3 **round table meetings** with all the different agencies and their storm people and botanists and traffic guys and engineers at the same table to get their input and suggestions and do it right the first time around. **Give us the rules: what to do, how to do it and how long it will take**, and we will do it. You cannot plan for what you don't know."

(2) "There is need for sitting around the table, for a **collaborative process for setting rules and policy.**"

**Meaning:** The issue of lack of technical assistance was raised by several of the interviewees. Dairy farmers, especially, are experiencing difficulties with compliance and the implementation of nutrient management plans without any technical and financial assistance from government. Federal regulation of milk prices and regulatory restrictions on the use and subdivision of farmland give the dairy industry a very unfair disadvantage.

Similar to the requests from the LFB, there is a need for the explicit outline of rules that apply to a site and for a process that allows for obtaining a development permit within a reasonable time frame. Need has also been expressed for roundtable meetings with all the relevant parties involved, for a collaborative process of setting rules and policy.

**Compassion**
(3) "Have compassion for well meaning actors and unintended events."

(3) "It would be really good if they recognized that people are willing to do the right thing if you let them do the right thing."

Meaning: to have compassion for well meaning actors and unintended events and to recognize that people are willing to do the right thing if you let them do the right thing.

Theoretical Implications for Unmet Needs

The LFB and the Puget Sound look more similar than different in the case of unmet needs. In the LFB the interviewees discussed needs for education and need for legislation, as they did in the Puget Sound interviews. However, one additional issue area raised in the Puget Sound was the need for compassion.

Theoretically speaking, the interviews support my contention that the feedback from penalties and from the responses of firms to both regulators and future firms is weak. The firms cite a lack of knowledge about the outcomes of their penalties for other firms in the industry and whether or not the government learned anything from the event. While this seems quite negative, the firms also expressed a willingness to learn more about the post-response consequences of their actions and actions by similar firms. Even simple suggestions like newsletters and follow-up reports were cited as useful in both the LFB and PS.

The lack of compassion is a deeper issue. Like the lack of trust, this emotional level response means that the learning in the system by individuals and their firms may be negative rather than positive. Learning theory has underscored the importance of positive emotional environments and feedback for constructive, adaptive learning; but the negative halo of being charged and fined for environmental offenses may prevent such outcomes in the two regulatory systems. It is interesting that I found some evidence of this in both the Unmet Needs and Perception Sections. Current environmental management and regulatory systems are supposed to be becoming more normative and user friendly. My observations question this trend.

EXISTING FEEDBACK SYSTEMS, OR THE LACK OF THEM AND THE CONSEQUENCES

As discussed in Chapter Two, the learning/feedback question is good for assessing learning feedback arrows for both the ACTOR and REGULATOR; that is, the link between outcome/response to a penalty and the feedback that regulators and regulates receive formally and informally. The number of comments in this category was even less than in the previous one (2LFB, 8PS) and their convergence was not the case.

Lower Fraser Basin

(1) "We have a resident black bear and dears and all kinds of wildlife for which we have built a pond and a we left a 45-75 meter range of undeveloped land buffer for wildlife corridor. The boundary of our operation has been suddenly changed and enforced on us without any notice due to a lack of communication between the City of ....and the BC Ministry of Mines. This site is
partially crown land, partially city land and partially privately owned land. The boundary issue has cost us about 4 million and the real costs are non-recoverable."

(1): "We seem to be becoming the recycling depot for the neighbourhood for: used oil, containers full of dead fish, used furniture and appliances such as beds, couches, and boilers end up on the property. I have called the City of ...and the local MLA to report the issue but so far we had no response."

**Meaning:** Lack of communication and coordination of approval processes (permits, licenses) between the different agencies and levels of jurisdictions result in very expensive decisions for companies that affect the boundaries of their operations. Further, local governments don't seem to be very responsive to such reported issues as accumulation of used oil, containers full of dead fish, used furniture and appliances on commercial properties.

**Puget Sound**

The core issues raised were:

1) No communication  
2) Conflicting feedback  
3) Positive remarks

**No communication**

(1)"**Between industry** nothing is shared, there is no communication, and there are different corporate philosophies. The "big boys" with the big money sometimes organize meetings and workshops to talk about wastewater discharge permits. We don't have access money to throw away so we don't often have the opportunity to go to workshops, train, share information."

(1): "Companies don't like to talk to each other."

**Meaning:** Some of the regulated actors felt that there was no communication between themselves and the opportunities for feedback and learning were out of their reach.

**Conflicting feedback**

(2): "There is feedback but not good."

(2): "We once thought that if we had all the regulators in one room it would help to eliminate confusion and speed up the process of approval to rebuild and expand our dock. So in 1984 we invited everyone. We ended up with 13 agencies on the mill site (representatives from Ecology industry section, water quality section, EPA, Fisheries, local tribes, etc). We did a presentation and took them around the plant so they can understand the process and what we were hoping to accomplish. We gave them a list of questions related to rules we were hoping they can help us with. Not a single agency claimed leadership to take charge to move it forward or to give up the rights, or to criticize. They still haven't figured out the rules or an agreement."

PS: "There was a site with a creek on it that we were going to work on. We sat down with Ecology and Fisheries to figure out what to do about the creek. We worked out a $450,000 mitigation plan to build a fish bearing pond and a salmon ladder. They approved it and we went
ahead and built it. It took up 1/4 of the site we were going to develop. Then the county came in and said:

- You can't build here, you have salmon on site and you need a 350 foot buffer.
- That means we cannot use 3/4 of the site. What do you mean? We just implemented a mitigation plan for addressing that problem that has been approved by Fisheries and Ecology.
- Doesn't matter. You are not getting a building permit for this site.

In the meantime we were paying $50,000/months interest on the loans we took out two years ago to develop the property. The monthly opportunity loss on it was actually more like $90,000, and it was just sitting there growing grass. We call it the "Cohotel". We finally sold the site at a huge loss."

(2)"Feedback needs to be a continuous process, particularly within industry groups. Sharing of information is a must."

Meaning: Similarly to the experiences in the LFB, companies were disadvantaged by consequences of jurisdictional conflict. Given conflicting rules to follow results in long delays and high monetary costs in terms of their day-to-day operations.

Positive remarks

(3) "Marine industry newsletters are very helpful - incidents and case studies are discussed."

(3) "The pulp and paper industry is mature, over regulated, we have in place solid communication on the issues."

Meaning: Marine industry newsletters proved to be very helpful in the dissemination of information regarding incidents and case studies. Actors from the pulp and paper industry felt that there was solid communication in place with regulators, however they felt over regulated.

Theoretical Implications of Information on Feedback Systems

Feedback simply implies "what is fed back to the regulators and regulates"—not whether or not anything is necessarily learned. Institutional theory, especially NIT, emphasizes that learning may never occur or occur in unintended ways. Therefore, feedback, as a broader category of learning must be considered before positive/negative feedback and adjustment (learning) is discussed. Complexity theorists have a similar interest, and also think about different levels or order of feedback loops that occur over time in systems.

