Toronto's Private Tree By-law:
Performance Measurement Design and Cost-Benefit Analysis

A practical application of integrated management towards greater accountability, policy effectiveness and performance management.

MPA Research Report

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Abstract

Applying the principle of integrated management (organizational alignment) against Toronto`s Private Tree By-law, this paper presents a practical application of designing and implementing a robust performance measurement system that addresses five criteria. It will:

i. Satisfy accountability reporting requirements to elected officials and to the public at large;
ii. Facilitate policy and program effectiveness measurement;
iii. Support management reviews that help inform service quality and efficiency improvements;
iv. Guide staff from the apex of management down to front line service delivery personnel on specific goals and deliverables; and
v. Increase staff productivity, satisfaction and motivation by providing meaningful feedback on goal accomplishment.

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As with all such works, this paper reflects wholly my own observations and conclusions, and none of its content should be construed as attributable neither to The University of Western Ontario or its faculty; nor to the City of Toronto or the Urban Forestry Branch. Any errors within this paper are similarly this author's sole responsibility.

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A. Introduction

1. Why Performance Measurement?

Accountability, service responsiveness and efficiency, while representing some of the most enduring values and exigencies of the public service sector, have perhaps never been emphasized as much as today. Performance measurement has become both imposed as a requirement and adopted as a solution in an effort to address these factors within local government. As argued by Schatteman in her various published works, while performance measurement is almost universally accepted and practiced, practitioners and academics alike continue in their skepticism of the practical utility of such in the real world.[1] It appears that a significant disconnect between performance measurement system design and practice exists. An integrated performance measurement system, aligning front line practice with top level organizational goals, would be helpful in bridging this gap.

2. Successful Performance Measurement

This paper proposes that a successful performance measurement system should provide the information necessary to meaningfully and clearly reflect policy and service outcomes in order to:

i. satisfy accountability reporting requirements to elected officials and to the public at large (Schatteman, Public Performance Reporting 322; McDavid and Hawtorn 339);
ii. facilitate policy and program effectiveness measurement (Schatteman, Public Performance Reporting 313; McDavid and Hawthorn 301);

[1] Schatterman discusses this often in her published works. On the academic side, Schatteman includes many such references. For example, in 2008 she argues that "the literature is still 'light' in terms of evidence" supporting the effectiveness of performance measurement (318). Her 2007 paper includes an entire section entitled: "Performance Measurement Skeptics" (13). She concludes that performance measurement systems have not "made a difference on the ground" (Public Performance Reporting 322). On the practitioner side she outlines how public service managers have not seen the usefulness of performance measurement systems (State of Ontario's municipal Performance Reports 542-543).

iii. support management reviews that help inform service quality and efficiency improvements (Schatteman, Public Performance Reporting 322; McDavid and Hawthorn 353);

iv. guide staff from the apex of management down to front line service delivery personnel on specific goals and deliverables (Schatteman, Public Performance Reporting 321; McDavid and Hawthorn 353); and

v. increase staff productivity, satisfaction and motivation by providing meaningful feedback on goal accomplishment (Whetten and Cameron 327 and 332; Locke and Latham 705-717).[2]

Good support exits for the notion that in order for performance *measurement* to be effective, it should be developed in the context of a broader performance *management* system.[3] Furthermore, in order to address organizational goals and priorities, performance management is seen as most effective if it aligns with strategic *planning*, which itself must comprise a part of a broader strategic *management* process. The current state of the subject of strategic management itself, however, can be characterized as somewhat complex and often confusing.

3. <u>The Complex and Confusing World of Strategic Management</u>

Poister and Streib, for example, point out that although a "conventional strategic planning process has developed...a lively debate remains on how to go about... [it] in government in terms of scope" (46). This is, perhaps, not surprising as strategic management is seen as "an approach that synthesizes much of what management theorists have long recognized as effective management process" (Vinzant 1743). Therefore the capacity of any public organization to implement so-called strategic planning depends upon its overall set of effective management skills. While subsuming all these skills under a single discipline of strategic management may be a useful synthesis, such can also act as a barrier to adopting strategic

[2] While academic support exists for these five (and other) criteria, the author proposes that these five are specifically critical in the design of a practical, integrated system.

[3] Plant et al devote an entire work to this principle. Schatteman (The state of Ontario's municipal performance reports 546) and Chan and DeGroote (206) also support this principle.

management as it may well take on an overwhelming aspect, discouraging adoption. Attempting to read the preeminent expert of modern public sector strategic management John Bryson's very detailed and comprehensive text in its entirety can be found to illustrate this challenge. As Vinzant points out: "Its [Strategic Management] strength – its comprehensive nature – is also one of its major shortcomings...requiring significant capacities of the organization and leaders who organize it" (1771).

The academic challenge of developing a practical, applied discipline of effective management can be seen to require a number of discrete steps:[4]

i. Identifying fundamental principles
ii. Establishing practical, workable applications from those principles
iii. Codifying and compiling these principles and applications
iv. Developing tools for the evaluation of practitioner skill sets to determine gaps
v. Providing a systematic program of study and practical internship based upon i., ii., iii. and iv. above
vi. Establishing a validation process to ensure that the end result of effective management is achieved through implementation of i. to v. above

Sadly, the discipline of management in general (let alone the more complex subject of public management) is nowhere near this either in discovery of basic principles by academics or in the development of uniformly effective practical applications by practitioners. Apparently recognizing this, authors such as Byson offer "no guarantees of success" and resort to encouraging one's efforts at developing strategic management skills with platitudes such as

[4] These steps are derived from the author's own observations, experiences and conclusions of effective, workable educational methodologies in the workplace. Elaboration is not attempted as such would constitute an entire study and paper. This, therefore, should be viewed as a theoretical framework or model.

Hubert Humphrey's admonition to not "get so overwhelmed by the problems of today that we forget the promise of tomorrow" (29).

Together with Roering, Bryson further observes that "normal expectations have to be that most efforts to produce *fundamental* decisions and actions in government through strategic planning will *not* succeed," (emphasis added) primarily due to the exigencies of political decision making and the pressures for public accountability (995). Undeterred by his own pessimism, however, Bryson has continued to vaunt the benefits of strategic management for the public sector, but with the caveat that it is "strategic thinking, acting and learning activities that are important, not strategic planning, per se" (2). By his own admission, he is preaching to the converted, asserting in his "paradox of strategic planning" that "it is most needed where it is least likely to work, and least needed where it is most likely to work" (14). He recommends that organizations lacking strategic skills should first focus their efforts on *becoming* strategic – thus supporting his own argument through perfectly circular logic, but failing to provide any substantial practical advice on how to address this strategic skills deficit.

Lightbody argues that the constitutional parameters and related political realities of Canadian cities renders strategic planning very challenging, if not impossible - primarily due to the absence of a disciplined focus in urban, non party-based political systems dominated constitutionally by the next level of government. At the same time, he recognizes that strategic planning is "clearly essential" given the challenges faced by Canadian municipalities (21).

Given the dilemmas and challenges outlined above, how then should municipalities proceed in implementing strategic management and planning, including the use of purposeful performance measurement?

4. A Practical, Integrated Framework of Performance Measurement

This paper, utilizing Toronto's Private Tree By-law as a case study, attempts to create a practical, integrated system of performance measurement. Rejecting Bryson's complex models along with a seemingly endless expanse of academic skepticism, this author proposes that performance management *can* be aligned with strategic management and that organizational goals and performance measures can be designed into a meaningful integrated whole towards achievement of the five goals outlined earlier in section A-2.

Such an approach is not without support in academic literature. Chan and Degroote, citing Kaplan and Norton discuss the critical role of performance management to "ensure goal congruence" (206). Plant et al propose a "municipal performance management model that details the interconnections between higher level decision making and operational performance" (5). Furthermore, they note that program purposes are often not attained, with disappointing results occurring in the absence of aligning policy with practice (5). McDavid and Hawthorne discuss the ideal scene for performance management, where "individual and group objectives … connect with program objectives which … connect with organizational objectives"(320).

While alignment as a principle is present within the literature, this paper suggests that its importance as a critical success factor has neither been properly evaluated, nor presented thoroughly or consistently.[5] This paper therefore proposes that the alignment of an organization starting with its goals and purposes, moving through its policies, programs and activities and continuing to its performance measurements and specific outcome targets is both desirable and critical to an organization's success.

[5] It is noted that Plant et al do emphasize alignment as critical. However, they fail to present a complete list of organizational elements that should be so aligned.

American philosopher L. Ron Hubbard does take this approach. He has developed a useful management tool he terms the "Administration Scale" ("Admin" being the short version). This scale provides a system to analyze any organizational activity with regard to its consistent alignment with the goals, policies and plans of the organization as a whole. Hubbard's concept, simple in nature, is to work these items up and down until they are in agreement with one another. Items higher on the scale are senior to those lower. Hence items lower on the scale, if not in alignment with those higher, must be appropriately modified. Alternatively, misalignment may indicate a fundamental problem with upper level items. The scale itself, then, assists in aligning organizational goals, policies, plans and actions as well as in establishing appropriate and meaningful performance measures (stats).

ADMIN SCALE

GOALS

PURPOSES

POLICY

PLANS

PROGRAMS

PROJECTS

ORDERS

IDEAL SCENES

STATS[6]

VALUABLE FINAL PRODUCTS

(Hubbard, 262-263)

[6] Hubbard's use of the term "statistics" ("stats" for short) is meant in the narrow sense of "performance measures" and not in the broad sense of statistics in common usage.

B. Logic Models: Applying the Admin Scale to Toronto's Private Tree By-law

1. Introduction

Logic models constitute an effective way to display, examine and analyze an organization's goals, policies, programs and activities. The models themselves, along with an analysis, can be used to demonstrate the relative alignment of these administrative elements as recommended by Hubbard. In accomplishing such, the models inform the development of meaningful performance measures.

The logic model set presented in this paper depicts the City of Toronto Harmonized Private Tree By-law in various contexts. All sources of information (with the exception of interviews and one document) that were referenced to build this model are City of Toronto official documents that are part of the public record. (Appendix 1)

2. Private Tree By-law Nested (Aligned) Context Model (Appendix 2)

The Private Tree By-law is best understood within the context of Toronto's broad plans: Strategic Plan, Official Plan, Environmental Plan and Parks, Forestry and Recreation Strategic Plan. Nested as it is within these, the By-law is predicated upon the same goals; is addressing the same problems; and shares many of the same assumptions. In other words, alignment as prescribed by Hubbard can be found to exist.

The City of Toronto Strategic Plan sets the overall program philosophy, establishing "Sustainability" as a central guiding concept in City building (City of Toronto Official Plan 1.2). Here the three factors of Economy, Environment and Social Development are intended to be managed in a dynamic balance towards attainment of the goal of creating a high quality city. The Official Plan provides a more detailed look as we follow the environmental link towards the Private Tree By-law, explicitly naming the urban forest as "essential to the City's character" (3.24) and listing "regulating the injury and destruction of trees" (3.25) as a necessary policy

towards the goal of preserving the urban forest. The Environmental Plan while being less explicit with its policy recommendation - "Improve the health of the urban forest"(49) - still forms the final piece of the overarching, interrelated triad of official City-wide directional documents that ultimately inform the By-law.

Following on down to the Parks, Forestry and Recreation (PFR) Strategic Plan, the Urban Forest is covered under the broad category (the PFR Plan has three) of "Steward the Environment." Here we find the first stated measurable goal relating to the urban forest: "increase the existing tree canopy of 17% to 30-40%" (33). Guided by this, the Urban Forestry (UF) Strategic Plan (itself interrelated with the Tree Canopy Study, Every Tree Counts and UF Management and Service Plans) lists as one of its three programs: "Protect Trees." The Private Tree By-law is one program under the "Protect Trees" category with the specifically intended actions of "educating and regulating." Thus, the Private Tree By-law (PTB) can be seen as in alignment with higher level City of Toronto plans and goals.

3. Toronto Official Plan High Level Logic Model (Appendix 3)

Returning to the Official Plan for a more detailed examination is necessary to fully understand the policy environment within which the Private Tree By-law operates. The implied problem in the Strategic Plan is "How do we build a high quality city?" With the Official Plan, this becomes more specifically "How do we create a successful city?" The Official Plan defines this as one that is sustainable, competitive and provides high quality health and well-being to its inhabitants - business, institutional and residential (City of Toronto Official Plan 1.2). This problem embodies the underlying sustainability philosophy referenced earlier. (See Appendix 4: Toronto Official Plan Outcome Relationship Model for a depiction of the dynamic relationship envisioned.) Such broad problems are perhaps better formulated and viewed as goals, towards which specific programs are developed to solve problems that are obstacles towards the attainment of

the goals. In drilling down to the obstacles that prevent building a successful city, we can ascertain specific problem statements.

The Official Plan is quite definite about the specific problem that prompted the Private Tree By-law: "City building and development pressures … can create a difficult environment in which to sustain the urban forest" (3.24). The Official Plan sees economic (and therefore population and infrastructure) growth as essential to the attainment of its goals (1.1) and that therefore slowing or limiting growth which may adversely affect the environment is not a solution. In other words, the stated problem is actually a symptom - unless we are to view development itself as the problem, which the Official Plan specifically does not. Implicit within its recommended urban forest policy is the notion that people must be engaged in addressing the environmental degradation created through development. In other words, it is people's behavior towards trees, or lack thereof that is the real problem.

This is reflected in the rationale for the Private Tree By-law where the problem, derived from language in the By-law that permits destruction under certain circumstances, including development, can be stated as: "Private trees are being *unnecessarily* damaged and destroyed." Once again, we see adherence to the sustainability premise. Trees may be damaged as necessary, for example, if economic or social interests will be benefitted. It is *unnecessary* damage that must be prevented and it is through influencing human behavior that this will be accomplished. Fundamentally, the By-law is about solving the problem of human behavior that results in tree damage or loss.

4. Private Tree By-law Full Model (Appendix 5)

This model integrates the previous models into a full illustration of the By-law and its antecedents.

The Private Tree By-law Logic Model itself depicts the program at a broad activity level in three categories: Compliance, Enforcement and Appeals. Each category in turn includes broad activities which would entail several sub-activities and outputs. For example, the Communication and Education function would include web page development, media targets, pamphlet development and distribution, participation at appropriate events, paid advertising, etc. Logic Models for each category or activity could be developed to depict specific outputs to towards activities and their predicted outcomes. By doing so, a complete map of the inter-related activities would be available for analysis. (Section C of this paper maps out key activities.)

It should be noted that although "Enforcement" is listed as an activity category, a very small percentage of resources are allocated towards it. While enforcement activity is not completely absent, the emphasis of the program is "Compliance," with public education as a key component. For example, when a violation is discovered, education and compliance are pursued as opposed to prosecution and penalties. Violators are requested to cease the tree damaging activity and to provide tree planting or funding for planting as compensation for destroyed trees. This example illustrates the value of constructing fully complete Logic Models in order to gain a comprehensive picture of the program avoid incorrect interpretations.

An examination of the environment and of the assumptions that underlie this model are required to clarify its applicability in the real world.

5. Situational Analysis

The political environment at the time that the PTB was enacted was characterized by a mayor with a strong environmental leaning (David Miller) and a self-proclaimed and Council appointed "Tree Advocate," Councillor Joe Pantalone. Miller had the support of Council, and the By-law, although unpopular with some councillors in the suburbs, was approved by Council.

Strong support among former (pre-amalgamation) Toronto Councillors was not surprising - a Tree By-law had already been in place there for almost a decade. (Hence the establishment of the *Harmonized* By-law.)

The public context at the time is more difficult to assess, however one can assume that it generally was reflected by City Council. There were 77 deputants at the Committee Meeting where the By-law was introduced, indicative of a high level of public interest. While the content of these deputations is regrettably not part of the public record, one can recognize (from the list of participants) that the issue was a polarized one: Environmentalists and urban forestry advocates on the one hand; developers and private property rights advocates on the other (City of Toronto Harmonized City-Wide Private Tree By-Law: Consolidated Clause 24-26). Thus one could expect that implementation of the program would be challenging, with environmentalists insisting on strict enforcement; developers complaining about the additional cost and time involved in compliance; and private property rights advocates perhaps simply regarding the By-law as an infringement and ignoring it.

The cultural context could therefore be described as complex and polarized; with public values and attitudes reflecting economic priorities and private property rights in conflict with those emphasizing environmental goals and the public good. In such a context, some flexibility in implementation could be predicted to be both desirable and necessary. In fact, the By-law itself specifically provides broad flexibility, a characteristic that could prove to be of significant practical value with any change in leadership involving a shift of environmental values as some have assumed occurred in the last Toronto election with Rob Ford replacing David Miller as Mayor.

