RESEARCH REPORT

Nature's Revenue Streams: Five Ecological Value Case Studies

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Nature's Revenue Streams

Five Ecological Value Case Studies

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Executive Summary

The valuation of ecosystem services has been the subject of considerable study by high profile agencies such as the United Nations (Millennium Ecosystem Assessment) and the World Business Council. These agencies have stressed the need to monetize ecosystem services in order that ecosystems be recognized, and thus protected, by business and management decision-making processes. So-called "green infrastructure" is a key component of urban ecosystems, and building infrastructure to mimic nature's processes in one method of replacing lost ecosystem services within the urban environment. While the ecological value of green infrastructure is readily apparent in the form of green trees, healthy streams and abundant wildlife, its economic significance is less obvious. This study examines five projects that have applied nature's principles in the design of stormwater management facilities and compared their overall value to that of the traditional "pipe and drain" approaches. Focussed largely on stormwater, but with broader attributes, the question raised was whether the projects have tangible economic value, savings or other benefits either to the developer, the occupant, the community, or the municipality.

Figure 1: Leeds Creek (May 2008)

The five case studies examined are all located within the Colquitz River watershed in Saanich, British Columbia. They are: 1) the relocation and restoration of Blenkinsop Creek on the Galey Farm 2) Swan Creek restoration and wetland construction within the Willowbrook Subdivision 3) stream restoration within the South Valley Subdivision 4) Wetland construction adjacent the Rogers Farm Subdivision and 5) permeable paving and swale/wetland construction at the Vancouver Island Technology Park. Aqua-Tex Scientific Consulting Ltd. and their associates completed these projects within the space of a few years between 2000 and 2002. These projects included farmland, residential and institutional development projects that implemented innovative stormwater management practices, and creek and wetland restoration initiatives, as incremental parts of the watershed's gradual restoration.

Many ecological benefits had been noted for each of the projects; however there had been little quantification of the full financial benefit. Following review, the claimed benefits were confirmed in almost every instance by interviewing participants, but in the case of South Valley the information was difficult to substantiate and quantify as it was mostly unobtainable or insufficient to provide adequate

estimates. As a result, the South Valley case study does not have a value discussion, but remains in this study as it highlights many barriers with respect to the application of green infrastructure.

Overall, the primary conclusions were:

- There are capital cost savings or avoidance in almost all instances (*i.e.,* an ecological approach is less expensive in terms of initial capital cost, or can avoid larger capital costs that would typically accrue in a traditional approach to stormwater management);
- There is an expected operation and maintenance (O&M) savings that will accrue to the municipality due to the nature of the ecological infrastructure (upon comparison to O&M costs of traditional infrastructure). Continued monitoring in the future will confirm whether O&M costs will remain low in the long term, as the case studies are all relatively recent;
- There is increased value to a developer when applying an ecological approach to a development. However, this is largely received through increased lot yields (*i.e.,* density bonusing), faster development application approvals, faster lot or building sales or rentals, and other related benefits.
- Although many studies have shown that there is an increased market value (rent or sale price) in relation to the distance to green space (or greenways), we found this almost impossible to quantify with any certainty. Lack of sufficient quality data and other external impacts (distance to highway / arterial roads) made identifying any value differential inconclusive; the benefit may exist, but we could neither prove nor disprove it.
- The ecological solutions have operational cost savings, but we identified an instance where the initiatives had not worked (due to poor maintenance) and as a result will increase management costs. This solution may be replaced with a more traditional solution;
- Municipalities can secure savings and extra value from the implementation of ecological solutions; and
- To ensure the success of the ecological solutions reviewed, ongoing management and training of operations staff is desirable or costs may rise.

Economic value and cost-benefit is usually assessed for a single party and it is the developer's profit that usually triggers development. Developers see profit from their perspective, but other values can also arise from projects of this nature. Communities and councillors have different value perspectives, as might neighbours, planners and so on. This may not always be well addressed in the typical assessment of market value, but the overall "Public Interest Value" can be substantial. Multiple people obtain value from projects of this nature and this is not always understood or appraised. In short, multiple stakeholders benefit from projects of this nature. Lastly we note that there will be benefits in reviewing the way that projects of this nature are approved and tracked if the value is to be proven.

Sommaire

L’évaluation des écoservices a fait l’objet de vastes études par divers organismes d’importance, dont l’Organisation des Nations Unies (Évaluation des écosystèmes pour le millénaire) et le World Business Council. Ces organismes ont fait valoir la nécessité de chiffrer la valeur des écoservices pour que les processus décisionnels des entreprises et des gestionnaires reconnaissent les écosystèmes et en assurent la protection. Ce qu’on appelle « l'infrastructure verte » est un élément essentiel des écosystèmes urbains et l’imitation des processus de la nature est l’une des stratégies permettant de remplacer la perte des écoservices dans un environnement urbain. La valeur écologique de l’infrastructure verte est facilement apparente et se manifeste par la verdure des arbres, la santé des cours d’eau et l’abondance de la faune. Toutefois, son importance économique est moins évidente. La présente étude porte sur cinq projets d’aménagement qui ont appliqué des principes de la nature à la conception d’installations de gestion des eaux de ruissellement et en ont comparé la valeur globale à celle d’aménagements classiques reposant sur des réseaux d'égouts et de drainage. L'étude est principalement axée sur les eaux de ruissellement, mais elle élargit son champ d'action et on se demande si les initiatives ont une valeur économique tangible et si elles procurent des économies ou d’autres avantages au promoteur, à l’occupant, à la collectivité ou à la municipalité.

Les cinq aménagements examinés sont tous situés dans le bassin hydrologique de la rivière Colquitz à Saanich, en Colombie-Britannique. Ils comportent : 1) le déplacement et la restauration du ruisseau Blenkinsop sur la ferme Galey; 2) la restauration du ruisseau Swan et l’aménagement de milieux humides au sein de la subdivision de Willowbrook; 3) la restauration de cours d’eau dans la subdivision de South Valley; 4) l’aménagement d’habitats humides adjacents à la subdivision de la ferme Rogers; 5) l’installation de pavage perméable et l’aménagement de baissières ou de milieux humides au Vancouver Island Technology Park. La société Aqua-Tex Scientific Consulting Ltd. et ses collaborateurs ont achevé ces aménagements en quelques années, entre 2000 et 2002. Ils ont aménagé des terres agricoles et réalisé des aménagements d’ensembles résidentiels et institutionnels en y intégrant des pratiques novatrices de gestion des eaux de ruissellement et des programmes de restauration de ruisseaux et de milieux humides. Les travaux ont été entrepris dans le cadre de la restauration graduelle du bassin hydrologique.

Bien que l’on ait relevé de nombreux avantages écologiques pour chacune des initiatives, on a peu quantifié leur plein avantage financier. Les entrevues réalisées auprès de participants ont confirmé que les avantages prétendus étaient bien réels dans la plupart des cas. Toutefois, il a été difficile de valider et de quantifier les avantages de l’aménagement de la South Valley, car il a été impossible d’obtenir les renseignements nécessaires ou suffisants pour y parvenir. L’analyse de cet aménagement ne traite donc pas de la valeur, mais comme elle met en relief nombre d’obstacles relatifs à l'application des principes de l'infrastructure verte, elle demeure dans la présente étude.

D’une manière générale, les principales conclusions sont les suivantes :

- Presque tous les aménagements ont permis de réaliser des économies ou d’éviter des coûts au plan des immobilisations (*c.-à-d.*, l’adoption d’une approche écologique réduit les coûts d’immobilisations initiaux ou évite des coûts d’immobilisations plus

importants qu'il aurait fallu assumer dans une approche traditionnelle de gestion des eaux de ruissellement).

- On s'attend à ce que la municipalité réalise des économies au chapitre des frais d'exploitation et d'entretien, vu la nature de l'infrastructure écologique (par rapport aux frais d'exploitation et d'entretien d'une infrastructure conventionnelle). Il faudra toutefois vérifier si ces frais demeurent peu élevés à long terme, car les études actuelles sont relativement récentes.

- Le promoteur qui adopte une approche écologique voit augmenter la valeur de ses travaux d'aménagement. Cette augmentation découle principalement d'un plus grand rendement du terrain (*c.-à-d.,* prime de densité); de la réduction des délais d'approbation des demandes d'aménagement; de la location ou de la vente plus rapide des terrains ou des bâtiments; et d'autres avantages connexes.

- De nombreuses études ont démontré que la proximité d'espaces verts (ou de corridors verts) augmentait la valeur sur le marché (prix de location ou de vente), mais nous avons réalisé qu'il était quasi impossible de quantifier cette augmentation avec certitude. Le manque de données fiables et d'autres facteurs externes (distance des autoroutes ou des artères principales) n'ont pas permis de déterminer des écarts de valeur de manière concluante; l'avantage est peut-être réel, mais nous n'avons pu le prouver ni le réfuter.

- Les solutions écologiques réduisent les coûts d'exploitation, mais dans l'un des cas étudiés, nous avons remarqué que les initiatives n'ont pas donné les résultats escomptés (à cause d'un manque d'entretien) et qu'en conséquence, les coûts de gestion augmenteront. La solution écologique sera peut-être remplacée par une solution plus traditionnelle.

- La mise en œuvre de solutions écologiques permet aux municipalités de réaliser des économies et d'obtenir une augmentation de la valeur.

- Pour assurer la réussite des solutions écologiques examinées dans la présente étude, il sera souhaitable d'effectuer un suivi constant et d'offrir une formation adéquate au personnel responsable de l'exploitation. À défaut de ce faire, il est possible que les coûts augmentent au fil du temps.

La valeur économique et la rentabilité d'un aménagement sont généralement évaluées pour le compte d'une seule partie et c'est le profit du promoteur qui donne généralement l'impulsion aux travaux. Les promoteurs ont une vision du profit qui leur est propre, mais des aménagements de cette nature peuvent aussi générer d'autres types de valeurs. Les collectivités et les conseillers municipaux ont différentes façons de considérer la valeur, tout comme les voisins, les urbanistes et les autres intervenants. L'évaluation typique de la valeur sur le marché ne tient pas toujours compte des différents points de vue, mais la « valeur de l'intérêt public » peut être substantielle. Nombre de personnes retirent de la valeur d'aménagements écologiques. On ne le comprend et on ne l'évalue pas toujours bien, mais de multiples intervenants profitent d'initiatives de cette nature. Enfin, nous avons souligné qu'il sera avantageux de revoir les modes d'approbation et les mesures de suivi d'initiatives de cette nature pour en montrer la valeur.

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Introduction

This project is part of a larger study to "…*assess, monitor, and quantify results from previous alternative stormwater projects and utilize these results to design and test a set of management tools that will assist in promoting ecologically engineered alternative stormwater management and smart urban development*" (Barraclough & Lucey, 2005).

The Federation of Canadian Municipalities, the District of Saanich and the Canada Mortgage & Housing Corporation have sponsored this study, with
Aqua-Tex Scientific Consulting Ltd. acting as the prime consultant and project manager.

Using five case studies, the following report sought to compare the costs associated with traditional stormwater infrastructure solutions to the costs of ecologically engineered alternative stormwater management. Furthermore, this study sought to identify and quantify additional use and non-use benefits that can be derived when ecological infrastructure is applied to manage stormwater. The five case studies examined were:

- The Blenkinsop Creek Restoration;
- The Willowbrook and Glanford Station Developments;
- The South Valley Estates Development;
- The Rogers Subdivision Development, and;
- The Vancouver Island Technology Park (VITP) Development.

In analysing the projects, we have primarily attempted to reconcile their attributes using value equivalents, but have also applied a "Triple Bottom Line" methodology *(i.e.,* assessing the costs and benefits with reference to ecological, social and financial criteria). Triple Bottom Line (TBL) is a widely referenced concept[i] in which attributes are evaluated under the three headings or "accounts" (*i.e.,* economic, social equity, ecology). At the outset of this study, we attempted to stay as closely as possible to valuation standards and guidelines developed by the International Valuation Standards Committee.[ii] However, given the lack of data that met these criteria, supplementary information from published literature and proxy data were required in order to try and fully capture as many of the benefits as possible. Commentary is given on how valuation standards may be augmented to adapt to evaluating sustainable principles. A data collection checklist is also provided to enable future projects of a similar nature to better track and assess their full value.

Scope & Methodology

Scope

This report is to provide an analysis of the value (costs and benefits) of alternative solutions to traditional stormwater management practices within urban environments. The contract specified:

"An economic review and cost benefit analysis of five alternative systems vs. conventional techniques will be documented in case study fashion. These case studies will examine their marketability and profitability in comparison to standard practices by the housing industry. Elements to be considered in the analysis will include: construction cost, operation and maintenance cost, market value and municipal infrastructure cost, ecological benefit, and social benefit (i.e., use a Triple Bottom Line method). Where possible the case studies will note regulatory barriers, incentives, and potential liability issues" (Barraclough & Lucey, 2005).

The five case studies were chosen in conjunction with Aqua-Tex Scientific Consulting to assess the overall benefit of ecologically engineered alternative stormwater management to traditional stormwater design and treatment (piped infrastructure). All the projects were located within the Colquitz watershed in the District of Saanich, BC.

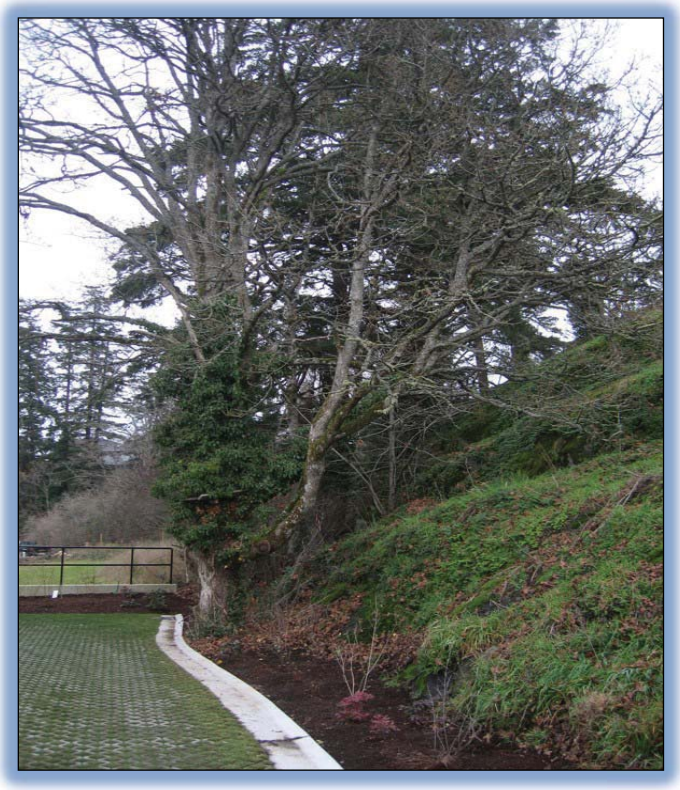
Figure 2: Galeys' Farm Creek Restoration

It was intended that the report assess the differences from each beneficiary's perspective (*i.e.,* taking into account the different benefits for a planner, politician, developer, lender, and so on). We have thus, following discussion with others involved in the case studies, tried to assess and summarize the key benefits and detriments affecting their role in the urban development process. These are summarised both within the each of the case studies and salient aspects are summarised in the conclusions.

Our analysis was not restricted to the information provided to us, nor solely to the participants in each of the case studies. We researched at a preliminary level, literature and best practices that might affect or inform this report, and have provided commentary and reference to these other documents. The scope included providing comments on our findings and we have thus provided observations and recommendations. These include municipal barriers, political, legal and practical impacts affecting a more natural approach to stormwater treatment while concentrating on the relationship of ecological solutions to value (*i.e.,* how financial and non-financial value and efficiency might be improved).

The scope included comparing traditional methods of construction with those chosen for each of the case studies. For example, we attempted to evaluate the use of stormwater drainage as a comparison for creek restoration. It exceeds the project's scope and budget to have detailed designs drawn up and costed for each project; however we approached engineering experts and sought their advice on the likely components for traditional alternatives, using estimates drawn from comparable examples. We then cross-tested opinions against other experts' opinions in an attempt to validate any single individual's opinion, and sought input from non-expert participants[iii].

Figure 3: Grasscrete permeable paving at South Valley



The scope, and thus our analysis, had reference to not only identify the original capital costs of each project, but the maintenance and operational costs as well. This is because the long-term operations, management, finance, and risk associated with each project is normally part of the business case for approving a major capital project. In normal construction, the long-term operations of a building can substantially exceed the original capital costs of construction. Thus, attention to the long-term aspects of a project is just as important as the original construction.

Review/audit difficulty is a challenge when evaluating and reviewing projects that break new ground. When each project was started, the full extent of its benefits was unknown, and each was undertaken for ecological reasons, not solely for financial ones. Therefore, a proper business case was not constructed at the outset of each project and the parameters that needed to be tracked for future review of the benefits were unknown. As a result, neither the financial nor other outcomes were sufficiently tracked or detailed enough to conduct a conclusive review and valuation according to international valuation standards.[iv] To the extent possible, key information was crosschecked, reconciled and the data validated, but this does not provide assurance that all the data are accurate or as reliable as we would prefer. As a result, we were satisfied that, although proper business cases had not been used, each project represented an appropriate investment of taxpayer, private and non-profit investment.

Methodology

The scope of the project encouraged the application of a Triple Bottom Line methodology. Triple Bottom Line is a concept originally put forward by John Elkington in his book "Cannibals with Forks" in which the business case for an activity comprises more than purely an economic exercise and should in-fact measure social, and environmental and economic impacts of an activity as well. As such, the triple bottom line (TBL) methodology is a flexible tool that can be used for corporate *planning* and reporting to help further the goals of corporate social responsibility and sustainable development. Defined by Elkington, the triple bottom line construct "at its narrowest … is used as a framework for measuring and reporting corporate performance against economic, social and environmental parameters. At its broadest, the term is used to capture the whole set of values, issues and processes that companies must address in order to minimize any harm resulting from their activities and to create economic, social and environmental value" (Elkington, 1998).

Figure 4: Ducks in Blenkinsop Creek (Post Project)

The TBL concept is essentially a clever term "for highlighting the non-market and non-financial areas of performance and responsibility: environmental, social and economic," but its application can be difficult:

"A triple bottom line is not a quest for a new bottom-line metric but rather an approach to management and performance assessment that stresses the importance and interdependence of economic, environmental and social performance. However, the relevant dimensions of corporate performance are not always neatly divided into these three categories, with some companies already talking about a fourth pillar in corporate governance and ethics. Triple bottom line is therefore best seen as a metaphor that encapsulates the task of managing, measuring and publicly reporting multi-dimensional corporate performance" (Suggett & Goodsir, 2002, pg 12).

Since Elkington's original hypothesis, there has been an increasing realization that there are more than three bottom lines, including the political and cultural bottom lines, therefore enabling one to measure or cope with local aboriginal cultures, or in Canada, First Nation historical interests. While this was included in the review, preliminary discussions and initial review of texts relating to the sites suggested there was limited cultural history to be considered, albeit Galeys' Farm was adjacent to a former rail alignment that had been preserved and had cultural value.

Methods

The methods used in this study require explanation as they provide insight into how the analysis was undertaken and the limitations of the conclusions.
In attempting to analyse the differences in value and cost/benefit of natural solutions we have used direct monetary methods or proxies to assess value.

The two main direct monetary valuation methods applied were: the direct comparison or investment methods, and the cost method:

- The direct comparison method looks at examples of similar projects or aspects, where the values are known, to conclude a value. For example, if one house on a street sells for $x, then a similar house next door that's comparable, is probably worth a similar amount of money;
- The cost method uses costs to conclude the value of something. For example if it costs $x to build a creek, then the theory is that the total cost is what the project is "worth" to the owner (*i.e.,* the cost of the project, which they would not have undertaken if the cost was too high).

Figure 5: Recycled Curbing at VITP

In practice, the methods used in evaluating the five projects had to be adapted to use proxies for estimates of costs, revenues, and social benefits because many of the case studies were found to lack sufficient information recorded in a usable/accessible way, therefore limiting our capacity to identify the actual project expenses and revenues.

For example, in the Blenkinsop Creek Restoration, much of the benefits of the project could not be tracked by comparing yearly crop yields pre- and post-project, because of the nature of crop rotation and plantation schedules, method of land management, and the change in global/local produce markets. Furthermore, as some benefits were related to the project itself, other external and unrelated factors affected the farm viability. By comparison, more direct methods could be applied to assess how much time was saved in an average year (*i.e.,* multiply by the hourly gross wages and translate this to a financial benefit based on cost).

As such, the benefits derived from each project were evaluated and the components assessed. The benefits were discussed in non-financial terms and we then assessed values or value equivalents to each aspect, where possible. We then developed (or considered) a business case discussing how each project might have been undertaken if they had not been done with sustainable methods (*i.e.,* comparing what was done

with more traditional methods, for example using storm sewers instead of swales). This was assessed with input from current and former Saanich staff, consultants, and Aqua-Tex staff. We then undertook a comparison cost/revenue analysis for each aspect of the costs and benefits for the "traditional" method of development. Differences between the "ecological" approach and "traditional" approach were then compared and stabilised to the extent possible. Values that could not accurately be identified were estimated using proxies identified in the valuation literature. To ensure that our approach is as conservative as possible, we have split our value analysis into three different tables (traditional, sustainable, and estimated additional benefits) for each project. The traditional and sustainable tables strictly compare the hard costs and benefits between "traditional" and "sustainable" projects that could be tangibly proved with hard data; the third table, "estimated additional benefits" includes the estimated values of benefits that we derived from the literature in order to provide a more holistic analysis. The present value analysis for each heading is separate and discrete for clarity. The present values from the three tables are combined and are totalled as a net benefit.

Once the projects had been identified and chosen with Aqua-Tex, we jointly inspected them discussing what the extent of the potential business case for each project might be, the complexity involved, and probability of producing a good analysis. One project was rejected and replaced as a result. We then completed on-site videotaped discussions with Aqua-Tex explaining the project. The tapes were reviewed and distilled to create the overall project summaries and areas for further research were noted. The next step was to internally discuss the approach to a business case for each component of each project. The immediate difficulties identified were the lack of sufficient or reliable data, differences of approach or opinion, and the lack of available of evidence. Furthermore, we found there was some uncertainty over costs, with interviewees' memories proving inconsistent. This led to a review of data in an attempt to validate the information provided by various sources. We have used our best estimate from the information available and where the data appears unreliable have we noted our reservations.