What was found overall about feedback in the LFB and PS that might bear on either institutional or complexity theory? Overall, there seemed to be a greater volume of feedback in the PS than LFB, but the feedback was also more negative. From the point of view of NIT, it is hard to discuss the nature of feedbacks' effect on "cognitive" or "normative" structures in a regulatory system if the feedback is about emotion and affect. Suppose distrust is high and that negative feedback occurs, as well as negative secondary responses? So what? Does that mean that the feedback will cause adjustments in behaviour or the adoption of new policies—or resistance?! The role of resistance just has not been thought about in the adoption of new policies, although some new work is beginning to do so (Creed and Seo, 2002).
From the point of view of complexity theory, for any system to function and evolve, feedback loops must be in place for learning and adjustment in the system to occur. Feedback needs to be an ongoing process between industry groups, between regulators and regulated actors, and between regulatory agencies. Interactions have to be rich and meaningful. When agencies are competing with each other for the preservation of their outdated programs instead of maximizing cooperation and the harmonization of their processes, interaction is minimized. The same applies to constantly competing corporations.

In my interviews, I found some evidence for the establishment of new patterns due to feedback and micro adjustments in networked elements. The cases (the above quoted firms) indicate evidence of adaptation, where there has been overtime adjustment in the system allowing the basic pattern to survive but be modified.

LEARNING EXPERIENCES

As was stated before, learning is feedback about a performance (positive or negative) that will affect future performance (positively or negatively). Assessing the nature and process of learning for both the actor and the regulator is the purpose of this section. An equal number of comments arose from the two regions about learning experiences (6LFB, 6PS) and I haven't noticed any convergence among them. The nature of the learning expressed in the comments was related to either:

1. improvement in company management and operations, or
2. the agencies' enforcement process

Lower Fraser Basin

Improvement in company management

(1)"We found an engineering solution that worked, so in that sense the incident had benefits: we learnt and progressed from it. We have passed on the information about our learning experience to other municipalities through the ...Association so it benefited all on the long run. It heightened awareness of staff and provided for an excellent training exercise. It is nice to see staff being aware and prepared for new remedial action."

(1)"What I have learnt was that no matter what you have done, you need to reassess."

(1)"Public image was an important issue, the realized fine $ was irrelevant, the issue of conviction was much more important. I have learnt a lot."

(1)"Problem avoided is $ saved"

Meaning: The types of improvements in the LFB resulted from the application of engineering solutions, utilization of available feedback mechanisms, dissemination of meaningful information, increase in training, awareness and preparedness. There was a recognition of the importance of re-assessment of past decisions, of public image, and of the insignificance of the cost of a fine in comparison to the potential impact of conviction.
The agencies' enforcement process

(2)"It had educational benefits, I have learnt a lot about the process and the Ministry. We had to redirect our storm drain to a sanitary sewer".

(2)"Having gone through an event, I now know what steps one has to take, and who to contact."

Meaning: Two firms have felt that they have learnt about the Ministry and its enforcement process, especially about the steps to be taken and the people to be contacted in case of an environmental incident.

Puget Sound

Improvement in company management

(1) "We benefited from the incident in a sense that we have better control of our system and better relationship with the regulatory community. The incident would have repeated itself if we hadn't put in place the changes we did. We have learnt a lot in the process."

(1)"There is way too much food being produced and the oversupply is due to technology. We had a four-fold increase in milk production over the years - up to 30,000 pound of milk per cow/ year. We used to feed them 5-10 pounds of grain/day, now they are being fed 25-35 pounds per day. The productivity of the land and the plants themselves has increased several times. We used to get 34 bushels (50-60 pounds) per acre and now we are getting 150 bushels/acre. Some of the top guys are pushing 300-400 bushels/ac, by increasing fertilizer use. What they do nowadays is splitting the genes, taking the genes from nitrogen fixing plants (clovers, alfafa) and put them into potato, wheat, corn, etc. With roundup they found one plant that didn't get killed, so now they have put the gene of this plant into other plants so they don't get killed with roundup when they spray. They put genes from Salmon into tomatoes so it is more adaptable to cold weather. They are looking into Ecoli treatment with high-frequency sound waves."

Meaning: Incidences can have positive direct and indirect learning effects that lead to positive adjustments in the system and provide for the evolution of the systems itself. Having better control of operations and better relationship with the regulatory community are just a few of those aspects that can benefit regulated actors. The advancement and application of technology is having sometime positive sometime negative learning effects.

The agencies' enforcement process

(2)"Downtime is much more costly than getting a fine, but we actually didn't receive that $... penalty - their database is wrong, we did get an order however."

(2)"What has changed in the last 10 years? We have smaller lot sizes - used to be minimum 60 foot wide now it's 40-50, we have higher densities and increase in the size of open spaces/common areas. The side yards have gotten smaller. What doubled is the cost of construction, actually the cost of mitigation and government requirements. It takes twice as long to get half as much done. The same lot that used to sell for $45,000 finished now it sells for $95,000."
(2) "How are we supposed to know it all when they can't figure it out between themselves?"

(2) "What is important is how we as a society decide what's good, how do we translate that into a desired result and how we can as individuals contribute to that. We are all in it together, we all want clean air, water, healthy environment."

**Meaning:** Companies are looking to the regulatory community for guidance in terms of compliance, but when the information they receive is unclear or conflicting and only costing more year-to-year, the usefulness of the process is questioned. Downtime of operations has further reaching implications than receiving a fine.

**Theoretical Implication of Learning in the LFB and PS**

There is definite evidence of successful adjustment within a cluster of regulated actors in the LFB providing for a pattern that has the potential to be the basis of the LFB system's evolution. Looser coupling of the regulatory system with the organizational field and lower structural complexity in the system led to increased innovation and better utilization of available feedback mechanisms, thus learning (both direct and indirect).

From an institutional theory point of view there is evidence of unintended and indirect learning about enforcement. However, gaining experiential knowledge of a process after the fact, at the cost of negative ecological consequences, does not prove to be a proactive and preventative way of going about protecting the environment.

In the PS, there seems to be short-term response and adaptation by companies to regulations and enforcement. This is in a sense "positive learning". But there is also a lot of ambiguity about the bigger picture and where regulations are going. This more ambiguous long-term, feedback appears to lead to ambiguous learning. That means that learning may be less clear in the long run than in the LFB.

**Summary and Theoretical Implications of Chapter VI**

The argument that many institutional theorists make is that values must be institutionalised (accepted widely as legitimate) before they can affect behaviour. This means values must be articulated socially in ways that motivate conformity. In order to institutionalise values for maintaining ecological health, institutional theory maintains that the necessary cognitive, regulative and normative processes must be in place (Scott, 1995 and Hoffman 1997).

More specifically, there has to be a clear understanding of and consensus on the jurisdictional boundaries of the different issues, along with an agreed upon method for their categorization and processing. These methods and processes manifest in the form of rules and laws. Once these rules and laws are established, actions that are prohibited and permitted, along with their processes of authorization, are identified. After these rules, laws, the prohibited and permitted actions and their authorization processes becomes unwritten rules of behaviour, there is an
arrangement of individuals or organizations with clearly defined rights to exercise over clearly defined decisions and actors in clearly defined situations.