In that the By-law addresses the preservation living organisms, natural environment factors are important situational elements. While the by-law may prevent unnecessary damage and

destruction of trees from direct human activity, the overall goal of tree canopy preservation and growth is impacted by more sweeping factors. For example, the introduction of foreign invasive insects, highly destructive of the urban forest, could potentially reduce the canopy considerably. At the time of the By-law report, two such pests (Asian Long Horn Beetle and Emerald Ash Borer) were known threats. Climate change, with its potentially canopy weakening symptoms such as drought and increased temperature must also be considered. The effects of pollution (air, water and soil) can also be deleterious. Finally, the age and make-up of the urban forest itself will have a considerable effect upon canopy longevity. For example, large areas of former Toronto's street tree population are nearing the end of their useful life. Their loss will represent a significant hole in the tree canopy. These environmental threats to the overall goal of an enhanced tree canopy can also be seen as part of the rationale for a tree by-law that will at least eliminate *preventable* damage.

6. Assumptions

The fundamental assumptions underlying the Private Tree By-law logic lie within the Official Plan. First, the "Sustainability" concept itself (depicted in Appendix 4) constitutes a specific perspective about human organization – that the three factors of environment, social development (including equity and inclusiveness) and economy are primary considerations. A critique of the assumptions that underlie this conceptual framework is beyond the parameters of this paper. Nevertheless, as comprehensive as this integrated model appears, yet it is still primarily a political model, intended to help build consensus and not a complete model of human communities. For example, it ignores completely spirituality and religion - factors that historically have had, and continue to have a profound effect on human society. As well, the sustainability model does not address exactly what the balance between the three factors would

optimally be. One could argue, for example, that economic and community factors are utterly dependent upon the platform of the environment.

Second, as embodied in the Official Plan, it is clear that economic factors trump everything else. Such an approach, of course, ignores the problem that a sufficiently degraded environment may not support human life, let alone an economy. These emphases on the economy and of the necessity for continuous growth in order to be "successful," while clearly a biased, if naively hopeful assumption yet appears to enjoy almost universal agreement. Nevertheless, Planet Earth is a closed system, and unlimited, continuous growth is clearly impossible.

This perspective must be recognized in order to understand how the by-law was constructed and how it would be implemented: not as an absolute guarantee of tree protection; not preventing growth or development; but rather, influencing people to avoid *unnecessary* damage or destruction of trees. It is the interpretation of the word "unnecessary" that will inform the application of the By-law and it is the lack of specific definitions within the By-law itself that perhaps provides the flexibility necessary for politically friendly implementation over time - adjusting to the prevailing mood of Council and the public (or indeed, of individual Councillors) over a number elections.

The logic underlying the outcomes predicted by the Official Plan is provided in two models. The first (Toronto Official Plan Outcome Relationship Model, Appendix 4)) depicts the integrated "Sustainability" model and how the three factors are related to the creation of a "successful" city. The second (Official Plan High Level Logic Model, Appendix 3) depicts the causal relationships that are considered to ultimately result in a successful city. Here we see the final underlying (implied) assumption: that municipal investment in actions that lead to a successful City will somehow, through a feedback loop, help fund further actions – thus creating a

perpetual motion machine of an ever improving City. Given the revenue streams currently available to municipalities (and Toronto) this assumption is clearly flawed. Toronto will need to have a share of the affluence it hopes to create (income and/or sales tax) in order for this to work. Property tax itself has never appropriately reflected a city's improved economic status; development has always been highly subsidized by municipalities. This was most likely well understood by the architects of the By-law who intended for the program itself to be 90% funded through fees generated by implementation, a calculation based upon past activity of the non-harmonized, former Toronto only by-law.

The By-law itself involved some additional, specific assumptions. As with any regulation, there is some assumption about the degree of expected compliance, raising the question: "Are public values such that an education/compliance mode of implementation will be successful?" Accompanying this, of course, is the assumption that the allocated resource level will be sufficient to achieve the level of compliance necessary to protect enough trees to significantly contribute towards the attainment of a 30-40% tree canopy. None of this appears to have been explored, let alone calculated, planned or predicted in the By-law development process. An interview of Toronto staff reveals that the goal to have a private tree protection by-law was essentially almost an end unto itself. In other words, the assumption was that simply the presence of the By-law would result in benefit. While such an approach is understandable when no other options are available, still it entails considerable risk of failure, not only because success is undefined and therefore hard to demonstrate when accountability is demanded, but also because in the vacuum of defined outcomes, public and Council will inject their own ideas and their expectations may exceed the capacity to deliver.

7. Potential Adverse Outcomes

The intent of the By-law is to prevent the unnecessary damage and destruction of private trees. It is possible that property owners, searching for a way to stop an adjacent, unwanted development, will attempt to have the Tree By-law (inappropriately) used towards these ends. While the municipality clearly has control over how the By-law is administered, in a political environment such attempts can consume a lot of effort as people work their way through various officials (elected and staff), appeal processes, etc. Similarly, those intent to save trees in their own right (perhaps regardless of the circumstances) may also generate significant additional work. Finally, the By-law may result in an underground tree removal industry, servicing those who believe they need to circumvent the rules for their own ends.

8. Causation Attribution

Protecting trees forms part of the overall strategy to develop and sustain an urban forest canopy of from 30-40% - the size deemed by current research to provide significant environment benefits towards the creation of a healthy city (Nowak). Trees are seen as providing economic, social and environmental benefits that in combination contribute towards the creation of a successful, competitive sustainable city as outlined in the Official Plan. (Appendix 6: Benefits of Trees) Whether or not the By-law itself results in sufficient tree protection to significantly contribute to these beneficial outcomes is another matter entirely, of course. More significantly, even if tree protection was sufficient to this task, it is patently impossible to measure such benefits in isolation of all other causal factors. The fundamental assumption, therefore, is that tree protection is beneficial, and that the more trees that are protected, the more benefits will accrue.[7]

[7] The challenges of benefit analysis are discussed in Section D of this paper.

9. Summing Up

The logic model set presented in this paper provides an overview of the Private Tree By-law and its context within the City of Toronto's broad planning framework and sociopolitical environment, illustrating that it can and does align with the broad goals envisioned in the Official and Strategic Plans and continues to do so down to the unit responsible for implementation. As well, its design aligns with the need to adapt to the shifting policy environment characteristic of the local government arena; and in particular in times of Council and Mayor change. Drilling down to develop the more detailed models for each activity is required in order to establish a comprehensive program review and performance measurement framework.

C. Performance Measurement System Design and Implementation[8]

1. Introduction

The City of Toronto Harmonized Private Tree By-law was established by City Council in October, 2004. Original input and output projections appear to have been based upon estimates derived from experiences with the by-laws in former Toronto and Scarborough. There were no standardized performance measures or system, and data was sourced from a study of paper files. Since then, despite the continued lack of valid and reliable performance measurement, the Urban Forestry Branch has twice publically reported the successful achievement of the By-law's outcome: "proven to be an effective tool in the protection, renewal and public awareness of Toronto's urban forest." (City of Toronto Tree By-law Amendments 2008, 3 and City of Toronto Revisions to the Tree By-laws 2011, 3).

[8] This entire section was heavily influenced by McDavid and Hawthorn's "Program Evaluation & Performance Measurement," chapters 8, 9 and 10.

With By-law permit revenues exceeding $1.1 Million in 2010 (City of Toronto SAP), this is clearly a significant program. A meaningful and practical performance measurement system is desperately required as a foundation on which to undertake policy evaluation; as a means to fulfill public accountability; and as a management tool to inform implementation improvements and efficiencies.

This performance measurement system is being designed for real life use at the City of Toronto. Ensuring its effectiveness is critical. Therefore the system design, implementation methodology and data analysis approach has been subjected to and informed by consultation at three levels: front line program delivery team; Urban Forestry management team; and a corporate expert review panel comprised of management staff in the performance measurement, strategic planning and information technology (IT) areas[9].

2. By-law Logic Model and Key Outcomes

As demonstrated earlier, the Private Tree By-law seeks to solve the problem that "Private trees are being *unnecessarily* damaged and destroyed." The By-law acknowledges the public value of trees and seeks to preserve this value through influencing human behavior.

The performance measurement system design in this paper addresses seven main Private Tree By-law activities. (Appendix 7: Private Tree By-law Performance Measurement Model depicts these activities and their outcomes.) Logic models for each activity depict process flows, outputs and outcomes, providing a comprehensive picture of the inter-related activities. (Appendices 8-12)

As the By-law seeks to "prevent unnecessary damage and destruction to private trees" (i.e.: to protect trees), the primary outcome measure, perforce, is "protected trees." However, the By-law is specifically intended to allow tree removal where necessary to allow for development

[9] This last review has to date been only through informal consultation.

and construction. Therefore both "tree destruction" and "tree protection" are significant, key outcome measures, as is "tree planting" which is a requirement when trees are destroyed. Taken together, these three outcomes provide a picture of the broader By-law purpose: "to enhance and preserve the urban forest." These have been combined in a "Tree Protection Index" intended as the key performance indicator for the program.[10]

The intended beneficiaries of this program are the broad public, as the benefits of trees are considered a public good. However, as with all permit-type programs, actual permit applicants end up paying fees and bearing the time costs of the permit process - a somewhat unavoidable outcome resulting from the By-law. However, applicants also benefit through getting advice on protecting trees on their own property that did not need to be damaged through construction, but may have been had they not been educated in tree protection techniques. This performance element will be measured through a post permit process user survey which is discussed later in this paper.

Broad measurement of the value and therefore support of the general public for tree protection and this By-law is not included in this design, as it is assumed that given Council support, such is not an issue.[11]

3. Performance Measurement System Applications

This performance measurement (PM) system will establish baseline post implementation data of the Toronto Private Tree By-law program that was established in 2004. Such will provide a comparison to the predicted (if very incomplete) values contained in the 2004 By-law report and form the basis of comparison against future performance.

[10] This is covered in more detail later in this paper.

[11] Nevertheless, should By-law continuation become an issue, the performance data collected through this system should help inform the decision making process.

Performance measurement is an essential prerequisite to the design of an eventual full program evaluation. Measuring and evaluating program performance – activity costs, output and outcomes - with geographic (the By-law is administrated on a four district model) and longitudinal comparisons will form the core of a program process evaluation (Pal 310). As well, the PM system will inform a limited impact evaluation. This limitation is primarily due to assumed causation arising from significant attribution challenges associated with the By-law program. Efficiency evaluation will also be attempted through use of indicators also included in this system design. An economic assessment in the form of cost-benefit and cost-utility analyses rounds out the program evaluation.[12]

4. Key Questions

In developing output and outcome measures and collecting such along with corresponding program expenses, this performance measurement system proposes to address the following questions:

i. "Does this program do what it is supposed to do?" (Pal, 306). It will do so through examining outcomes within the explicit proviso of *assumed* causation.

ii. "What was the true cost?" (assuming that indirect costs can be accurately determined)

iii. "Are resources appropriately distributed among district teams?" It will do so by examining output measures against resource levels.

iv. "Can the administration of the by-law be accomplished more efficiently or effectively?" It will do so through analysis of performance data as part of an ongoing program process review.

[12] This is fully covered in Section D.

5. Users and Purposes

The Urban Forestry Director is perhaps the key user. These measures will contribute towards the Director's need to demonstrate accountability for the urban forestry program. As well, the Director is the key interface with upper management and the executive management team where program and budget allocation recommendations are finalized prior to going to Council. This system must address the Director`s needs, or it will fail.

Four additional primary user groups are anticipated. First, City Council and the broad public will use this data to evaluate the effectiveness of the program, satisfying the need for public service accountability. Second, the PM system will guide staff recommendations and Council decision making about policy priorities and funding levels. Third, management staff will use this data to evaluate program effectiveness and efficiency towards the end of informing program improvements. Fourth, front line program implementation staff can use the data to monitor their own performance - most importantly along the outcome dimensions thus validating their work goal accomplishments and contributing to morale and motivation, both of which are increased through such evidence of success (Whetten and Cameron 327 and 332; Locke and Latham 705-717; Beauregard).

It will be important to clarify the purpose of the performance measurement system with the different users, and in particular to have the buy-in of staff responsible for data collection by ensuring they see its usefulness (McDavid and Hawthorn 313). Grasso cautions that a multiplicity of audiences will have divergent needs and, like McDavid and Hawthorn (328) recognizes the challenges of combining accountability needs with program implementation staff needs, suggesting that "the trick…is to find a way to meet both sets of needs" (Grasso 508). Although the proposed PM system will be used to fulfill the current corporate accountability reporting requirement, it is also designed to address the staff concern that existing indicators

are almost completely inappropriate. The new system will provide indicators that will more accurately reflect staff efforts and outcomes, acknowledging such while providing senior management and City Council reliable and valid measures – hopefully meeting both needs.

A likely fifth set of users is comprised of various stakeholder groups including environmental groups and other municipal urban forestry sections that have or are considering developing private tree by-laws. Wisniewski observes that "little attention has been paid to the performance needs of stakeholders," recommending the development of a "performance information portfolio" deliberately designed to include "the total set of performance information needed by a service to allow key stakeholders to assess its performance"(224). His pilot revealed, unsurprisingly, that this approach was "both challenging and time-consuming" (232). Recognizing that the goal of this design is "a working model that is based on the best information available" within organizational resource constraints, no special information collection for such stakeholders is included in this design (Treasury Board, 16). Rather, all information will be made available as "open data," hopefully satisfying many needs.

6. Implementation Context

The current context is much different than that described in section B-5 when the By-law was first enacted. Mayor Rob Ford, in keeping with the suburban philosophy of lessening or eliminating what is seen as government interference, communicated his intention to cancel the Private Tree By-law at his first meeting with the Urban Forestry Director in December, 2010. Interestingly, the November 2011 City of Toronto Revisions to the Tree By-laws report did not prompt any direction or motions from the Mayor or Council to weaken or eliminate the By-law. Neither did the corporate service review of the same year ever consider the By-law as anything but core.

Never-the-less, the 2010 shift in political environment must be considered in order to ensure that the performance measures will be relevant (Grasso 513). For example, it may be necessary to stress the volume and percentage of tree removals related to development that were approved, as opposed to demonstrating how the By-law successfully saved trees from construction. This approach assumes, of course, that either By-law administration was always construction-friendly or that a shift has occurred since the election. In addition, the quite real concern that reported performance measures may be used as ammunition to weaken or destroy the By-law will represent a challenge to Urban Forestry management to communicate findings accurately and ethically, avoiding the urge to game the numbers, even if for altruistic purposes.

The current Council, along with senior management from the City Manager down through the Urban Forestry Director, are all strong proponents of performance measurement for accountability purposes. The Parks, Forestry and Recreation Division is in the process of organizational transformation towards an "information based, performance driven" model. While this represents a good window of opportunity to establish a performance measurement system for the Tree By-law, when coupled with an environment of staff lay-offs and service reductions as was recently the case in Toronto, such can pose significant challenges for staff buy- in. They will be very concerned with how the data will be used. The PM system implementation will need to include sensitivity towards this and pay special attention to staff buy-in.

It will be interesting to see if and how the PM numbers are interpreted and/or manipulated when the system is in place. McDavid and Hawthorn point out the possibility of gaming in the presentation and interpretation of performance measures, often related to preserving and enhancing self-interest matters such as program budget levels (366).

These matters speak to the risks and pitfalls associated with implementing performance measurement. Successful implementation will be contingent, among other factors, upon the presence of a strong champion willing to speak truth to power (avoiding gaming) and able to provide credible leadership to the staff team.

7. Data Sources and Collection

a. Cost Data

Direct costs, defined in this design as those incurred by the program delivery section, have been obtained from cost accounting records. The City of Toronto uses SAP with Cost Centre (program unit) and Cost Element (type of expenditure) data available. Indirect costs will be calculated utilizing the corporate designated percentage for overhead. (Appendix 13 – Private Tree By-law Costs Catalogue)

b. Outcome and Output Quantitative Measures

All output and outcome measures will be captured through the TMMS (IT) work management system on specific screens capturing this data for each activity. Some output and outcome measures are currently captured in TMMS and/or in paper files. Some minor IT modifications along with organizational change management (including buy-in, training and monitoring/correction) will be required to ensure the availability, completeness and reliability of data. As Tree By-law staff are known to be motivated to demonstrate their effectiveness in achieving outcomes, this is not expected to be unduly challenging. Nevertheless, a change management program (including a specific decentralized train-the- trainer component) will be vital to the successful implementation of performance measurement, especially considering the current labour relations environment in Toronto involving as it has, significant staff reductions.