Figure 6. Willowbrook Subdivision with wetlands in the foreground and Swan Creek on the right.

Location Plans

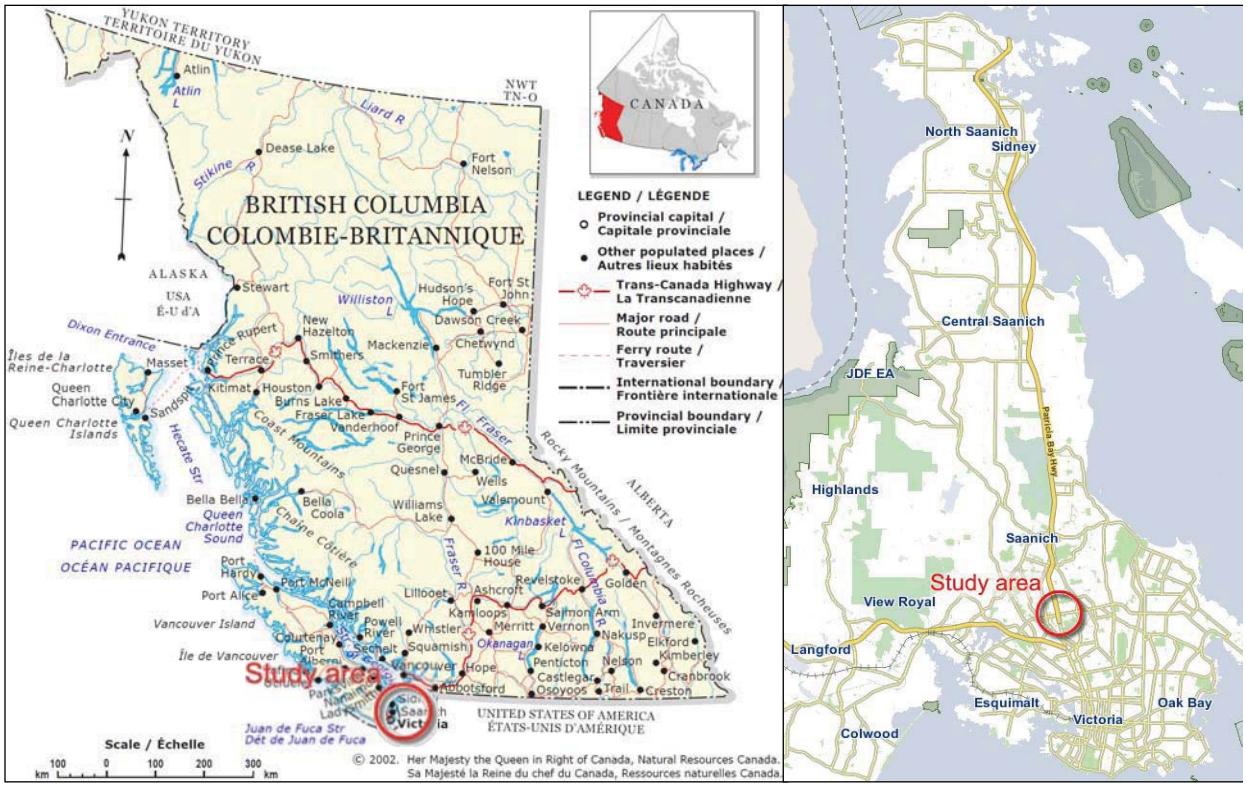


Figure 7: Locations of the Projects Examined in the Study

1: Blenkinsop Creek Restoration 2: Willowbrook Subdivision 3: South Valley Subdivision
4: Rogers Subdivision 5: Vancouver Island Technology Park (VITP)

Blenkinsop Creek Restoration

Project Description

Figure 8: The original drainage ditch on the Galey Farm prior to relocation and restoration.

This project was undertaken on Galeys' Farm located in the Blenkinsop Valley, Saanich BC (location 1 in Figure 7). The site is situated between a former railway and Blenkinsop Road, with a local minor road servicing the Valley. Land in the Valley largely consists of urban agriculture, with most of the agricultural lands located within the Valley being classified as Agricultural Land Reserve (ALR)[v]. The site is downstream from Blenkinsop Lake (to the north), the headwaters of Blenkinsop Creek, and within the Colquitz watershed, which discharges southwards into Swan Lake downstream from Galeys' Farm. In summary, the project comprised of the removal of a drainage ditch (Blenkinsop Creek) and realignment of the ditch to the west side of the property where it was rehabilitated to an ecologically functioning creek. The main objective of the project was to restore ecological function to a 650 m length of the creek, and to demonstrate the application of Proper Functioning Condition (PFC) assessment[vi] method as design criteria.

Prior to the commencement of the project, a long-established drainage ditch divided Galeys' field. The ditch ran approximately north-south, in parallel to the original path of the creek, which had long been degraded by farming practices (Figure 8). The field's division into two parts meant each parcel, in effect, had to be farmed individually. The size and shape of the fields prior to the project reduced the operational efficiency of the farm due to the large turning radius required for farm vehicles which was greater than the width of portions of the fields when divided by the ditch.

Upon the commencement of nearby development (West of the field) and the installation of the Galloping Goose Trail (the adjacent rail alignment was turned into part of the walking/riding trail system), vandalism to both farm property and crops increased. Since there was no direct trail or access to Blenkinsop Road from the Galloping Goose, large numbers of cyclists, hikers, and passers-by would wander onto the farm roadways and fields in order to access Blenkinsop Road, failing to give way to farm machinery and vehicles. In the process, both crops and farm equipment were regularly damaged, at an estimated cost of $100,000 a year[vii].

In the late 1960's, a dam had been erected downstream of the Galey Farm at the request of local farmers to help retain water for summer irrigation and manage winter flood volumes, thus reducing periodic flooding risk to the homes and infrastructure downstream. As a result of changing weather patterns, the frequency and duration of flooding of farmers' fields in the Blenkinsop Valley has increased in recent

decades. With continued climate change, increased severity and frequency of storm events is expected to further impair the efficiency of the farm. The result of these aspects and increasing interest in this watershed, combined with farming difficulties, prompted the suggestion of a creek restoration project in the late 1990's. By realigning the ditch and re-forming the creek in a more efficient location, it was felt that farming efficiency would be improved and other watershed benefits could be obtained.

At this time, farming in the region had become gradually less viable, owing to competition from overseas markets and aspects such as farm and field size. With many farmers ageing and seeking retirement, pressure to improve farm efficiency had also resulted in the Galeys seeking to diversify into agritourism. Success with small ventures such as corn mazes and similar attractions suggested that the creek restoration could create additional interest. Through the Municipal Freshwater Planning Process and funding and partnership opportunities, the Galey Bros. Farm location was identified as a potential restoration module within the SwanCreek/Blenkinsop Creek subwatershed. Aqua-Tex developed the project concept and organized funding partnerships (Malmkvist, 2002). Planning was completed and the project was undertaken and completed in 2002.

Figure 9: Galeys' field prior to realignment of the creek

(Aqua-Tex photo)

Site Plan

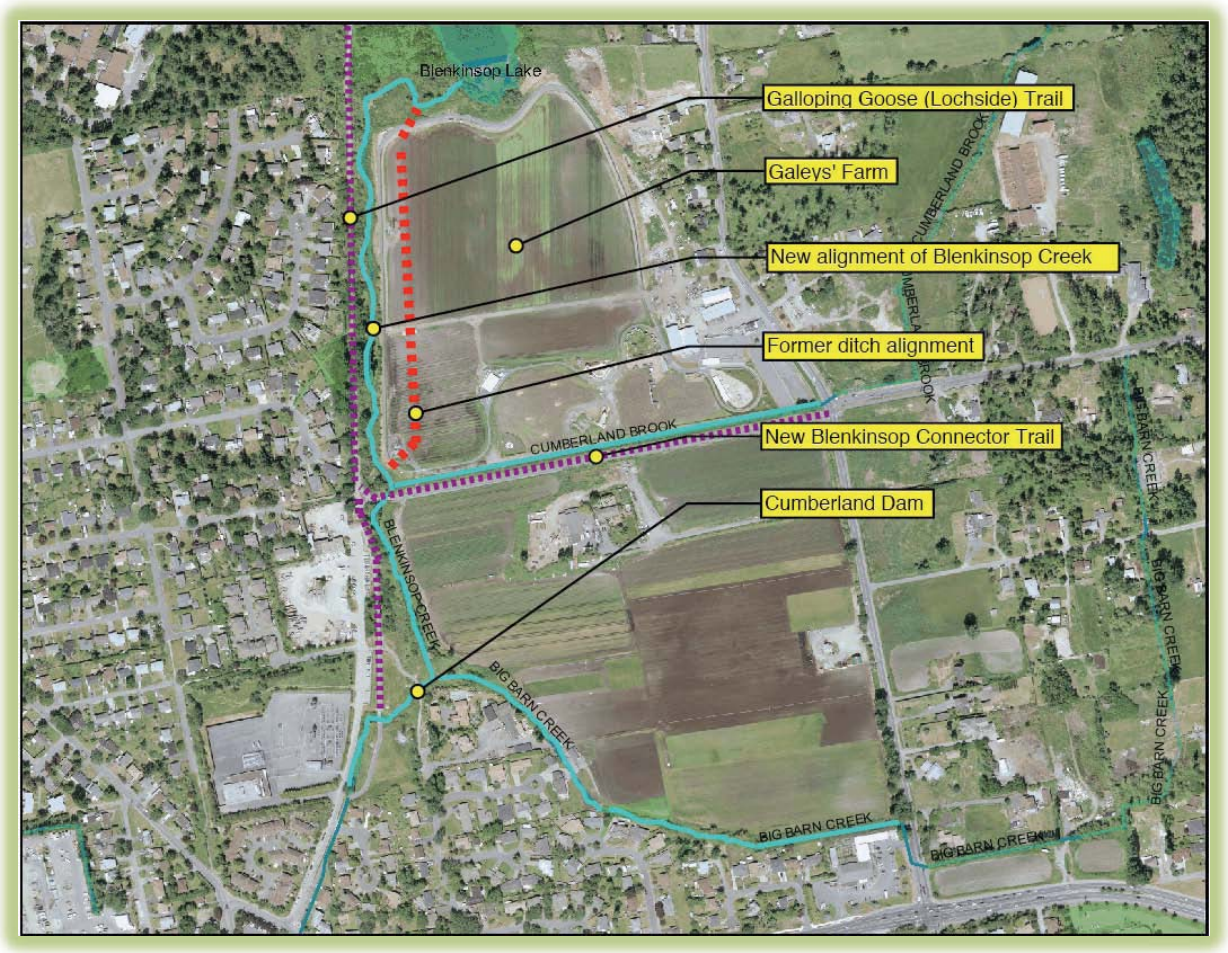


Figure 10: Galeys' Farm Site Plan

Analysis

Project Cost

Discussion and review of the project with Aqua-Tex confirmed the project cost had been audited by a qualified accounting practice. A copy of the audit report for the creek restoration project was obtained from the Swan Lake Christmas Hill Nature Sanctuary, the non-profit society that provided administrative services for the project. We reviewed the report with them and while there is a question whether all the contributed time and effort was included, the audited statement appears to be the best possible indicator of the project's cost.

The audited statement indicated a slightly lower project cost than was assessed by Aqua-Tex and we determined the difference was likely due to costs and contributions not claimed or accounted for in the accounting audit. The Aqua-Tex assessment of project cost is taken at face value at $375,000, which provides the metric against which the individual project benefits can be judged. Although it was a related benefit of the creek restoration (it was an agreement between Saanich and the Galeys post-project), it should be noted that this value does not include the costs of the trail that was installed along the road easement. The trail cost was approximately $500,000.

We attempted to assess a comparable project cost of a similar-sized ditch (prior to restoration), given that we had data on the cost of the creek. We met with an engineer and Chartered Quantity Surveyor, and also discussed this with the farmer. Each had a different view of the probable project cost:

Figure 11. Blenkinsop Creek Facing North (May 2008)

- The engineer suggested a rather large value of $10,000 for what we believe to be a fully loaded cost of an equivalent government contract for the construction and installation of a traditional pipe stormwater system. We believe this results in a project cost that is too high, since it reflects a traditional engineered solution to a problem previously solved by a simple ditch;
- The Chartered Quantity Surveyor (CQS) suggested an intermediate cost estimate could be applied, more in line with that of constructing a ditch, but indicated the cost would likely be nominal if the work could be done simultaneously with other work on the farm;
- The farmer did not consider whether or not there would be a cost because the machinery was already owned and creation and maintenance of a ditch is a simple task, one that is required and therefore not measured economically by the farmer (*i.e.,* a cost of doing business).

The views of the CQS and farmer closely coincide suggesting that the cost would be low or nominal, probably in the order of $2,600-$5,200 if the cost of machinery and time was properly estimated.[viii] This is considerably less than either the cost of an engineered solution or the restoration program that took place. However this solely assesses the project *cost* and not the projects *value*. Overall, we concluded that a traditional approach to install ditches might cost approximately $5,200 and the ecological restoration of the creek in the order of $375,000. On first examination, the extra expenditure is not warranted, however a more holistic evaluation of this difference shows that the extra cost is worthwhile.

Operations and Maintenance

Field Efficiency

The existing ditch separated the field into two parts, requiring the farmer to farm each as a distinct and separate field. This impacted efficiency due to the reduced turning radius of farm vehicles. Moving the drainage channel and converting it into a stream merged the different land areas into a single contiguous parcel able to be farmed more efficiently, thus reducing the amount of farmland lost through stream (ditch) setbacks and access roads. Aqua-Tex calculated the improvement in land area from the realignment to be approximately 7% more arable land, reported as yielding an additional net 1.5 acres (*i.e.,* as part of fields totalling approximately 21.4 acres).

Figure 12: Miniature Railway-Agritourism Feature of the Galey Farm

A review of farm land selling at the date of this report suggests that land of comparable size and nature may sell in the range of $50,000 per acre, since farmland in Blenkinsop Valley is considered desirable and sells well above the realistic economic value of the land in farm use. This suggests the improved value of the land is in the order of $75,000. In other words, in order to purchase an additional 1.5 acres of farmland equivalent to the arable land they gained, the Galeys would have to pay about $75,000. In essence, this reflects more speculative influences and lower expectations of revenue/investment return than appear to be justified by farm economics alone. However, since land prices in the Blenkinsop Valley are driven by factors other than suitability of a parcel for farming, the increase in potential productivity of the Galeys farm would have little bearing on its resale price.

Even for the Galeys, the $75,000 gain is less than the cost of the project and thus, based on this indicator alone, a traditional land appraisal analysis would reject the creek realignment project as unviable. Thus, the improved net area of land capable of being farmed is the only impact on land value we could identify.

Irrigation system

Prior to the project, the farmer had to move the irrigation system between different parts of the field and/or have duplicate systems operating. This meant moving the machinery and/or manual watering, which increased time and cost and reduced efficiency. In addition, irrigation water was being taken from the main regional drinking water supply, indirectly adding to the upstream costs incurred by the Capital Regional District. After the project, Mr. Galey realised the creek was capable of supplying water, since it remained filled even during the summer months when it had previously gone dry, and he held an existing water license on the creek. Since a sub-surface drainage system had already been extended as part of the creek restoration, it was possible to reverse the flow of the drainage pump and instead of pumping water from the field into the creek; the pump was reversed to pump from the creek into the fields and still maintain an adequate flow in the stream.

The amount of water that is used in this way is limited, because the farmer does not wish to excessively drain the creek and in consequence, negatively impact the upstream lake or downstream creek, thereby attracting criticism. The main advantage is that with a single irrigation system, the farmer is able to improve the amount of automatic irrigation and reduce the amount of manual intervention, thus improving efficiency (both of irrigation and farm labour).

It is interesting to note that had the existing surface irrigation system been used for creek water, it would not have complied with health standards, which prevent creek water from being sprayed on produce that is to be used directly for human consumption, due to the possibility of contaminants settling on the edible parts of the vegetables. However the same creek water that could not have been dispensed through the spray irrigation system can be safely irrigated using sub-surface distribution, with no other treatment. Unfortunately, the farmer (pre- or post-project) did not measure the impact on potable water usage, but the Galeys estimated the reduction at 7%. In order to estimate the value of potable water saved, we used provincial agriculture and irrigation statistics to determine a per hectare water usage of 6,614m^3/ha/year. Using current Capital Regional District water rates and the estimated reduction of 7% of potable water usage, we estimate that the net present value of the potable water reduction is $8,548.[ix] Furthermore, we anticipated an increase in crop yield from the increase in farmable land, but unfortunately, other factors such as differences in climate and crop rotation schedules meant that isolating the increased crop yield benefit was not possible.

Theft & Vandalism

Interviews with the Galeys indicated that vandalism was higher prior to the completion of the project. Vandalism costs included:

- Theft of farm tools and implements. The cost of this varied but the labour cost included lost harvest time, and time staff had to go off site, purchase a replacement and return; the cost of time likely exceeding the cost of the tool;
- The theft of saleable crops. Largely experienced at night, areas of the farm located adjacent to areas of public access remote from farm security, experienced theft from saleable or consumable crops, reducing crop yield;
- Crop damage from people crossing the field from the adjacent housing development, as they attempted to reach Blenkinsop Road where transit access and further recreation exists. A favourite pastime of local teenagers was smashing pumpkins in the field, just prior to harvest;

Vandals and trespassers usually crossed onto the Galey farm from Galloping Goose Trail and then crossed the valley on Galeys' internal farm road which ran East-West through the Galey property and connected to Blenkinsop Road. The reason that there was not a public access through the site was that Saanich owned only a half-width road easement which was not large enough for a road or trail designed to municipal standards, and therefore Saanich could not install a road (or a trail) unless they had the Galeys' permission. Fearing that a road or trail would increase the vandalism (and associated stresses), the Galeys would not allow Saanich to install either one.

After construction of the creek (which effectively established a water-filled moat running north-south between the Galloping Goose Trail and the field), and as a direct result of the rapport and trust built between the Galeys, Aqua-Tex and Saanich, the Galeys agreed to allow Saanich to install a trail along the east-west easement to connect the Galloping Goose to Blenkinsop Road (provided the Saanich installed a high fence, on either side of the path). This also improved access to the land by farm vehicles (via the raised pedestrian and cycle path) during the early fall and late spring when soils tend to be boggy. Overall, this trail has had several benefits:

Figure 13: Blenkinsop Creek facing north (Post Project - December 2001). Note the barrier that the creek provides between the trail and the field.

- Reduction in property and crop damage, tool and implement thefts, and consequent improvement in avoidable capital and operating expenses. Although the Galeys had not tracked the damage, theft or other instances of vandalism, they estimate that the cost of vandalism and damage (*i.e.,* labour, crop costs, etc) exceeded $100,000 per year. After completion of the project, the realigned creek acted as a moat, keeping trespassers and vandals off of the property;
- Improvement in crop yield resulting from reduction in crop accessibility and associated vandalism, without offsetting costs;
- Improvement in farm access and farm efficiency, improving options for harvesting.

Pesticide

Prior to the commencement of the project, the ditch had little or no ecological function, providing minimal, if any, habitat value. However moving the creek adjacent to an existing hedgerow along the Galloping Goose Trail not only supported that hedgerow, but also in effect created a 'moat' reducing vandalism, as noted previously. As a by-product, the restoration and enhancement of hedgerow function meant that biodiversity has been enhanced, attracting predatory insects, birds and other animals.

Figure 14: Blenkinsop Creek facing north (February 2007)

The Galeys report that prior to the creek realignment, at the worst of times, pesticide application was almost weekly during the growing season. This resulted in high pesticide and herbicide expenses, vermin control and so on. By contrast, after the completion of the project, the newly-planted streamside vegetation began to establish and provide extensive habitat for birds and other wildlife. Over the years, pesticide use has gradually dropped until the Galeys recently quit applying pesticides, and allowed their pesticide licence to lapse. In effect, the natural systems eliminated the need for chemical applications. Farmers are normally concerned with situations that increase insects, birds and other animals for they tend to reduce crop yields. What has been noted at the Galey farm is in fact the opposite; birds (particularly raptors) and other animals that have been attracted to the site are predatory and therefore farm mice and other crop pests are a source of food supply. As a result, the Galeys have experienced appreciable savings in pest control, with pesticide usage dropping to zero.

The impact has been significant enough to persuade the Galeys to employ an integrated pest management system (*i.e.,* using ladybugs instead of sprays to control many crop pests). Mrs. Galey believes the farm could now qualify as an organic farm, if not for the proximity to other farms who use herbicides and pesticides (whose use cannot be guaranteed or controlled), as well as for the winter flooding of the fields with creek water that carries contaminants from road runoff in the upper watershed. Since isolation from contamination is a criterion for gaining designation as an organic farm, the farm cannot be designated. However it does mean they are able to distinguish their product in the marketplace and claim to achieve greater sales volume as a result, and/or higher revenues from sales. The farm has been recognized by The Land Conservancy (TLC) as a Conservation Partner[x].

Pesticide savings were estimated to amount to a cost of $1,650 per acre per year (this being a combined assessment of reduction is chemical costs and time/machinery costs) over 21.4 acres ($35,310/yr). Using a conservative discount rate (to reflect the secure nature of the benefit – *i.e.,* 5%), applied to the area of the farm estimated to have benefited but excluding areas beyond the immediate fields that may also have benefited, suggesting the NPV of the estimated pesticide savings in the order of $497,657.[xi] The NPV of the pesticide savings alone exceed the total project costs of $375,000; suggesting the project would have

been viable based solely on pesticide reduction, however, the return on investment (ROI) is not very fast (*i.e.,* the rate is discounted at 25 years).

Creek Maintenance

Prior to the realignment and restoration of the creek, the Galeys reported that the ditch required regular maintenance. The shift to a natural stream channel required less maintenance and management. Whereas the old ditch was not self- managing and tended to "clog" due to in-growth of vegetation, agricultural run-off, and upstream sedimentation deposition, the natural stream channel, in contrast, does not rely on nor need regular digging to maintain its integrity, and therefore reduces costs. In addition, prior to creation of the creek, certain areas of the adjacent fields were noted as being boggy, impacting farming efficiency, crop choices and thus farm economics and crop yield.