**Figure 53 Institutional Development - The Process**

**COGNITIVE PILLAR**
(It is first to dominate the field where action occurs):
*What types of problems fall under who's jurisdiction?*
*How these problems are categorized and processed?*

**REGULATORY PILLAR**
(It is second to dominate the organizational field)
*What actions are prohibited and permitted?*
*What sanctions are to be used?*

**NORMATIVE PILLAR**
(It is the last to dominate the field where action occurs):
*Who has authority/right to exercise over what decisions and actors in what situation?*

The cognitive becomes objectified in **RULES and LAWS**

The cognitive and the regulatory become **UNWRITTEN**, taken for granted **RULES OF BEHAVIOR**

My results suggest that these processes are not fully in place in either the LFB or the PS systems. This explains the lack of expected al change, and the perceived need for further enforcement. The rules that constitute the nature of reality and the frames through which meaning is made are often unclear, difficult to interpret, or undefined all together. When a company is required to obtain permits from thirty different agencies, submit the same information in several different formats to many different places, is given conflicting rules, or none at all, and is witnessing constant jurisdictional battles between the agencies, the stability of the cognitive, regulative and normative pillars become very unreliable, resulting in no behavioural change.

Meanings arise in interaction and are maintained - and transformed - as they are employed to make sense of the ongoing stream of happenings. When there is no interaction or feedback to confirm meaning, no one knows what the rules are, what they mean, what is allowed and not allowed, and who is responsible for what. When there is no consistency in the application of the rules people simply lose faith and trust in the purpose, need, and the validity of the process. The sense of chaos in the system is partially due to overlapping jurisdictions that often lead to conflicting situations between the multitudes of agencies in charge. This is certainly the case in terms of storm water management issues and streamside protection strategies. The “unwritten rules of” that introduce a perspective, evaluative, and obligatory dimension into social life are not well established. They are a source of confusion since the goals and the objectives and the appropriate ways to pursue them have not been clearly articulated, nor have they been agreed upon in consultation with the regulated community. That is why the need for sitting around the table and collectively establishing rules and policies is being addressed.

As far as determining which of the two enforcement systems is perceived more clear, consistent and fair, overall it is safe to say that the LFB system was perceived marginally better than that of the PS, but in different ways and with variation between the different industrial sectors. The
most common experiences in both was expressed by real-estate developers in the construction industry:

"We can't cut a trail in our blackberry bushes without getting fined and losing our rights" (PS)

"You invest a lot of money into a 4 acre property and then all the rules change on you after 6 months. They not only want the 200 feet but another 45 feet on the top of the embankment due to slope steepness. They also want me to jail myself by putting a fence up and not have access to that part of my property. I'm all for conservation, but give property owners the chance to protect their ravines, do proper landscaping on their back yard, etc. If we are not trusted to look after our environment than buy out the property for a fair price and look after it yourself." (LFB)
CHAPTER VII. DISCUSSION AND CONCLUSIONS

REVIEW OF SUPPORT FOR THE HYPOTHESES

I examined the following three main hypotheses in order to find support for the central argument of this thesis:

In the case of organizational compliance and performance, the effects will be greater in the Puget Sound area than the LFB watersheds, because

- **H1:** In the Puget Sound area, the enforcement processes from inventory to monitoring to enforcement to outcomes are more complex and tightly coupled with the organizational field than they are in the LFB.

- **H2:** In the Puget Sound Area, the sanctions for non-compliance are higher for organizations, particularly if measured by direct and indirect associated costs of non-compliance, than in the LFB.

and in the case of prevention and long-term learning,

- **H3:** In the Puget Sound Area, the more complex and ambiguous feedback lead to less positive long-term learning and prevention on the part of organizations than in the LFB.

I tested the argument about the differences between these two subsystems by collecting data in each system on ecological and regulatory inputs, and regulatory and ecological outputs. More specifically, for testing Hypothesis 1, I examined the creation of water quality standards and the permitting process in each system and tried to examine the rates of compliance with these permits. I came across a number of issues that are worth noting here. First, not all incidences are necessarily permit violations; in fact the majority of LFB cases were not. Second, not all incidences are reported and responded to and therefore their total number is unknown. So when I talk about incidences I refer to those events that have been reported to the Ministry and were responded to either by a NOV/warning letter, an order, or by the means of issuing a penalty/fine. Unfortunately, the total number of incidents and the number of charges for the LFB could not be obtained due to the fact that the requested information from the Department of Fisheries and Oceans and the BCMOELP's Nanaimo office were not provided to me. Thus, the comparison of the totals in the two regions for the rates of charges relative to incidents could not be calculated.

However, the connection between ecosystem inputs and enforcement inputs in the Puget Sound area has proven to be tighter and relatively more complex than in the LFB, it did not seem to lead to an improved permitting process. In spite of the fact that exact compliance rates were not obtained and compared I think it is safe to deduce that compliance rates are generally higher in the Puget Sound area than in the LFB, which indicates more effectiveness of the PS system on the input side.

To test Hypothesis 2, I examined response and remediation in both systems based on the analysis of systematic, randomly sampled data that compared outcomes in the Puget Sound and LFB ecosystems.
In terms of charges and compliance effects, penalties/fines for violations were not higher in the PS area than in the LFB. The cost of the penalties in PS ranged from $4000-$20,000 with an average of $8,357 while the range of the fines in the LFB were much larger, $200-$200,000, with an average of $20,670. However, when additional penalties for non-compliance measured by direct and indirect associated costs were taken into account, they proved to be higher in the PS area than in the LFB. From all the tangible costs examined "withdrawal of investments" represented the highest, and "reduced market competitiveness" the lowest cost firms encountered. As far as intangible costs, "damage to industry reputation" was considered to cause the most significant impact while "damage to reputation with investors" had the least significant effect that firms experienced.

On the benefits side, the development of "new management and planning practices" was the greatest (70%), and "savings in energy, water and solid waste" was the least frequently reported tangible benefit. From the category of intangible benefits the "more consensus on environmental issues" was recognized as the most significant (48%), while "improved relationship with investors" was the least important intangible benefit firms identified (9%). In terms of the benefit to the regulatory system, overall deterrence levels were quite low. Only 38% of the firms in the LFB and 24% of the respondents from the PS thought that the incident and the enforcement action had any impact on other companies or industries.

It is true that the connection between the enforcement outputs and ecological outputs in the Puget Sound Area are tighter and relatively more complex than in the LFB, however, it is difficult to say anything meaningful about the rates of remediation since the question hasn't been asked directly. It seemed to me from the interviews that in the case of each incident in both regions action was taken to remedy the situation where it was possible to do so. If cleanup rates and costs are any indication of remediation, then based on these the following arguments can be made. The rates of remediation in terms of cleanup in the PS were actually lower than in the LFB. Only 52% of firms have reported cleanup in PS whereas in the LFB over 81% of the companies have claimed cleanup costs. Cleanup costs in PS ranged between $750-$100,000 while in the LFB they ranged between $800-$65,000.