The goal will be to establish close to real time data through incorporating the recording of performance measures as a routine function of By-law processes, including utilizing handheld devices when in the field.

c. Qualitative Measures

Two qualitative indicators are proposed: “increased public awareness of the value of trees” and “increased public knowledge of tree protection.” Two populations can be identified for inclusion in the survey instruments suggested as measurement tools: those who have participated in a By-law related activity, and those who have not. Initial measurement will focus on a user group post participation survey that will seek to determine their perceptions of increased awareness and knowledge. This could potentially be administered along with a general service satisfaction survey offered to all participants as an on-line post service choice, accepting the inherent reliability limitations of data derived from a self-selected group. Alternately, a random sample of users could be generated annually. This choice will be predicated upon corporate needs and available resources.

An on-line survey could likely be accomplished within existing resources. However, funding dependant, a structured survey of a random sample of users in the past year could be conducted through a professional agency with direct telephone contact in order to obtain the most accurate, complete, valid and reliable data (O’Sullivan 191-193).

Adherence to service standards is currently being measured for public facing functions that are integrated with Toronto’s 311 service request system. The Bylaw function itself is not currently 311 integrated. Nevertheless, it is reasonable and useful to measure service standard compliance. In the case of the By-law section, the service standard was set by Council at permits being issued within 30 days of the request. This indicator is problematic in that it is corporately measured on a dichotomous scale (on time/late). Inclusion of some type of

graduated scale is recommended. For example, a graph could be plotted depicting the number of applications completed against number of days taken, providing a full picture of service standard achievement. Such a picture would facilitate much more informed analysis and decision making than does the current system. This type of scale has recently been successfully implemented by the Tree By-law Section for the Development Review Application process and will be extended to include the By-law permit function.

8. Tree Protection Indices: The Key Performance Indicators

A simple index, intended to be comprehensible and meaningful to staff, management, City Council and stakeholders interested in tree protection within the context of the By-law purpose is proposed.

Aggregate Outcome – Tree Protection Index – effectiveness measure:

Number of Trees Protected

Plus: Number of Trees Planted (including cash in lieu conversion)

Minus: Number of Trees Destroyed

Equals: **Net Trees Protected** (Outcome)

Then:

Tree Protection Utility Index – efficiency measure:

Total Costs

Divided by: Net Trees Protected

Equals **Cost per Tree Protected** (Efficiency)

These indices, along with the qualitative measure(s) noted earlier will form the core, aggregate indicators for the By-law function. They will likely replace the current effectiveness and efficiency measures in use through Financial Planning and Reporting System (FPARS) (City

Budget 2012,17). Note that only the current *service level* measures appear in this FPARS document. A more complete, non-public version includes one each of effectiveness, efficiency and quality measures for the Tree Protection and Plan Review unit in which the By-law functions are administered.

9. Data Analysis and Interpretation

Data analysis and interpretation will primarily be a management function, with the section Manager taking lead, guided by corporate standards and direction. The Urban Forestry management team and the expert panel (noted in section C-1) will be engaged by the section Manager to provide advice on and guide data interpretation. Never-the-less, program delivery staff will be encouraged to participate, with the goal of ensuring that staff understand and buy-in to any program implementation changes that are informed by performance measure interpretation. As well, an open data approach will be taken with performance measures shared with the entire section and staff encouraged to manipulate and interpret the data. Dialogue will be encouraged in order to enhance understanding and to generate creative program improvement ideas.

10. Change Management

McDavid and Hawthorn observe that "Performance measurement is perhaps the most undervalued aspect of evaluation" and that data is not likely to be used if it has not been collected in a reliable way (160). Useful analysis is utterly dependent upon good data and good data, in turn, is utterly dependent upon the actions of program staff utilizing a practical data collection mechanism. While establishing a suitable information gathering methodology and mechanism can be relatively easily accomplished, staff buy-in can be another matter.

Pal points out that performance measurement, involving as it does increased transparency and a focus on outcomes and continuous improvement, can make people uncomfortable. What

is required is to establish a willingness (both within individual staff and more broadly as a group or organization) to have one's actions measured and evaluated. He sees the critical implementation success factor as behavioral change – people "thinking and behaving differently" (326). Considering both McDavid and Hawthorn 's and Pal's advice, the vital necessity of change management in implementing a PM system is abundantly clear.

There is a history of unsatisfactory performance measures being utilized in the By-law section. Interestingly, this has not lowered motivation to engage in performance measurement. Rather, staff have communicated their desire to establish a valid system that reflects their efforts and captures outcomes. Nevertheless, a change management program (including a training component) will be vital to the successful implementation of performance measurement.

The change champion will be the section manager who is an acknowledged expert practitioner, having successfully implemented performance measurement previously. This manager is also the Urban Forestry representative for implementation of the corporate Financial Planning and Reporting System (FPARS) which established efficiency, effectiveness and quality indicators that became part of the budget process and were first reported in 2011 (City of Toronto. 2011 City Budget Summaries 29-30).

The change manager will need to include several factors that have been identified as necessary for successful implementation. Chan and DeGroote provide a useful compilation derived from the experience of municipal governments (216):

i. Top management commitment and leadership buy-in.

   Here, the buy-in of the Parks, Forestry and Recreation General Manager and the involvement of the expert review panel will be critical. Given the strong support for

performance measurement corporately and within the Division, this should be relatively trouble free.

ii. Departmental, middle-manger and employee participation and buy-in

The UF management team (in particular the Director) and Private Tree By-law program supervisors and staff are the critical players here.

iii. Culture of performance excellence

The change manager is known as a champion for excellence and currently teaches two modules of the Effective Management Skills course provided to managers at the City of Toronto: Motivation; and Empowering and Delegating. Such skills will be critical in encouraging excellence. In particular, nurturing *public service motivation* will be required as tangible performance incentives are not a current option (Beauregard).

iv. Training and education

Technical training will be provided through a combination of IT led formal training and ongoing coaching provided by expert By-law program supervisors and staff.

v. Keeping it relatively simple, easy to use and understand

Hopefully the logic models for this design do represent such an approach. Staff consultation prior to finalizing implementation processes will inform any necessary further simplifications.

vi. Clarity of vision, strategy and outcome

Once again, the program logic model does have reasonable clarity of vision and outcome: One prevents unnecessary damage and destruction to trees (protect trees) in order to preserve and sustain the urban forest. The more challenging task lies in strategy formulation – how best to accomplish this outcome within existing

organizational constraints. The intent, of course, is to have strategy informed by performance measurement data.

vii. Link of [performance measures] to incentive

Here, public service motivation, rather than private sector incentives will be applied. In short, one appeals to the inherent motivation of public employees to help the community; to "make a difference." This, in part, will be achieved primarily through management recognizing and acknowledging staff's positive impact and achievement of program purpose as well as staff's self-recognition of such based on their own observations - one of the purposes of this PM system design.

viii. Resources to implement system

The "Shoestring Evaluation" principle will be applied: sticking to data collection and recording methods that can be accomplished within the existing resource envelope (McDavid and Hawthorn 156).

11. Implementation

An inclusive, gradient approach will be used, including:

i. Utilizing change management principles prior and through-out implementation
ii. Vetting proposed measures and data collection procedures through the actual users (as well as consulting senior management)
iii. Piloting the system to inform system enhancements and glitch corrections
iv. Developing, piloting and providing training
v. Establishing system champions and experts at each work location
vi. Evaluating individual needs for training and coaching and supplying such
vii. Rolling out the program gradiently (as opposed to a sudden absolute hard launch)

viii. Learning as we go, regularly initiating improvements to the system and implementation processes

ix. Establishing a hard launch upon team readiness

12. Review

The Private Tree By-law PM system will be reviewed as part of the existing Urban Forestry PM review process, with no additional resources being required. Actions will include:

i. Developing channels for regular user feedback

ii. Establishing an expert review panel derived from the corporate talent pool to address issues and problems as well as to participate in periodic reviews

iii. Conducting independent assessments (such as conducting an anonymous survey of staff or bringing in outside experts)

iv. Developing a system to validate data, to correct data collection and input errors, and to safeguard against gaming

13. The Broader Picture: Performance and Strategic Management

The benefits of performance measurement can only be fully realized in the broader framework of performance *management*. Performance measurement must be continuous in order to provide information that allows for longitudinal analysis – data is only meaningful if assessed against a benchmark such as a performance target or against an earlier period in time. Utilizing this data for organizational improvement can become continuous, and when performance measurement evolves into performance management, it includes strategic consideration towards goal congruence – a situation that is desirable in any organization (Chan 206).

The City of Toronto FPAR System is exactly this type of PM and strategic planning framework, demonstrating formal corporate support for such an approach. The PM system

proposed in this paper can evolve into performance management by utilizing derived data to inform strategic planning, and conversely by considering strategic goals in analyzing performance data. Proponents like Chan emphasize the role of performance measurement in organizational transformation (205). The current perspective in Toronto Parks, Forestry and Recreation is that *significant* transformational change is required, and is required quickly – with FPARS and related PM initiatives driving the change. It is therefore desirable to review the public service strategic planning context in some detail as this could materially affect the proposed PM system.

Padovani et al observe that effective PM systems tend to involve "continuous changes with the aim of improving [the system]." They further note that a PM system requires about 5 years to evolve and mature (615). In contrast to the current public sector trend that sees the need for dramatic change, Padovani observes that an "*incremental* path to improvement" (emphasis added) as opposed to rapid change is a common denominator of *effective* PM systems (620).

The concept that strategic planning (and performance measurement) concerns fundamental and often dramatic change is an enduring theme. Such a theme is what led Swanstrom (in part) to protest that strategic planning was incompatible with the dynamics of developing local government policy within the context of liberal democratic theory. He points out that the assumption that "local government policy can be *radically* shifted by top management in response to environmental trends" (emphasis added) is very unrealistic in the public sector where consensus building and implementation can be formidable barriers. He makes mention of the liability of placing too little emphasis on "day-to-day problems" and concludes that strategic planning is useful, but only as a *part* of urban policy making (Swastrom 145, 146 and 151).

Bryson and Roering, noted public service strategic management gurus, conclude that "normal expectations have to be that most efforts to produce *fundamental* decisions and actions in government through strategic planning will not succeed," (emphasis added) primarily due to the exigencies of political decision making and the pressures for public accountability (995). Continuing to perpetuate the notion that "the heart of the strategic planning process...is the identification and resolution of strategic – that is *very important and consequential* – issues," (emphasis added) Bryson also dismisses the concept of incremental change (unfortunately negatively termed "muddling through" by Lindbloom in his seminal paper of the same title) as "typically resulting in suboptimization of organizational performance" (Bryson 18 and 15). Bryson and Roering's ambivalence is characteristic of such tension in most public sector organizations; many feel that strategic management principles should be implemented, but that they somehow cannot find a practical, workable way to do so.

Lindbloom, not suffering from this tension, points out that public administrators in western democracies generally work on incremental change and that this is a reasonable approach, given the complexity of the political environment and the need to meet the requirements of democracy of using "agreement on policy" as a test (84). Backoff et al also point out the "profound influence" of the political process on the design and strategic behavior of local government"(130). Lindbloom concludes that "successive limited comparison" (as previously noted, humorously but perhaps unfortunately also termed "muddling through") leading to incremental change is therefore a perfectly legitimate and practical means of public management (87). Lindbloom's ideas on incrementalism are complemented by Stephen Krasner's 'punctuated equilibrium' model of institutional change, which characterizes change as periods of relative stability 'punctuated' at 'critical junctures' (usually when organizations are in fundamental discord with their environments) when dramatic and fundamental change occurs

(Horak, 21). Considering Lindbloom's and Krasner's models, one could conceive strategic planning and related performance measurement applied towards incremental change during periods of stability and restrained activity, punctuated by application towards more radical change when environmental factors present the need and/or opportunity.

Sancton's 2011 local government textbook arguably supports the principle that meaningful change lies in continuous, effective municipal governance and decision making processes (241). An important corollary to this principle is that, contrary to popular belief and the organizational change faddism of the past two decades, revamping municipal structures and procedures is not the magic bullet that will bring about miraculous changes (Sancton 196).

Throughout strategic management and planning literature, the requirement to adapt processes to the organization and the need to work within organizational capacities is stressed (Eadie 447; Vinzant 1996, 139 and 154; and Berry 333). As local government is often involved in managing incremental change in a politically limiting environment, surely it is reasonable to suggest that strategic thinking, acting and learning within this context is still "strategic" even if it does not involve fundamental or profound change. And perhaps the *strategic* thing to do in some cases is not to change at all. In such cases, given the obvious advantages of organizations operating "on the same page," perhaps Hubbard's Admin Scale system should be seen as fundamentally strategic – at least from an implementation point of view.

This paper therefore concludes that an incremental approach to the implementation and application of this proposed PM system prior to undertaking a more broad strategic planning process would be most appropriate. Clearly, with no baseline data whatsoever, any major strategic decisions made prior to having at least one full year of data will perforce be based upon conjecture and/or anecdotal data.

14. Summing Up

This Private Tree By-law Performance Measurement System design seeks to provide a balanced set of indicators that presents a complete, yet concise picture of the activities and outcomes of the program and how they are contributing towards the program goals.[13] Program Logic Models were constructed from source documents and vetted through program staff as were the related indicators. Based on this consultation, it is clear that these indicators enjoy face validity and hopefully this bodes well for their construct validity.

As outlined in this paper, the further development and implementation of this system will include continued consultation with the user groups as well as periodic reviews. Due to the present political, organizational and labour relations environment at the City of Toronto, considerable challenges will likely be involved in the implementation of this system. Ironically, perhaps (and assuming continued support for the goals of the By-law) it is just such a PM system that could help a program gain stability and function better in this type of environment. Solid performance data is the foundation of a compelling argument in support of continued funding during program and budget reviews. This of course assumes that the data reflects effective and efficient use of resources towards a publicly, Council supported goal. From a professional program evaluation perspective, one must remain open to the possibility that the data collected will inform and/or be interpreted by decision makers towards a different course – perhaps the elimination of the program.

The By-law section and the broader organization is expected to learn from experience and improve this system as it is operationalized. Such an iterative process is exactly what is required to both successfully implement this system and to utilize it towards its goals of program improvement and accountability in the current volatile public service environment.

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[13] Once again, employing the critical principle of alignment

Finally, it should be noted that largely (but not exclusively) because this performance measurement system is based upon an aligned set of goals, policies and programs, the measurements are meaningful and will fulfill the five criteria set out in section A-2. For example, staff at the program implementation level will have the purpose to protect trees, and where tree injury or removal is not avoidable, to address the future sustainability of the urban forest through planting. Their goal achievement will be validated through the collection of "Trees Protected" and "Trees Planted" measures thus stimulating satisfaction, motivation and further productivity (Whetten and Cameron 327 and 332; Locke and Latham 705-717; Beauregard).[14] On the broader policy evaluation front, program effectiveness will be measured through the Tree Protection Index.[15]

Financial performance measurement beyond simple efficiency studies have become increasing emphasized, usually with the purpose to facilitate comparative policy evaluation and to demonstrate either a net benefit position or a maximizing of excess benefits over costs (Treasury Board of Canada 1). Therefore any robust performance measurement system must include a cost-benefit analysis component.

D. Cost-Benefit Analysis

1. Introduction

Although the Private Tree By-law appears to enjoy broad acceptance, there remains an ongoing debate between those who feel on one hand, that it is too lenient and on the other hand, that it is too strict. A cost-benefit analysis (CBA) can provide some clarity to the debate by establishing a credible, defensible value (or lack thereof) for staff, City Council and the public.

The growing prevalence of private tree by-laws in Ontario is indicative of the recognition of trees as a public good - most intangible benefits generated by the urban forest can be

[14] Satisfying criteria v, page 8.
[15] Addressing criteria i and ii, page 8.

experienced by everyone regardless of direct access to any individual tree located on private property. Toronto's Private Tree By-law, a case in point, protects healthy, mature private trees, requiring permits (and a fee) for their removal. While the By-law does act to prevent *unnecessary* tree removal and damage, thousands of trees are permitted for removal each year. Where such permits are issued, the stream of functional benefits that would otherwise have accrued to the public for the life of the tree is foregone. However, the By-law requires that removed trees are compensated by the planting of new trees which will themselves generate a stream of benefits into the future.

Both public and private benefits and costs result from the By-law. The question is: "How do the costs incurred by the By-law measure up against the benefits generated by the planting of trees and not foregone[16] by protecting trees?"

2. Scope of Design

Since the Private Tree By-law is intended to preserve trees as a public good, such is best measured through intangible benefit valuation rather than through the tangible, structural value accruing solely to the owner. The intangible benefits of the urban forest are often described as comprised of social (health and community), environmental and economic values (City of Toronto Official Plan 1.4). Although there is a growing body of economic theory and methodology for calculating the value of public goods and the intangible benefits of trees, the factors involved are immensely complex and their contribution extremely difficult to isolate. Current valuation is best described as still in its infancy (Wolf, What Could We Lose? 7). In recognition of this, and in order to provide continuity with the City of Toronto's official urban forest valuation methodology as utilized in Every Tree Counts, this study will limit the measure of benefits to three environmental factors: carbon sequestration, energy savings for heating and

[16] It is assumed that trees protected through by-law administration would otherwise have been destroyed.

cooling and air pollution mitigation. The Urban Forestry Effects Model (UFORE) (Nowak et al) calculations of these functional benefits of trees in the City report are therefore drawn upon for this CBA.