After implementation of the project, and despite differences in seasonal temperature and rainfall, the farmer noted reduced field maintenance and gradual improvement in the soil stability. Most importantly from a value perspective, is that higher value crops could now be grown in areas previously incapable of supporting more viable and valuable crops. We enquired into these aspects and found some challenges in quantifying the improvements. Data tracking the higher yields and crop usages was either not available or agglomerated within larger data on crops and thus not capable of individual assessment. The farmer also felt that differences in seasonal weather conditions would mean that clearly evaluating the improvement would be difficult and therefore this aspect could not be quantified.

The farmer did not keep records of how often the ditch was maintained, nor what the associated cost was. Therefore, we estimated a maintenance schedule of a normal ditch to be on average every 5 years and in the case of the Galeys' ditch the estimated cost is approximately $2,600 every 5 years. To adequately compare costs and values for the purposes of this report, the discounted present value (PV) cost of the ditch over 25 years was applied using a 5% discount rate. In the case of the ditch amounting to the discounted maintenance values totalled $6,632.[xii]

Figure 15: The Galey Farm (Extent of the Flooding, 2003)

Municipal Infrastructure Cost

Flood Protection

The Galey Farm, and indeed much of the Blenkinsop Valley, acts to store floodwaters during extreme flow events. This is partly due to topography (it is an old lake bed) but mostly due to flow regulation on Blenkinsop Creek in the form of the Cumberland Dam. Intense hydrological modelling would be required to confirm and interpret the protective value of the farmland for downstream infrastructure, which is complex and requires legal advice; however, using values from the literature an estimate is provided.

Figure 16: Flooding of the Galeys' Field

The Galey farm sits within a long-standing flood plain. In the late 1960's[xiii], a dam was constructed at the south end of the Blenkinsop Valley at the request of local farmers "to control winter storage, drain off water in the spring for agriculture, and hold water in the summer for irrigation. An operating curve established by Saanich Engineering in consultation with stakeholders and administered by Saanich Public Works governs flood control in the effort to balance downstream flows and upstream storage. As agriculture is a significant land use in the Valley, managing stormwater to have a positive impact on producers is desirable" (Saanich, 2003). As weather patterns have changed, flood waters have been held later into the spring and fields begin getting saturated earlier in the fall. This has a negative impact on agricultural production.

While the dam has been a benefit to downstream development, it unfortunately results in the Galeys and other farms being flooded not only during the winter (when there are no crops in the ground) but also during seasonal and major storm events (due to preponderance of fine soils strata and commonly, Victoria Clay subsoil). The question was raised whether this is an unpaid "insurance benefit" that could be quantified.

Underlying this question is the concept of Public Interest Value (*i.e.,* that there is a public benefit in something happening that may not be properly reflected or compensated by market forces or traded property values). For example, acquisition of land for public roads arguably has similar comparisons (*i.e.,* the land is acquired because the public needs it, but government does not pay based on the benefit to drivers, but on the value of the land as if it had been sold for its current or permitted purposes, as if the road project had not happened). Since such lands are often compulsorily acquired, mechanisms exist for compensation and there are also provisions for compensation when land is, in effect, acquired even when there has not been a formal purchase (this is often referred to as "Constructive Expropriation").

The contention made to the authors during interviews is that the Galeys' land is 'temporarily expropriated' during storm events, impacting crops and business yield, and thus land value. This happens because, rather than the runoff flooding homeowners and businesses developed downstream, farms in the Blenkinsop Valley flood. The impact reported can be extensive, with damage to crops and livestock, farm capital and operating equipment. The question is whether the land has, in effect, been expropriated

through the creation of the dam, and whether the creek restoration benefits the residences and municipality downstream. In expropriation terms, compensation relates to the difference in the owner's situation before and after the expropriation. In this instance, it would require measuring the extent of the flooding prior to the installation of the dam and afterwards, as well as assessing the pre and post– project flood risk/damage. Unfortunately, our discussions could not confirm with certainty that the land did not flood as extensively prior to the dam being built. We also identified little clarity with respect to the extent and level of present flooding, reducing our ability to accurately quantify the impact on the farm's business. For example, in the last quarter of 2006 and first quarter of 2007 extended periods of heavy rain resulted in severe flooding to the lands in question, but farmers were so busy dealing with saving crops and livestock that accurate measurement and documentation of the extent of flooding was not done; rather we were provided with an estimate that 60% of the lands flooded at an estimated depth of 1m at the worst times.

The benefit of the creek compared to the farm ditch is difficult to quantify, however the Galeys reported that it has reduced the frequency and extent of surrounding land being boggy, and is believed to reduce impacts downstream. Furthermore, the restored portion of the creek and associated floodplain has been observed to retain water for longer due to the increased width/depth, available floodplain, and the creek's "U" shape (compared to the ditch's shallower "V" shape). The creek channel now has a higher capacity thereby addressing larger volume flows. Although hydrologic modelling has not been completed on the Blenkinsop system, and the true extent of the flooding cannot be properly established, an estimate can still be derived from the literature showing the potential value of the flood mitigation provided by the Galey (and surrounding) farms.

For instance, Ming *et al.,* (2007) calculated flood benefits, by identifying the capital cost of reservoir construction and converted the value to $/m^3$. Applying this value to the Galey farm study, the flood protection benefit provided annually by the Galey farm is estimated to be $54,313. Discounted over 25 years at 5% this benefit amounts to $765,485.[xiv] This value is intrinsically low, for if flood damage was to occur to residences downstream the cost is likely to begin in the million-dollar range; therefore showing how inexpensive flood protection is upon comparison to the actual cost of damage if downstream flooding was to occur.

The values identified by Braden and Johnston (2004) may be more accurate in this regard for they have shown that the economic value of flood protection services is within the range of 0-5% of market value; "the range is dependant upon the difference that retention makes to downstream exposure" (Braden & Johnston, 2004). Nevertheless, these proxy methods are cost related (*i.e.,* damage avoidance cost related) and do not take into account the measures of social welfare, nor do they account for individual preferences in the absence of such services. For example, the absence of flood protection provided by the Galeys' (and neighboring) lands may well induce individual action forcing the municipality to prevent flood damage, through the acquisition and restoration of land or other means. In addition, the US Army Corps of Engineers have shown that "flood peaks may be as much as 80 percent higher in watersheds without wetlands than in similar basins with large wetland areas" (Braden & Johnston, 2004). Specific to the Galey farm, the value of the farmland in public use would not only have a value in addressing storm situations but also in public amenity. It may be that local and provincial governments should carefully consider this if the situation worsens as a result of global warming and increased upstream urbanization.[xv]

Ecological Benefit

Prior to a detailed economic review of this project the ecological benefits derived were visible, but none had been quantified in financial terms. Though it is difficult to monetize ecological benefit, the following aspects have been examined by other researchers and rough estimates of their financial value can be made by considering the value of a functional stream (which incorporates the items listed below) vs. a non-functional ditch, which is missing these elements:

- The prior ecological condition of the ditch was rated as non-functional. Therefore, we conclude that the ecological value of the ditch would likely have been close to zero. This determination is based upon a literature review and photos of the area prior to the commencement of the project. The following excerpts from the literature support this conclusion:
    - The construction of dams, reservoirs and diversions for the purposes of decreasing flooding and flow volumes, results in interrupted sediment transport (Goodwin *et al*., 1997; Green, 1996). Sediment is necessary for the rebuilding of soils and stability of streambanks. The Cumberland dam downstream of the Galeys' property decreases flooding downstream, but also reduces sediment transport downstream and may increase or alter the timing of flooding in the Blenkinsop Valley.
    - Increased urbanization (*i.e.,* watershed-wide disturbances such as farming, road construction, and logging) increase the amount of impervious surfaces resulting in higher peak flows, lower base flows, changes in runoff timing, and excessive sedimentation (Goodwin *et al*., 1997; Green, 1996). As a result the freshwater system becomes degraded and is more likely to be irreparably damaged by a storm event (Green, 1996; Prichard, 1998; etc). Furthermore, sedimentation harms fish in lakes and streams by damaging spawning and feeding areas and by reducing respiratory efficiency (Olewiler, 2004).
    - The constriction of water movement (*i.e.,* due to ditching, or other stream modification) has been documented extensively that such practices result in high sediment loads and high water flows allowing for pollutants (*i.e.,* road run-off, fertilizers, pesticides, etc.) to move quickly through the watershed, causing serious damage reducing water quality and habitat value for both aquatic and upland species (Booth & Reinelt, 1993; CWP, 2003).
    - Excess nutrients that are not absorbed into the water system interact with soil to slow organic decomposition and destabilize nutrient and pH levels, leading to acidity problems, thereby reducing water quality and sensitive aquatic species (CWP, 2003; Olewiler, 2004).
    - Stream channelization (*i.e.,* straightening and berm construction for flood conveyance and land drainage), results in the simplification of the channel, isolation of the channel from the floodplain, loss of habitat, increased hydrological energy, reduced friction and increased runoff efficiency (Arnold & Gibbons, 1996; Goodwin *et al*., 1997; Moses & Morris, 1998).
- Bird surveys were conducted along Blenkinsop Creek to provide baseline and comparative information for before and after construction of the realigned channel. Since the realignment, bird presence has notably increased (Malmkvist, 2002).

- An interesting side-benefit noted by Aqua-Tex during one inspection is the consequent benefit of restored biodiversity. For example the hedgerow acts as an incubator for local plants, so rather than using an expensive nursery, the hedgerow provides the new plant material to meet demand. This reduces costs in plant replacement. The value benefit is likely to be small and contributory rather than comprise a business, without impacting the ecological function.
- Although pesticide concentration in the stream was not measured prior to restoration, the discontinuation of pesticide use has an immediate benefit on the water quality of the creek.

When a system is restored to proper functioning condition, it has proper vegetation, shade cover, hydrological flows (suitable to the landscape), and soils, and is able to withstand high flow events when they occur. Varying studies have shown that functional streams provide important ecological values, such as water treatment and sediment deposition, thereby supporting salmonid populations, other aquatic organisms and wildlife (Langford, 1975; Ptolemy, 1982). In the case of the restored portion of Blenkinsop Creek, the permanent vegetative cover helps increase the productivity of the creek by preventing the creek from warming, reducing bank erosion and sediment loading, reducing nutrient input by buffering runoff, taking up nutrients, decreasing downstream flooding, reducing GHG emissions, providing carbon sequestration, and offering habitat to a variety of species.

By using other studies as proxies, a rough dollar value for the functioning portion of the Blenkinsop Creek can be estimated. A study completed by Ducks Unlimited (2004) noted a value estimate of the net primary production for each hectare of an estuary may annually be worth $22,832; lakes and rivers $8,498; temperate/boreal forests $2,007; and grass/rangelands $232. Although this study may not be able to accurately quantify specific variables or services (and these services can be highly speculative due to issues of generality, double-counting, and the appraisers objectivity/bias) that result from functioning ecosystems, such values do serve as a reminder of the lost value if a functional ecosystem is destroyed or degraded. Therefore in the Blenkinsop case study, we used values from a recent Capital Regional District (CRD) land purchase as a proxy. The CRD recently purchased more than 9,700 hectares of land for $64.7 million in order to protect the future of the region's drinking water supply and to substantially add to the region's park system. The CRD has acquired this previously logged watershed in order to protect it and allow the forest to regrow and naturally filter and purify the water entering the Leech River. Once the forest has regrown, the water will be suitable as a back-up supply for drinking water in the region (CRD, 2007). This is a direct local example of the value of ecosystem services. Applying the CRD proxy, we can estimate that the social value of a functional 650 meters of restored creek and riparian area (30 m wide zone including riparian buffers) that provide benefits such as water quality and biodiversity is worth $12,006.[xvi]

Regarding water clarity/turbidity and health-related performance, the creek's sinuosity helps significantly. Restored to create more natural alignment, compared to the ditch, the new creek can help slow the path of water and the riparian vegetation acts to "filter" the creek water enabling sediment deposition in the floodplain. Complementing this report is a year-long stormwater sampling study on various aquatic systems within the Colquitz watershed, which included monitoring the restored portion of Blenkinsop Creek. The results of the stormwater study are impressive, but unfortunately these results cannot be easily quantified because pollutant-loading rates had not previously been determined (this is a result of the lack of historical hydrological modelling). If the loading rates had been determined, substitution values for what it would cost a treatment plant to reduce values by such could be applied as proxies and calculated as a cost (or in this case benefit). For example, the costs of removing phosphorus vary from $21.85 to

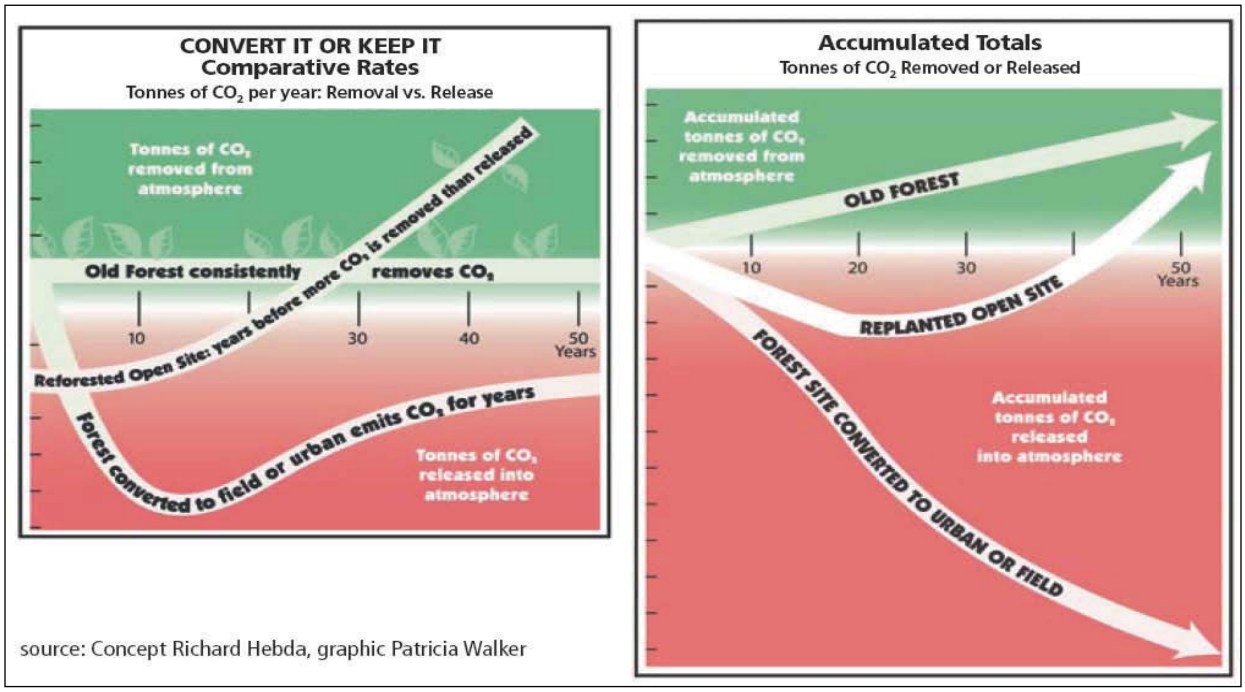
$61.20 per kilogram at Vancouver's primary and secondary waste treatment plants, while costs for nitrogen vary from $3.04 to $8.50 per kilogram (Olewiler, 2004). If the creek had been hydrologically modeled, a value for the average yearly loading or treatment (in kg) could be estimated.

Although we could not value the results of the sampling program because loadings are not available, the capabilities of the functional systems to treat stormwater are worth mentioning.

- Blenkinsop Creek was very effective at removing nutrients. The channel removed between -1.2% and 38.9% of the total nitrogen with an average removal efficiency of 18.8%. On average, the ammonia was reduced by over 55.6%, the nitrate by 20.15% and the nitrate by 13.9%. The ortho-phosphorus was reduced by an average of 20.1%.
- The restored channel reduced Total Suspended Solids (TSS) more than 50% of the time.[xvii]
- Oxygen values were very low, ranging between 0.07 mg/L and 11.8 mg/L at the lake outlet and between 0.21 mg/L and 10.8 mg/L. This is due to the eutrophic conditions in Blenkinsop Lake where the decomposition of the biomass strips oxygen from the water, and due to the fact that the reconstructed creek channel has very little gradient and therefore no opportunity for physical aeration.
- Heavy metals concentrations tested declined significantly. The effective removal of arsenic was 44.7%, cadmium 83.4%, chromium 19.8%, copper 39.9%, lead 90%, mercury 58.3% and zinc 64.7%. This suggests that Blenkinsop Lake, and not the neighbouring field, is the source of the heavy metals in Blenkinsop Creek and that the heaviest particulates to which the metals are bound, are settling out significantly before they reach Galeys' field. It is important to consider how the change in channel morphology, from a ditch intended to convey water quickly, to a sinuous stream channel intended to slow the water and create complexity, might have assisted in removing these heavy metals from the water column.

The vegetation also has an added benefit in its capacity to sequester carbon. In Figure 17 below, Wilson and Hebda (2008) show that as a forest is converted into an urban setting or field, the capacity of the system to sequester carbon dioxide is hindered and in fact, destruction of such systems releases carbon dioxide into the atmosphere. The consequence for this review is that few data were available to permit pre- and post-completion comparison. Furthermore, due to the small size of the project, the carbon sequestration component is small, but worth noting because the restored area has been extremely productive in vegetative growth (as can be seen in the photos). Applying carbon calculations derived from an urban forest study, completed by Rowntree *et al.,* (1991), we estimate that the Blenkinsop Creek riparian zone stores 78.1 tonnes of carbon (at maturity) and annually sequesters 1.76 tonnes/yr. Since the market does not yet grant credits for stored carbon, only sequestered carbon, we cannot use the storage value in the valuation of the riparian zone. The present value of the carbon sequestration is $496.13.[xviii] Although these values are small, when extrapolated to the municipal scale, the value can add up quickly. For example, the value of the canopy cover in Saanich was calculated as part of a larger CRD study using the CityGreen model. This model estimated that the 13,000 acres (5261 ha) of tree cover in Saanich sequestered 4355 tons (3951 tonnes) of carbon annually and represented storage of 559,502 tons (507,571 tonnes). The NPV of the sequestration is $1,113,869.00. As the BC provincial government moves towards carbon neutrality, restoring degraded land or streams to functional systems may, in fact, enable municipalities to achieve carbon neutrality goals, as well as generate revenue streams.

Figure 17: Reforestation and land conversion impacts on carbon storage



Social Benefit

The possibility that there might be First Nation interests on the Galey property was reviewed. For those sites in this report that were developments, this is a normal part of the development process in British Columbia. With respect to the Galey Farm, our preliminary reading and discussion suggested the area had been characterized as boggy prior to its current use, but its prior cultural tradition was not recorded. It is however, well understood that wetlands in the region were used by First Nations for wild cranberry harvest and several important plants were harvested from wetlands[xix].

The farm sits in a strategically important location between Blenkinsop Road and a portion of the Saanich trail system. Upon the development of the Galloping Goose trail system (prior to the project), large numbers of cyclists, hikers, and passers-by using the trail would trespass on to the Galey farm to access the road easement and connect to Blenkinsop Road. While Saanich owned a half-width right-of-way through the field, after completion of the project, the Galeys agreed to sell Saanich enough land to create a full right-of-way so that Saanich could install a connecting path along the easement. Saanich installed a high fence, on either side of the path, to prevent trespass, thus formally linking the trail system and Blenkinsop Road and forming a key connection the Saanich trail system (see Appendix A). In short, the site has significance for the community and the addition of the trail connector provided a community benefit.

From observation, the connector trail has been successful. Saanich Parks estimates that the connector is used for 500 trips per day, closely aligned with the neighbouring Galloping Goose (Lochside) Trail which receives 170,00 trips per year or 465 trips per day (Fleming, pers. comm.). Although we have not extensively studied the benefit derived from the trail and connector, we can utilize varying studies to speculate on the economic social benefits that may have been achieved:

- Creating an interconnected system of parks and open space is manifestly more beneficial than creating parks in isolation.[xx] In addition cities can use parks to reduce public costs for stormwater management, flood control, transportation, and other forms of built infrastructure (McMahon & Benedict, 2003);

Figure 18: Blenkinsop Connector- Galloping Goose Trail Extension (2004)

- Access to parks and trails can increases the frequency of exercise. There is strong evidence that when people have access to parks, they exercise more. "In a study published by the Centre for Disease Control, creation of, or enhanced access to, places for physical activity led to a 25.6 percent increase in the number of people exercising on three or more days per week" (Sherer, 2006). Furthermore, studies reviewed in the American Journal of Preventive Medicine showed that "creation of or enhanced access to places for physical activity combined with informational outreach" produced a 48.4 percent increase in frequency of physical activity" (Emily *et al.*; Task Force on Community Preventive Services, 2002);
- Increased cycling, walking and contact with nature has both physical and psychological benefits and with further study, this benefit could be quantified as a reduction in costs to the public health care system in British Columbia[xxi];
- Obesity is more likely to occur in unwalkable neighbourhoods, but decreases when measures of walkability go up (*i.e.,* dense housing, well-connected streets, and mixed land uses reduce the probability that residents will be obese) (Sherer, 2006);
- Increased real-estate values of property; "In a 2001 survey conducted for the National Association of Realtors by Public Opinion Strategies, 50 percent of respondents said they would be willing to pay 10 percent more for a house located near a park or other protected open space. In the same survey, 57 percent of respondents said that if they were in the market to buy a new home, they would be more likely to select one neighborhood over another if it was close to parks and open space" (Sherer, 2006);
- Green space and habitat is highly valued. For example, a survey from Okotoks, Alberta, showed that 81 per cent (of a survey of 1000 individuals) of respondents stated they would pay $2-5,000 more for a home in a neighborhood with linked opens spaces and habitat features (Fisher, 2002).

- Pratt *et al.,* (2000) concluded from a survey of 20,041 respondents in the Unites States that if the portion of survey respondents (43.2%) who reported no regular physical activity during the survey became regularly active, an estimated annual direct cost savings would accrue to the health care system between $330 and $1,053 per person;
- Jones & Eaton (1994) estimated that a $4.3 billon dollar cost savings would accrue if the entire sedentary population in the United States began walking regularly; and
- Wang *et al.,* (2005) studied trail usage in Lincoln, Nebraska concluding that the per capita net benefit of trails was $564.41 which exceeded the total sum of per capita cost of trail usage, construction and maintenance, and equipment and travel.