In conclusion, Hypothesis 2 was only partially supported by the results because benefits for the regulatory system were higher, the costs for firms were lower, and rates of remediation were higher in the LFB system indicating more effectiveness on the output side, than that found in the PS.

To test Hypothesis 3, I examined the case data of the two systems and the qualitative data from my interviews with the companies in each system. This argument was more difficult to test because many of the over time effects have not happened yet for the firms sampled. It is impossible to say anything specifically about the longer-term tangible and intangible costs and benefits of enforcement actions since nobody was able to complete the "long-term" column in the C/B table. However, I think there is sufficient information to make some grounded claims about the hypothesis. In terms of feedback about the effects of charges and compliance I found that there was much higher resistance and feeling of injustice in the PS than in the LFB. I also found fewer firms utilized mechanisms for feedback relative to the process and outcome mechanisms in the PS compared to those found in the LFB. The longer-term effects of penalties are more positively moderated in the LFB than in the PS by the development of current centrally positioned environmental management systems in companies. This is the case not only because
the B.C. government, instead of focusing on permitting and enforcement, is aiming at providing more active facilitation in the design and implementation of EMSs than the government in Washington State, but also because the actual number of environmental management systems in place or in the process of implementation is much higher in the LFB (50% of firms) than in the PS (12% of firms).

So:

*Is one regulatory system better for ensuring organizational compliance with water quality standards and improving environmental performance, and, if so, why?*

Yes and no. I believe that the PS system is better for ensuring organizational compliance with water quality standards in the short term but not on the long term, simply due to its focus on compliance and coercion. In terms of improving environmental performance I believe the LFB system is more equipped and more capable, due to the fact that it is more adaptable because of smaller system size and more opportunities for constructive feedback.

*Does a more collaborative system of water quality objectives and permitting and a moderately legalistic enforcement of non-compliance in Canada have some advantages over the agency- and legally-driven, standard setting and enforcement process in the U.S.?*

Yes, and the reasons why this is true are discussed in the following section.

**THEORETICAL IMPLICATIONS**

It has been stated at the beginning of this document that recent studies applying the principles of institutional theory are finding the US environmental enforcement system shifting from a regulative towards a more normative stance and the Canadian system shifting from a previously mainly normative to a more regulative position. The results of this research do not fully support that claim. In order to say anything meaningful about this argument I would need to illustrate that over-time rates of enforcement vs. rates of incidents are decreasing in the PS and increasing in the LFB. Unfortunately, I do not have enough information about compliance rates to be able to prove that to be the case. However, based on feedback from the interviews the presence of coercion in the LFB system was very evident, while one person from the PS has clearly stated "lately (in the last 2 years) they have been more punitive, before that they have been more helpful and assisting". Thus, I haven't experienced any indication towards a normative shift in the US system. On the contrary, with the implementation of the Endangered Species Act for salmon and the phasing in of "no touch riparian zones" the process appears to be even more coercive than before.

On the grounds of systems theory and institutional theory combined it has been stated that more tightly coupled, complex linkages and better articulated policy understandings will lead to clearer processes. My research results for the PS and LFB environmental enforcement systems do not support this claim. The very presence of overly complex linkages prevented the well articulation of policy understandings. The higher the complexity of the system the less user friendly it seemed to be and the more difficult it was to draw meaningful understanding out of it. This phenomena seems to be well supported by Claude Shannon's claim that the more disorderly a message, the higher its information content, the more highly structured a message, the lower its
information content. I think it is safe to say that a system with more complex linkages will be less clearly structured, leading to the provision of more disorderly messages with higher information content that is less easily understood, than a system that has less complex linkages and clearer structure with orderly messages containing less information that is more easily understood. In order to decide which of these two characteristics is more applicable to either of the two systems under examination, I look at the evaluation of complexity a bit deeper.

There were a whole array of characteristics and requirements outlined in the theory section of this document that determined the complexity of a system. I would like to quickly go through that list and sort the elements that are applicable to the PS and the LFB systems.

Table 4 Comparing the complexity of the PS and LFB systems

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<tr>
<th>Complexity of PS System</th>
<th>Complexity of LFB System</th>
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<td>Consists of larger number of elements</td>
<td>Consists of a fewer number of elements</td>
</tr>
<tr>
<td>The elements interact but the interaction is less dynamic</td>
<td>The elements interact and the interactions are more dynamic</td>
</tr>
<tr>
<td>Less change with time</td>
<td>More change with time</td>
</tr>
<tr>
<td>Interaction is often linear and not rich</td>
<td>Interaction is non-linear and rich</td>
</tr>
<tr>
<td>There are fewer loops in the interactions</td>
<td>There are more loops in the interactions</td>
</tr>
<tr>
<td>The feedback is more often negative (deterring, inhibiting)</td>
<td>The feedback is more often positive (enhancing, stimulating) than negative</td>
</tr>
<tr>
<td>Longer system history</td>
<td>Shorter system history</td>
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</tbody>
</table>

Proposition 4 in the first chapter stated that if the regulatory system in the PS region is more complex than that in the LFB, it will contain more components, levels, interactions, history, adjustments, and feedback mechanisms. Yet, more than 71% of PS firms haven’t experienced any change in their relationships with regulators or the local community. Based on what I have found so far, it is true that the PS system has more components, more levels, longer history, and a larger number of interactions and available feedback mechanisms than the LFB system. However, the actual number of adjustments in the system that ultimately determine change is questionable for the following reasons. For example, reporting the same information in different formats to several different agencies can be considered, aside from a waste of time and energy, as a large number of interactions, but it doesn’t say much about the quality of the interactions. When there is no verification of reporting or any constructive feedback to them, the quality of the interaction is very low, so there is no adjustment, no learning and no change. Also, the availability of feedback mechanisms is not meaningful in itself if they are not utilized effectively. Learning, adjustment and thus change is highly dependent on: 1) the nature, content and meaningfulness of the information exchanged, 2) the frequency of the utilization of available feedback mechanisms, and 3) the participants' ability/skill to process and integrate the information received.

It has been stated that institutional structure depends on the complexity of linkages both within and between institutions and that it has a major influence on the cognitive learning of environments. The type of information available will also determine the nature of this structure, and the learning itself. It has also been stated that less attention to and elaboration of outcome and feedback (learning) effects will undermine the system on the long run. Therefore, the question of "What is the appropriate level of institutional complexity that will facilitate the most
effective cognitive learning processes and actual adjustments, and thus lead to highly adaptable systems?" emerges. This is a question for future research perhaps.