Costs are determined as direct costs incurred by the City of Toronto for administration, monitoring and enforcement of the By-law (Treasury Board of Canada 25) plus compliance costs borne by the private sector (Treasury Board 24).

This design specifically measures the stream of benefits generated by one year of By-law administration 'investment.' The cost of By-law administration activities and compliance along with the stream of intangible benefits generated by that activity is measured utilizing data from 2011. Benefit calculations are derived from the 2010 City of Toronto Every Tree Counts report, which itself is based upon Nowak`s Every Tree Counts 2008 data.[17] While each year of By-law activity will likely vary in its cost-benefit ratio, the calculation of one year's results (including the present value of the entire stream of future benefits) will provide baseline data for future year comparison. As well, the capability of manipulating and isolating variables in a sensitivity analysis will help inform potential efficiencies, demonstrating the relative benefit of different by-law activities at different levels of resource support.

This design explicitly excludes tree planting, maintenance and removal[18] costs. Clearly, any property owner complying with the By-law will incur these expenses. A survey of relevant hedonic studies indicates that property values potentially increase from 2 to 15% due to the presence of trees (Wolf 2007, 35). Such property value increase will almost certainly offset any

[17] Intangible benefits urban forest valuation methodology and technology continue to develop and evolve, as do economic valuation factors. Nevertheless, Every Tree Counts represents the best currently available source of data.

[18] "Removal" refers to the eventual removal of a tree that was planted in compliance with the By-law, and not the removal that was initially permitted for the sole benefit of the applicant.

tree maintenance costs. As this paper attempts to measure the public value of intangible benefits, it is logical to exclude costs that result in benefits solely to an individual.[19]

3. Positive and Negative Externalities

Protecting and planting trees results in community-wide positive benefits- economic, social (including health) and environmental. While these functional benefits arguably accrue more directly and in larger quantity to the residents on whose property trees reside, the By-law is often seen as an infringement on the right of personal property control by owners who wish to remove trees for their own and various reasons.

Negative effects to individuals also include the maintenance and removal costs that may have been avoided in the absence of the By-law. As mentioned above, these are arguably small in relation to the value that trees impart to property alone. Nevertheless, the removal of older, large trees is very expensive and rarely budgeted in advance, and hence is often seen in negative light. Property damage, injury to life and disruptions caused by falling trees and limbs represent another negative effect. Regular inspection and proper maintenance can lower but not eliminate the probability of falling trees and limbs.

More specifically, the Private Tree By-law incurs permit costs of time and money on applicants. This is likely seen as negative, especially by those who do not object to personally benefitting from the externalities provided by others' trees, but who prefer to avoid the personal cost and inconvenience associated with tree preservation on their own property.

4. Cost-Benefit Analysis (CBA) Design

It is common and appropriate for cost-effectiveness analysis (CEA) or cost-utility analysis (CUA) rather than CBA to be used for public programs for which "there is already general agreement on the nature of the program" as is the case for the Private Tree By-law (Pal 331 and

[19] Nevertheless, a Toronto specific study examining this contention would be advisable. Such is outside the scope of this paper as it would constitute a complete study in and of itself.

McDavid and Hawthorn 245, 247 and 250). In CUA, outcomes are taken as given, with the goal being program improvement. No judgments of relative program worth or benefits are undertaken; rather this is left to the decision makers (Toronto City Council in this case) who will apply other criteria to determining the program mix. Therefore, CUA can be seen as more suitable to the needs of the users for whom this study is intended. Furthermore, designing a CBA that is predicated upon a CUA will be very relevant to the City of Toronto while providing the added value of calculated benefits.

The "utility" of the Private Tree By-law is defined as the aggregate of "protected" trees plus "planted" trees. The CUA calculates the cost per utility – that is, the cost to protect or plant one tree. Augmenting this, the CBA calculates the present value of the future benefit stream of planted and protected trees less the present value of By-law administration costs.

5. Costs Calculations (Appendix 13)

By-law administration costs[20] were estimated as a function of the percentage of time spent on By-law activities. This percentage was double-checked through a second, independent exercise that calculated time spent on development review applications, the second major activity of the section.[21] The sum of these two activities was 86% of the section's time, leaving 14% for other activities. While these calculations are *estimates*, they do have face validity in the section – that is, they make sense to the experienced professionals who conducted the study on the basis of the potential to either gain or lose program funding; hence the motivation for objectivity was very high.

[20] All cost and revenue figures were derived from the City of Toronto Financial Accounting System (SAP) for year ending 2011.

[21] The development review application time estimate was compared to two earlier studies. One, conducted in 2010 by the former section Manager and one conducted from 2008-2010 by an independent consultant. Results were within 10% (plus or minus 5%) of the 2011 estimate.

As the section involved deals with three By-laws (Private Tree, City Tree and Ravine), the labour costs of the Private Tree By-law needed to be isolated. Ravine By-law costs were easily excluded as they are performed exclusively by staff dedicated to that function. City Tree By-law costs were isolated by applying the ratio of permit-types issued. Costs for materials, services, equipment, etc. were then calculated from section total costs as a function of the percentage of labour spent on the Private Tree By-law. Finally, the City of Toronto standard 6% organizational overhead was included to cover support costs.

The total cost of the Private Tree By-law in 2011 was calculated at $1,315,145. Permit applicants bore $940,800 of this cost as permit fees, with the tax base covering the balance of $374,345. Permit applicants also incurred the opportunity costs of time spent in applying for permits and in constructing tree protection zone fencing. Permit time costs can easily be considered to be so small as to be insignificant for the purposes of this study, and tree zone fencing can be seen as an investment in the owner's structural tree value – much like maintenance costs discussed earlier. Therefore, neither are included as costs in this CBA.

In that this CBA is measuring the cost-benefit of *one* year of By-law investment, the present value of costs equals the current investment – no present value calculations of future costs are required as no future costs are involved. As such, the opportunity cost equals the present cost of $1,315,145. This sum could be either not expended and invested for a future flow of monetary returns by the City or individual By-law permit applicants, or expended in another manner for immediate benefits.

6. Benefits Calculations

Benefits were calculated as the future stream of environmental value generated by a planted or protected tree. This entire calculation is predicated upon the assumption that generalized data from the UFORE study can be particularized for a specific year. As such, it is

assumed that trees involved in any CBA study year will reflect the tree size and species distribution ratios as listed in the current UFORE study.[22]

Applying this principle for the purpose of establishing a benefit valuation for planted and protected trees, aggregate UFORE data has been reduced to an annual tree benefit value. (Appendix 14) This is calculated within the 11 UFORE tree size ranges. As annual values for trees larger (and older) are not provided by UFORE, such is calculated as increasing at 2.5% per year, a conservative estimate proposed by Scott and Betters in their replacement tree decision CBA methodology (70). *Planted* trees (the first of two benefit units) calculations are assumed to be 4 years old at planting (year 0 of the benefit calculation) and to start to provide benefits in year 5 (year 1 of the calculation).

In the absence of specific data about *protected* trees (the second benefit unit) a number of assumptions have been made. First, as the by-law protects only trees that are 30 cm in diameter (trunk measure at 1.4 metres from ground level), a *protected tree* is designated as the median size within the entire protected range. Considering the UFORE designated 11 tree size categories, the median is trees of 53 – 61 cm. Second, as tree ages and mortality are required in order to calculate the future stream of benefits, ages have been assigned to tree sizes (See Appendix 15) and a mortality limit of 83 has been calculated. (Appendix 16)

7. Assumptions

While it is clear that By-law costs would be zero in the absence of the By-law, it is impossible to establish baseline figures for tree benefits as one cannot measure the number of trees that would be protected or planted voluntarily in the absence of regulatory control. This study therefore assumes that trees protected or planted under the auspices of the By-law would not otherwise have occurred and that all benefits derived from such are a result of the By-law. This

[22] CBA calculation data will be refreshed upon each periodic iteration of UFORE studies.

assumption, while clearly very significant in scope, is nevertheless necessary as no practical means exists to measure what may have happened in the absence of the By-law. (Another approach could be to assume a certain percentage of planting or protection would have so occurred.)

Given that the the UFORE Model is utilized to calculate intangible benefit values, all assumptions and errors inherent to UFORE will apply to this CBA. As noted earlier, urban forest valuation methodology and technology continue to develop and evolve, as do economic valuation factors. The 2008 UFORE study utilized, while already somewhat outdated by recent methodology enhancements, does, nevertheless represent the best *available* data. Of the three intangible environmental benefits measured through UFORE, the energy savings calculations are the most sound, being based on local consumption and costs as well as being validated through a detailed hedonic analysis (Pandit). As Jeff Brick has outlined, the challenges and complexities associated with any valuation of carbon sequestration or pollution mitigation are considerable (5-6).

One cannot ignore Wolf's observation that "the issue of valuation has become paramount" and "non-market valuations are important contributions to local decision making." She wisely cautions, however, that as such studies are "fraught with uncertainty and assumptions," it is important to ensure that both report writers and readers understand these limitations (Wolf 2007, 34 and 36). It is within this context that the UFORE valuations are utilized in this CBA. While these valuations constitute the best available data, they are yet "fraught with uncertainty and assumptions."

8. Discount Rate and Net Present Value

The flow of urban tree benefits and costs are extremely difficult to determine. They do not occur in structured patterns susceptible to standard discounted cash flow analysis. In an

attempt to address this deficit, specialized discounting formulas have been recently developed. While these represent an improvement, they require further development to accurately reflect the complex and fluctuating realities of urban tree costs and benefits (Peterson).

In this Private Tree By-law CBA, designed as it is to determine the future benefit of a one year investment in tree protection, future cost is not a factor. We need only be concerned with the present value of the 2011 cost. Benefits are another matter. In view of the challenges noted by Peterson, future benefits have been calculated for each year of the protected and planted trees' lives, with present value calculated for the aggregate benefit stream. (Appendix 17)

Four discount rates are utilized. First, 2.3% is calculated, representing as it does the consumer price index for year ending 2011 (Bank of Canada). Second, 4.2% is included as it is the rate of return that the City of Toronto achieved on its investment portfolio in 2010[23] (City of Toronto Investment Portfolio). This is somewhat appropriate, as tax dollars not expended on the By-law could have invested at this rate of return. On the other hand, tax-based funding only comprises 28% of total costs, and therefore 3% is included (the third discount rate) as a more realistic interest rate that the average permit purchasing person could hope to have received in 2011. Fourth, 8% is used on the basis that it is recommended by the Treasury Board of Canada, and calculated relatively recently (2007) as an appropriate opportunity cost for capital (37).

9. Cost-Utility Sensitivity Analysis (Appendix 18)

For cost-utility we are concerned with the cost per tree (protected plus planted) as a result of the By-law. Discount rates do not apply in a CUA as benefits are not measured. Four key variables have been selected for this analysis:

i. Compliance rate to By-law permit planting requirements

ii. Tree survival rate of trees planted in compliance to By-law

[23] The 2011 rate would be more desirable, but was not available at the time of this study.

iii. Trees protected (not destroyed) as a result of By-law compliance[24]

iv. Cost

Compliance to By-law imposed planting requirements and tree protection, the key determinants of effectiveness, were unfortunately not measured in 2011 or earlier.[25] Therefore no current baseline against which to measure alternative scenarios is available. The survival rate of planted trees, another important factor, was also not measured in 2011. A rate of 80%[26] has been set as a reasonable survival rate for trees that have been planted as a By-law requirement.

Assuming an 80% compliance rate, an 80% tree survival rate and 1.5 trees protected for every 1.0 removed (tree replanting is required at a 3 to 1 ratio of trees removed for construction-related removal permits) at the 2011 expense level, a cost per tree of $364 results. Three other theoretical scenarios are generated[27] at the 2011 expense level resulting in a cost-utility range of $298 to $583. Of course, these figures are somewhat meaningless in the absence of base-line data. Once key indicators are measured, as planned for the latter part of 2012 and on, the cost-utility figure will represent the key efficiency measure of the By-law.

Modeling variations in cost, while still only producing theoretical results in the absence of actual performance measures, does demonstrate the value of a CUA. For example, Scenario 4B assumes a baseline of 50% compliance which is improved to 75% by the additional investment of two inspectors. Under these assumptions, cost-utility improves from $583 to $446. Similarly, the result of a 10% budget cut along with corresponding productivity reductions is calculated, apparently demonstrating that economies of scale-type phenomena applies to tree

[24] Trees can either be directly or indirectly protected. In the absence of specific measurement, this figure has been conservatively calculated as a function of construction related tree planting, required at a 3 planted to 1 removed ratio. At a 50% rate, 1.5 trees are protected for every one that is removed due to construction.(Non-construction related removals are replaced at a 1-1 ratio.)

[25] A performance measurement system including this key indicator is being implemented in 2012.

[26] This is a conservative estimate based upon usual industry expectations.

[27] Any number of scenarios can be generated through the model developed for this study.

protection.[28] Capturing actual performance indicators will render such calculations of use in decisions about reallocation of resources within Urban Forestry. For example one could explore the best mix of investment between By-law compliance and planting trees in public spaces.

For the purposes of this study, Scenario 1 at a cost-utility of $364 and Scenario 3 at $416 are presented as the best possible range of estimated values likely to reflect actual values. But to be clear, these definitely are *estimated* values, based as they are upon assumed rates of permit condition compliance and planting success. Measuring actual compliance and planting success will be essential in validating these assumptions.

10. Cost-Benefit Sensitivity Analysis (Appendix 19)

For cost-benefit we are concerned with the net present value of the future stream of benefits generated through the By-law. Five key variables have been selected for this analysis:

i. Compliance rate to By-law permit planting requirements

ii. Tree survival rate of trees planted in compliance to By-law

iii. Trees protected (not destroyed) as a result of By-law compliance

iv. Cost

v. Discount Rate

The cost-benefit sensitivity analysis shares the same weakness of the CUA: Key performance indicators have not been reliably measured; hence estimates have been used. Four scenarios, holding unchanged the cost at 2011 levels have been generated with each scenario calculated at four discount rates.

The dramatic effect of discount rate on present value is perhaps the most telling result of this analysis. (See Summary, end of Appendix 19) It would seem to demonstrate that the

[28] This result is in fact directly linked to the fact that trees appreciate in functional value over their life.

benefits of trees are less valuable when investments enjoy a higher rate of return.[29] It is proposed that a discount rate of 4.2% is the most appropriate, representing as it does the most recent, available data on the rate of return that the City of Toronto realizes on its monetary investments. At this discount rate, the net present value of the By-law varies from a high of $545,976 to a low of -$389,847 dependant on the other variables. As with the CUA, Scenario 1 at a NPV of $165,331 and Scenario 3 at -$19,728[30] are proposed at the likely range (best case scenario range) within which the actual value will occur upon collection of performance indicators.

Of interest, with the same assumptions as for the CUA, the addition of two inspectors results in a positive increase in NPV of $267,014 (in this case, actually less of a negative NPV). As with CUA calculations, this is not surprising given the fact that trees appreciate in their functional value over time. It is important to note, however, that the City of Toronto contains a finite amount of tree-plantable space. Any increase in NPV related to tree planting will eventually be limited by this factor, especially in view of the fact that construction related removals are required to be replaced at a 3 to 1 ratio. Increases in future benefits become more and more limited as available planting spaces are used up.

11. Quality of Life Factors

The benefits of a preserved or expanded urban forest go well beyond the three factors valuated in this CBA. On the economic side (and aside from property value enhancement), a healthy urban forest has been shown to encourage tourism and consumer behavior and to significantly lower storm water management costs. Quality of life for all occupants and visitors is enhanced through the provision of a more pleasant environment with improved aesthetics,

[29] This problem is fully discussed in the next section (11 – Quality of Life Factors) of this paper.
[30] Preliminary indications, therefore, based upon the guestimated performance level in this study, are that the By-law is economically worthwhile as by and large, it enjoys a positive NPV.

cooling, shading, and wind and sound abatement. Health benefits also derive but could well be seen as double counting of air quality (in this CBA – pollution mitigation) and the pleasant environment benefits listed above. Outdoor recreation experiences are often (but not always) enhanced by the presence of trees. Finally, wildlife habitat is enhanced and created, resulting in (to many) a more engaging and fulfilling urban experience. Including all these factors in this CBA is neither practical nor possible, however they should be appropriately considered when assessing the results generated by it; particularly when the discount factor utilized appears to demonstrate that an investment in tree protection is not viable.