Figure 19. Blenkinsop Connector March 8, 2008 (Bill Irvine photo)

Specific to British Columbia, the Ministry of Health states that the cost of physical inactivity in British Columbia for 2005 was $211 million a year in direct costs (hospital, physician, drug, institutional and other costs) and $362 million each year in indirect productivity losses due to premature death and disability, totalling to an annual cost of $573 million (Province of BC, 2008). The increased installation and usage of trails can help reduce this cost. For instance, applying the lower value from Pratt *et al.,* (2000) adjusted for time and currency, the estimated annual benefit of the Blenkinsop Connector portion of the trail can be estimated. Saanich staff estimate the usage of the trail to be approximately 170,000 trips per year (3269 one way rips per week)and the connector is approximately 500 m long. The health benefits of moderate activity can be obtained with as little of 20 minutes of exercise, 3 times per week. It takes approximately 10 minutes to walk the length of the Blenkinsop connector and back (e.g. return trip), but most users will access the trail via the neighbouring trail system and therefore walk longer. At 1635 return trips per week, 545 people could each take 3 return trips. Applying the Pratt *et al*., (2000) value of health care cost reduction from improved physical activity, and adjusting it for time and currency ($430), 545 users, 3 times per week results in a total trail benefit of $234,295/year. Therefore, the net present value of the connector trail discounted over 25 years at 5% (assuming no increase in trail usage) amounts to a community benefit of $3,302,784. This does not include the benefits of: improved air quality, reduction in fossil fuel use, value of a reduction in traffic congestion, or value of improved pedestrian and cyclist safety.

Stakeholder Perspectives

Developer/Owner

From an owner/developer's perspective, the project has been deemed viable since the cost was exceeded by the returns received through improved benefits to the occupant [the Farmer], business efficiency and productivity, as well as public profile.[xxii] However many farms are currently challenged in their economic viability. The inability to tap into funding, as well as the slow return on investment (ROI) may dissuade many farmers from undertaking habitat restoration even though it is beneficial to them and to the surrounding community. Furthermore, from a farmer's perspective, ditching a creek increases hydrological flows, thereby ensuring that water drains off of the land as fast as possible and enabling the farmer to access the land sooner to plant varying crops for the season (an economic motivator). From an ecological point of view, ditches tend to have little function with regard to riparian and upland vegetation, and aquatic and biodiversity habitat, which tends to require available floodplain, amongst many other aspects (*i.e.,* vegetation, large woody debris, etc). As farmers are financially constrained due to increasing land and input cost values, while food prices are kept artificially low, the farmer's short-term economic viability supersedes the benefits of ecological restoration, and therefore little restoration of the Colquitz watershed along agricultural lands (or residential for that matter) has occurred. Ditching a creek may be considered a HADD (harmful alteration, disruption or destruction) and requires permits and compensatory work under the Federal Fisheries Act, enforced by DFO. The Farm Practices Protection Act, a coordinated effort between the Ministry of Agriculture and Lands and the ALR, gives farmers the "Right to Farm" (*i.e.,* farmers have basic rights to farm land without the fear of lawsuits), therefore over-riding the federal requirements.

Figure 20: Developer Interest in Galeys' Experience

Municipal

From a municipal perspective, the project provided considerable community benefit. It opened up a new trail system connector, improved visual appeal, reduced theft and vandalism, increased stormwater attenuation and provided flood protection; attributes that would be politically saleable. Despite this, Aqua-Tex identified regulatory barriers when filling in the ditch and realigning the creek. From a community planner's / policy maker / politician's perspective, if the goal of the OCP or the Strategic Regional Plan is to reduce stormwater, provide downstream flood protection, improve water quality, increase greenspace, etc., municipalities will need to establish a scheme upon which farmers (such as the Galeys) or landowners are paid for the service their land provides as well as the forgone opportunity cost of crop sales or development. From an elected official's perspective, this project provides support for agriculture and support for community goals noted previously: augmentation of green space, natural environment protection and support to agriculture, and general community benefit of trail systems, GHGs and human health.

Community

From the community's perspective there was considerable public community benefit: the Galeys' farm is less labour intensive to farm, and therefore (all other things being equal) more viable. This improves the likelihood that the farm will remain in production and continue to provide locally produced food to the community. This also preserves the rural views from the Galloping Goose Trail. The new creek and riparian zone provide significant habitat, especially for birds, which add interest to the trail and provide active enjoyment for the dedicated group of birders in the Victoria area. As a result of realigning the ditch, it became possible for the Galeys to develop a miniature railway around the field. This is an added recreational amenity for the region, particularly for the children. It also provides an educational opportunity for children to learn about how and where their food is produced. The Blenkinsop Trail connector, which was agreed to by the Galeys as a direct result of this project, is a very well-used and much desired community amenity that reduces traffic congestion on neighbouring roads, significantly improves safety for cyclists and pedestrians, and provides a recreational amenity that improved the activity level and health of local citizens. Though not obvious to most residents, the air quality benefits of less traffic and more vegetation are also significant. The community value of this project was recognized by the Federation of Canadian Municipalities in 2002 when the project was awarded the FCM/CH2M Hill Sustainable Communities Award.

Barriers

Federal regulation would normally require going through an application process to obtain permission under the Federal Fisheries Act and the Water Act to fill in the farm ditch, especially where this might impact a riparian zone.[xxiii] The time and costs to undertake approvals can be so extensive that it acts as a barrier to more sustainable practices. Furthermore, the provincial regulations associated with the setbacks were negotiated; specifically, the Streamside Protection Regulation under the Fish Protection Act[xxiv] that is enforced by the Ministry of the Environment (MOE). Though it does not apply to agricultural land, the SPR normally requires significant setbacks surrounding all water bodies on private land that is being considered for development or redevelopment. In this instance, the SPR did not apply, but in a show of good faith the Municipality of Saanich, the Department of Federal Fisheries (DFO) and the Ministry of the Environment (MOE) representatives met on-site with Aqua-Tex and negotiated appropriate riparian setbacks, as it was recognized that the existing ditch had very little ecological value and the new stream would be a net benefit. In this instance, 15 m setbacks were negotiated on either side of the creek and a Section 9 Notification under the Water Act was required and an application submitted. The setbacks were reduced because the regulators involved viewed this project as an improvement; as such, the creek was re-aligned to the western portion of the property, thereby utilizing an existing buffer of vegetation that ran parallel to the trail that was Saanich's property. Strategically re-aligning the creek ensured that SPR regulations would be complied with (as 15m of the setback would be situated on Saanich's property which consisted of a vegetated buffer and the Galloping Goose Trail), but with less of an encroachment on the farmable land (only 15 m setback on the Galey property, rather than an entire 30 m). The regulations surrounding riparian vegetation have changed post-completion of this project, but continue to exempt both institutional and farm uses, it is expected that the setbacks negotiated would have been the same if the project were to commence today.

Neither Aqua-Tex, nor others interviewed, specifically identified planning implications or barriers, although these may exist in different circumstances. Most arise through community benefit, which planning should reflect. Planning benefits accrue from the retention and augmentation of green space, enhancement of the natural environment, protection and support for agriculture, and community benefit in expanding trail systems, reducing GHGs and improving human health which fall under the goals of most Official Community Plans (OCP) and Regional Growth Strategies (RGS).

This project was jointly funded by numerous federal, provincial and local funding sources, at no cost to the farmer (other than foregone profits from his crop that year). This is the major barrier to most similar projects- most farmers could not afford to finance such project, regardless of the return on investment or savings in labour, as they do not have access to ready cash.

Value Discussion

Since indirect or incidental economic benefits were not anticipated from the outcome of the project, specific data relating to these outcomes were not tracked prior to project commencement, or after project completion. The expected outcomes for the project were related to re-aligning and rehabilitating the creek so that it could achieve Proper Functioning Condition and Aqua-Tex and the landowner indicated this was achieved.

Though the lack of economic information has hampered the accuracy of the values determined, this is not altogether surprising and should not be interpreted as criticism: projects breaking new ground such as this have a degree and extent of impact that often cannot be predicted. Furthermore, the extra cost of capturing data prior to works, and comparing by post-completion audit, can add considerably and unacceptably to project cost. Commonly therefore it is not the first project that undertakes detailed pre- and post-completion analysis but subsequent projects, since the probable impact is better known, and an assessment process identifying specific criteria (as well as the audience) can be determined and measured before, during and after the commencement of a project.

Though there is little ability to reconstruct a review that accurately identifies the value of the project, this does not mean there has been no benefit. We have concluded that given the various identified aspects of cost and revenue using actual information and proxies, the net value of the project was positive by the measurable reduction in pesticide use alone.

The key quantifiable value aspects are:

- Restoration increased arable land by approximately 1.5 acres. Based on land sales at 2007 values, suggests a net benefit to the land of $75-90,000 in total. Agricultural land values do not appreciably fluctuate in this location;
- Pesticide use has halted as a result of habitat restoration. This affected fields totalling approximately 21.4 acres on the Galeys' farm, and presumably benefited other lands. The savings were amounted to some $1,650 per acre per year. The present value (PV) of these savings discounted at 5% over 25 years amount to a savings of $497,657;
- Reduced potable water used in irrigating lands. The present value of this benefit is $8,548.
- Elimination of vandalism costs to the Galeys. Prior to commencement of the project, vandalism costs averaged approximately $100,000 per year. If the project had not been

completed, vandalism costs would have continued to mount; this yearly cost discounted over 25 years would have amounted to $1,409,394;

- As the climate changes and storm events increase in frequency and magnitude, downstream flooding may become more of a political issue than it is today. Using proxies to estimate the value (or cost) of flood protection, the discounted value of flood protection is $765,484.[xxv] Upon comparison to actual flooding costs that occur (*i.e.,* in the millions), such an insurance value paid to a landowner would be relatively cheap in comparison.
- We estimate that the present value of ecological benefit that has resulted from the restoration of Blenkinsop Creek and riparian area is $12,006..
- The present value of carbon storage and sequestration for 650 m of restored creek amounts to $496.13. Although, this value is small, carbon sequestration aggregated over the entire municipality results in quite a large value ($1,113,869.00) (see Blyth and Laing, 2008).

The financial summary (see below) shows that this is a viable project for the farmer. This is an important point to note as the farmer or land-owner would likely be burdened with the cost of the project, and rarely do farmers have enough liquid capital to undertake such projects. In total, we estimate that the costs to the farmer prior to the restoration of the creek exceed $1.4 Million dollars over 25 years, with little value accruing to either the municipality, farmer, or those affected by water flows downstream. By comparison, by taking into account the cost of the project, as well as a conservative loan (although one was not required as this project was taken at public cost and no finance rate applied[xxvi]), the estimated net benefit (PV) to the farmer from the realignment and restoration of 650 m of Blenkinsop Creek is $1.6 Million. In addition, there is a net benefit to the municipality and surrounding community; the expected net present value of their benefit is estimated to be $4.0 Million.

Data Gaps/ Further Study

In our opinion there is a structural problem with how projects of this nature are appraised. Because land appraisals are generally undertaken for purposes of asset security, etc., they may not always identify business benefits, in this instance received by the farmer. Such appraisals would also be unlikely to identify community benefits because many of the business and community benefits are unlikely to trickle through to the land value, so evidence would not be available to prove a benefit to capital asset value. Accounting methods may be more likely to highlight cost savings without identifying the market value benefit to either the business or to the asset and especially, are unlikely to assess the "Public Interest Value" (*i.e.,* the broader array of interests such as flood protection, societal and cultural benefits, health improvement, etc). Once these issues are fully evaluated and the costs taken into account, it may be that the retention of this land with improvement of creek function would be sufficient to justify continued farm use or in the event that farm use was discontinued, the municipality could justify conversion to parkland and floodplain protection. Furthermore, current valuation standards and process standards in Saanich, as with other municipalities, do not generally contemplate the broader evaluation of Public Interest Value. Even on the basis of highest and best use and value, the creek restoration project would have been justified, but policy would need to be changed to require public interest assessment where doing so would be valuable.

Figure 21: Galey Farm Financial Summary

Blenkinsop (Traditional)	**Municipality**	**Farmer**
Installation of Ditch		($5,200.00)
PV of Ditch O&M		($6,631.69)
PV of Vandalism Costs		($1,409,394.46)
Total Present Value	$0.00	($1,421,226.14)

Blenkinsop (Sustainable)	**Municipality**	**Farmer**
Cost of the Restoration		($375,000.00)
Cost of the Connector Trail	($500,000.00)	
PV of the Cost of Financing		($26,607.17)
PV of Pesticide Savings (adjusted for the cost of integrated pest management)		$497,657.18
Increased Value of Land		$75,000.00
PV of Potable Water Savings		$8,548.33
PV of Flood Cost Avoidance to the Municipality	$765,484.59	
PV of Ecological Benefit	$12,006.19	
PV of Value of Carbon Stored and Sequestered	$496.13	
PV of Trail Connector Benefit	$3,302,784.65	
Total Present Value	$3,580,771.55	$179,598.34

Net BENEFIT	**$3,580,771.55**	**$1,600,824.48**

Willowbrook & Glanford Station

Project Description

Figure 22: Willowbrook Subdivision

Willowbrook Subdivision was developed by Cadillac Homes Ltd. and is an urban in-fill development of 31 single family detached residences on former agricultural land. It is partially within the 200-year floodplain for Swan Creek in Saanich. Swan Creek was upgraded from an agricultural drainage ditch, relocated and restored through the site (with 17% of the property dedicated to Saanich as parkland), as an addition to a neighbouring linear park. Six ponds were created to manage stormwater, extend wildlife corridors, connect local public walking trails and provide habitat. Approximately 750 meters of fish bearing creek was restored to conditions similar to the 1930's before urban development. A sewer right-of-way was used as a space to provide additional wetland stormwater treatment and to construct a walking trail- thus adding functionality to otherwise unused space and retaining full access for repair and maintenance.

Two different developers had previously approached the municipality with development proposals that included traditional engineered solutions to stormwater management and flood control. These failed to obtain requisite approvals as the traditional methods did not meet City bylaw requirements or sufficiently address floodplain liability. The projects also did not receive community support. Under Cadillac Homes, hydrological requirements were established and the new 200-year floodplain determined by hydrological modelling of the flows in Swan Creek. This approach was essential to address due diligence with regard to flooding. The design of the urban stormwater treatment ponds and wetlands was based on the Proper Functioning Condition (PFC) criteria, and used to define how the subdivision and road layout would be developed given the need to keep water on the land as long as possible. The design also incorporated public safety issues, wildlife habitat requirements plus aesthetic and recreational benefits to the new park.

Glanford Station is a detached single-family residential subdivision of 22 homes plus a pre-existing subdivision of 6 homes that manages stormwater from both subdivisions by using wetlands constructed between Swan Creek and an adjacent Garry Oak preservation area. The stormwater drains from the subdivisions into a cascading series of ponds and wetlands, constructed by the developer, before entering Swan Creek.

Site Plan

Figure 23: Willowbrook/Glanford Site Plan

Analysis

For purposes of this analysis we have considered the two projects as a single contiguous whole.

Figure 24: Willowbrook Trail

Project Aspects

The wetland reconstruction and creek restoration permitted the Willowbrook development to proceed whereas this had not been achieved by prior private development proposals. Furthermore, the proposal went through the necessary permits and approvals processes on an expedited basis. This had both cost and risk benefits to the developer.

Support for an ecological approach was so strong that permits from all the regulatory authorities were obtained in less than two months. During the period when this project was undertaken, the traditional permitting process on projects involving riparian and floodplain regulations was often in the order of two (2) years. Approval processes requiring Department of Fisheries and Oceans (DFO) approvals due to working in or around fish habitat or fish bearing streams could take up to three (3) years to obtain. According to Aqua-Tex, confirmed (but not quantified) by the developer, the expedited approach saved the developer enough money in borrowing costs on the land to pay for the stream restoration program. Aqua-Tex reports the restoration cost was in the order of $120,000. By choosing to develop the property in conjunction with the restoration and stormwater treatment, the developer was able to expedite approvals and start construction in 63 days.

Working with the regulatory agencies enabled a relaxation of building setback requirements. As portions of the site are within the 200-year floodplain, careful design allowed some mitigation of setback requirements for buildings by constructing the habitable floor areas of the homes above the level required by statute. Thus some foundations are within the 200-year floodplain boundary. This permitted the retention of the allowable number of housing units to enhance viability of the project.

The geology and hydrology of the site required special measures if the site were to be developed. Given the magnitude of the dedicated open space, and to encourage similar restoration-related projects, a new subdivision bylaw was instituted to accommodate small lot sizes of +/-290 m^2 (3,000 sq. ft.) with reduced setbacks. While the lots were up to 50% smaller than the traditional lots in the neighbourhood, the impact was only a 15% to 20% reduction of traditional lot values. The developer stated that the profitability was restored to some degree by cost savings associated with the compact configuration of the lots and the corresponding servicing cost reduction due to the shorter span of utility and other lines such as collector pipe, lamp standards required, road length installed, etc. It is unclear what impact the added open space had on mitigating the smaller lot size of the subdivision. Furthermore, donating 17% of the land enabled the developer to achieve 14 additional lots in density bonusing bringing the lot count from 17 to 31.

In the case of the Glanford subdivision, restoring the wetland and applying ecological principles to the development enabled the developer to utilize a public utility corridor to accommodate stormwater treatment and management off-site. The benefit to the developer was that he reduced the area needed for dedication by not having to build stormwater treatment within his development. Costs were estimated to be approximately equal if the stormwater treatment facilities were built on-site or off-site. Thus the benefit to the developer was the increased lot yield, and associated revenues are estimated at a sum in excess of $200,000. This added lot yield had an indirect value to the municipality as well as increased overall tax base revenues.

Figure 25: View of the wetland between Willowbrook and Glanford, 2003

The implemented ecological stormwater solution was found to be cheaper than a traditional pipe solution would have been, if allowed. The estimated cost of construction for the entire stream and stormwater project for Willowbrook was $120,000 for construction and consulting fees. The hydrology modelling costs were approximately $60,000 representing 50% of the total restoration costs. Due to the proximity to Swan Creek, an alternative solution would have required a traditional stormwater management system that would control discharge into the nearby creek. Such a solution would have been to construct a stormwater holding tank under the street with a pump system, at a cost estimated at $260,000 to $300,000. Although expensive, it would not achieve the same degree of particulate and contaminant treatment achieved through the restorative method.[xxvii] It would also have failed to contribute to the habitat or visual amenity of the community, as the creek would not have been restored.

In terms of direct market value, those buildings fronting the wetland had not been specially marketed, in other words, the developer felt the proximity to wetland had no incremental benefit and thus, did not market or design the housing to take advantage of the natural amenity. We observed that little was done to the architectural treatment to increase views at the upper floor levels, and ground levels have no view of the wetland area. We researched property records to assess whether the wetland has subsequently shown to have added value to those lots fronting or viewing the area. A review of sales and tax assessment information from 2004 to 2006 of homes in the project failed to show any special differences between those houses fronting the wetland and those that do not.[xxviii] On the face of it, this tends to suggest that there is no special relationship to open space proximity and value premium for this project. Furthermore, it is reported that the project, due to uncertainty around the impact of the restoration project, was not marketed to take advantage of the open space and added recreational features, nor were the homes designed to take advantage of the proximity to the open space.

The paper "*Corridors of Green and Gold*" by Hamilton & Quayle (1999), prepared for Fraser River Action Plan, Department of Fisheries and Oceans looked at the benefit of greenways in riparian zones.[xxix]

Unfortunately the study area did not include the District of Saanich as the data were not available during the author's assessment of the Colquitz system. As a result, the authors concluded, "*the results were very disappointing*." The reason was non-availability of data, the same problem affecting our analysis. Generic conclusions were nevertheless drawn from other assessments, that there is additional value:

"Our general conclusions support both the perception of increased economic value on the part of those living in the study areas, and a statistical increase of increased real property prices to residential suburban properties due to proximity to a greenway. The statistical results indicated an order of magnitude of a 10% to 15% increase in value, after controlling for other factors such as age, location, and other adjacent amenities."

Various other studies have supported the linkage between the distance to greenspace and real estate values as well:

Figure 26: Rear of the Willowbrook Subdivision (2003)

- A study of property values near greenbelts in Boulder, Colorado, noted that housing prices declined an average of $4.20 for each foot of distance from a greenbelt up to 3,200 feet. In one neighborhood, this figure was $10.20 / foot. The same study determined that, other variables being equal, the average value of property adjacent to the greenbelt would be 32 % higher than those 3,200 feet away (Correll *et al.,*1978);
- In Oregon, a study found that urban land adjacent to the greenbelt was worth approximately $1,200 more per acre than urban land 1,000 feet away from the greenbelt boundary (all other things being equal) (Nelson, 1986);
- A study of market appreciation for clustered housing with permanently-protected open space in Amherst and Concord, Massachusetts, noted that clustered housing with open space appreciated at a higher rate than conventionally-designed subdivisions (appreciation was measured as the percent increase in open-market sales prices) (Arendt, 1996);
- The clustered homes studied in Amherst appreciated at an average annual rate of 22%, as compared to an increase of 19.5% for the more conventional subdivision. This translated into a difference in average selling price of $17,100 in 1989 between the two developments (Arendt, 1996);
- In 1991, Environment Canada examined the selling prices of homes in Windsor, Ontario within 915m (3000ft) of green spaces and noted that there was an increase in property value of approximately $26.24 per m ($8.00ft) closer to greenspace;

- An American Lives Inc. real estate study found that 77.7 percent of potential homeowners rated natural open space as "essential" or "very important" in planned communities (American Lives, 1999);
- In The Green Building Council of Australia's recent publication "Valuing Green - How green buildings affect property values and getting the valuation method right" the authors state: "*All respondents identified the Discounted Cash Flow (DCF) approach as being the most suitable method to assess the valuation of green buildings*." As sustainability in a wetland or in a building have shared characteristics, there is a clear bias to the DCF approach as being helpful in valuing sustainability;
- A study by the Royal Institution of Chartered Surveyors, "Urban parks, open space and residential property values," published in July 2007 identified a range of improved values between 0.44% and 19.97%. This is a wide range and the report references other international studies, including hedonic analyses (*i.e.* assessments based on larger data sets and thus likely to be less prone to anomaly). One study identified a statistically significant 16% extra value for properties within 450 m of public open space (Dunse *et al.,* 2007).