"When we look at systems in terms of how they behave instead of how they are made we find the two extremes of order and chaos. (Chaos theory originally had little to say about the fundamental principles of living systems or of evolution, but it did explain how systems starting out in a state of random nothingness could then organize themselves into complex wholes.) In between the two extremes, at a kind of abstract phase transition called "the edge of chaos", we find complexity: a class of behaviours in which the components of the system never quite lock into place, yet never quite dissolve into turbulence, either. These are the systems that are both stable enough to store information, and yet evanescent enough to transmit it. These are the systems that can be organized to perform complex computations, to react to the world, to be spontaneous, adaptive and alive." (Waldrop, 1992, p.293)

Farmer (in Waldrop, 1992) says that when you get to something like an ecosystem or an economy, it's not obvious how concepts like order, chaos and complexity can even be defined very precisely, much less a phase transition between them. Nonetheless, he says, there's something about the principle that feels right. Common sense suggests that healthy economies and healthy societies alike have to keep order and chaos in balance - and not just a wishy-washy, average, middle of the road kind of balance either. Like a living cell, they have to regulate themselves with a dense web of feedback and regulation, at the same time that they leave plenty of room for creativity, change and respond to new conditions. "Evolution thrives in systems with a bottom-up organization, which gives rise to flexibility...But at the same time, evolution has to channel the bottom-up approach in a way that doesn't destroy the organization. There has to be a hierarchy of control - with information flowing from the bottom up as well from the top down." The dynamics of complexity at the edge of chaos seems to be ideal for this kind of behaviour (Waldrop, 1992, p.294).

Finally, it might be crucial to recognize that the rug has been pulled out from under Darwinian theory of evolution along with the notion of competition leading to survival. Evolution is purposeful, the result of the organism making a positive direct interaction with the environment, not just an example of random chance. Competition is not the mechanism of survival, but cooperation is, and consensus building, with its opportunities for rich and meaningful interactions is a more suitable framework for solving complex problems, such as deciding on an adequate level of ecosystem and human health that ultimately depends on water quality.

**POLICY IMPLICATIONS**

**The Impact of Indicators on Policy - Are we making a difference?**

*(Based on my notes from Rethinking the Line: The Canada -US Border Conference, November 2001, Vancouver, B.C.)*

One of the best ways I found to participate in consensus building is to volunteer during conferences that bring together the people I am trying to build consensus with. One of the key questions that was posed during a conference session on Tracking changes in the Georgia Basin Puget Sound Transboundary Ecosystem (Rethinking the line the Canada US border, November 2000, Vancouver, BC.) was whether or not indicators impact/influence policy decisions. Are we making a difference?
In process it is slow. In B.C. it is just starting to make it into policy, and it is used for performance planning in government. "Outcome indicators, that don't look at so much what we do but what is the result that we are expecting, are going to be part of our performance planning, business planning. It has highlighted for us the need to monitor. We had over the past 10 years significant decreases in monitoring funding. We don't do enough monitoring, in fact it will be hard to do another report if we don't do monitoring". (Smith, BCMOELP, 2000).

Recently there has been a shift in the provincial government about how to spend money on monitoring and reporting of those results. It's not only a result of the work on indicators, but it certainly had a big impact on pushing that agenda. Policy makers don't intuitively understand, they have to see it in a language that they can understand, and that's what indicators do.

One of the challenges for the provincial and federal state agencies is to make indicators relevant at the community level. These indicators do have an impact at the policy level, at the senior government level. They are significant attempts at creating a new policy and legislative framework, but many of these indicators don't have resonance with the community. We are not doing a very good job of helping people understand what these indicators mean. The "shellfish" indicator is a good example: we can demonstrate shellfish pollution, but what does that mean for the economic viability of that community, what does that mean for the First Nations?

Several important issues have been raised about designing effective and meaningful indicators and measurement techniques for tracking changes in transboundary ecosystems, as well as about developing an interactive common reporting framework that conveys the results to a wide variety of audiences. The general OECD "pressure state response framework" is applicable to most reporting organizations, requiring the development of (1) indicators that show the state of the environment, (2) indicators that show the pressures on the environment, and (3) the response from government. The capacity to reach out and bring people together from across disciplinary boundaries has been given great emphasis and importance in applying this framework effectively in practice. Several organizations in the Lower Fraser -Puget Sound basin are involved in this highly complex social process (i.e. The Georgia Basin Puget Sound International Task Force for Transboundary Institutional Initiatives)

**Environmental Indicators: Purpose, characteristics, methods of selection, evaluation criteria and applications across the border**

In a transboundary ecosystem such as the Georgia Basin Puget Sound there are a number of challenges and interests that we share between the two countries. We do want to better understand the ecosystem that we share and how it functions. Hence, we have indicators, monitoring programs, and the science behind it. One of the main challenge we all face is to identify the relationships and create the links between environmental trends and social and economic issues, while incorporating such measuring systems as First Nations' traditional knowledge. We also want to maintain and enhance the quality of life in this region, which is one of the reasons people move here and as a result we have a population growth concern. We are collectively trying to address this issue through growth management initiatives, and implementing sustainable development practices in a number of areas. Thus, it is essential that we improve inter-jurisdictional collaboration on measurement tools, monitoring and reporting, which are all linked together, and evolve into sustainability initiatives.
How do we know we are improving? How do we know our quality of life if being maintained and enhanced? How do we know we better understand the interrelationships between air, land, water, and human activities in the ecosystem? Those are the indicators. Some of them are environmental indicators, some are performance measures, but there is an urgent need to have some sort of measurement or yardstick against which we can evaluate performance. However, the question still remains: What indicators do we use? How do we select them? How do we relate them to sustainability? Ultimately, can we extend/use them across the border?

Designing, selecting, and defining effective indicators is not a simple task of just taking measurements - there are some well established principles and process criteria in place. If it's just a measurement and doesn't have any meaning beyond itself it maybe very useful for management, but it's not an indicator. The first principle is that it has to be scientifically credible, and this is true for all indicators whether they are social, economic, or environmental. They have to have a solid base in science, a credible methodology behind them using well-established techniques. That doesn't mean that they cannot be based in some other type of science, such as First Nations' science. In fact, there is a huge interest in incorporating First Nations traditional knowledge with scientific information because it allows for the extension of the timeframe that we have information for. A good example for incorporating traditional knowledge into the development of indicators is the Memorandum of Agreement on the State of the Environment Reporting for the Mackenzie River Basin, the largest river basin in one jurisdiction in the world covering 7 provinces and territories in Canada. There has already been some excellent work done in the Yukon for example, on trying to marry scientific and First Nations' knowledge, and the Mackenzie project is building on that.

In addition to being scientifically credible, indicators have to be easily understandable, representative, sensitive to change, policy relevant, and they have to have some meaning beyond just that measurement. We can have detailed measurements that would be very useful for reporting to management, but it wouldn't be an indicator, it wouldn't push the policy. Further, indicators should have trend data available. These criteria are not always applicable because there are important indicators that we do not have historical data for. As a result, it is necessary to report on their status now while knowing that we will be able to examine trends later if there is a commitment to do future monitoring.

There are all kinds of indicators that are being measured and reported on in the form of regular status and trend reports, as well as several websites which have been published for that purpose. However, all the different jurisdictions are collecting data, analysing it and reporting it in a way to suit their own purposes. As a result, there is no shortage of information. In fact the problem is the lack of a common reporting framework sorting and integrating the constantly accumulating, and sometimes overwhelming amount of information on all the different indicators.