12. Summing Up

Along with the implementation of a performance measurement and management system, this CUA/CBA will constitute the methodological framework for a full program evaluation which will ask the fundamental questions: "Does the Private Tree By-law do what it is supposed to do?"; "What is the true cost?"; "Did the outcome(s) achieved justify the investment?"; and "Was this the most efficient way of realizing the desired outcome(s)?" Measuring and evaluating program performance – activity costs, output and outcomes – is the essence of a program impact evaluation that determines if intended effects resulted and at what cost.

While this CBA is predicated, in many instances, upon educated estimates of performance outcomes, it nevertheless constitutes a practical methodology by which to calculate actual cost-utility and cost-benefit once key performance indicators become available as planned for 2013. As well, this study has served to reveal the common assumptions upon which most tree function benefits evaluations are based, along with identifying some fundamental problems. For example, this study appears to demonstrate that cost-utility and cost-benefit would always improve with increased investment. Clearly this is not the case, as such would require unlimited expansion of the urban forest – a patent impossibility.

This failing will need to be addressed by establishing a theoretical but practical "ideal" urban forest size and age composition given the current land base and uses in Toronto and then factoring in the potential for diminishing returns as this is approached. One could postulate a certain level of equilibrium at which point the forest is maintained at this "ideal" level, with no practical expansion possible. The By-law would clearly need to modify its 3 to 1 replacement requirement at that point.

Perhaps the greatest benefit of this study is not in determining whether or not the goal of protecting trees is economically worthwhile, but rather in stimulating public managers, elected officials and the public to reflect on *how* we protect trees. Thoughtful reflection often will lead to creative solutions on how to better achieve goals. Insofar as tree protection continues to have the support of elected officials and the public, such solutions can only serve to improve achievement of this worthwhile goal.

E. Conclusion

This paper has presented a practical application of designing and implementing a robust performance measurement system that addresses five criteria It will:

i. Satisfy accountability reporting requirements to elected officials and to the public at large;

ii. Facilitate policy and program effectiveness measurement;

iii. Support management reviews that help inform service quality and efficiency improvements;

iv. Guide staff from the apex of management down to front line service delivery personnel on specific goals and deliverables; and

v. Increase staff productivity, satisfaction and motivation by providing meaningful feedback on goal accomplishment.

It has done so by ensuring at the design outset that program goals, policies, activities and performance measures are aligned throughout the organization – from the apex of policy and By-law design at the City Council level; down through upper management level requirements for clear cost and performance accountability; continuing through to the program management level where collected data can be analyzed to help inform efficiencies; and most importantly, to the front line service delivery level where specific performance indictors will demonstrate to staff their effectiveness and contribute therefore to their sense of accomplishment - boosting their morale, motivation and productivity (Whetten and Cameron 327 and 33;, Latham and Locke 705-715; Beauregard).

This is by no means a perfect system. However, a learning, iterative process has been built in to the implementation methodology, allowing for both informed improvements and adaptation to a changing environment. It can therefore be characterized as a *workable* system - one that can be implemented to successfully achieve its stated goals.

Of course the proof will be in the implementation itself. As implementation is currently a work in progress, the author welcomes inquiries. In due course, a further study will be produced to report on the implementation results.

Works Cited

Backoff, Robert, Barton Wechsler and Robert E. Crew Jr. "The Challenge of Strategic Management In Local Government." Public Administration Quarterly. 17.2 (1993): 127-144.

Bank of Canada. Consumer Price Index, 2000 to Present. 20 June 2012 http://www.bankofcanada.ca/rates/price-index/cpi/

Beauregard, Arthur. "The Effect of Reorganization on Goal Clarity and HRM Applications of Goal Setting and Motivational Theory in the Public Sector." Unpublished paper available from author, University of Western Ontario Public Administration 9922b – Human Resource Management. April 2011.

Berry, Frances S. "Strategic Planning as a Tool for Managing Organizational Change." International Journal of Public Administration. 30.3 (2007): 331-346.

Brick, Jeff. "Valuation of an Intangible: The Environmental Value of Urban Trees." Unpublished paper available from Beauregard, University of Western Ontario, PA 9913B – Economics. February 2012.

Bryson, John M. Strategic Planning for Public and Nonprofit Organizations: A Guide to Strengthening and Sustaining Organizational Achievement. 3rd ed. San Francisco: Jossey-Bass, 2004.

Bryson, John M. and William D. Roering. 1988. "Initiation of Strategic Planning by Governments." Public Administration Review 48.6 (1988): 995-1004.

Canadian Forest Service. "Lifespan of Common Urban Trees." 20 June 2012 http://www.cbc.ca/news/background/environment/trees_lifespan.html

Chan, Yee-Ching Lilian and Michael G. DeGroote. "Performance measurement and adoption of balanced scorecards: A survey of municipal governments in the USA and Canada." The International Journal of Public Sector Management. 17.3 (2004): 204-221.

City of Toronto. 2011 City Budget Summaries: Financial Planning and Reporting System (FPARS). 20 June 2012 http://www.toronto.ca/budget2011/2011_budget_summary/pdf/fcp/fpars.pdf

City of Toronto. City Budget 2012: Parks, Forestry and Recreation Operating Budget Analyst Notes. 20 June 2012 http://www.toronto.ca/budget2012/2012_budget_summary/pdf/operating/parks_forestry_rec.pdf

City of Toronto. Environmental Plan. February 2000. 20 June 2012 http://www.toronto.ca/council/pdf/etfepfin.pdf

City of Toronto. Every Tree Counts: A Portrait of Toronto's Urban Forest. Spring, 2010. 20 June 2012. http://www.toronto.ca/trees/pdfs/Every_Tree_Counts.pdf

City of Toronto. Harmonized City-Wide Private Tree By-Law: Consolidated Clause in Policy and Finance Committee Report 7, which was consider by City Council on September 28, 29, 30 and October 1, 2004. 20 June 2012 http://www.toronto.ca/legdocs/2004/agendas/council/cc040928/pof7rpt/cl002.pdf

City of Toronto. Investment Portfolio Income for 2010. 20 June 2012 http://www.toronto.ca/finance/investment.htm

City of Toronto. Municipal Code Chapter 813 - Trees; Article III: Private Tree Protection. 30 Sept 2004, 7-15. 20 June 2012 http://www.toronto.ca/legdocs/municode/1184_813.pdf

City of Toronto. 2012 Parks, Forestry and Recreation Services and Service Levels. 20 June 2012 http://www.toronto.ca/budget2011/pdf/profiles/clusterA/PFR_serviceprofile.pdf

City of Toronto. Parks, Forestry and Recreation Strategic Plan: Our Common Grounds: Consolidated Clause in Economic Development and Parks Committee Report 5, which was considered by City Council on July 20, 21 and 22, 2004. 20 June 2012 http://www.toronto.ca/legdocs/2004/agendas/council/cc040720/edp5rpt/cl002.pdf

City of Toronto. Parks, Forestry and Recreation - Urban Forestry. Draft Strategic Management and Service Plans. Internal documents 2012.

City of Toronto. Parks, Forestry and Recreation - Urban Forestry. Interviews with Urban Forestry Tree Protection and Pan Review Staff. 2011 and 2012.

City of Toronto. Revisions to the Tree By-laws: Parks and Environment Committee Report No. 9.2 adopted by City Council on November 29, 30 and December 1, 2011. 20 June 2012 http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2011.PE9.2

City of Toronto. SAP Financial Accounting System for 2011. Internal City of Toronto e-documents 2011.

City of Toronto. Toronto Official Plan. November 2002. 20 June 2012 http://www.toronto.ca/planning/official_plan/pdf_chapter1-5/chapters1_5_dec2010.pdf

City of Toronto. Toronto Strategic Plan . (as referenced in the Official Plan)

City of Toronto. Tree By-law Amendments: City of Toronto Municipal Code, Chapter 813 (Public Notice): Parks and Environment Committee Report No. 12.3 adopted by City Council on January 29 and 30, 2008. Council decision document, page 23. 20 June 2012 *http://www.toronto.ca/legdocs/mmis/2008/cc/decisions/2008-01-29-cc16-dd.pdf* *Parks and* Environment Committee Report: Tree By-law Amendments: City of Toronto Municipal Code, Chapter813. 20 June 2012 http://www.toronto.ca/legdocs/mmis/2008/pe/bgrd/backgroundfile-9619.pdf

Eadie, Douglas C. 1983. "Putting a Powerful Tool to Practical Use: The Application of Strategic Planning in the Public Sector." Public Administration Review 43.5 (1983):447-452.

Grasso, Patrick G. "What Makes Evaluation Useful? Reflections from Experience in Large Organizations." American Journal of Evaluation. 24.4 (2003): 507-514.

Harris, John A. Tree and Landscape Appraisal: Trees and Landscape Values are Still Divergent in Practice. 20 June 2012 http://www.treeandlandscapeappraisal.com/article2.html

Horak, Martin. Governing the Post-communist City: Institutions and Democratic Development in Prague. Toronto: University of Toronto Press, 2007.

Hubbard, L. Ron. The Management Series Volume 1. Los Angeles: Bridge Publications, 1991.

Lindbloom, Charles E. "The Science of Muddling Through."Public Administration Review. 19.2 (Spring 1959): 79-88.

Lightbody, James. "The Strategic Planning Component in Policymaking Process for Municipalities in Canada." Policy Studies Journal. 21.1 (1993): 94-103.

Locke, Edwin A. and Gary P. Latham. "Building a Practically Useful Theory of Goal Setting and Task Motivation." American Psychologist. 57.9 (Sept. 2002): 705-717.

McDavid, James C. and Laura R.L Hawthorn. Program Evaluation & Performance Measurement: An Introduction to Practice. Thousand Oaks: Sage Publications Inc., 2006.

Nowak, David J., Daniel E Crane, Jack C., Stevens, Robert E Hoehn, Jeffrey T. Walton, and Jerry Bond,. "A Ground-Based Method of Assessing Urban Forest Structure and Ecosystem Services." Aboriculture & Urban Forestry. 34.6. (2008): 347-358.

Nowak, David J., Daniel E Crane, and John F. Dwyer. "Compensatory Value of Urban Trees in the United States." Journal of Arboriculture. 28.4 (July 2002):194-199.

Nowak, David J. Every Tree Counts – Research Documents: Raw Data, Charts, etc. Internal City of Toronto documents. 2008.

O'Sullivan, Elizabethann, Garry R Rassal and Maureen Berner. Research Methods for Public Administrators. 5th ed. New York: Pearson Longman, 2008.

Padovani, Emanuele, Ana Yetano and Rebecca Levy Orelli. "Municipal Performance Measurement And Management In Practice: Which Factors Matter?" Public Administration Quarterly. (Winter 2010): 591-635.

Pal, Leslie A. Beyond Policy Analysis: Public Issue Management in Turbulent Times. 4th ed. Canada: Nelson Education, 2010.

Pandit, Ram and David N. Laband. "A Hedonic Analysis of the Impact of Tree Shade on Summertime Residential Energy Consumption." Arboriculture& Urban Forestry. 36.2 (2010): 73-80.

Peterson, Kristin S. and Straka, Thomas J. "Specialized Discounted Cash Flow Analysis Formulas for Valuation of Benefits and Costs of Urban Trees and Forests." Arboriculture and Urban Forestry. 37.5 (2011): 200-206.

Plant, Thomas, Carol Agocs, Emmanuel Brunet-Jailly and Janine Douglas. From Measuring to Managing Performance: Recent Trends in the Development of Municipal Public Sector Accountability. Toronto: Institute of Public Administration of Canada, 2005.

Poister, T. H. and G. Streib. "Elements of Strategic Planning and Management in Municipal Government: Status after Two Decades." Public Administration Review. 65.1 (2005):45-56.

Sancton, Andrew, W. Canadian Local Government: An Urban Perspective. New York: Oxford University Press, 2011.

Schatteman, Alicia. "The state of Ontario's municipal performance reports: A critical analysis." Canadian Public Administration. 53.4 (December 2010): 531-550.

Schatteman, Alicia. "Is Public Performance Reporting Living Up To Its Expectations?" Public Performance and Management Review. 32.2 (2008):309-327.

Schatteman, Alicia. "Uses and Reporting of Performance Measurement Results in Small and Medium Cities in Ontario, Canada" published as " Who Cares? Implementation of Ontario's Municipal Performance Measurement System." Rutgers School of Public Affairs and Administration. 18 April 2007. 20 June 2012 http://andromeda.rutgers.edu/~ncppca/PDFs/cpsa2007.pdf

Scott, Jessie L. and David R. Betters."Economic Analysis of Urban Tree Replacement Decisions." Journal of Aboriculture. 26.2 (March 2000):69-76.

Streib, Gregory D. and Theodore H. Poister. "Assessing the Validity, Legitimacy and Functionality of Peformance Measurement Systems in municipal Governments." The American Review of Public Administration. 29.2 (June 1999): 107-123.

Swanstrom, Todd. "The Limits of Strategic Planning for Cities." Journal of Urban Affairs. 9.2 (1987): 139-157.

Townley, Peter G.C. Principles of Cost-Benefit Analysis in a Canadian Context. Scarborough: Prentice Hall Canada Inc., 1998.

Treasury Board of Canada. Canadian Cost-Benefit Analysis Guide: Regulatory Proposals (Interim) 2007. 20 June 2012 http://www.tbs-sct.gc.ca/ri-qr/documents/gl-ld/analys/analys-eng.pdf

Treasury Board of Canada. Supporting Effective Evaluations: A Guide to Developing Performance Measurement Strategies. 29 September 2010. 20 June 2012 http://www.tbs-sct.gc.ca/cee/dpms-esmr/dpms-esmr00-eng.asp

Vinzant, Douglas H. Jr. "Strategic Management and Public Organizations: Lessons from the Past and Prescriptions for the Future." International Journal of Public Administration. 19.10 (1996): 1743-1779

Vinzant, Douglas H. and Janet C. Vinzant. "Strategy and Organizational Capacity." Public Productivity and Management Review. 20.2 (1996): 139-157.

Watson, Gary. "Comparing Formula Methods of Tree Appraisal." Journal of Arboriculture. 28.1 (January 2002):11-18.

Whetten, David A. and Kim S. Cameron. Developing Management Skills.(righth Edition) Boston: Prentice Hall, 2011.

Wisniewski, Mik and Derek Stewart. "Performance measurement for stakeholders: The case of Scottish local authorities." The International Journal of Public Sector Management. 17.3 (2004): 222-233.