Hamilton and Quayle's study demonstrates that a portion of the benefit is only obtained if the properties are oriented so the view of the riparian zone is optimized. The Willowbrook development was not; it was oriented to the street front, with almost no windows overlooking the riparian zone. Available real estate data underscored this, with no clearly demonstrable difference in values between identical houses one block back from the riparian zone and those fronting it.[xxx] There were, however, fewer sales fronting the riparian zone than identical homes a block off the riparian zone, suggesting homeowners are happier with the limited extra benefits of riparian frontage afforded by the designs. We feel the building orientation could have been improved to maximize the value of the visual appeal of the creek from the houses and some homeowners had extended their deck use as the only way of exploiting this benefit. In short, the subject project probably did not optimise value. If the houses had been oriented and marketed with views of the green belt, we conservatively estimate an increase in value in the order of 3%.

Figure 27: Views of the back side of the houses which face the wetland. Views are not optimized.

Ecosystem Services

Figure 28: Home purchased based on the views of the wetland.

Stormwater run-off from the site is treated on-site, the benefit of this having been paid for by the developer. The treatment of water, storage channel and pond system is expected to improve flood control, and has been noted to treat various elements of stormwater, creating a tangible benefit to the municipality. Unfortunately, similar to the Blenkinsop case study, no historical hydrological modelling is available and consequently neither loading rates nor values can be applied to this study. If values could be associated, we would expect the values to be similar to what other studies have reported. For example, Olewiler (2004) concluded that the present value (50 years at a 6% discount rate) per acre of waste assimilation (*i.e.,* nutrient filtering) and water supply services provided by wetlands in Massachusetts is $75,196 and $291,357 respectively. In addition, the same study performed a literature search identifying a range of values between $5,792 and $24,330 for each hectare of wetlands (values for habitat; water supply; erosion, wind, wave barrier; storm and flood control; and recreational opportunities) (Olewiler, 2004). Furthermore, when discussing such values, it should be noted that the value estimates for either net primary production of an ecosystem or a specific service such as the savings of water treatment costs provided by nature, are likely to underestimate the total value because such calculations do not reflect society's total willingness to pay for the ecosystem service(s) provided (Olewiler, 2004). For example, the willingness to pay for drinking water quality improvement provided by wetlands in the US Midwest ranges from $70 to $87 per person per year. In Saanich, when asked to allot an imaginary $100 to a selection of 10 capital projects, residents choose to allot the largest portion, $13.02, to roads and traffic control, followed closely by parks and trails at $11.15, the municipal water system at $10.81 and the sewer and drains system at $10.53.[xxxi] Surprisingly, residents value their parks and trails more than their drinking water system, though no specific monetary value can be calculated from these findings..

Specific to water quality, the results of the 2006/07 sampling program are as follows:

- The wetland at the Willowbrook subdivision was effective at removing nitrogen from the water. On average, the inflow concentration of total nitrogen (as calculated by summing the

ammonia, nitrate, nitrite and Total Kjeldahl Nitrogen) was 1.86 mg/L and the outflow concentration was 1.54 mg/L. Outflow concentrations were higher than inflow values in the fall of 2006, but lower on all other occasions. This wetland was consistently a significant exporter of ortho-phosphate. On average, concentrations leaving the wetland were 239 µg/l or 1103% higher than concentrations entering the wetland. This is likely because the sediments have been allowed to build up in the wetland, and, combined with the accumulation of dead plant material, the wetland plants are now unable to use up all the phosphorus that is entering the water either through new inputs from stormwater or from decomposition processes.

- The wetland was effective at reducing the total dissolved solids (TDS) in the water. On average, TDS was reduced by 167 mg/L (average removal efficiency of 32.7%). The average removal of Chloride was 21.7%.
- The Willowbrook wetland was less effective at removing suspended solids than anticipated since periodic maintenance has not occurred (*i.e.,* the cleaning out of sediment deposition chambers). The average outflow concentration was 16.85 mg/L compared to an inflow concentration of 6.88 mg/L.[xxxii] The Glanford wetland, by comparison, removed an average of 17.7 mg/L of TSS (average reduction of 28%) because it was maintained by Saanich during this period. This underscores the need for education of City staff and scheduling of maintenance for these systems, as with any other form of infrastructure.

Costs to treat these pollutants by conventional means are outlined in the Blenkinsop Case study, above, though since loadings are not available, no monetary value can be calculated.

Maintenance

Periodic maintenance of the restored creek system is less onerous than the operating and maintenance (O&M) costs required by servicing a storage tank (and pumps), various catch basins, and dredging a ditched creek. Furthermore, in addition to operation and maintenance costs, the traditional infrastructure would eventually require replacement, requiring an infusion of capital and borrowing costs. In contrast, the restored wetlands and creek do not depreciate (rather they appreciate and can be self-maintaining provided there is proper management). In addition, periodic maintenance for the reconstructed wetland channels and treatment ponds with restored creek is estimated on an annualized basis to cost the municipality approximately $2,000, which, during interviews, the municipality identified as being less than might have been the case had a traditional approach been used, although the exact amount was not quantified. Furthermore, there had been no pre-project audit of the above items and post-project data could thus not be compared to quantify the exact difference. Our conclusions are limited to literature reviews, interviews, and observations from the limited pictures taken prior to the project, compared to evidence on site today. These conclusions are as follows:

- Neighbourhood floodplain storage capacity was enhanced to defer or avoid downstream flood hazard in collector areas compared to traditional pipe solution (no previous such attempt);
- Improved water quality and sediment reduction;
- Reduced stormwater volumes discharged. Consequently, downstream flooding was reduced through the reduction of peak flows and the total volume of runoff. The wetlands and the north end of the project treat and slow stormwater from an older subdivision as well as the

Willowbrook site. The wetlands at the south (near McKenzie Avenue) only treat and slow Willowbrook's stormwater, while the wetlands at the center of the property treat and slow Glanford Subdivision's stormwater. These three areas work together to treat and slow stormwater prior to entering Swan Creek thereby reducing peak flows and the associated downstream ecological and property damage that can result;

- Improved quantity and connectivity of public open space (this had been a goal of Saanich Parks Department) and recreational amenities in the area with trails (the land owner donated 17% of his land to park space, versus the normal municipal requirement of 5%). Connectivity of public open space in an enhanced state to other neighbourhoods, schools and other wetland segments in the watershed catchments area (previously private property);
- The restored area has educational value and opportunity. Nearby schools have used the area as an outdoor classroom and a site for schools involved in planting programs. Furthermore, various studies have reported that parks enhance education by serving as destinations for local field trips and outdoor classrooms that illustrate natural and life science lessons (Heffernan, 1994; Lucas, 1995; Klemmer *et al.,* 2005).
- Improved biomass generation creating improved carbon sequestration and reducing localised heat gain (limited previous biomass from grasses, limited additional growth, compared to more substantive growth of willow, and other wetland/upland species); and
- Enhanced fish, bird and wildlife habitat within an urban environment (there had been little habitat in this area previously).

One of the important benefits of the project is the conversion of a single-purpose sewer line corridor into an upgraded proper functioning wetland, and linked neighbourhood trail system, thus adding functionality to otherwise unused space and retaining full access for repair and maintenance. This has added bird and wildlife habitat at developer cost, and improved a public right-of-way in a way that benefits the community. It also provides park space, recreation, and habitat, as well as stormwater management in a single corridor and treats runoff from both the new and existing subdivisions.

Some studies have noted concerns about creating park space that will attract crime, but this may simply be a design issue. For example, designing greenways to "minimize potential homeowner - park user conflicts and maximize the access and views of the greenway can help to avoid a decrease in property values of immediately adjacent properties" (Seattle Office for Planning, 1987). The Crime Prevention Through Environmental Design (CPTED) program has codified this process and is in use in new developments in Saanich. Furthermore, The American Planning Association has concluded that "park-like surroundings increase neighborhood safety by relieving mental fatigue and feelings of violence and aggression that can occur as an outcome of fatigue" and that barren spaces are more prone to crime than parks landscaped with greenery (McMahon *et al*., 2003). In the case of the Willowbrook subdivision, as one purchaser liked the proposed concept he decided to purchase a key lot with views over the wetland. Unlike other homes backing on to the park, the homeowner did not install a fence barrier between his home and the public trail and, in fact, orientated and installed large windows to look out over the wetland (Figure 27). This home has no evidence of vandalism or break-in, where in contrast, homes with fences erected backing onto the park, have evidence of vandalism.

We identified a potential barrier to effective management of the wetland, because the municipal jurisdiction for long-term management sits with the Saanich Parks Department, whereas the ongoing maintenance with the wetland is an engineering department concern and responsibility. We expect this may lead to eventual possible challenges in maintaining the function of the wetlands (to capture sediment and consequently treat water before discharging into Swan Creek, as has been noted in the water sampling). Furthermore, we also noted that the management techniques currently being applied that could eventually degrade the wetland's utility as part of the trail system (*i.e.,* inadequate maintenance schedule to remove invasive species which have now overgrown). What appears to be required is the development of a "management manual" to guide the long-term management and maintenance of the wetland and surrounding area.

Figure 29: Willowbrook, 2002 & 2007

Stakeholder Perspectives

Various stakeholders had appreciable benefits from the project. By managing stormwater on site using engineered wetlands prior to discharging into Swan Creek, water quality, and biodiversity have improved. This project reutilized a corridor that added little aesthetic benefit and converted it to a linked trail system that provides an attractive contribution to the community thereby adding valued public amenity at no cost to the public.

Community

From the surrounding community's perspective, the ecological solution met their required collective criteria of not impeding the 200-year floodplain; an issue that was not addressed by prior development proposals. This was a key factor affecting the outcome and contributed to the expedited public process. From the perspective of residents of the development, the ecological solution likely provides greater assurance that properties will sell faster and potentially at higher prices. For the municipality, this solution provides increased utility from an existing asset, which was developed at no cost to the municipality because the developer covered this expense. In addition, the long-term maintenance and management of this ecological solution is expected to be cheaper than the costs associated with a traditionally engineered solution.

Developer

For the developer, there was increased revenue from density bonusing, lowered capital and borrowing costs from utilizing green infrastructure (rather than traditional), as well as reduced permitting delays. The wetland persuaded the community to support the project whereas others had failed, so clearly it was instrumental in producing a successful project or any project at all. Originally the land had been zoned for 17 lots with a 5% parkland contribution. By enabling the community to participate in the development process as well as proposing to use green infrastructure, restoring a portion of Swan Creek, and donating 17% of land to parkland, the developer was able to rezone his property to 31 lots. The ability to use public land to install infrastructure reduced the impact on the developer's lands and consequently mitigate cost impacts. From the developer's perspective, the ecological solution minimized loss of value, and avoided extra cost that would have resulted from traditional engineering solutions for stormwater management. Unfortunately, the layout and design might have leveraged the added amenity better than it did, but the project was successful nonetheless.

Regulatory

From a regulatory perspective, this approach required negotiations with the same authorities as described in the Blenkinsop case study. This approach required the same regulatory approvals (*i.e.,* Section 9 approval from the Ministry of the Environment, approval from the Department of Federal Fisheries (DFO)) and setbacks negotiated with all parties (including the municipality) under the Streamside Protection Act. If the project was to commence today, it would face a different regulatory environment and unlike the Blenkinsop case study, the Willowbrook subdivision would not have fallen under the institutional qualification today. As a result of the changed regulatory requirements surrounding riparian vegetation (*i.e.,* larger setbacks – 30m [at the high water mark based upon the current stream width]), the installation of the stormwater ponds adjacent to the creek may not have been approved, for the new Riparian Area Regulations (RAR) states that no stormwater treatment facilities can be placed within the Streamside Protection and Enhancement Area (SPEA). Consequently, it can be speculated that the developer may have been forced to install more traditional infrastructure, and may have lost some density as a result of the new regulations.

Municipal

Rezoning, density increases, and securing development permits proved to be the key barrier to prior attempts at development because they failed to win public support. In certain respects therefore, but solely due to the community's desire for better solutions, regulation and public process in fact worked in favour of sustainability. This does not mean to say that current engineering requirements were easy to resolve, for this required extensive site visits, hydrological modelling, and community seminars on the benefits of improved creeks for the municipal staff, the developer, and the community. Furthermore, considerable education and policy shifts are required to connect the municipality's Parks and Engineering departments, processes and budgets in order to further enable projects of this nature. As a result of the prior point, there is a clear benefit from a planning perspective. The questionnaire undertaken by the authors of "Corridors of Green and Gold" has clearly demonstrated public support for planning policies favouring sustainability. This point identifies the benefit that can accrue to politicians and planners wishing to meet community preferences as well as the benefit in orienting Official Community Plans (OCP) and rezoning processes to support public interest. Planners may wish to consider positively supporting sustainable projects in some way (*i.e.,* shorter processing or cost incentives) depending on community interest in sustainability.

Value Conclusion

From available information we conclude:

The cost of a traditional storage tank system with pumps was estimated to cost the developer between $260,000 and $300,000. In contrast, the ecological approach that was undertaken cost the developer $120,000, creating an immediate savings of $140,000 to the developer.

The project could have made greater use of the potential value from the creation of the wetland, but the design of lots fronting the wetland did not optimise views or access. The main value to the project was securing approvals and expedited municipal process (63 days versus 2-3 years, which was not quantified); without approvals, the land would have had limited utility and value, so the ecological approach essentially created the value. This is not to say that an alternate "green" but less ecologically progressive approach might not also have secured approvals, however it would likely not have increased lot yields (that created additional revenues of $200,000 in the case of Glanford and $650,000 in the case of Willowbrook) by applying innovative stormwater management practices. Therefore, by rehabilitating Swan Creek from an agricultural drainage ditch, creating stormwater wetlands to manage stormwater, extend wildlife corridors, connect local public walking trails and provide habitat, and dedicating this 17% of the property to Saanich as parkland created a net benefit to the developer of $850,000.

The municipality also gained from this approach as well. If the traditional method had been approved, the developer would have installed a containment and pump system at his cost, but the long term operations and maintenance cost would have fallen on the municipality. Using Blenkinsop's ditch proxy, we expect that the portion of Swan Creek that runs the length of the property would not have been restored to a functional condition and therefore would have required a similar maintenance schedule as well as cost.[xxxiii] Furthermore, the infrastructure installed would have yearly electric and routing maintenance and every 10 years would need to have the tanks pumped out and the pumps replaced; discounting for time (25 years) at a 5% interest rate, the maintenance of the Swan Creek ditch as well as operation and maintenance of the stormwater infrastructure would have a present value cost to the municipality of $17,560. In contrast, we estimate that the current system will require maintenance (*i.e.,* removing sediment from natural deposition chambers) every 6 years at a cost of approximately $2,000. This value discounted for time (25 years) at 5%, would amount to a present value cost of $4,057, therefore in operations and maintenance alone the net benefit of an ecological approach to the municipality is estimated to be a benefit of $13,503. Similar to the Blenkinsop study, accounting for estimates of other benefits such as carbon storage and sequestration ($2,680) as well as benefits such as water quality and biodiversity ($12,470), increases the total net benefit to $28,653. Although a small amount accrues form the carbon component, the GHG impact is worth noting by the ample illustrations in Figure 27. We estimate that due to the increase in vegetation and provision of bird habitat there is also a pest control value.

Another value that has been infrequently studied within the literature is the educational benefit arising from the environment. For instance, Shafer *et al.,* (2003) concluded that the educational benefit arising from forested areas is approximately $3.70/person/year. As many schools have used the area for study, we can roughly quantify the value of this benefit. Therefore, adjusted for time and currency, Shafer *et al.,* (2003) value in today's dollars is $5.75/person/year. In the context of the Willowbrook study, there are four schools within walking distance of the site: Pacific Christian School, Rogers Elementary, Glanford Middle School and St. Andrews. In total, approximately 2,119 students attended these schools this past year. Assuming only 20% of the students walk through the site and/or have had a class at the site, the

educational value could be estimated to be $2,437 per year; discounted over 25 years at 5% results in a present value benefit of $34,345. As Baxter Pond (Rogers Creek study) is in close proximity, it is hypothesized that it too would have such a benefit. In total, the present value of the net benefit to the municipality is $62,998. In order to better measure the intangible benefits, a Public Interest Value approach would be necessary where not only are the Triple Bottom Line accounts evaluated but also, several recipients' contributions and benefits are valued. While discussions with residents, Saanich officials and others identified a sense that there was extra value, but there was no hard data to substantiate this common view. As such, this type of "three dimensional valuation" is uncommon and costly.

Figure 30: Willowbrook/Glanford Financial Summary

Willowbrook/Glanford (Traditional)	**Municipality**	**Developer**
Cost of the Traditional Stormwater System		($260,000.00)
PV of Ditch Maintenance	($7,651.95)	
PV of Costs for Future Capital Replacement of Stormwater Infrastructure	($9,908.03)	
Total Present Value	($17,559.97)	($260,000.00)

Willowbrook/Glanford (Sustainable)	**Municipality**	**Developer**
Cost of Restoration		($120,000.00)
Increased Lot Yield		$825,000.00
PV of Wetland Maintenance	($4,057.28)	
PV of Educational Value	$34,344.83	
PV of Ecological Benefit	$12,470.09	
PV of Value of Carbon Stored	$515.30	
Total Present Value	$43,272.94	$705,000.00

Net BENEFIT	**$60,832.91**	**$965,000.00**

South Valley

Project Description

The South Valley Creek project is located within the District of Saanich in the Wilkinson Valley, an area of small acreage holdings in transition to urban infill of single family detached and townhouse development. The infill developments are being completed in several phases as previous owners' properties are assembled. The valley's land use plan is designed to be continuous and linked as the redevelopment of the area occurs. The proposed neighbourhood plan identifies the area for residential infill allowing various forms of residential development providing the overall density does not exceed the permitted units per hectare.

Figure 31: South Valley Bioswale and Creek (2005)

Peers Creek, a tributary to the Colquitz River, has been ditched along the valley bottom. In a portion of the development it has been restored to a functional condition. The restored portion of the creek in the newly created subdivisions was relocated and restored to a functioning condition for stormwater management, habitat enhancement and recreational amenity. The exception was a segment south of Tulip Avenue on South Valley Drive. This development primarily comprises single-family homes with an installed underground culvert to accommodate the pre-existing creek under the road which discharges into the restored Peers creek north of Tulip Avenue where the case study segment begins.

This case study overviews four of the phases of the infill redevelopment in Wilkinson Valley and looks at the details of one segment, highlighted on the site plan in Figure 32 on page 46. The Tulip Avenue and South Valley Drive segment is comprised of 6 single-family lots and a single townhouse component of 8 detached and semi-detached units. Total land assembly for this phase was +/-3.15 acres (1.275 Ha).

Within the 18 m road right-of-way is a 6 m road, 3 m trail, bio-swale along the east side of the paved road and a portion of the relocated creek. The road allowance was enhanced by 5 meters to include the creek restoration and was dedicated as park. The bio-swale and trail were designed to accommodate the existing sewer line.

Site Plan

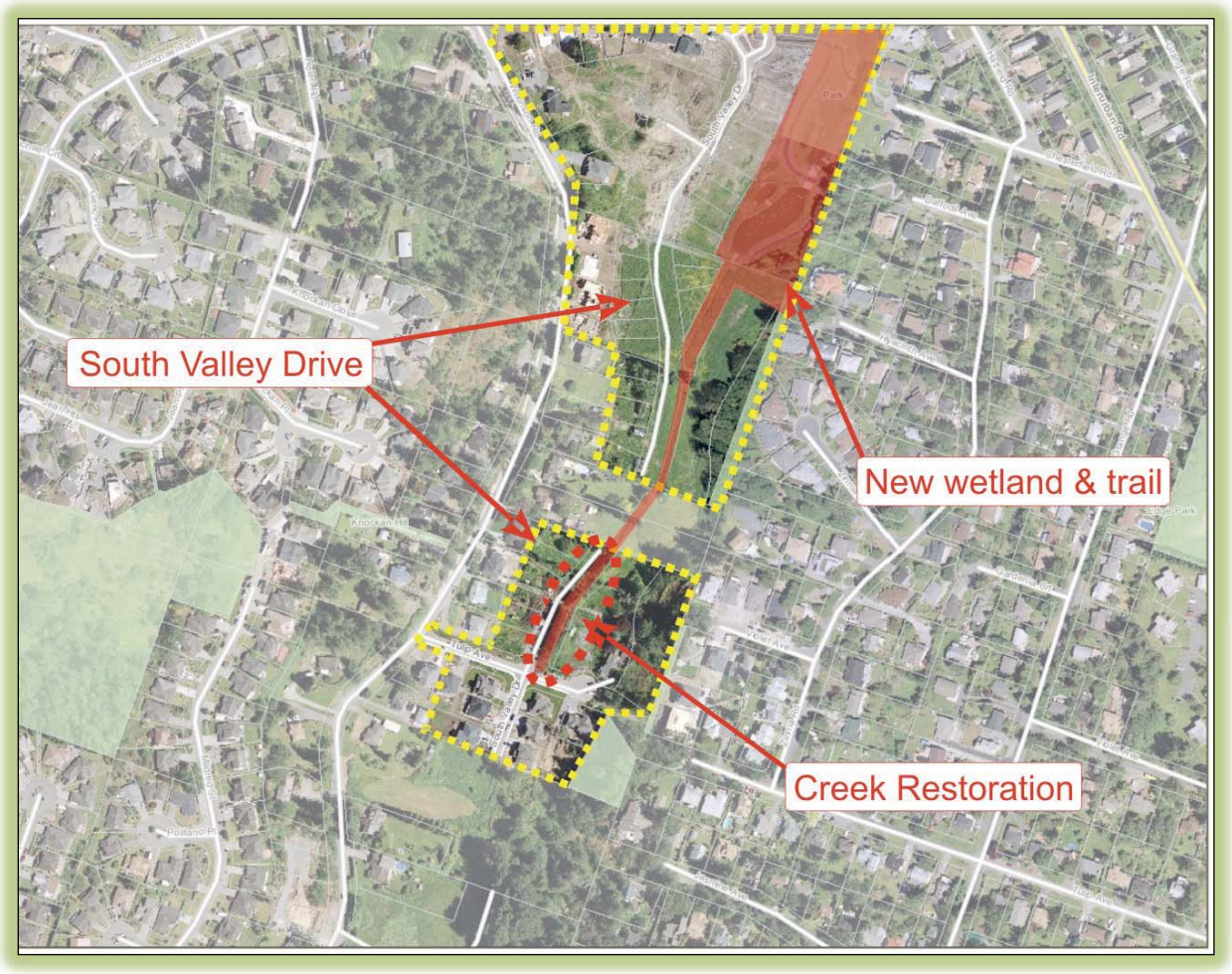


Figure 32: South Valley Drive Site Plan

Analysis

Project Aspects

The overall project benefit was one of substantially improved visual appeal, creating a linear park from what is essentially, a stormwater drain. The attraction of the creek was deemed sufficient that an artist's rendition of the creek was used for the main marketing board and material. This aspect is worth highlighting, because the appeal and value of natural solutions when compared to traditional engineering solutions is easy to miss, but provides appreciable value.