Some of the other issues are related to data incompatibility. Samples are collected and analyzed differently in Canada and the US as a result of having different standards in place, different quality control and quality assurance programs underlying the different regulatory regimes. Problems also arise from the issues around the ownership of the data due the different regimes around proprietary use of information between the two countries. In many cases, information that is free in the United States one has to buy in Canada. This makes the play interesting in terms of how even a government agency can report on information that belongs to another government.
Further, there are gaps in the data. This is really a reflection of not knowing what questions to ask, and what kind of information to collect, but it's also a reflection of declining resources in government to implement long term comprehensive monitoring programs. Governments like to find short-term solutions to environmental problems, and long-term environmental monitoring programs are harder to sell. In terms of their comprehensiveness and their funding, these programs in the US are better supported than in Canada. On the other hand, public demand for any kind of information in the context of the indicators is increasing. Recently, through the World Wide Web people can get information anywhere, about anything, anytime, if the information is in fact there. The government is trying hard to get the information in a format that is understandable and useful not only to other decision makers, environmentalists, and scientists, but to the general public as well. In this difficult process of trying to translate science into information (indicator trend reports) that is usable by a wide variety of audience, Canada is behind the US.

Finally, indicators have an important role in planning government budget cycles and the prioritisation of the issues for the design of management plans for each cycle. (See the conceptual image of this process outlined in Appendix A3). Washington for example uses a two years budget cycle. Putting together a work plan starts out with the identification of priorities for action within agencies. Then the objective is to identify resource needs for carrying out the action plan. In the year 2000 the Puget Sound Action Team used indicators for the selection of the priority areas while agencies provided proposals for resources in those areas. The next step was to rank order the requests from the most necessary to sort of trivial in a way that they are coupled with/corresponded to the indicators that showed negative trends. An important function of indicators is feeding into gaps in management issues.

Summary

In terms of choosing the best indicator what is fundamentally important is realizing the meaning you draw out of it, the story that you nest it into. The process of integrating traditional knowledge, qualitative and intangible measures into the design of indicators reflects a real maturity in the indicators movement over the past 20 years. It is important to recognize that we do share a number of issues and challenges of the ecosystem, related to growth and the environmental problems associated with that. We also share the desire to measure the impacts and report it in a way that has resonance not only with decision makers but also with the people who live here. And that is the challenge! It is necessary to have credible science translated into information that help people make better decisions and maybe make change in terms of their behaviour at all levels.

In the context of transboundary measurements, the idea that regulatory levels are convenient ways to design indicators doesn't hold when there are no matching regulations across the border; in fact they become a barrier. The calculation of loading has been identified as one of the biggest problems that need to be addressed. Companies provide monthly data to the state on the contaminants of their discharges, and according to one of the Georgia Basin -Puget Sound Task Force members it wouldn't cost the government all that much to add a capability to that data base to calculate loading. It could be identified either by industry, or by geographical area, but it has not been connected with the regulatory agency to get that done. The Y2K issue was one of the reasons why it has not been accomplished in spite of the fact it was included in the Puget Sound Action Plan.
Based on the feedback from the companies, especially on their previously identified unmet needs, I have developed a list of general as well as industry specific policy recommendations to be considered in the process of government budget cycle planning and the prioritisation of the issues for the design of management plans.

**SPECIFIC LEGISLATION, POLICIES AND THEIR IMPACTS**

In the context of specific legislation, policies and their impacts only two comments have been made in the LFB and nine in the PS were worth noting (see Appendix B3-5). The majority of the PS comments converge around the issues related to the Endangered Species Act.

**Lower Fraser Basin**

The following legislation was brought to my attention as "having significant impact on company operations and regulative requirements":

- The Land Development Guidelines of the Fisheries Act and the Streamside Protection Regulation of the BC Fish Protection Act require 15-50 meter setbacks from the water depending on the water course in order to protect riparian zones
- Contaminated Sites Legislation requires the writing of expensive technical reports and compliance certificates that are perceived to be blocking development. "It costs $30,000 to do the investigation and get a certificate of compliance for a site that is worth $5000."

**Puget Sound**

In the PS the following legislation and policies have been brought to my attention as creating chaos and posing requirements on firms that are very difficult to meet:

- The Endangered Species Act (ESA) for salmon and the new changes to the Clean Water Act as a result of the ESA
- The Land Use Plan for the State of Washington (nobody knows how to use it)
- The Nutrient Management Act and the implementation of Farm Plans by 2003 (according to one of the farmers it really makes farms look like a drug store and it is very expensive to implement. Without financial assistance it won't happen)
- The new state law that anybody can sue for environmental violations
- The state law about having to haul out boats from the water for the purpose of repair (it is costly and requires significant behavioral changes from fisherman who are not very easy to change so it drives boat yard work out of Washington to Canada and Mexico.)

The majority of the complaints were about the application of the Endangered Species Act to salmon and the implications of the 200 feet no-touch riparian zone for properties and facilities near water bodies. "There are no water activities allowed between March 15th and May 15th in order not to disturb the salmon fries." The legislation raises temperature and mixing zone issues requiring new limitations, changes in local planning, shoreline development, new water quality parameters, even longer permitting processes, and switching to a use based system. "It is poorly written, ill-conceived, attached to special interests, has no funding for its permitting process, no support to make it work. The Army Corps of Engineers are untrained, they don't have the proper background to carry it out so it is very difficult to comply." Nobody seems to know what the rules are and how to interpret the legislation, so everything is in a state of flux. The consequence for many companies is the implementation of closed loop systems, while some perceive the ESA leading to the inability to compete anymore on the national and global markets.
USEFUL ADVICE
Useful advice was limited to two simple comments from the PS. "Don't dump anything into manholes, no matter who tells you it's ok." and "Let the City help you".

General policy recommendations
There are several recommendations that have been voiced by the regulated actors during the interviews, and some of my own that surfaced based on the observation and analysis of the two environmental enforcement systems.

In the context of the LFB and the issues related to (a) the enforcement process being perceived as an obstacle and a waste of time, (b) the officers lack of preparedness and fairness, and (3) problems of interpretation of policy, the following recommendations are posed:

(a) The revaluation and redesign of the environmental monitoring, reporting and inspection framework seems necessary in order to ensure that valuable resources are not wasted but instead enhance innovation and creativity in improving overall environmental performance. We also need to re-examine the underlying policies to make sure that they are interpreted properly and there is common understanding of those interpretations.

(b) Better training of officers, increased communication and meaningful, consistent feedback between the different actors will be necessary to clarify the requirements and validity of the regulations and guidelines, to make them explicit and applicable to all the different circumstances.

(c) Differential treatment of players is unacceptable since it completely undermines the very purpose of the environmental enforcement system: the creation a level playing field. In terms of improved streamlining of permit approvals, the process applied by the Port of Vancouver should be examined in more depth to uncover its success rate in achieving water quality objectives and especially those aspects that make it superior to other approval processes.