Wolf, Kathleen L. "What Could We Lose? Economic Values of Urban Forest Benefits." Paper for 6th Canadian Urban Forest Conference, October 19-23, 2004 – Kelowna, B.C. 20 June 2012 http://www.naturewithin.info/Policy/EconCnda.pdf

Wolf, Kathleen L. "City Trees and Property Values." Arborist News. 16.4 (August 2007): 34-36. 20 June 2012 http://viewer.zmags.com/publication/c56eaa7c#/c56eaa7c/31

Appendix 1: Logic Models Source Documents

City of Toronto. Environmental Plan. February 2000. 20 June 2012 http://www.toronto.ca/council/pdf/etfepfin.pdf

City of Toronto. Every Tree Counts: A Portrait of Toronto's Urban Forest. Spring, 2010. 20 June 2012. http://www.toronto.ca/trees/pdfs/Every_Tree_Counts.pdf

City of Toronto. Harmonized City-Wide Private Tree By-Law: Consolidated Clause in Policy and Finance Committee Report 7, which was consider by City Council on September 28, 29, 30 and October 1, 2004. 20 June 2012 http://www.toronto.ca/legdocs/2004/agendas/council/cc040928/pof7rpt/cl002.pdf

City of Toronto. Municipal Code Chapter 813 - Trees; Article III: Private Tree Protection. 30 Sept 2004, 7-15. 20 June 2012 http://www.toronto.ca/legdocs/municode/1184_813.pdf

City of Toronto. Parks, Forestry and Recreation Strategic Plan: Our Common Grounds: Consolidated Clause in Economic Development and Parks Committee Report 5, which was considered by City Council on July 20, 21 and 22, 2004. 20 June 2012 http://www.toronto.ca/legdocs/2004/agendas/council/cc040720/edp5rpt/cl002.pdf

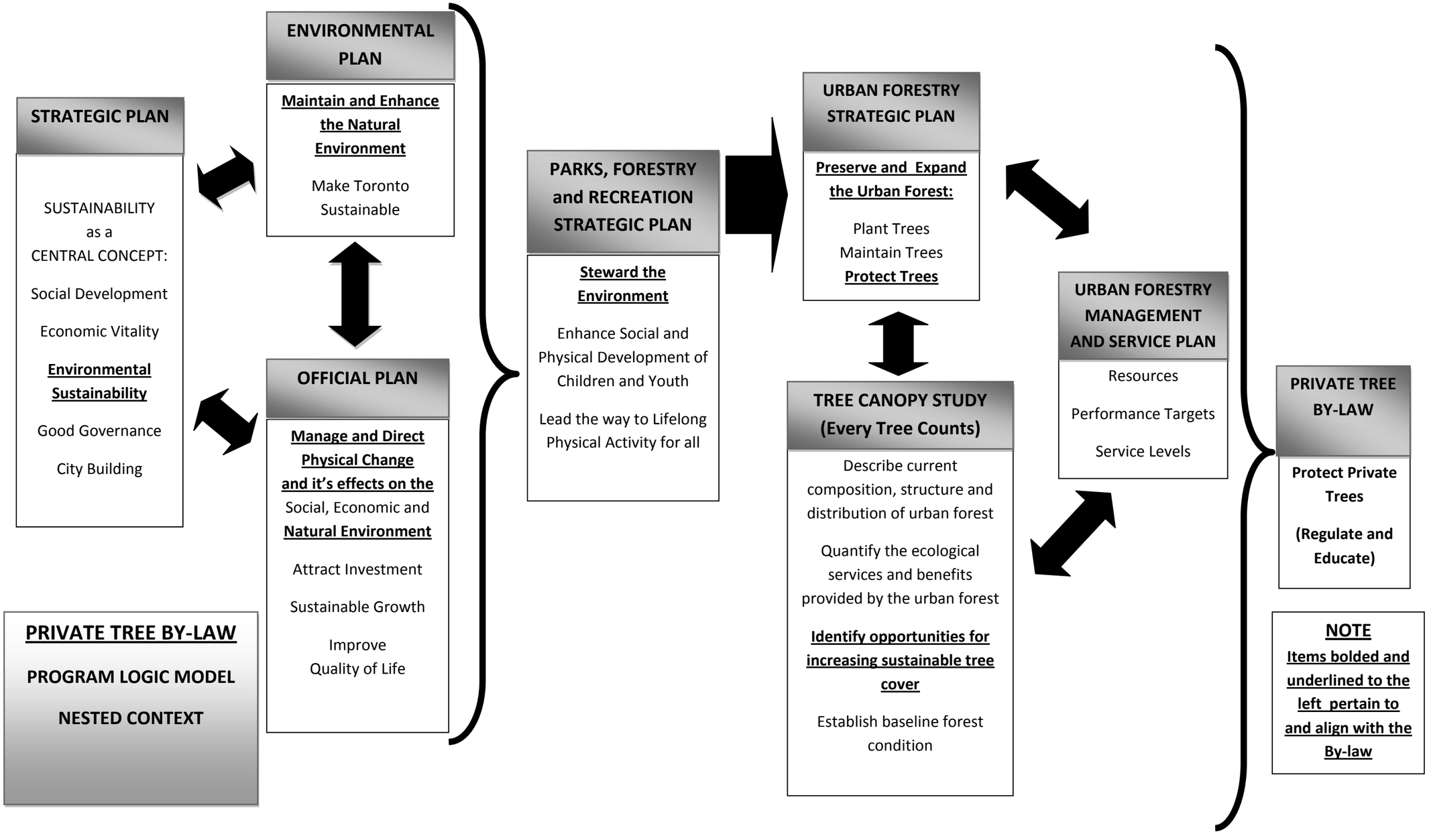
City of Toronto. Parks, Forestry and Recreation - Urban Forestry. Draft Strategic Management and Service Plans. Internal documents 2012.

City of Toronto. Parks, Forestry and Recreation - Urban Forestry. Interviews with Urban Forestry Tree Protection and Pan Review Staff. 2011 and 2012.

City of Toronto. Toronto Official Plan. November 2002. 20 June 2012 http://www.toronto.ca/planning/official_plan/pdf_chapter1-5/chapters1_5_dec2010.pdf

City of Toronto. Toronto Strategic Plan . (as referenced in the Official Plan)

Appendix 2


STRATEGIC PLAN
SUSTAINABILITY as a CENTRAL CONCEPT:
Social Development
Economic Vitality
Environmental Sustainability
Good Governance
City Building
ENVIRONMENTAL PLAN
Maintain and Enhance the Natural Environment
Make Toronto Sustainable
OFFICIAL PLAN
Manage and Direct Physical Change and it's effects on the Social, Economic and Natural Environment
Attract Investment
Sustainable Growth
Improve Quality of Life
PARKS, FORESTRY and RECREATION STRATEGIC PLAN
Steward the Environment
Enhance Social and Physical Development of Children and Youth
Lead the way to Lifelong Physical Activity for all
URBAN FORESTRY STRATEGIC PLAN
Preserve and Expand the Urban Forest:
Plant Trees
Maintain Trees
Protect Trees
TREE CANOPY STUDY (Every Tree Counts)
Describe current composition, structure and distribution of urban forest
Quantify the ecological services and benefits provided by the urban forest
Identify opportunities for increasing sustainable tree cover
Establish baseline forest condition
URBAN FORESTRY MANAGEMENT AND SERVICE PLAN
Resources
Performance Targets
Service Levels
PRIVATE TREE BY-LAW
Protect Private Trees
(Regulate and Educate)
NOTE
Items bolded and underlined to the left pertain to and align with the By-law
PRIVATE TREE BY-LAW
PROGRAM LOGIC MODEL
NESTED CONTEXT

Appendix 3

TORONTO OFFICIAL PLAN
HIGH LEVEL LOGIC MODEL

SITUATION (Problem)

Local, National and International

COMPETITION

(Threat to Toronto's well-being and prosperity)

Values and Priorities

Caring

Friendly

Clean

Green

Sustainable

Creative

ACTIONS

OUTCOMES

ENHANCED DIVERSITY

Vibrancy

Opportunity

Inclusiveness

Adaptability

ENHANCED BEAUTY

Heritage

Creativity

Arts

Natural Beauty

EHANCED CONNECTEDNESS

Sustainability: Social, Economic and Environmental Factors

Connected Greenspace Network

ENHANCED LEADERS and STEWARDS

Participation

Volunteerism

Everyone taking responsibility for the natural environment

MEDIUM TERM OUTCOMES

ATTRACT INVESTMENT

ATTRACT and RETAIN

Creative, Skilled, and Knowledgeable

PEOPLE

GENERAL OUTCOME

HIGHER QUALITY OF LIFE

LONG TERM IMPACT

A WORLD CLASS CITY

That is

Competitive and Sustainable

FEEDBACK LOOP

EXTERNAL ENVIRONMENT

ATTRACTED OUTCOMES

SKILLED AND CEATIVE INDIVIDUALS

INVESTMENT

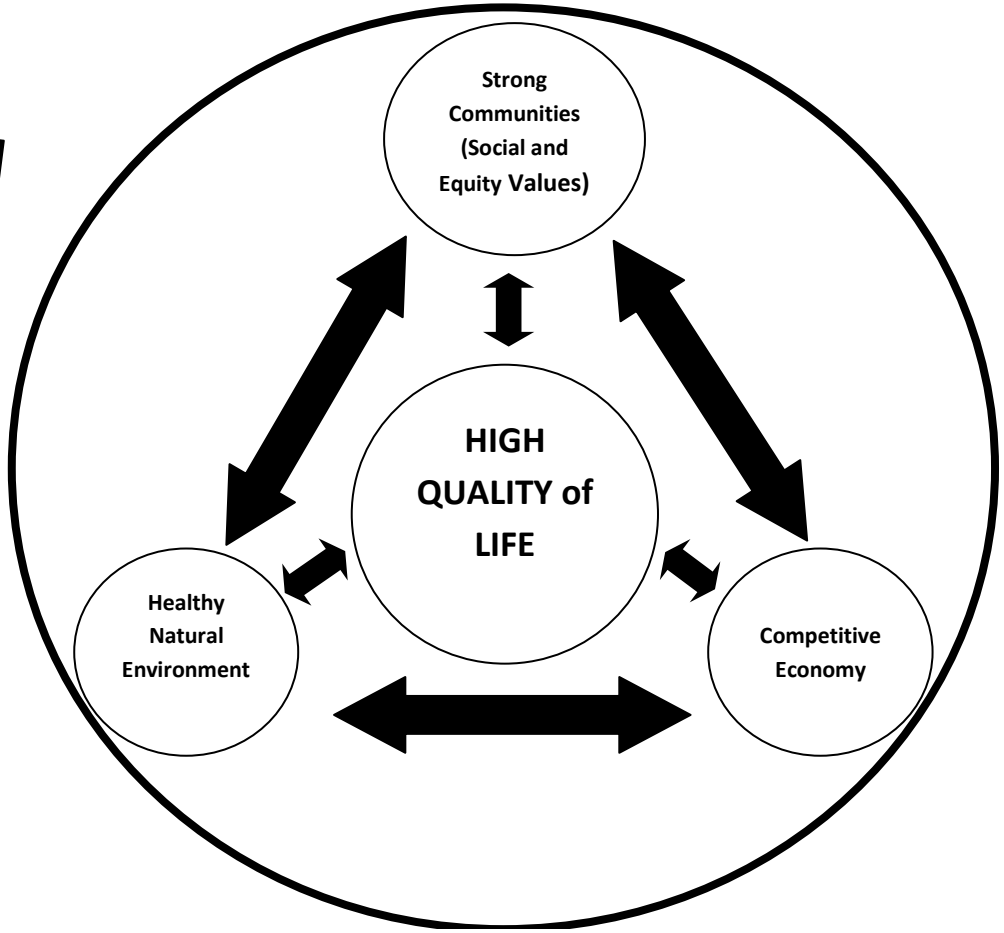
Appendix 4

TORONTO OFFICIAL PLAN

OUTCOME RELATIONSHIP LOGIC MODEL

INTERNAL ENVIRONMENT

OUTCOME RELATIONSHIPS (INTEGRATED SYNERGY)



LONG TERM IMPACT

SUCCESSFULL CITY:

SUSTAINABLE & COMPETITIVE

QUALITY HEALTH & WELL-BEING of RESIDENTS, BUSINESSES and INSTITUTIONS

Appendix 5

City of Toronto Private Tree By-Law -Full Logic Model

SITUATION

PROBLEM

Private Trees are being unnecessarily damaged and destroyed.

CAUSES

Lack of awareness of the benefits of trees; lack of knowledge on how to protect trees; and attitudes that place a higher priority on outcomes that are seen as in competition with protecting trees.

NEEDS

Environmental, social and economic factors that contribute to the quality of life

ASSETS

Current Urban Forest; expertise of staff and UF profession; will of public and Council (support for tree protection); research on trees; internal experience; and bench mark data on tree by-laws

RISKS

Pushback and non-compliance; unrealistic expectations on enforcement and outcomes; resource allocation too low; unexpected adverse outcomes

STAKEHOLDERS

All residents, businesses, property owners, institutions, public agencies, etc. in Toronto

PRIORITIES

STRATEGIC PLAN -
High Quality of Life: Environmental, Social and Economic factors and values. (Including trees)

OFFICIAL PLAN
Support environmental health in order to create a competitive economy and high quality of life by (in part) preserving and enhancing the urban forest, including regulating the injury and destruction of trees

STRATEGIC PLAN - PFR
Establish an UF Management Plan that increases the tree canopy from the existing 17% to 30-40%

MGMT PLAN - UF
Plant More Trees; Maintain and Protect Trees Better

INPUTS (RESOURCES)

- TIME & MONEY
- STAFF
- LEGAL STAFF
- PLANNING STAFF
- TECHNICAL SERVICES STAFF
- SERVICE COUNTERS
- 311 SERVICE
- STAFF FACILITIES
- EQUIPMENT
- IT
- RESEARCH
- CITY COUNCIL
- RESIDENTS
- UF INDUSTRY
- ENVIRONMENTAL GROUPS
- MEDIA
- DEVELOPMENT INDUSTRY
- COURT SYSTEM

OUTPUTS

ACTIVITES

COMPLIANCE
Broad Public Communication and Education

Development Review Application Process

Permit Process

Exceptions Process

Committee of Adjustment Process

Building Permit Tree Declarations Process

ENFORCEMENT
Inspection Process

Public Complaint Process

Stop Work Process

Offense Process

Default (cost recovery) Process

APPEALS
Administrative Appeal

Community Council Appeal

OMB Appeal

PARTICIPANTS

- Property Owners
- Residents
- Businesses
- Development Industry
- Construction Industry
- Architects and Landscape Architects
- Public Utilities
- Urban Forestry Industry
- Media

OUTCOMES – IMPACT

SHORT TERM

- Increased awareness about the benefits of trees - Increased knowledge about protecting trees - Increased awareness and knowledge about the tree by-law
- Trees are protected from unnecessary damage
- Trees are not destroyed unnecessarily
- Trees are planted in compensation for damage or destruction of healthy (and unhealthy) trees
- Permit Fees fund 90% of the UF costs of program administration
- Increased awareness of consequences of tree by-law violations

MEDIUM TERM

An aware and knowledgeable community that values , protects and enhances the urban forest

Most private trees are not damaged or destroyed unnecessarily and develop to full maturity with a full life span

LONG TERM

Private trees form a significant portion of the healthy, sustainable Toronto Tree Canopy, that itself reaches 30-40%

BROAD IMPACT

SOCIAL, ENVIRONMENTAL & ECONOMIC BENFITS

HIGHER QUALITY OF LIFE

A SUCCESSFUL, COMPETITIVE, SUSTAINABLE CITY

FEEDBACK LOOP

ASSUMPTIONS

Broad Impact: Sustainable, continuous (unlimited) growth (providing higher quality of life) is possible
Economy: Economic benefits from increasing quality of life will accrue, in part, to the municipality
Social Values: People will comply with the by-law, given appropriate information and understanding
Environmental: Level of effort will be adequate to have a significant impact, despite deteriorating state of environment

EXTERNAL FACTORS

Economy: Effect on City revenues; development and building costs; energy costs; public mood (priorities)
Competition: Development Costs (including tree protection portion)compared to other cities
Political and public environmental values and support for tree protection
Environmental : Climate change and catastrophic pest effects on tree growth and survival

Appendix 6

BENEFITS (OUTCOMES) of TREES and the URBAN FOREST

STRATEGIC and OFFICIAL PLAN GOALS (IMPACTS) of TREES

CO_2 Sequestration Mitigating Global Warming
EN

Reduce Wind Speeds
EN

Moderate Temperature Extremes
EN

Reduce Heat Island Effect
EN

Lower Energy Costs (Heating and ACC)
EC

Create Natural Connections Between Neighborhoods and Communities
S

Define Unique Character of Neighborhoods
S

Embody and Emphasize Heritage Values
S

Provide Continuity in Areas Undergoing Dynamic Change
S

Reduce Crime
S & EC

Increased Sense of Community
S

Produce Oxygen
H

Clean the Air (Reduce Air Pollution)
H

Noise Reduction
H

Provide Shade (Protection from UV)
H

Link to Natural Environment (Recreation and Exercize)
H

Beautify City and Provide Significant Vitas
H

Improve Health and Speed Illness and Injury Recovery
H

Lower Indirect Health Care Costs*
EC

KEY

EN – Environmental

EC – Economic

S – Social

H – Health and Well-Being

*** - Absenteeism, etc.**

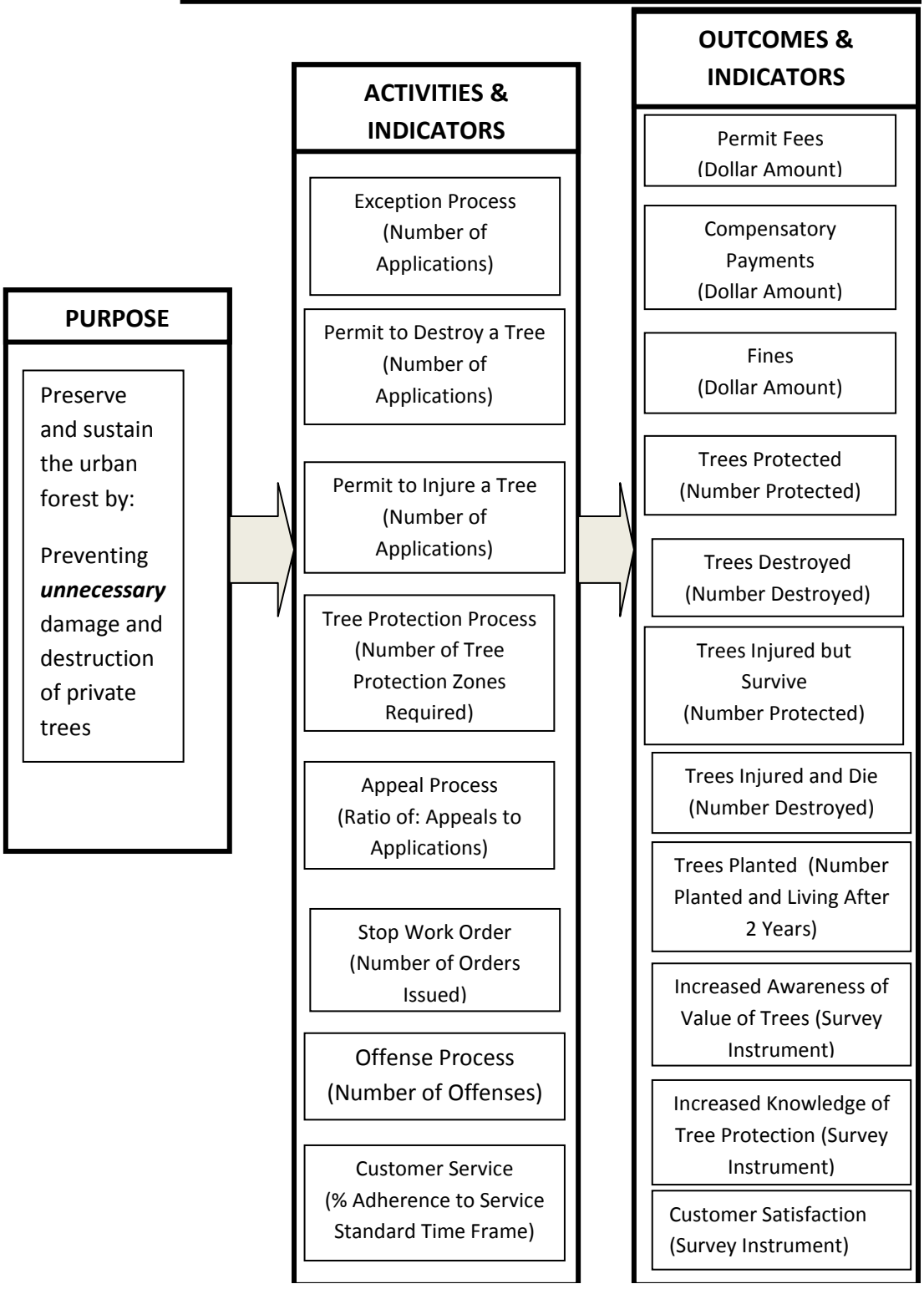
ATTRACT INVESTMENT, SKILLED LABOUR and TOURISM
EC