The point is best illustrated by contrasting the two approaches. On the one hand, it is difficult to envisage that a traditional stormwater pipe would ever form the focus of a sales and marketing campaign; on the other hand, natural approaches to rainwater management are not just environmentally and ecologically appropriate, but are also aesthetically pleasing, sufficient to form the poster for marketing. Clearly from

our interview of the contractor/developer, this was deemed an aspect that would help sales – both values achieved and the speed of sales.

Other aspects of the project identified include:

- The Wilkinson Valley Action Plan required a 5-metre setback from the creek. Rather than adhering to the regulations the municipality allowed the developer to meander the creek within that total area (meaning that in some places the setback is less than 3 metres and in some areas more). Furthermore, the municipality also allowed the developer to install the bioswale, trail and creek within the road right-of-way (ROW). If the municipality had not been flexible with these regulations, the developer would have required an additional 5-7 metres for the creek and riparian zone enabling the developer to minimize the impact on the number of lots built, albeit they would be smaller. Specifically, this enabled the townhouse cluster fronting Tulip Avenue to be sized and configured to maximize value within the allowed density. By changing the setbacks without negatively impacting the function of the restored creek, the density achieved provided the revenues that permitted the developer to fund the creek restoration.

Figure 33: Grasscrete at South Valley

- The application of low impact development (LID)[xxxiv] techniques (*i.e.,* the roadside bioswale, grasscrete, and other stormwater best management practices) as well as the restored creek provides an added landscape feature over traditional curb and gutter boulevards. This helps to differentiate the project from other subdivisions, thereby enhancing value through faster lot sales, as reported by the developer.

- Overall unit density was maintained over the development through a mix of single family and townhouses. This may be more dense than might otherwise have been envisaged, but is consistent with densification and minimisation of excess land use, which itself is consistent with Smart Growth.

Figure 34: South Valley Trail and Creek

- There is a reported benefit in improved marketing of townhouse development (anecdotal from the developer as units had not sold at the time of interview). In justification of this claim, the developer related an instance of a prior purchaser seeking out this project due to superior landscaping and amenity features, including the restored creek. The developer considers that this kind of investment in his projects over a traditional minimalist development approach has benefits in terms of absorption (that is, time it takes to sell) and the price achieved. He considered the investment in extra costs would be recouped as the features improved the perception of a superior quality neighbourhood.

- A beneficial aspect is that the agricultural drainage ditch that had little ecological function (similar to Blenkinsop and Willowbrook) was upgraded and restored to a proper functioning creek. The benefit of this (apart from visual appeal) is the additional carbon sequestration, expected increase in water quality and decrease in downstream sediment transport, but also natural solutions generally require lower maintenance cost and time than engineered or managed solutions as has been documented with the Blenkinsop and Willowbrook case studies.

- Part of the project included creating and expanding the public trail corridor through the subdivision and connecting to the larger regional trail system. For homeowners interested in such connections, proximity is an added sales feature and attraction, further benefiting sales. Balancing this, others are concerned that public access via trail systems can lead to vandalism, putting off potential buyers by this feature. On balance, sensitivity to design can overcome negative aspects of public accessibility.

- Enhanced park and open space dedication (estimated at approximately 10% versus 5% required dedication) at no additional municipal cost, benefiting the municipality in avoided costs (*i.e.,* purchase of the land) and to residents since it adds to amenity visible form their property.

Figure 35: South Valley Agent's Marketing Image

- Costs were unclear because there was no external audited assessment and as the costs are private, the developer declined to make the costs available. Attempts to estimate the cost independently were unsuccessful as we identified duplication of costs between the stormwater pipe and creek and we concluded data could not be adequately separated to be meaningful in any way. The developer indicated that the duplicate costs were in the order of $120,000, but this did not include delays identified during the approvals process and we could not substantiate the sum mentioned.

- Additional value to homes from constructing the creek, at the time of the writing of this report, are not yet clear, but will be once the remaining homes sell and are publicly registered. An interview with the developer identified that 'the extra cost was worth it in terms of extra value' in the developer's opinion. Sales of the lots were deferred until completion, which is common in the local market appealing to local buyers, who want to see completed product. Unfortunately, the market dipped part way through construction and thus absorption slowed, so evidence on absorption and prices is expected to be inconclusive given the change in market, sales method and small data set. Asked whether the developer would do the same again in another project (*i.e.,* apply low impact development techniques to manage stormwater and creek restoration), his answer was that he would. This is the only indication available of extra value from applying low impact development techniques to manage stormwater and from the restoration of the creek, but it is an important one.
- The trail system was built to meet Saanich's standards, and this precluded using permeable solutions. Preferably, alternate approaches such as crushed rock or permeable concrete could be used and further reduce the need for stormwater infrastructure (*i.e.,* catch basins, etc), since this solution would reduce or eliminate the need for rainwater runoff management. This highlights the need for an alignment between Engineering and Parks department standards in order to facilitate sustainable practices.
- Stormwater treatment and management on-site, plus treatment and management of stormwater from the adjoining subdivision, lowered the downstream stormwater

management cost to the municipality (increased pipe capacity and management systems handling)

Stakeholder Perspectives

This aspect has been separated due to the complexity we identified. It highlights a common but complex issue of how municipalities struggle to adapt to an ecologically-centric approach to planning, engineering, codes, and development itself. It is stressed that while the following identifies room for improvement in the system, it should not be deemed a failure. It is symptomatic of change.

We identified that contrary to initial claims, there had been an avoidable duplication of stormwater solutions on the project. Originally it was claimed that there had been cost savings through undertaking the project but when meeting the developer on site, he noted and we confirmed the circumstances illustrated in Figure 37, which attempts to illustrate the layout of the storm drainage on the site. Reference is made to this diagram to explain the issue.

The first phase of approvals for the site related to the lots marked "A." These included provision for traditional engineered solutions of underground stormwater drainage taking the runoff from single-family development (*i.e.,* both road and sidewalk surface drainage, and house rainwater runoff). After this was approved, a move was made to encourage more sustainable approaches, resulting in the restoration of a portion of the creek, the inclusion of the bioswale and other low impact development techniques to address the extension of the existing stormwater pipe, as well as road and building rainwater runoff from the adjacent multifamily development ("C" in Figure 37). Stormwater runoff pipes were also required for the second phase single-family development, noted as "B."

The storm drain discharges into the creek, which absorbs the rainwater energy through the use of natural design and acts as something of a "reservoir" in storm events, something the storm drain cannot do. Important to identify here is that the creek is able to function not only to address the inability of the storm drain, but also provides drainage for the adjacent lands, noted as "C" on plan. The underground storm drain that links "A" and "B" in Figure 37 is designed to handle runoff from the houses behind but also, to address road runoff. This seemed peculiar since the intent was that the bioswale would manage this. On enquiry, we were advised this is because the road "crowns" (*i.e.,* the centre of the road is slightly higher than the edges, sending the rainwater to one side or the other). We questioned why the road could not have been sloped entirely towards the bioswale and thus have a single drainage solution, and were told that a crowned road is the municipal standard.

Figure 36: South Valley Stormwater Drain

We also enquired about residential building runoff and were told that the new houses (noted as "B" in Figure 35) needed to drain to somewhere and that the municipal standard is to use stormwater pipes. We noted that other jurisdictions do not require this and that the multi-family directly opposite was using grasscrete systems[xxxv] and drain tile. We were told that "B" needed a different, piped solution due to site characteristics (*i.e.,* slope and the need to stop water rising into the basement).[xxxvi] We are unable to verify this and from observation, training and experience, note that very old buildings have long existed on sites with greater slopes while draining into soakaways. The usual requirement is to require hydrostatic pressure to be addressed in combination with good insulation (to offset interstitial or surface condensation), vertical and horizontal moisture-proof membranes.

The result of this is a duplicate drainage system and an increase in costs that we believe may have proven avoidable or capable of mitigation, with sufficient commitment to effecting change. The problem appears to be that existing practices, standards, codes and bylaws have created barriers to change and more sustainable practices. In the case of the South Valley project, the municipality was not flexible in policies surrounding the trail width or the application of permeable paving (a LID technique), as a consequence, this appears to have actually doubled sidewalk widths and increased the amount of impervious area and stormwater run-off. As low impact development techniques are continually applied and documented elsewhere, it is hoped that the municipality will become more flexible in its policy towards the application of such practices. As it stands, the municipality's strict adherence to policy requirements increased costs impacting the project's value and the developer's revenue.

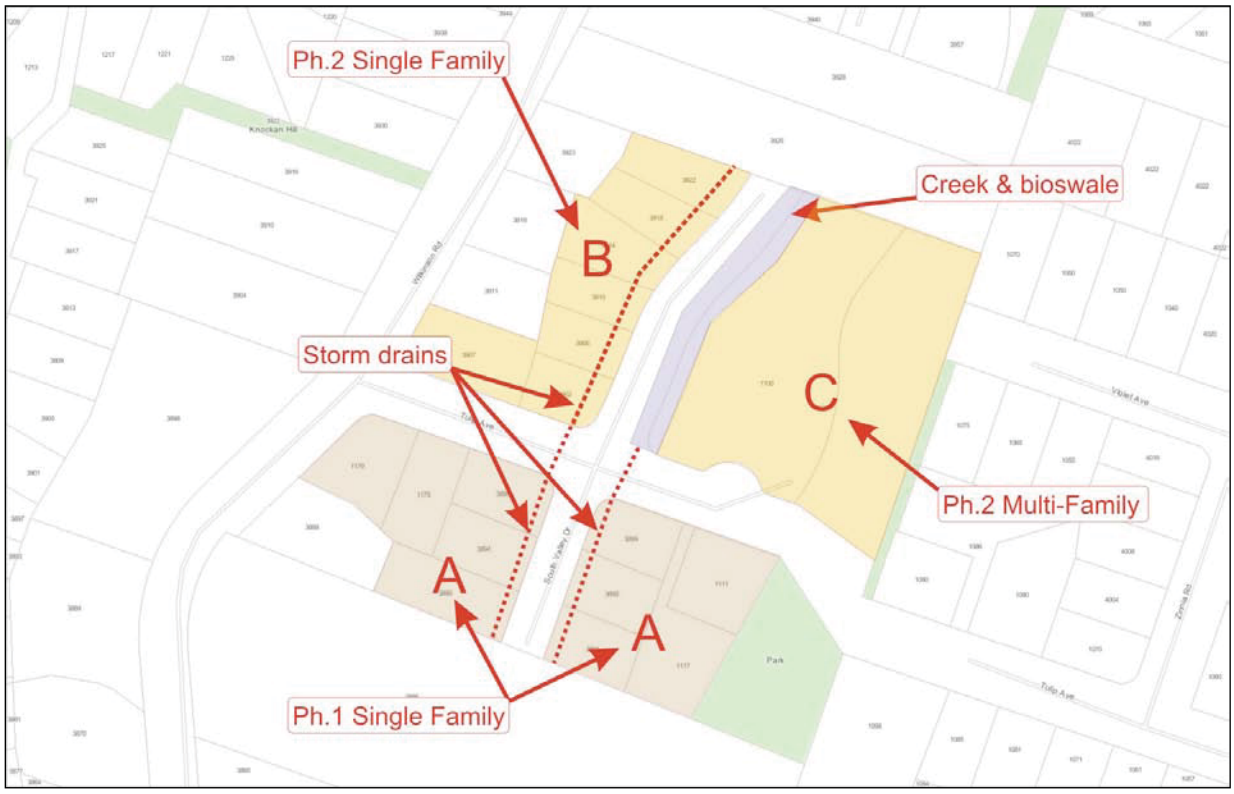


Figure 37: South Valley Drainage & Phase Diagram

The foregoing represents complex stakeholder issues. Clearly there is political direction for an ecological approach to stormwater management, which from "Green into Gold" mentioned previously, we believe responds to community interest and Official Community Plan (OCP) guidelines.[xxxvii] However there is engineering department hesitance, largely supported by historic practice and stated reliance on building codes and bylaws. Interviews with staff identified risk aversion as the driving influence: concern was expressed that storm drainage would be needed to avoid groundwater infiltration to basements. On the face of it this makes sense, however we point out that the creek has not resulted in moisture issues on the opposite side of the street and we conclude that this may be more a function of change in strategies for stormwater management than bylaw or code issues. Notwithstanding, the province has initiated a green building code review and ongoing review of municipal bylaws and practices will be needed. Thus:

- We documented that there are engineering issues with the low impact development approaches taken (and those proposed – *i.e.,* porous pavement). These impact process and risk and appear out of sync with other stakeholders' perspectives;
- From our discussions with municipal staff there are perceived risk issues with the ecological approach, however the evidence does not substantiate the claim and we conclude the risk is low and capable of simple mitigation;
- Political and community interests support an ecological approach;
- There is perceived value (the developer supports the ecological approach) but this cannot yet be quantified with the South Valley case study (this has been shown with the Blenkinsop, Willowbrook and the Rogers Subdivision case studies);
- As other developments have now used South Valley, Willowbrook, and Rogers subdivisions as models, there is clearly broader stakeholder interest in applying an ecological model to development.

Value Conclusion

While there may be direct property value from a project of this nature, at the time of review the homes adjacent to the bioswale and creek were not available for sale. It may be possible to revisit the project when fully occupied and assess what incremental value was obtained, however it is considered more likely that the steps taken reduced the time to sell out the project rather than add distinctive value. We consider the relatively small number of homes would create difficulty in providing conclusive evidence of increased sales price.

From our discussion with the developer, there were no cost savings to the developer from this approach, because the bioswale and creek duplicated traditional engineered solutions (on the opposite side of the street). We do estimate that because of the flexibility with regulatory setbacks in regards to the right-of-way and the creek, the developer was able to maximize the density of the development and therefore increase his overall revenues. In time, we expect increased awareness and different approaches to handling stormwater will lead to changes in Codes, bylaws, statutory constraints and increased awareness amongst engineering, planning and other staff, councillors and others, such that an ecological approach can be more appropriate and cost effective than the alternative. Governments at all levels will need to take steps to effect this change however, and introduce measures[xxxviii] to reduce barriers to more sustainable solutions, for there are valuable benefits that can be derived from such solutions (pollution abatement, protection of downstream water sources (*i.e.,* flooding), ground water recharge, improved water quality, habitat improvements, and increased aesthetic values).

There is arguably a small benefit from the dual use of the roadway at the rear of housing fronting the creek. Basically, the roadway serving some of the houses has been laid as grasscrete and will be linked to the public trail system when other adjacent sites are developed. It remains to be seen whether this will be an actual long-term saving since the more logical pathway immediately fronts the stormwater feature and the trail can easily be redirected at no cost. The savings are thus considered negligible because the difference in cost between different surface types and treatments is likely small, but the benefit ecologically from using grasscrete is that tree roots and water flows are disturbed less than with other alternatives.

Rogers Subdivision

Project Description

Rogers subdivision is a 72-house, phased development on Christmas Hill (previously known as Rogers Farm) in the District of Saanich, BC. Rogers Subdivision is situated the east side of a major Highway (the "Patricia Bay Highway" – Highway 17), which serves as a connection from the City of Victoria to the airport and ferry terminal, as well as other communities on the Saanich Peninsula.

Figure 38: Baxter Pond 2007

Seeking to subdivide and develop Rogers Farm, the developer was initially asked to provide on-site stormwater detention reservoirs which, given the geology of the site, would have required blasting and excavation of bedrock on an area of land equivalent to three single family residential lots. The stormwater from these detention ponds would have been conveyed by storm drains directly into Gabo Creek, situated across the highway and accessed via underground stormwater pipes. The cost of the on-site treatment was expected to be expensive and after several years of conflict with the municipality, the developer sought a more cost-effective ecological alternative.

A wetland on a linear parkway at the base of Christmas Hill had previously been used as a fill dump and was no longer adding functionality to Gabo Creek. As part of the Rogers Farm subdivision construction, this wetland was restored and expanded, called Baxter Pond. Public parkland was used to manage stormwater, as it would allow the wetland to capture stormwater from the new Rogers Subdivision, a segment of Highway 17 and a portion of two older adjacent subdivisions, thus maximizing protection of Gabo Creek.

As a result of the approach using existing public land as a stormwater treatment solution, the ecological function of Baxter Pond and a portion of Gabo Creek were restored to a functional condition creating a significant amount of waterfowl, songbird and aquatic habitat. The community permitted the use of public land and, in return, received stormwater treatment for the entire sub-watershed plus a restored park at the developer's cost.

Site Plan

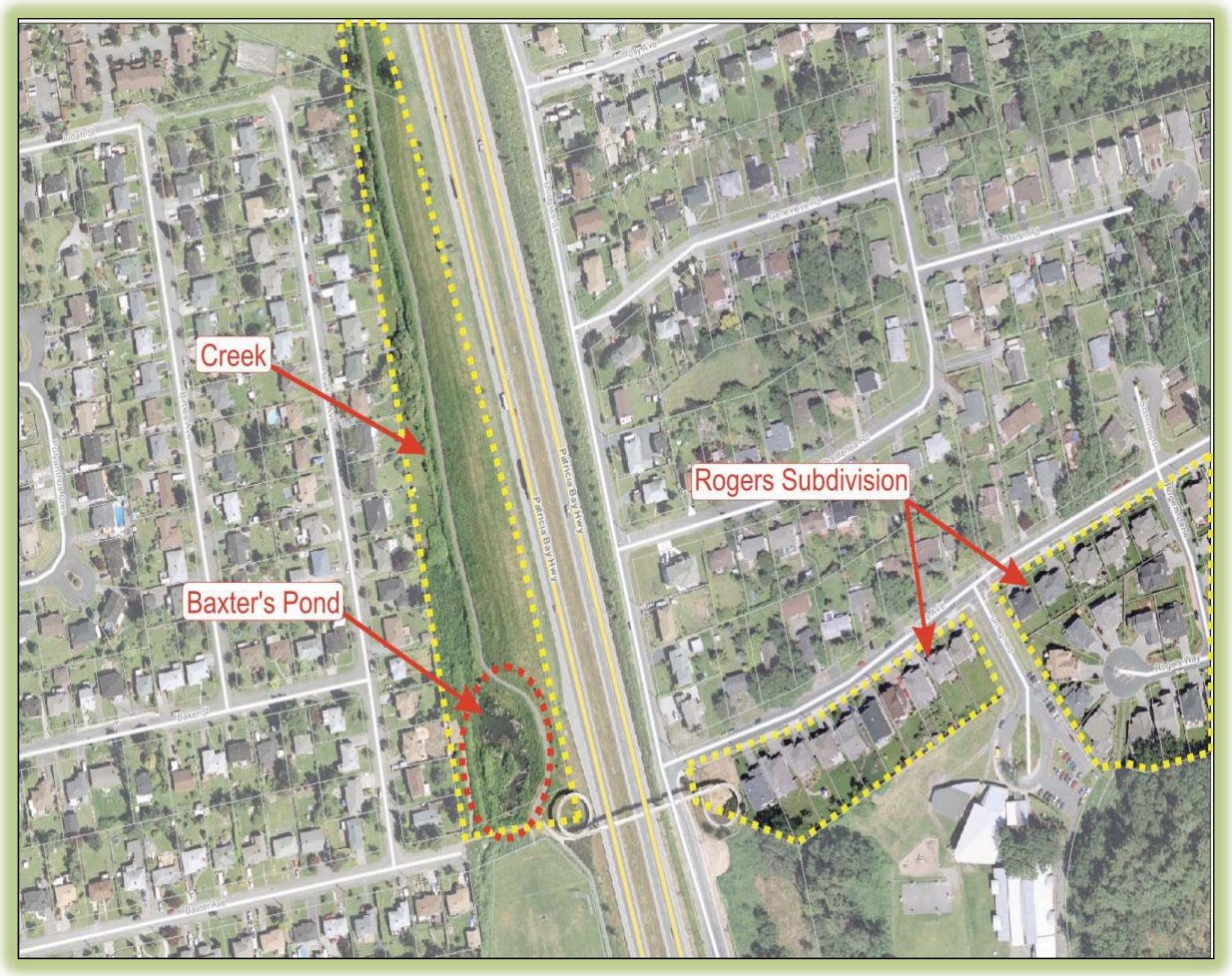


Figure 39: Baxter Pond Site Plan

Analysis

Project Aspects

The key aspects of the project are:

- The off-site stormwater treatment and management reduced cost and helped expedite development permit applications and approvals. The cost for traditional on-site treatment was estimated at in excess of $275,000, whereas the cost of rebuilding the wetland on public land was $75,000. There was an immediate cost saving of $200,000 to the developer.

- From the District of Saanich's perspective this solution meant a cash injection of $75,000, which restored previously lost ecological function but also created a significant public amenity as an improved trail/park facility.

- From the developer's perspective this approach meant that three building lots were saved that would otherwise have to be committed to on-site stormwater management. The financial benefit of this saving is estimated at in excess of $345,000 ($115,000 per lot in 2002).