To improve the existing feedback system and the utilization of their potential also requires the availability of meaningful information. The publication and distribution of brochures containing information on lessons learnt from incidences, cleanup methods, monitoring, and remediation was requested. It was also recommended that the testing of buildings for waste and energy flows would enhance the process of creating closed loop systems and maximize the efficiency of industrial operations.

Similar to the issues in the LFB, in the PS it was felt that the elimination of jurisdictional conflicts, the clarification of the overwhelming amount of regulations and guidelines to follow, and assistance with their interpretation and application required the most urgent attention. Attending to that is fundamental in order to prevent the unfair situation of "getting stuck with a fine before one can understand the rules".

The need for revising current legislation and putting in place an initiative that requires any new legislation to have a lead agency before it gets passed was addressed. Developing education, training and compliance assistance programs is a must. Any information sent to companies should be clear, simple, easy to understand. The establishment of round table discussions and collaborative processes for setting rules and policy seems necessary to be able to deal with the
complexities at hand. Meaning arises in interaction, so it is paramount that affective feedback systems are in place and beneficially utilized.

**Industry-sector-specific policy recommendations**

**Agriculture, Fisheries and Forestry**
It is urgent to put in place education, training and a compliance assistance program in the State of Washington for the development and implementation of Farm Plans (especially for dairy farms). Reconsidering federal regulation of milk prices would help the industry tremendously. Allowing for the subdivision of large farmlands would not only create smaller and more sustainable farming operations but would also diversify land use potential.

**Construction**
In B.C. and WA, in cooperation with the real-estate board, develop site portfolios outlining site characteristics, potential uses and considerations of all the different regulatory requirements applicable to those potential uses, in order to let potential property buyers know ahead of time what their options are.

Develop testing methods not only for structural, material, and energy efficiency requirements but for waste flows as well.

Complement the permitting process with roundtable discussions to allow for more productive feedback, problem solving, and expedience.

Make the rules and regulations applicable to the phasing in of no-touch riparian zones under the ESA and the Streamside Protection Strategy very clear and communicate it in a user friendly and meaningful way.

**Manufacturing**
Develop materials flow inventories and exchange programs for a wide array of products and provide clear disposal recommendations for them.

Develop a compliance assistance program to facilitate the process and improve communication. Ensure the verification of incident reporting and provide companies with feedback on the improvements they want to make.

**Transportation and Warehousing**
Provide international spill response training for drivers - not only with regards to incidents occurring at fueling stations but on the road as well.

**Waste Management, Remediation Services**
Provide companies with information on turbidity issues not only with technological guidance but letting them know where to go, who to talk to solve the problem.

Provide clarification on the role of beaver dams, whether or not they automatically change the use protection of a site, and when approval is needed for their removal.
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(http://www.wa.gov/puget_sound/shared/shared.html)


IX. APPENDICIES

Appendix A: Systems Diagrams:
   1) Operational, Collective and Constitutional Choice Rules
   2) Government Budget Cycle Planning & Management Plan Design for Each Cycle
   3) The Implementation Of The Endangered Species Act For The State Of Washington:
      Development Approval And Permit Review Process For Marine Construction (Local, State & Federal Jurisdictional Institutional Actors)

Appendix B: Interview questions and responses:
   1) Survey Instrument - Questionnaire for Data Collection
   2) Summary of Survey Results (graphs for tangible and intangible cost and benefits)
APPENDIX A1: Operational, Collective and Constitutional Choice Rules

**OPERATIONAL RULES:**
When, where, how to utilize the environmental resource? Who and how monitors the actions of others? What information must be exchanged or withheld? What rewards and sanctions apply to resource use?

Problems at this level:
- Poor reliability of EMS's
- Poor monitoring and evaluation
- The administrative merging of regulators and implementors of environmental management. When conflicting duties are administratively combined, regulators must operate under cognitive dissonance – fulfilling one duty violates the other.

**COLLECTIVE CHOICE RULES:**
Have an indirect impact on operational choices. Managers and officials use these rules to form environmental policy and to design EMSs.

Underlying problems identified:
- The administrative fusion of the control over different stages of environmental management technology
- For example, in the case of drainage and irrigation: cognitive conflict between the necessity to ensure profits for irrigated agriculture and the conviction that the striving for profits also undermines environmentally sustainable drainage management.
- Paralyzed decision making which shields the bureaucracy against political conflict over drainage but also commits it to manage a gradually degenerating agricultural system.

**CONSTITUTIONAL CHOICE RULES:**
Influence the formulation of environmental policy and management agenda. Determine who is eligible to participate in resource use. Guide the design of collective choice rules which in turn affect the set of operational rules. Deals with the relationship between economic activity and environmental sustainability.

Underlying problems identified:
- The institutionalized fusion of the social interest to reorient society toward an environmentally sustainable path of development with the social interest to guarantee the short-term viability and profitability of the society's economic actors.
- Becomes evident by virtue of the nested structure of the different levels of environmental institutions
- The assumption that environmental regulation and the implementation of environmental technology could both be made operational as parameters and variables in a single model capable of generating a socially optimal solution.
- The roots of the cognitive dissonance originate at the deepest, most informal level of institution, where the constitutive conflict is between the perceived need for policies that meet short-term economic demands and the conviction that those same policies endanger the ecological foundation of economic activity in the long run.
APPENDIX A2: Government Budget Cycle Planning & Management Plan Design for each cycle

OVER TIME DECISION MAKING MODELS & FEEDBACK LOOPS OF THE ENVIRONMENTAL MANAGEMENT CYCLE & THE "DOUBLE LOOP LEARNING"

EVALUATION OF RESULTS:
Compliance = staying within the carrying capacity of the biosphere
Environmental improvements
Reduced material throughput and energy consumption

IMPLEMENTATION

DEVELOPMENT OF LEGAL BASIS/ REQUIREMENTS/EVALUATION FRAMEWORK
- Legislation
- Regulation
- Permits and licenses
- Court Cases
- Precedents (BMP)
- Programs (e.g. GBEI)
- Consensus building

DEVELOPMENT & IMPLEMENTATION OF STRATEGY/ PROGRAM
- Compliance and Enforcement Strategy/Program
- Ensuring Enforceable Requirements
- Priority Setting
- Compliance Promotion
- Compliance Monitoring
- Enforcement Responses
- Roles and Responsibilities
- Evaluation Measures
- Accountability Systems

PERFORMANCE PLANNING

GOAL SETTING
- Reduce Risk
- Improve and Maintain Environmental Quality
- Prevent Pollution
- Sustain Environmental Uses (e.g. fishing)
- Clean Up Past Contamination

SELECTION OF MANAGEMENT APPROACHES
- Risk-Based
- Pollution Prevention
- Economic/Market Based
- Command-and-Control
- Voluntary
- Liability
- Regulatory

FEDERAL & STATE

ARMY CORPS OF ENGINEERS:
Jurisdiction: Mean Higher High water (MHHW & Waterward)