IMPROVED OVERALL QUALITY OF LIFE
H

A SUCCESSFUL, COMPETITIVE SUSTAINABLE CITY

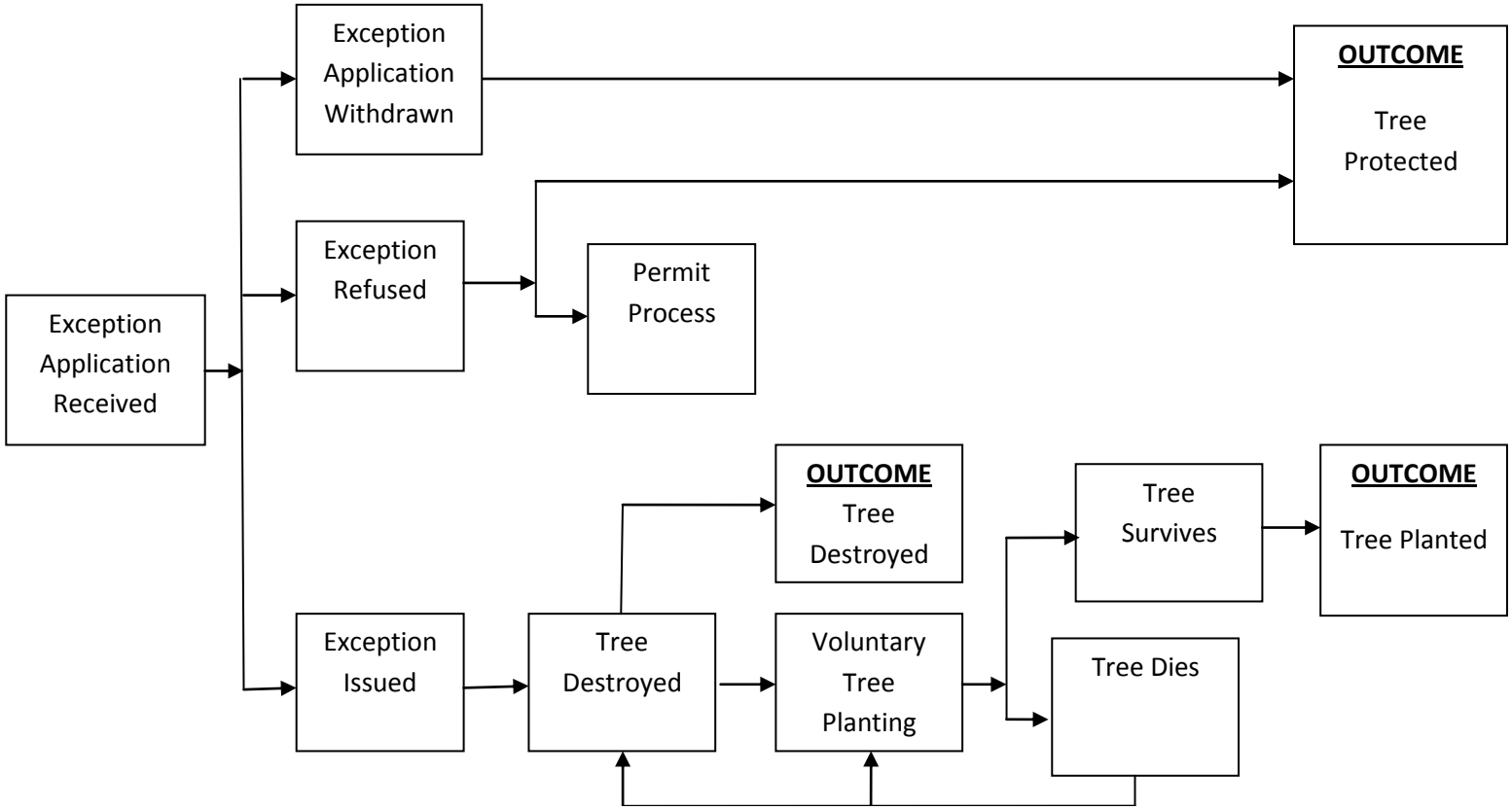
Appendix 7

TORONTO PRIVATE TREE BY-LAW PERFORMANCE MEASUREMENT LOGIC MODEL



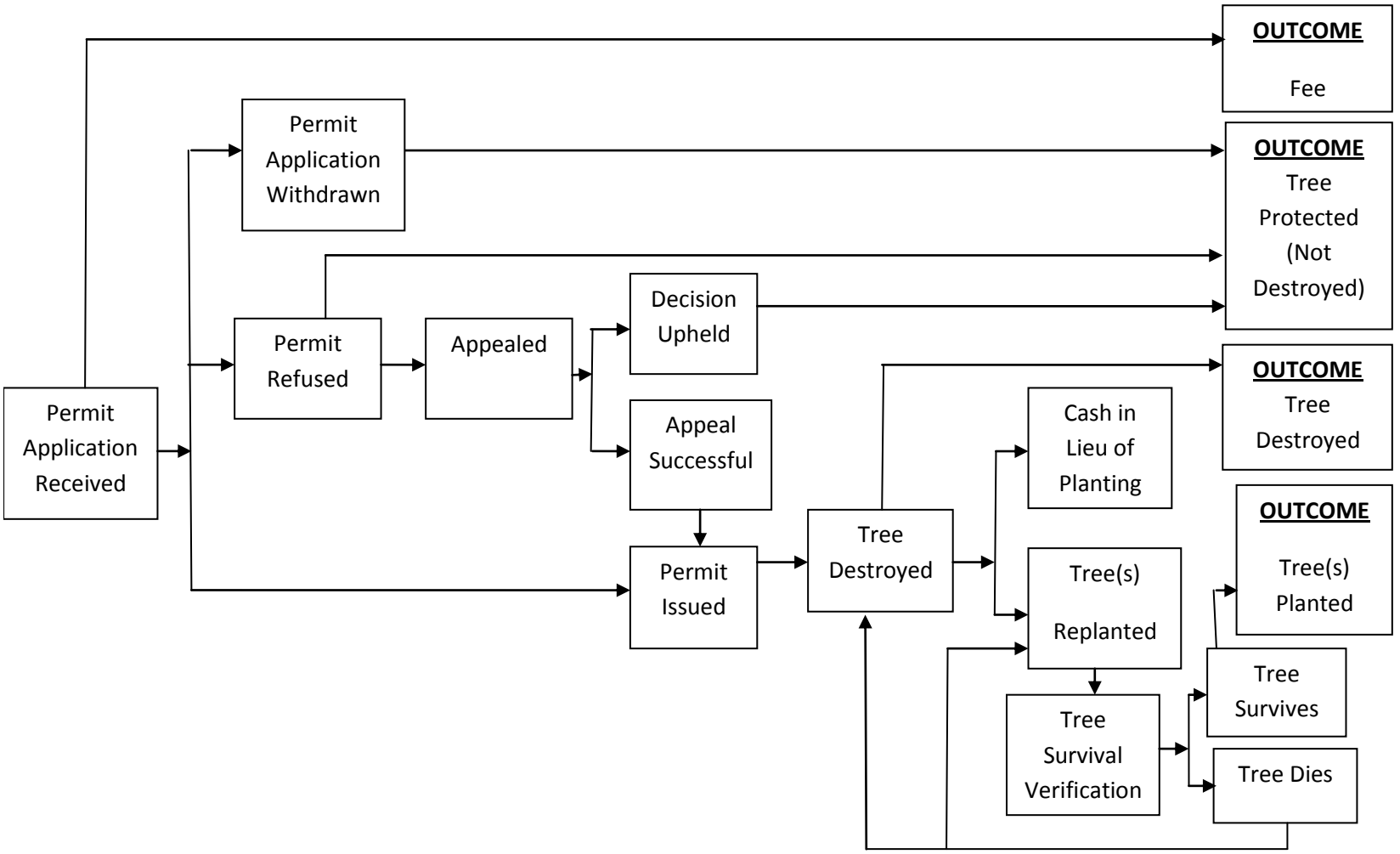
Appendix 8

EXCEPTION TO DESTROY TREE PROCESS



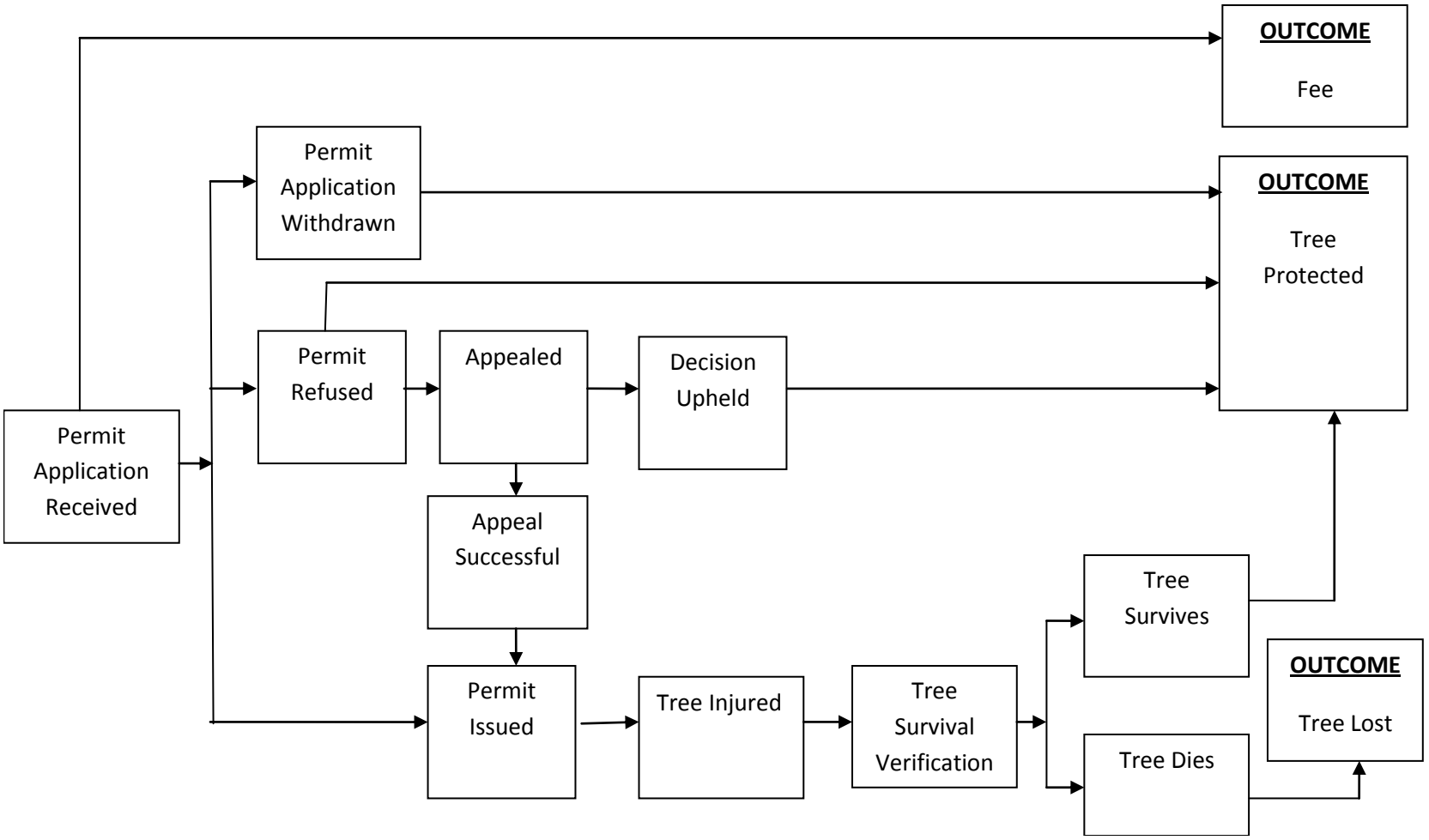
Appendix 9

PERMIT TO DESTROY TREE and APPEAL PROCESS



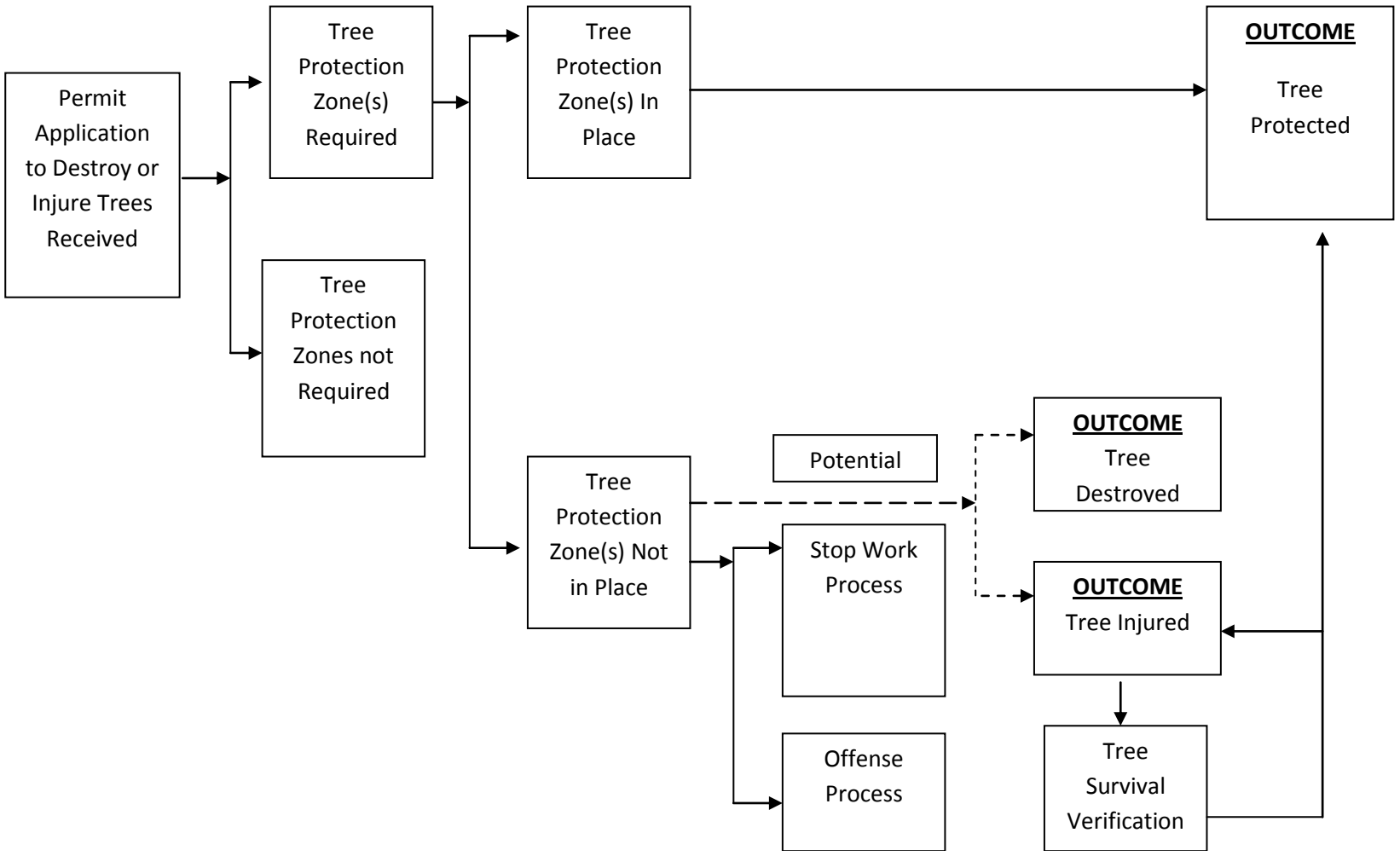
Appendix 10

PERMIT TO INJURE TREE and APPEAL PROCESS



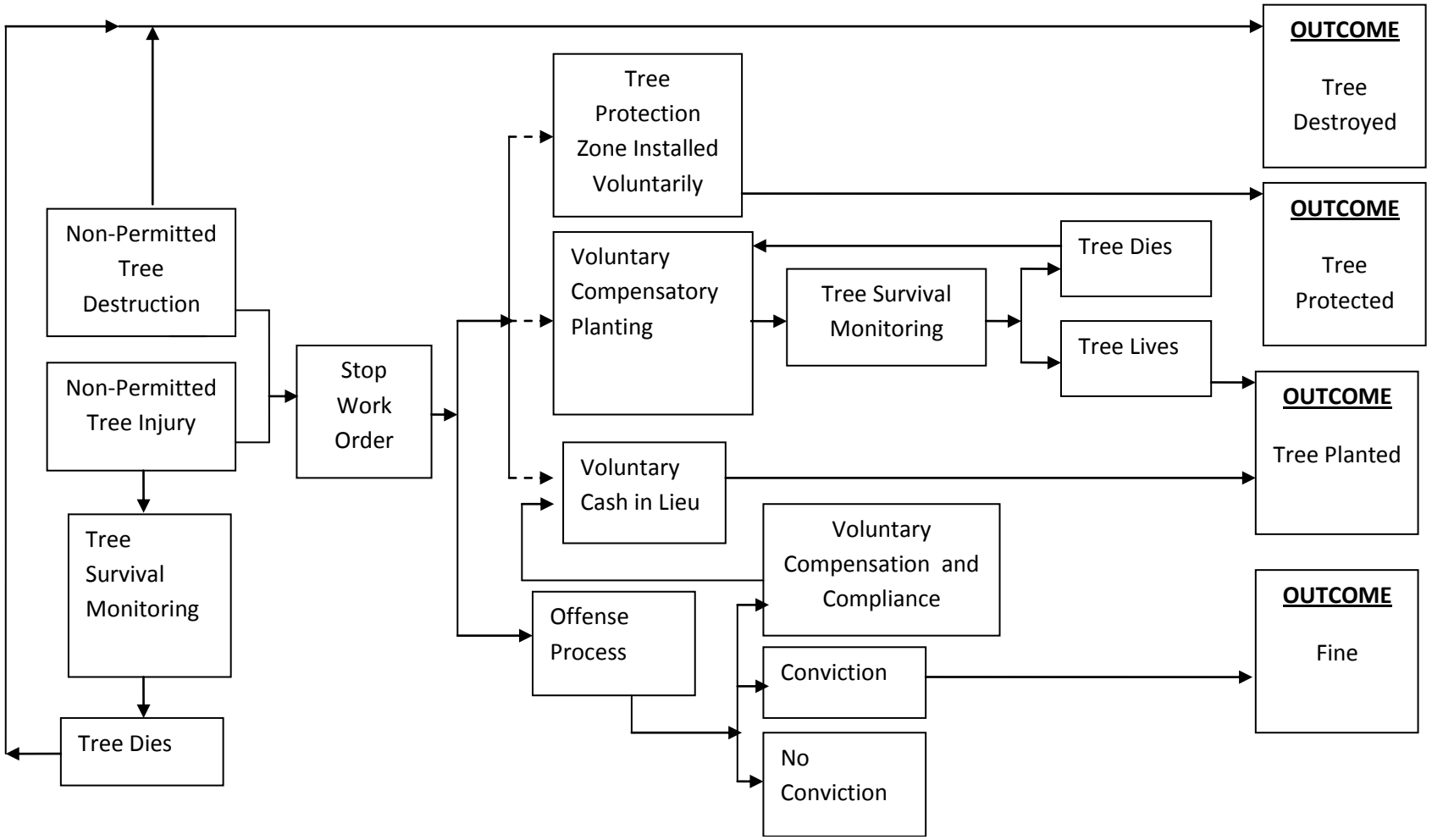
Appendix 11

TREE PROTECTION PROCESS



Appendix 12

STOP WORK and OFFENSE PROCESS



Appendix 13: Private Tree By-Law Costs

Classification	Weeks	Annual	25% Benefits	Number	Total	Time on Tree By-laws	Cost		City Tree By-Law	Private - Non Construction	Private - Construction	Private Tree By-law
									12.10%	17.50%	70.40%	
Manager, TPPR		$114,837	$28,709	1	$143,546	40%	$57,418		$6,948	$10,048	$40,423	
Supervisor, TPPR		$92,092	$23,023	4	$460,460	40%	$184,184		$22,286	$32,232	$129,666	
Supervisor, RNFP		$92,092	$23,023	1	$115,115	0%	$0		$0	$0	$0	
Planner, TPPR	52.2	$76,789	$19,197	4	$383,944	0%	$0		$0	$0	$0	
Planner, RNFP	52.2	$76,789	$19,197	4	$383,944	0%	$0		$0	$0	$0	
Assist Planner, TPPR	52.2	$65,352	$16,338	8	$653,518	40%	$261,407		$31,630	$45,746	$184,031	
Arborist Inspector	52.2	$70,825	$17,706	8	$708,250	75%	$531,187		$64,274	$92,958	$373,956	
Support Assistant C	52.2	$50,042	$12,510	9	$562,967	50%	$281,484		$34,060	$49,260	$198,164	

Note: Top range of salary was used

Labour Cost			$1,315,680	$159,197	$230,244	$926,239	$1,156,483
Materials	$28,858	39.6%	$11,416	$1,381	$1,998	$8,037	$10,035
Purchase of Service	$27,733	39.6%	$10,971	$1,328	$1,920	$7,724	$9,644
Equipment	$1,115	39.6%	$441	$53	$77	$311	$388
IDC	$102,525	39.6%	$40,559	$4,908	$7,098	$28,554	$35,651
Bank Charges		100%	$32,426	$3,924	$5,675	$22,828	$28,502
2011 Total Costs			**$1,411,494**	**$170,791**	**$247,011**	**$993,692**	$1,240,703
Overhead @ 6%				$10,247	$14,821	$59,622	$74,442
Total Costs Plus OH				**$181,038**	**$261,832**	**$1,053,313**	**$1,315,145**
2011 Revenue			**$1,069,800**	**$129,000**	**$187,500**	**$753,300**	**$940,800**

Cost to Applicants	**$940,800**
Cost to Tax Base	**$374,345**
Total Cost	**$1,315,145**

Appendix 14: Annual Benefits per Tree (Source: Internal Toronto Parks, Forestry and Recreation Every Tree Counts I-Tree source data)

Tree Size Ranges - Diameter	Number of Trees	Percentage	Annual Pollution Mitigation	Annual Pollution Benefit per Tree	Annual Carbon Sequestration	Annual Carbon Sequestration Benefit per Tree	Annual Energy Savings	Annual Energy Savings Benefit per Tree	Total Annual Benefits per Tree
2.5-7.6	4,602,652	45.0%	$1,220,268	$0.27	$101,714	$0.02	$772,891	$0.17	$0.46
7.7-15.2	2,409,679	23.6%	$1,704,031	$0.71	$162,585	$0.07	$1,079,295	$0.45	$1.22
15.3-22.9	988,453	9.7%	$1,713,386	$1.73	$137,411	$0.14	$1,085,220	$1.10	$2.97
23.0-30.5	843,414	8.3%	$2,396,140	$2.84	$183,785	$0.22	$1,517,662	$1.80	$4.86
30.6-38.1	484,189	4.7%	$2,086,317	$4.31	$148,297	$0.31	$1,321,426	$2.73	$7.34
38.2-45.7	341,302	3.3%	$1,818,035	$5.33	$136,203	$0.40	$1,151,503	$3.37	$9.10
45.8-53.3	223,115	2.2%	$1,392,622	$6.24	$113,916	$0.51	$882,055	$3.95	$10.71
53.4-61.0	133,414	1.3%	$1,113,558	$8.35	$87,130	$0.65	$705,303	$5.29	$14.29
61.1-68.6	69,866	0.7%	$680,534	$9.74	$53,010	$0.76	$431,035	$6.17	$16.67
68.7-76.2	40,909	0.4%	$442,696	$10.82	$42,670	$1.04	$280,394	$6.85	$18.72
76.2+	83,064	0.8%	$1,526,445	$18.38	$133,281	$1.60	$966,816	$11.64	$31.62
Total	10,220,057	100.0%	$16,094,034		$1,300,000		$10,193,600		

Appendix15: Tree Age Assignment

Tree Size Ranges - Diameter	Tree Age Range Assignment
2.5-7.6	1 to 5
7.7-15.2	6 to 10
15.3-22.9	11 to 15
23.0-30.5	16 to 20
30.6-38.1	21 to 30
38.2-45.7	31 to 40
45.8-53.3	41 to 45
53.4-61.0	46 to 50
61.1-68.6	51 to 55
68.7-76.2	56 to 60
76.2+	61 to 65
Plus Plus	66 to 83

Appendix 16: Average Life Span Expectancy Calculations (Life Expectancy Years Data Source: Canadian Forestry Service)

Top 10 Toronto Trees from Every Tree Counts based upon frequency and size

Tree	% Tree Pop	% Leaf Area	IV[31]	% of Top Ten	Life Expectancy (Years)	Life Expectancy Prorated to IV
Norway Maple	6.5	14.9	21.4	18.7%	100	18.72
Sugar Maple	10.2	11.6	21.8	19.1%	75	14.30
Manitoba Maple	5.0	5.5	10.5	9.2%	50	4.59
Green Ash	3.6	5.0	8.6	7.5%	75	5.64
White Spruce	3.3	4.6	7.9	6.9%	75	5.18
Silver Maple	0.9	4.5	5.4	4.7%	100	4.72
American Elm	1.5	3.7	5.2	4.5%	30	1.36
Eastern White Cedar	18.6	2.8	21.4	18.7%	100	18.72