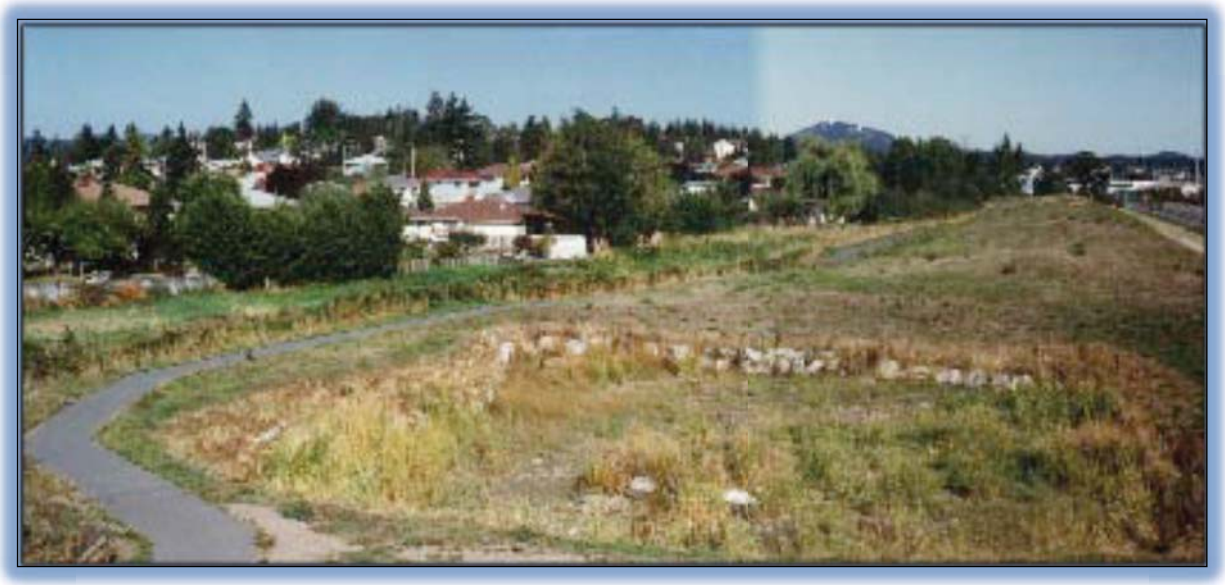
- This solution had greater benefits than simply the treatment for Rogers Farm subdivision, since, in effect, the developer funded stormwater treatment and management solutions for a portion of two existing subdivisions and a segment of the Pat Bay Highway (Hwy 17).

Figure 40: Rogers Subdivision Across the Pat Bay Highway from Baxter Pond

- Restoration of Baxter Pond resulted in the enhanced treatment and retention of stormwater runoff. As in other projects, large rainfall events are managed by the ecosystem, providing enhanced rainwater retention (although we could not quantify this value). Estimated benefits that arise from the project are carbon sequestration and storage ($2,498), educational value ($34,345) and the social benefit ($11,623) which is likely to encompass protection of downstream water sources (*i.e.,* flooding), ground water recharge, improved water quality, and habitat improvements. Such benefits could not be easily and cost effectively achieved with traditional engineered solutions.

- The issue of enhanced recreational amenity recovery is difficult to place a value on, due to its intangible nature. However, during our assessment of this project we spoke to several local residents using the trail system and there is clearly local approval for the Gabo Creek restoration as an enhanced amenity.

Figure 41: Baxter Pond Prior to Restoration



Stakeholder Perspectives

Community

The neighborhood has received an attractive amenity which, in turn, prompted the improvement of the local trail. The area includes an adjacent school (and three others nearby). We observed children watching the wildlife (*without* this being part of a class exercise) and there is thus an educational benefit. It also represents a possible liability risk, but steps have been taken to mitigate this through fencing and an engineered egress from the pond.

Developer

For the developer, adopting sustainable practices both improved overall financials and expedited permits. It increased lot yield and facilitated increased gross revenues. It also resolved a long-standing conflict between the municipality and the developer. There was a clear net gain to the developer.

Regulatory

This project set a precedent for treating stormwater on common (municipal) property that may be applicable to other similar situations where the public benefit outweighs the cost. Though Gabo creek has limited fisheries value, it is a tributary to the Colquitz, which is a very high value stream. This project has been showcased by the Ministry of Environment's case studies and is used as a positive example in their educational presentations to developers and design professionals[xxxix].

Municipal

For government and the community, there was a clear net gain. Not only did the developer fund the restoration of municipal lands, other benefits accrued. These included amenity improvements, visual improvements, addressing previously unaddressed highway runoff treatment, resolving stormwater impacts (improved water quality, sediment detention, and downstream flooding) from other subdivisions at no additional cost, and reduced long-term maintenance costs and all of this at no cost to the taxpayer. It also addressed acting as a holding area for storm event discharges. This provided both engineering and planning benefits in terms of a greater buffer from storm events.

Value Conclusion

The expected increase in the value of homes adjacent to the restored area is assumed to be nil because they back on to the creek which is not visible from their yards. Nor, did we identify any extra value accruing to the developers of Rogers Farm from this project: the development's location the other side of the Pat Bay Highway effectively severs the development from the project and the lack of immediate proximity (as well as the negative externality of the highway) means provable economic benefit is too distant. The benefit to the developer is thus largely the cost savings from undertaking this project relative to alternatives, plus additional lot yield.

Overall benefit to the developer was comprised of savings from blasting, avoidance of having to use three lots for stormwater management, and reduced costs of implementing a stormwater management solution. From estimates provided to us, we conclude the net benefit to the developer was $545,000, despite contributing $75,000 to public community improvement. This value was derived from stormwater engineering cost savings of $275,000, less costs of $75,000, plus increased lot yield valued at $345,000. It is worth noting that the developer made other contributions through development cost charges etc. that would have raised this amount but also comment that if Saanich had undertaken a development viability analysis of the savings and contribution being made, it may have sought a larger sum as a public contribution. Other municipalities have occasionally adopted this approach, successfully, with both the developer and the community mutually benefiting.

As noted previously, the developer was a clear beneficiary of the project, but so was the municipality. The financial net benefit to the municipality was $75,000. If other estimated benefits are accounted for the net benefit to the municipality amounts to $123,466. Furthermore, although not quantified financially, important to note is the level of improved water quality, sediment capture and storage the wetland provides. The results of the sampling program are as follows:

Figure 42: Sediment captured by Baxter Pond

- On average Baxter Pond removed 40.84% of the Total Nitrogen and reduced specific conductance by 4.4%. The pond was effective at reducing sodium, and to a lesser extent, at reducing mercury and zinc. Between the inlet and the middle of the pond, cadmium declined by an average of 26.2%, chromium declined by 9.7%, mercury by 24.1%, lead by 39.35% and zinc by 38.5%.
- Baxter Pond was very effective at removing large, heavier particles, as seen in Figure 42 following a winter snowstorm. Sand from the Pat Bay Highway and neighbouring streets was washed into the pond and trapped.[xl]

Although it cannot be measured for the same reason as the loading rates, the potential for downstream flooding has been reduced due to the restoration of Baxter Pond. Prior to the development, Baxter Pond was designed and engineered to be a dry pond (*i.e.,* the pond completely dries out in the summer); as a consequence, there was no vegetation due to the lack of water and constant mowing by the municipal staff (Figure 41). During winter storms the area would fill with water, buffer some of the flows and then subsequently discharge into Gabo Creek. During more frequent storm events, the pond would fill up and any additional flows would be discharged into Gabo Creek with no reduction in velocity or volume. The restoration of Baxter Pond included complete redesign to create a deeper and larger pond thereby

accommodating not only the existing flows, but the additional flows from Rogers subdivision as well. The design and layout (*i.e.,* depth, length, and vegetation) buffer frequent storm events by retaining and detaining stormwater and, as a result, slowing the discharge rate and high flows that would have traditionally been discharged into Gabo Creek. Not only does the municipality benefit from the reduction in downstream flood risk, the public do as well. Furthermore, the public have also benefited from the increased aesthetic value from the restoration as well as the improved trail.

As in other projects, we conclude that a traditional appraisal approach would not identify most of these values. Appraisers have to use a development residual analysis in order to identify the net benefit, and in our experience at best only 10% of this cost saving will trickle through to the land value. In most cases however, by the time savings of this nature are identified, the land has already been purchased and the benefit is to the developer's profit, which may be reallocated to risk management, quality improvement in the development or other aspects that improve sales value of the completed buildings.

Figure 43: Rogers Subdivision Financial Summary

Rogers Subdivision (Traditional)	**Municipality**	**Developer**
Cost to Install On-Site Stormwater Detention Systems		($275,000.00)
PV of Dry Pond Maintenance	($4,057.28)	
Total Present Value	($4,057.28)	($275,000.00)
Rogers Subdivision (Sustainable)	**Municipality**	**Developer**
Cost of Restoration		($75,000.00)
Value of Increased Density		$345,000.00
PV of Wetland Maintenance	($4,057.28)	
Avoided cost of Restoring Property	$75,000.00	
PV of Educational Value	$34,344.83	
PV of Ecological Benefit	$11,622.52	
PV of Value of Carbon Stored	$480.28	
Total Present Value	$117,390.35	$270,000.00
Net BENEFIT	**$121,447.63**	**$545,000.00**

Vancouver Island Technology Park

Project Description

Vancouver Island Technology Park (VITP) is a renovation of an existing set of buildings previously owned by the Province of British Columbia, known as Glendale Lodge. Built in 1973, it was a residential hospital for severely disabled patients but was vacated in 1996, due to its unsuitable design. Following abortive attempts to sell the property, the province granted approval to renovate the 165,000-square-foot former hospital into a research technology park (VITP). Work started in October 2000 and the project became fully leased in 2004/05.

The provincial government, through an interest-only loan, financed the project with the plan being to create a business park to support the University of Victoria and adjacent Camosun College, amongst other original participants in the venture. This was seen as an exit strategy alternative to selling the asset; it was felt that the renovation would create an investment capable of sale. When the project commenced, the high tech boom was in progress and leveraging educational and business aims was considered to be supportive for the economy, a primary driver for the concept.

Figure 44: VITP's Grasspave/Gravelpave Parking Lot

One vital fact is often overlooked, for the original funding application was based on a budget for a "traditional" renovation of the facility. As such, no "green" components were originally budgeted or envisaged. During planning however, rising construction costs elicited suggestions to deconstruct rather than demolish internal structures and to determine ways to utilize the surrounding lands more sensitively. Consequently, it was decided that an environmentally sensitive method would be applied in the construction of the project; upon completion, *VITP achieved the LEED™ Gold standard whilst remaining within the original (i.e., "traditional") budget*. This is important to note, since VITP was the first accredited LEED™ building in Canada, showcasing the ability to achieve sustainable development without the extra costs often claimed.

Site Plan

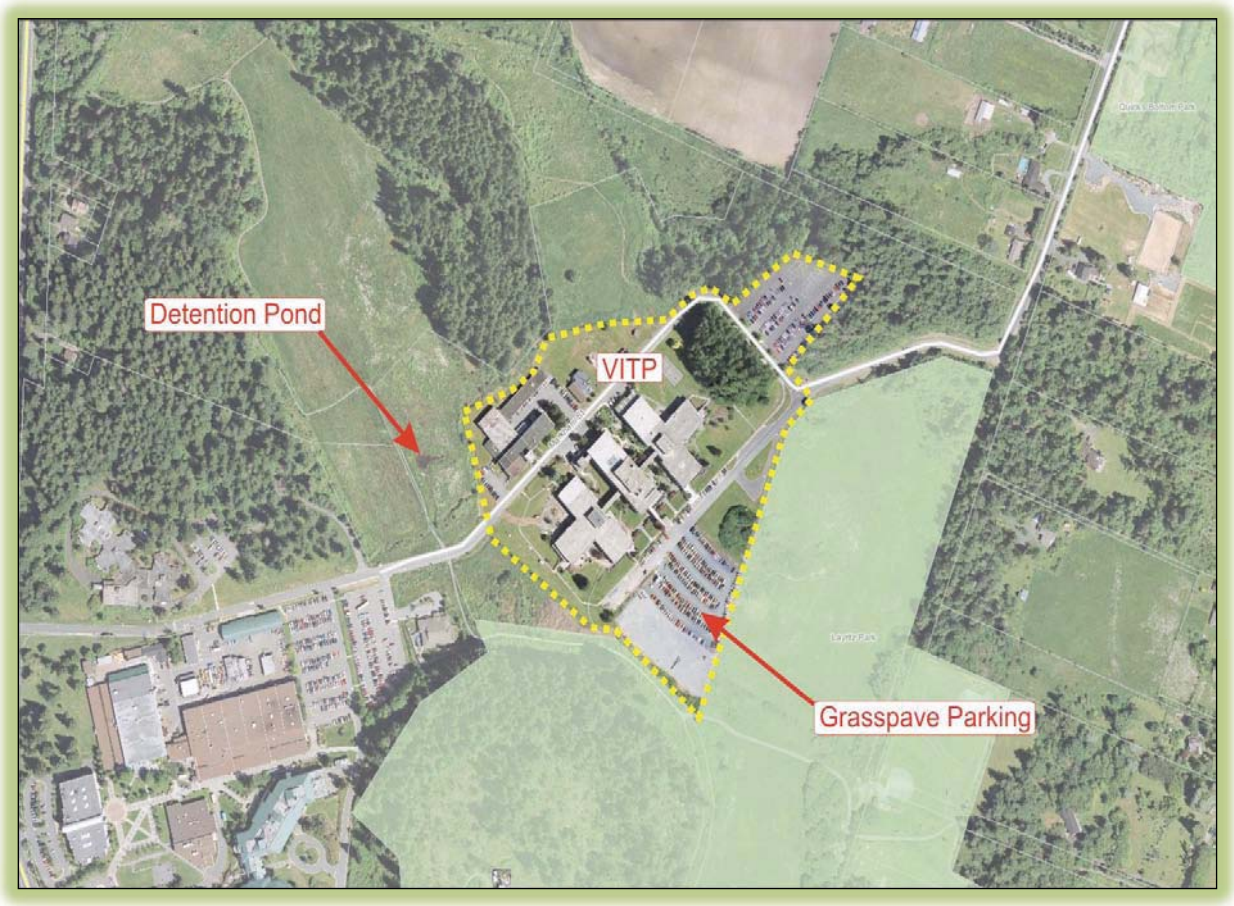


Figure 45: VITP Site Plan

Analysis

Project Aspects

Because VITP is a large project of which the water component is relatively small, it formed no part of the original business case and only a small (but important) part of the eventual development. We have thus restricted our comments to the main water-related components of the project.

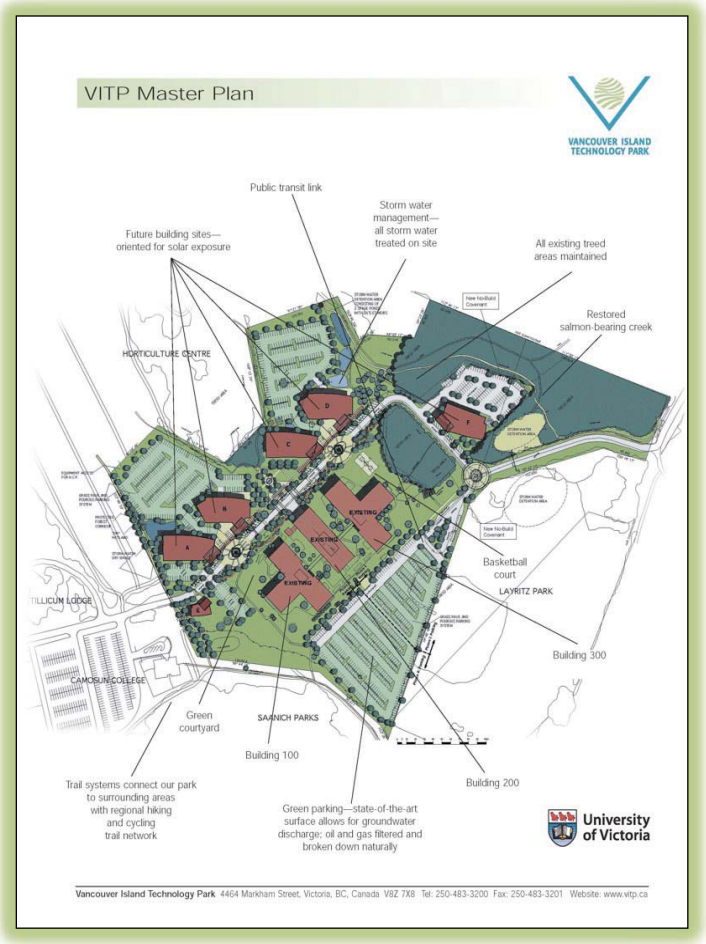


Figure 46: VITP Master Plan (2008)

- We attempted to obtain details of the project. We approached Accommodation and Real Estate Services (ARES) (formerly BC Buildings Corporation), VITP (now part of UVic) and those involved in the original project. None of the original costs for the project could be found, although the original business case and authors were identified and all main contributors were independently interviewed. We understand that, had the cost data been available, it may not have separately identified each of the ecological aspects of the project sufficiently to be useful. Individual aspects are commented on as follows.

- The original development had caused Goward Springs Creek (Viaduct Cr.) to become less than ideally functional. The project worked with Saanich and the community to restore the stream as part of school education. This helped gain community support and engagement, which has been attributed by the developer as a contributor to gaining development approval. Prior to this development proposal, the community had rejected alternative development proposals.

- With creek restoration linked to developing trails through the property, work was needed to mitigate runoff from paved areas. A solution was needed for the large parking area and VITP executives identified a U.S. product and worked with a local group to licence and

manufacture the product in BC. The solution is GrassPave™ and GravelPave™ both of which use a permeable structured solution embedded in the ground through which grass (for GrassPave) can grow or for gravel (GravelPave) and yet provides support for vehicles. This soil-based solution bio-remediates any deposits from vehicles and allows direct groundwater recharging without the need for stormwater collection, oil traps and piping. Furthermore, the parking lot was designed as a reservoir to handle the stormwater volume from a 10-year storm event.

Figure 47: VITP Bioswale

- Upon comparison to more traditional paving solutions for the 5,500 sq meter parking lot, the Grasspave / Gravelpave solution is estimated to have cost the owner approximately $146,120. In contrast, a traditional solution would have been an asphalt parking lot which would have required the standard stormwater infrastructure costing in the range of $680,000-$700,000. Using the lower cost value for the asphalt parking lot and stormwater infrastructure, the alternative parking lot saved the owner $533,880.

- To complement the Grasspave solution, swale restoration and curb cuts were used to mitigate stormwater management. Bio-swales and bio-filtration ponds were used on site to treat stormwater to remove contaminants and control rate of flow. The Grasspave parking lot stores the equivalent runoff of a 1 in 10 year storm event. These were essentially retrofit projects since the road system already existed, therefore we could not identify direct financial savings from these components.

- The project uses waterless urinals, dual flush toilets, infrared sensor sinks, shower flow restrictors, and has made provision for future rainwater collection. Also, VITP does not use potable water for landscaping, although temporary measures were used to establish native plant species. VITP could not provide data on water consumption that would have allowed us to compare this development with a traditional project. Review of Capital Regional District charges however, shows there would only be a small financial saving. The larger benefit is likely to be biodiversity improvement, which adds to the visual appeal of both the project and the surrounding area. One clear and identifiable benefit of reducing potable water consumption is that there is decreased need for new major infrastructure projects such as dams, treatment plants, piping and so on. These upstream costs are not always reflected in water charges.

- The total green space for the development is 76%. Approximately 17% of the site is treed, with a further 40% of open green space comprised of field and wetlands. Wildlife habitat has been restored with native plantings through the integrated stream and wetland areas. All clustered treed areas on the site have been retained and trees tagged and surveyed, with over 99% of trees being protected. Future development will be on previously disturbed lands or lands with minimal ecological impact. This is an unusually high proportion and commitment, and is more a legacy factor from the previous use and ownership. It was also necessary in order to gain public approval. It adds to the attraction of the project and undoubtedly helped contribute to the faster lease-up, which was represented by two independently interviewed participants in the project as having achieved 20% faster lease-up than the original budget, which itself was based on market norms for this type of project.

Figure 48: GrassPave Damage

- As part of the ecological restoration program, a process of community engagement was undertaken. This included working with schools and community groups to undertake stream restoration, which both improved stakeholder involvement and reduced construction costs. The long-term benefit that will likely result is reduced vandalism and greater respect for the ecological works. The cost saving from this was not tracked or accounted for, but is likely to have been small relative to the benefit of community engagement. This latter is thought to have helped with expediting process and municipal approvals.

- We noted damage to certain of the aspects of the stormwater management system. This was identified as both a vandalism and maintenance issue as vandals have been using vehicles to tear up the GravelPave. Furthermore, a lack of maintenance of the parking lot (*i.e.,* closing off parking areas to allow for the grass to grow, fixing areas that are pulled up immediately, and raking bare areas) was evident. This may be caused partly by knowledge transfer issues (staff have changed and the original understanding of how to manage the installation may not have been transferred), and partly due to the experimental nature of the installation (*i.e.,* GrassPave depth, structure and parking use intensity). We were advised during enquiries that

high-intensity-use portions of the parking lot may be need to be paved to reduce long term maintenance (*i.e.,* introducing catchments, traps, filters and other items that formed part of the original benefits and savings).[xli]

Stakeholder Perspectives

Developer/Owner

From the owner's perspective, the prior use had become redundant and without community approval there was no possibility of viable use of the site. The ecological aspects of the project were sufficiently appealing to the public to obtain approvals, but were paired with a financial business case that made the project viable. The most important aspect to note is that an environmentally suitable approach was successfully used as a cost management measure and the fact that this could be achieved within a budget already set by a traditional development expectations, demonstrates the viability of an environmentally sensitive approach to development. As previously noted, we only have verbal indications of this cost management benefit, as the data to quantify and confirm it was unavailable.

Figure 49: VITP Parking Lot (Aerial View)

This project was the first LEED™ development in Canada. As such, there was great incentive to deliver the project on time and on budget. The substantial savings in stormwater infrastructure greatly assisted in meeting these goals. The ecological aspects of this project also supported the marketing campaign and contributed to the profile of the project, whose coverage has been very extensive across Canada and internationally. This in turn, supported the creation of the Canada Green Building Council (which was first housed at VITP) and has accelerated the adoption of green building practices in Canada.

Community

For the public, prior proposals to develop the site had proven unacceptable whereas this proposal proved popular and acceptable. Without addressing the ecological concerns, the development could not have been undertaken. In addition, restoration of creeks and integration with expanded trail systems have clearly added considerably to public amenity. Engagement with the community was deliberate, which

improved stakeholder involvement and conferred educational long-term benefits upon those who participated in the process.

Regulatory

The restoration of Goward Springs Creek (Viaduct) required the normal environmental approvals, however no obstacles were encountered. The use of porous paving did, however, require an amendment to municipal engineering standards, as municipal standards required asphalt.