PAPER WORK FOR APPROVAL:
- Joint Aquatic Resource Project Approval (JARPA)
  (they are sent in on all proposals for project's waterward of ordinary high water (OHW))
- Biological Assessment and Evaluation (BAE)
- Hydraulic Project Approval Permit (HPA)

STATE co-ordinates with LOCAL through the SEPA process which needs to be completed as part of the permitting process

LOCAL JURISDICTION (City, County)

STATE ENVIRONMENTAL POLICY ACT (SEPA)

DETERMINATION OF NON-SIGNIFICANCE

DETERMINATION OF SIGNIFICANT IMPACT

ENVIRONMENTAL IMPACT STATEMENT (EIS)

ENVIRONMENTAL REVIEW (PLANNING)

PERMIT REVIEWED BY:
- planning
- engineering
- public works

Shoreline Substantial Development Permit (SSDP) (for large and new development)
Shoreline Substantial Development Exemption (SSDE) (with conditions)

MONITORING REPORTING & FEEDBACK
APPENDIX B1: Questionnaire for data collection

Date
Organization Name
Organization Address
Telephone, fax, contact person

Dear YYYY Contact Person,

We are researchers in Commerce and Business Administration and the Institute for Resources and Environment (IRE) at the University of British Columbia. Our team is conducting a study of the feedback effects of water-related charges against organizations in the Lower Fraser and Puget Sound Basin. We would like to compare the tangible and intangible costs and benefits experienced by companies in each region in order to improve feedback effects and company performance.

Participation in this study could have two main advantages for your company: first, it might bring forward some costs and benefits of the incident that you have not considered in your planning; and, second, it could give you some sense of those experienced by other organizations. We hope that each contacted company will agree to become part of our database on the costs and benefits of environmental incidents and that general information on the feedback effects can be distributed to you and the rest of the group. Of course, your company’s identity would be kept confidential and only used to help aggregate the information.

If you agree to be part of the study, we would appreciate doing an interview with you or another representative of your organization. The interview would take about 30 minutes and be based on the four questions and table of costs and benefits that are attached. In addition, we may take a few minutes to verify a few characteristics of the firm, such as your company’s size and industry. You would be free to withdraw from the interview or participation in this study at any time. We are required by the ethics review committee approving the questions attached to obtain consent from all participants. We will bring a copy of this consent form to the interview, or fax one upon your request, that you can sign to let us know if you are willing to participate in this project. We appreciate your participation. Thank you for any cooperation that you can give us.

Sincerely,

Dev Jennings
Associate Professor
Commerce and IRE, UBC

Emese Kiss
Masters Degree Student
IRE, UBC
Interview Questions for Companies/Organizations

(For our use only)
Company name: 
Recorded incident: 
Contact: 

Open-Ended Questions on Feedback Effects

1. If new environmental management practices and policies emerged could you please describe them?

2. If you think the incident had any effect on other firms and/or industries, could you please describe those effects?

3. If you think your relationship with the local community or with local regulators changed, could you please describe the change?

4. In your opinion, how could we improve feedback effects to companies from environmental incidents such as the one you have experienced?
### Tangible Costs:

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<td>Permits</td>
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<td>Capital investments</td>
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<td>New environmental management practices</td>
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<td>Withdrawal of investments</td>
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<td>Monitoring and reporting related to the incident</td>
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<td>Market competitiveness</td>
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### Intangible Costs:

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<td>Damaged relationship with regulators</td>
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### Tangible Benefits:

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<td>New processes and production</td>
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<td>New planning and management practices</td>
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<tr>
<td>Increased competitiveness and innovation</td>
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<tr>
<td>Better monitoring and reporting</td>
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<tr>
<td>More efficient on-site treatment options</td>
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<td>Reduced energy and material throughput</td>
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<td>Savings in annual energy, water, solid waste</td>
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### Intangible Benefits:

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| Improved industry reputation |
| Improved reputation with investors |
| Improved relationship with regulators |
| Improved relationship with local community |
| More consensus on environmental issues |
| Value the environment more |
| Other                        |
APPENDIX B2: Figures for Quantitative and Qualitative Analysis
Figure 11 PS Penalties by firm size

Figure 12 LFB Fines & Orders by firm size
Figure 14. Total Tangible Costs vs. Penalties by Firm Size (Higher Resolution)
Figure 15 Total Tangible Costs vs. Penalties by Firm Size (Lower Resolution)

Total Tangible Costs vs. Penalties by Firm Size

Amount ($) vs. Firm size

- Total TC
- Penalty
Figure 16 PS Cleanup cost

PS Cleanup Cost by Firm Size

Clean up cost $ (US)

$120,000

$100,000

$80,000

$60,000

$40,000

$20,000

$-

Firm size

Figure 17 LFB Cleanup cost

LFB Cleanup Cost by Firm Size

Clean up cost $ (Can)

$70,000

$60,000

$50,000

$40,000

$30,000

$20,000

$10,000

$-

Firm size
Figure 18 LFB Permit Costs

LFB Permit Costs by Firm Size

Figure 19 PS Permit Costs

PS Permit Costs by Firm Size
Figure 20 LFB Capital Investments

LFB Capital Investments by Firm Size

Figure 21 PS Capital Investments

PS Capital Investments by Firm Size
Figure 24 LFB Monitoring & Reporting

LFB Monitoring & Reporting Costs by Firm Size

Figure 25 PS Monitoring & Reporting

PS Monitoring & Reporting Costs by Firm Size
Figure 26 LFB Other costs (legal, training)

LFB Other (legal, training) Costs by Firm Size

Figure 27 PS Other cost (legal, training)

PS Other (legal, training) Costs by Firm Size
Figure 30 Damaged Industry Reputation

Figure 31 Damaged Reputation with Investors

Figure 32 Damaged Relationship with Regulators
Figure 33 Damaged Relationship with Local Community

Intangible Costs - Damaged Relationship with Local Community

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PS | LFB
Figure 35 New Processes & Production

Tangible Benefits - New Processes & Production

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Figure 36 New Planning & Management Practices

Tangible Benefits - New Planning & Management Practices

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Figure 37 Increased Competitiveness & Innovation

Tangible Benefits - Increased Competitiveness & Innovation

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Figure 38 Better Monitoring & Reporting

Figure 39 More Efficient On-site Treatment Options

Figure 40 Reduced Energy & Material Throughput
Figure 41 Savings in Energy, Water, Solid Waste

Figure 42 Increased Shareholder Value
Figure 44 Improved Industry Reputation

![Graph showing improved industry reputation]

Figure 45 Improved Reputation with Investors

![Graph showing improved reputation with investors]

Figure 46 Improved Relationship with Regulators

![Graph showing improved relationship with regulators]
Figure 47 Improved Relationship with Local Community

Intangible Benefits - Improved Relationship with Local Community

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Figure 48 More Consensus on Environmental Issues

Intangible Benefits - More Consensus on Environmental Issues

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Figure 49 Value the Environment More

Intangible Benefits - Value the Environment More

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