Austrian Pine	1.4	2.7	4.1	3.6%	75	2.69
White Ash	5.3	2.7	8.0	7.0%	100	7.00
Total	56.3	58.0	114.3	100.0%		
Average Life Span Expectancy						**82.95**

[31] IV= %Pop+%Leaf Area (Total =200 for all Toronto Trees)

Appendix 17: Stream of Benefits Extract

YEAR (Planted Trees)	Year 0 (4 Year Old Tree Planted and 46 Year Old Tree Protected)	Year 5 of Planted Tree Year 47 of Protected Tree Year 1 of NPV	6	7	8	9	10	11	12	13	14	15	16
Benefit - Trees Planted		$2,740	$7,361	$7,361	$7,361	$7,361	$7,361	$17,885	$17,885	$17,885	$17,885	$17,885	$29,253
Benefit - Trees Protected	**$11,479**	$11,479	$11,479	$11,479	$11,479	$13,394	$13,394	$13,394	$13,394	$13,394	$15,041	$15,041	$15,041
Total Benefits	$11,479	$14,220	$18,840	$18,840	$18,840	$20,755	$20,755	$31,278	$31,278	$31,278	$32,925	$32,925	$44,293
YEAR (Protected Trees)	**46**	47	48	**49**	50	51	**52**	53	54	**55**	56	57	**58**

Note: Stream of benefits reflect the increasing functional value of trees as they grow larger.

Both streams of benefits extend to year 83 – the life span used in this study.

Appendix 18 – Cost-Utility Sensitivity Analysis

Current Cost Level

Scenario	Scenario 1	Scenario 1B	Scenario 2	Scenario 3	Scenario 4	Scenario 4B
Compliance	80.0%	80.0%	85.0%	70.0%	50.0%	75.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Tree Protection	50.0%	100.0%	50.0%	50.0%	50.0%	50.0%
Trees Planted	804	1,607	854	703	502	753
Trees Protected	2,807	2,807	2,982	2,456	1,754	2,632
Total Trees	3,611	4,414	3,836	3,159	2,257	3,385
Current Cost	$1,315,145	$1,315,145	$1,315,145	$1,315,145	$1,315,145	
Cost Minus 10%	$1,183,631	$1,183,631	$1,183,631	$1,183,631	$1,183,631	
Cost Plus 2 Inspectors						**$1,510,780**
Cost per Tree (Current)	**$364**	**$298**	**$343**	**$416**	**$583**	**$446**

Cost Reduction Leading to Less Protection

Scenario	Scenario 1	Scenario 1B	Scenario 2	Scenario 3	Scenario 4
Compliance	63.0%	63.0%	68.0%	53.0%	33.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%	80.0%
Tree Protection	50.0%	100.0%	50.0%	50.0%	50.0%
Trees Planted	633	1,266	683	532	331
Trees Protected	2,211	2,211	2,386	1860	1,158
Total Trees	2,843	3,476	3,069	2,392	1,489
Current Cost	$1,315,145	$1,315,145	$1,315,145	$1,315,145	$1,315,145
Cost Minus 10%	$1,183,631	$1,183,631	$1,183,631	$1,183,631	$1,183,631

A. Cost per Tree (Current Cost)	**$364**	**$298**	**$343**	**$416**	**$583**
B. Cost (Minus 10%) per Tree (assuming corresponding productivity loss)	**$416**	**$341**	**$386**	**$636**	**$795**

Appendix 19 – Cost-Benefit Sensitivity Analysis

Scenario 1

Compliance	80.0%	80.0%	80.0%	80.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%
Tree Protection	50.0%	50.0%	50.0%	50.0%
Discount Rate	2.3%	3.0%	4.2%	8.0%
Net Present Value	$1,729,289	$970,806	$165,331	-$763,921

Scenario 1B

Compliance	80.0%	80.0%	80.0%	80.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%
Tree Protection	100.0%	100.0%	100.0%	100.0%
Discount Rate	2.3%	3.0%	4.2%	8.0%
Net Present VaLue	$2,275,925	$1,446,807	$545,976	-$555,118

Scenerio 2

Compliance	85.0%	85.0%	85.0%	85.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%
Tree Protection	50.0%	50.0%	50.0%	50.0%
Discount Rate	2.3%	3.0%	4.2%	8.0%
Net Present Value	$1,919,566	$1,113,678	$257,861	-$729,470

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Appendix 19 cont.

Scenario 3

Compliance	70.0%	70.0%	70.0%	70.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%
Tree Protection	50.0%	50.0%	50.0%	50.0%
Discount Rate	2.3%	3.0%	4.2%	8.0%
Net Present Value	$1,348,735	$685,062	-$19,728	-$832,824

Scenario 4

Compliance	50.0%	50.0%	50.0%	50.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%
Tree Protection	50.0%	50.0%	50.0%	50.0%
Discount Rate	2.3%	3.0%	4.2%	8.0%
Net Present Value	$587,626	$113,574	-$389,847	-$970,630

Scenario 4B (Add 2 Inspectors thus increasing Compliance)

Compliance	75.0%	75.0%	75.0%	75.0%
Tree Survival	80.0%	80.0%	80.0%	80.0%
Tree Protection	50.0%	50.0%	50.0%	50.0%
Discount Rate	2.3%	3.0%	4.2%	8.0%
Net Present Value	$1,343,377	$632,299	-$122,834	-$994,008

Difference NPV 4B and 4	$755,751	$518,725	$267,014	$23,378

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Appendix 19 – cont.

SUMMARY

Discount Rate	**2.3%**	**3.0%**	**4.2%**	**8.0%**
Scenario 1	$1,729,289	$970,806	$165,331	-$763,921
Scenario 1B	$2,275,925	$1,446,807	$545,976	-$555,118
Scenario 2	$1,919,566	$1,113,678	$257,861	-$729,470
Scenario 3	$1,348,735	$685,062	-$19,728	-$832,824
Scenario 4	$587,626	$113,574	-$389,847	-$970,630
Scenario 4B	$1,343,377	$632,299	-$122,834	-$994,008