Municipality

While the project was intended to resolve reutilization of a redundant asset, for the municipality and broader economy, the project added jobs while respecting the environment and community. Prior attempts to develop the site had been refused (*i.e.,* the way the project and community communications were handled – of which this was a key part – added jobs which had previously proven impossible). The additional value of the ecological aspects proved politically popular and restoration was undertaken at minimal cost to the owner. This approach also acted to minimize downstream impact on stormwater management, and upstream requirements for increased potable water capacity.

The economic impacts of the technology park itself included tax benefits comprised of employment taxes, development cost charges, property taxes, corporate taxes and expenditure in the community (with associated re-spending effects, probably in the ratio of: or 3:1, estimated with regard to community dependency ratios). These economic benefits are realized at federal, municipal and provincial levels. An assessment of this was undertaken by VITP in 2005 and the VITP Economic Impact Study identified direct and indirect benefits amounting to 2,000 jobs and $280M in direct, indirect and induced revenues.

Value Conclusion

The key value conclusion is that sustainable approaches to development can be undertaken within traditional budgets to achieve a highly recognized building standard [LEED™ Gold]. Specifically related to alternative infrastructure, the benefit to the owner included savings from building a traditional parking lot that would have required traditional stormwater infrastructure, reduced maintenance costs, and capital replacement. From estimates provided to us, we conclude the immediate net benefit to the developer was $533,880. This value was derived of stormwater engineering and asphalt pavement cost savings of $680,000, minus costs to install the current GrassPave/GravelPave parking lot of $146,120. There is an additional benefit to the owner as the current GrassPave/GravelPave parking lot has a potential life of 60 years (provided it is maintained), whereas in contrast an asphalt parking lot typically lasts only 20-25 years and then needs to be recapped. Accounting for this additional cost as well as the costs to maintain the GrassPave/GravelPave parking lot, a net benefit still accrues to the owner as the present value of recapping a similar sized parking lot is $32,813 whereas the present value maintenance cost of the current parking lot is $23,547; a difference of $9,267. [xlii] Therefore the total net benefit to the owner is $543,147.

There were other ecological components (*i.e.,* stormwater wetlands designed for future expansion) of the project could not be adequately isolated to prove distinct added value. However, from discussion with tenants and the development team, it is clear that they added an amenity that contributed to the green component of the park achieving a 20% faster lease-up. Leases are now being renewed and separate

studies in the next few years may identify whether there is a rental premium for being green, to which the current case study contributed.

Because VITP is something of a test project in British Columbia and many new concepts were brought together for the first time, the cost savings were clearly not as high as they might be today, given a greater experience with sustainable approaches. Also, almost all the executive and many staff have dispersed to other projects and with the sale of the property there is little corporate memory of the original development principles, making it more difficult to manage the assets sustainably (as seen with the parking lot) in the long term. This is likely to increase costs and elicit proposals to replace the sustainable infrastructure with more traditional solutions unless re-education can be undertaken. Of note, is that the manager of this project, Mr. Joe Van Belleghem, has now extended the lessons learned from VITP to his new, highly successful residential and commercial brownfield redevelopment project in the heart of Victoria. Dockside Green is intended to be the first LEED™ platinum community in the world and in July 2008 received the highest number of LEED™ points ever awarded, for its first building. The lessons of VITP are thus resonating throughout the region and province.

For appraisers, the key aspects demonstrated by this project are that sustainable approaches can improve the speed of occupancy considerably, at market rents equivalent to comparable projects. We were unable to identify an increase in rent initially, but with in effect no tenant turnover, there is an expected benefit to the net investment yield with improved lease renewals, rent free periods and tenant inducements. As components of the project reduce operating costs we expect the owners will be able to increase rent and improve both income security and overall yields over the life of the project. This is because tenants can afford to pay more rent while maintaining the same total operating costs they might otherwise pay in competing buildings. The link between these benefits and the subject of this case study is however, indirect. The benefits are attributable to a range of aspects and not just the stormwater management initiatives.

Figure 50: VITP Financial Summary

VITP (Traditional)	**VITP**
Cost to Prepare Site and Install Asphalt Paving and Connect to Existing Stormwater Infrastructure	($680,000.00)
PV of Costs for Future Capital Replacement (Recapping) of Parking Lot	($32,813.45)
Total Present Value	($712,813.45)
VITP (Sustainable)	
Cost to Prepare Site and Install the Grasspave /Gravelpave Parking Lot	($146,120.17)
PV of Operations and Maintenance	($23,546.55)
Total Present Value	($169,666.72)
Net BENEFIT	**$543,146.73**

*** PV calculations use a time frame of 25 years @5% (No values have been adjusted for inflation).**

Appraisal Commentary

Appraisal Methodology

There are two main categories within which valuation methods fall for analysing the economic benefit of riparian zones: market-based approaches to value, and non-market approaches. The former is evidence-based and the latter relies more on interview and opinion. Within these categories, several approaches to assessing value may be appropriate and some discussion is provided, relative to the case studies:

- The comparable approach is a market-based approach that uses evidence of actual sales to determine differences in value. Within this approach, data may be statistically significant (usually using hedonic models) or rely on individual (non-statistical) evidence. None of the case studies had sufficient evidence of value differential to provide reliable indicators (*i.e.,* there was not enough sales evidence over time to demonstrate a difference in value).
- The discounted cash flow (DCF) approach is potentially helpful in quantifying cost savings and takes inputs from costs and revenues (*i.e.,* it is evidence-based and permits adjustment for specific costs).
- The contingent valuation approach uses market survey to determine whether there is evidence of increased value. This is based on opinion (*i.e.,* willingness to pay) and is thus a non-market approach that is not based on evidence of value or cost savings. This is helpful in identifying preferences and has been used extensively in the literature reviewed, but it falls short of establishing market value differentials.
- Public Interest Valuation is the assessment of value to the public. Some valuers hold this to be a controversial technique because it does not establish market price but rather, identifies the values to multiple stakeholders across multiple accounts. Since the case studies accrued multiple types of value and savings, to multiple different interest groups, Public Interest Value is an important consideration for these case studies. It can combine both evidence-based, market and non-market (opinion) values, but is best implemented by reference to tangible value. It has in essence been used to assess the multiple accounts of public benefit, but fallen short in most instances of identifying each account's actual value due to the difficulties in assessing actual value.
- Highest and best use and value play a role. This is where market transactions occur because one party is able to pay more for an asset or feature than another. In the case studies and taking into account Public Interest Value, development happens because the developer has a higher value from development than the public does in the use of land as a park.
- In a traditional market valuation, the developer's benefit might be shown clearly by a DCF calculation if undertaken to sufficient level of detail, but the lack of clear differential benefit for riparian proximity makes a DCF of less utility for a market-based analysis.

The case studies discussed within this report identified multiple benefits accruing to multiple parties, characterizing (from experience) development projects that incorporate the conditions within BC, since

these are for the most part in the public domain. Market-based analyses would not capture the other benefits (non-use values) obtained by others such as the public, nearby residents and so on. In order to capture such values, a Public Interest Value approach would be needed where not only are the Triple Bottom Line accounts evaluated but also, several recipients' contributions and benefits are valued. This type of "three dimensional valuation" is uncommon and is not a driver of developments, unless some form of transfer pricing mechanism is in place so that the benefits from one party are transferred to another. In all the case studies, projects proceeded because there was sufficient benefit to a single recipient who was able to fund the project. In other words, the benefit accrued to the financer (*i.e.,* developer/owner) exceeded the cost. It is important to note, that the public and other benefits were found to be in essence ancillary with the real driver being the overall net benefit to the developer, but as these case studies have noted, the developments could not have occurred without community support.

Conclusions & Recommendations

Figure 51: South Valley Stormwater Channel

Though we experienced problems in reviewing and obtaining cost and value data for virtually every project, each project demonstrated a net benefit to the owner, municipality and community in addition to many intangible benefits. The difficulty in obtaining data can be attributed largely to the "pilot" nature of the projects, which results in many of the outcomes not being capable of prediction prior to undertaking the project. We do not believe any blame attaches to this, as it is a reasonably common experience, but it is not entirely consistent with meeting taxpayer accountability for project funding decisions. In addition, privacy, commercial interests and confidentiality issues restricted availability of some information and finally, lack of quantification significantly hampered our analysis (upon which we applied proxies, but these have the restriction of benefit transfer[xliii]). Those whose collaboration was needed in supplying data had little or no incentive to support this study and the data obtained (being detailed and difficult to assess) was thus largely insufficient as most data was simply unavailable.

The provincial government of British Columbia typically addresses this by using pre- and post-completion audit processes that are set up prior to project commencement and we therefore recommend similar practices:

- For significant pilot, test or exemplar projects especially, consider establishing and adopting a formal process to evaluate whether the project has met success criteria. Set the criteria for measurement and define success prior to commencement.
- Establish a baseline assessment of the main aspects likely to be affected by a project. Include those aspects affecting each identifiable stakeholder. At an agreed time during and subsequently after completion of the project, review any changes to the baseline data and assess whether any have changed. Periodically revisit the baseline and post-completion assessments to understand whether any long-term aspects of the project are found.
- Establish and use Triple Bottom Line methodology to develop assessment criteria for project reviews and ensure that there is fair assessment under each of the three accounts (*i.e.,* do not

ignore financial and economic impacts). Consider whether Full Cost Accounting – or more accurately, "Full Value Accounting" can be undertaken and do so where possible, even if non-financial aspects are difficult to quantify or set proxies.

Specific to stormwater infrastructure studies, we recommend that separate generic assessment be made:

- The study should assess the savings of treating stormwater with managed wetlands and ponds and restoring neighbouring streams based on several models: a parking lot, a road and buildings. Scalable sizes should be chosen so municipal officials, designers and developers can make calculations accordingly. The calculations should include sequestration benefit from stormwater redirection resulting from biomass increase and include biomass-harvesting frequency in a DCF model. It should also evaluate GHG and cost/maintenance impacts for the ecological approach. It may not be possible to add in value benefits for proximity of property (*i.e.,* adjust for housing proximity to greenspace and benefit to housing values) because this is dependent on multiple factors, but some discussion and attempt to model this may be possible.

Figure 52: Baxter Pond (Pacific Christian School in the Background)

- The calculations should differentiate from savings (*i.e.,* separately enumerate piping and pumping costs, maintenance, electrical energy savings and upstream GHG impacts resulting from marginal power consumption; use the GHG footprint for marginal power consumption – typically coal-powered).
- Since the cash flows and life cycles will differ substantially, and so will water flows depending on climate and location, these too must form part of the model. Ideally the model would be a spreadsheet that allows simple recalculation by adjusting for local circumstances and individual variable.
- As might be appreciated, the above scope illustrates why we could not undertake any kind of reliable analysis of the economic benefit of this item: the data was not available and too complex to undertake in the absence of sufficient base information. Saanich may wish to commission this when the next opportunity arises, but *undertake the analysis simultaneously with an actual project*. The lack of data captured during the project or access to it subsequently, made it impossible to restructure an analysis.

Although all very successful projects, underlying each were identified bylaws, codes, statutory and other process obligations and practices that consistently acted as barriers to "doing the right thing." Historical professional training and practices, and occasional political intervention, to make ecological and financially sensible proposals incapable of being accepted or implemented, compounded this. Although the developers were largely successful in establishing alternative methods to stormwater infrastructure, at times the barriers resulted in occasional duplication and redundancy and as a consequence contributed to dissuading developers and owners from sustainable efforts. All the projects that had a commercial aspect had expedited process as a result largely of community support. However *we could not confirm that any of the projects had reduced development cost charges*. Since development cost charges are intended to cover municipal infrastructure, in theory there should be a reduced charge where ecological approaches are used and, since ecological and sustainable initiatives reduce the burden on public infrastructure, requiring less review to ensure compliance with public objectives (as well as reduced future costs), consideration should be given to establishing the following policies:

- Use the development review process to consider the use of variances and density bonusing to secure or restore public amenities (*i.e.,* open space, riparian areas, landmarks, or cultural features).
- Utilize development control bylaws to achieve a more appropriate development in terms of streetscape, pedestrian environment, view protection, overall site design, and compatibility with the function of the landscape and (if applicable) the aquatic ecosystem.
- Require that site designs reduce the amount of impervious surfaces and incorporate features that will encourage ground water recharge such as vegetated swales, pervious paving material, as well as being open to considering ecological approaches to stormwater management. Ensure that policies are consistent amongst municipal departments.
- Support the understanding of growth management and sustainable development best management practices (*i.e.,* low impact development), through public events and online and printed information.
- Encourage accessibility through the incorporation of building support systems as design features and where appropriate, make them visible to the public (*i.e.,* green roofs, energy and water use monitoring).
- Work with private landowners to acquire trail rights-of-way, easements, or other services provided (*i.e.,* flooding) by donation or bequest of privately owned lands or payment for services provided.

There is a clear demand from the public for increased sustainability and these case studies show they can be achieved at the developer's cost rather than depending on taxpayer revenues. Especially for projects with a heavy stormwater engineering component, it is possible to benefit upstream and downstream infrastructure by using ecological solutions. We recommend that ecologically sensible development solutions can be achieved with greater benefits to government and the public, as well as the developer, if traditional stormwater engineered solutions are always considered alongside and compared to ecological alternatives. A process change of this type could be quickly instituted as part of municipal policy, where appropriate.

Although some members of the development, finance and appraisal sectors have historically been slow to adopt more sustainable practices, these case studies illustrate there is a clear benefit in terms of expedited approvals processes, improved cost management, improved profit and we believe in due course, will show tangibly higher values – across capital, rental and yield accounts. Furthermore, these projects show that the real estate sector will benefit from considering sustainable practices. Only one of the projects reviewed was a LEED™ project, demonstrating that ecological solutions make sense even without trying to achieve recognized certification.

Ecological solutions to stormwater and watershed management affect not only financial accounts, but also social and environmental accounts, and multiple stakeholders. Traditional cost accounting fails in that these aspects are rarely considered on the balance sheet. Currently, most businesses, lenders, and governments obtain appraisals or evaluations of the financial aspects of projects, each of them evaluating their perspective independently of the others, usually with unstructured analysis of the social and environmental implications of a proposal and often, without the balance of comparing all three triple bottom line accounts equally and transparently. This especially fails to take account of the multiple beneficiaries and stakeholders involved in such decisions and each of their gains or losses and will tend to perpetuate unsustainable solutions and practices, due to making decisions that favour a particular account or perspective. This is at the heart of Public Interest Valuation, the very thing that the appraisal industry appears loath to address. We recommend that municipalities consider not only a Triple Bottom Line assessment of a project but also evaluate *who* the stakeholders will be, and *how much* cost or benefit they will obtain. This goes beyond full cost accounting and most valuation approaches, but we believe is both achievable and desirable.

Data Collection Checklist for Future Projects

This project has highlighted the need for better tracking of information to enable full value analysis. The following list outlines some of the items necessary for a reasonably complete valuation:

Ecological Service Benefits:

- Pre and –post project data on the size/type/hydrological flows/hydrological data/water storage of a system;
- Water/sediment quality data pre and –post project;
- Locations of point/non-point source pollution;
- Water clarity (e.g. turbidity, TSS) pre and –post project;
- Stormwater catchment area;
- Biotic, fish, and wildlife inventories pre and post project;
- Ecological function of the system pre and post project (e.g. PFC assessment or other objective measure);
- Estimate of carbon storage and sequestration pre and post project;
- Canopy cover pre- and post-project
- Ambient air temperature of the area pre and post project;
- Local air pollution pre and –post project;
- Rainfall interception by vegetation canopy pre and –post project;
- Pest surveys pre and post -project (*i.e.,* West Nile Virus).

Economic Benefits:

Developer/land-owner:

- Construction finance rate;
- Design and construction cost (*i.e.,* professional fees, cost of building wetlands, cost of hydrological modeling, etc);
- Cost of stormwater infrastructure avoided/installed (*i.e.,* holding tanks, etc)
- Savings accrued from reduced regulatory delays or costs of regulatory barriers (*i.e.,* time delays due to council, municipal staff, provincial/federal regulations);
- Development cost charges;
- Value of lots or value of increased density (or lost revenues);
- Record of sales of the development and similar developments within the same time frame (*i.e.,* faster sales);
- Water usage pre and -post project (if applicable);
- Value of crop yields pre and -post project (if applicable);
- Costs of stress due to vandalism;
- Process barriers;
- Avoided costs of clearing and grading land (e.g. in conservation subdivisions or higher density projects).

Municipality:

- Costs of financing replacement infrastructure;
- Costs of stormwater infrastructure (*i.e.,* asphalt pavement, pipes, catchbasins, holding tanks, etc);
- How often stormwater infrastructure is maintained and/or replaced;

- Operation and maintenance costs (*i.e.,* managing invasive species, cleaning out catchbasins/sediment detention ponds, maintaining/installing ditches);
- Value of land donated;
- Value of increased tax revenues due to increased density;
- Flood models for the area of study.

Community/homeowners/landowner:

- Trail usage pre and -post project;
- Number of bird watchers, recreational use;
- Local health benefits accruing from the project;
- Value of project to the surrounding community (inclusion);
- Costs of downstream flooding;
- Costs of local air pollution;

In order to estimate the amenity benefits of greenspace researchers use hedonic models to compare how different characteristics (*i.e.,* amenity values, distance to greenspace, lake/river views, quality, etc) affect the price of similar marketed goods (most commonly used is real-estate). To complete such an analysis would require considerable time, experience with statistical models, access to statistical models and extensive data including: the size of the lots and homes in question, cost, market value, age, elevation, type of structure, number of bedrooms/bathrooms, and other features of the house, including type of electrical wiring, whether it contained a revenue suite, nature of heating. Other variables required include locational attributes (*i.e.,* distance from the city center, congestion and noise levels, crime level, population levels, climatic effects (*i.e.,* flooding), access to regional recreational facilities, such as golf courses, parks, bicycle trails, schools and libraries, etc). Aesthetic amenities variables must also be measured; this may include the presence and distance of a river, wetland, lake, or other waterbody, water clarity (*i.e.,* turbidity) as well as whether or not the homes in question have a view.

Future Study

During the period of research for this project, the authors, including Aqua-Tex, expanded the concept of green infrastructure valuation to include all facets of municipal water, wastewater and waste management. Many of those ideas arose directly out of this study. The result was another study undertaken for the BC Ministry of Community Services entitled "Resources From Waste: An Integrated Resource Management Phase 1 Study Report[xliv]." This study examined how energy, biofuels, water, heat, fertilizer and other resources can be extracted from liquid and solid waste and return a financial net benefit to the community, while providing tertiary sewage treatment, eliminating landfills and restoring urban aquatic habitat. A synopsis of this study is in press with the Journal of Industrial Biotechnology and will be published in 2008. Aqua-Tex is also extending the Nature's Revenue Streams (NRS) study through the work of graduate student, Mr. Daniel Hegg, University of Victoria, whose thesis will be available in 2009. All three projects are critical to helping municipalities overcome their mounting infrastructure and finance burden due to deferred infrastructure maintenance and replacement. Though relatively small in scope, it is hoped that this NRS study provides incentive for developers, municipalities and researchers to extend this work and re-examine infrastructure and development decisions under the lens of full valuation and not simply cost.

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End Notes

[i] TBL is originally credited to John Elkington in his book "Cannibals with Forks."

[ii] IVSC is an NGO (Non-Government-Organization) member of the United Nations and works cooperatively with member States, organizations such as the World Bank, OECD, International Federation of Accountants, International Accounting Standards Board, and others including valuation societies throughout the world to harmonize and promote agreement and understanding of valuation standards (http://www.ivsc.org/).

[iii] We found this caused greater uncertainty over approach rather than improved certainty and this is noted in the report.

[iv] One conclusion we quickly reached is that each project proceeded with a basic sense that the business case would be viable, but not with a more traditional [financial] analysis proving each project's worth. This made the scope difficult to pursue to the extent we would prefer or recommend in future, adding appreciably to complexity and time.

[v] The Agricultural Land Reserve ("ALR") was established by a provincial statute that provides protection of designated lands and preserves them for farming use. Further information is available from: http://www.alc.gov.bc.ca/alr/alr_main.htm.

[vi] Jointly developed by the U.S. Bureau of Land Management, the U.S. Forest Service and NRCS, Proper Functioning Condition (PFC) is a qualitative assessment tool based upon quantitative science that measures the state and health of riparian-wetland areas. The PFC assessment is not based upon values (*i.e.,* whether the stream is visually pleasing, suitable habitat for fish, etc), but rather on stream function (*i.e.,* whether the stream is stable from a hydrologic, vegetative, and soil perspective) (Prichard, 1998). PFC utilizes 17 criteria to determine stream health, thereby enabling users to rank rehabilitation priorities. The result of the PFC assessment is qualitative indicator identifying whether the system is in Proper Functioning Condition (PFC), Functional-at-Risk (FAR; with an upward or downward trend), or Non-Functional (NF). When a system is classified as PFC, it is in state of 'resistance" enabling it to withstand disturbance without "coming apart" during high flow events. Functional-at-Risk (FAR; with an upward or downward trend) has elements of a resilient system by remaining in a functional context, but has a soil, water, or vegetative attribute making the system susceptible to degradation. A Non-Functional (NF) system is a system that is one that is not clearly able to dissipate energies associated with high flow events (due to a lack of adequate vegetation, landform, etc) and thus cannot reduce erosion, improve water quality, provide habitat, etc. These ratings provide a "means of prioritizing areas for restoration so that when development occurs, resources can be allocated to the most critical areas" of the system, thereby preventing degradation of healthy areas by the rehabilitation (of function) of areas currently at risk or may soon be (Barraclough & Lucey, 2005). The assessment is checklist based upon the *capability* and *potential* of the system characterized by the interaction of the three components, hydrology, vegetation, and soils. Potential is defined as the potential natural community a system could achieve "given *no* political, social, or economical constraints" (Prichard, 1998). Important to the proposed project, potential can identify if the system is in "balance with the landscape setting" in terms of its ability to perform critical functions (*i.e.,* habitat, reduction of erosion, etc). Furthermore, capability is defined as what *could be* achieved given current the political, social, or economical constraints. Therefore, in the context of urban system, it is recognized that some systems can or may be constrained by various limitations that may be insurmountable (*i.e.,* urban land use, major roads, zoning, political barriers, etc); not precluding rehabilitation, but may limit the systems function. Important to note is that PFC *is not* "a replacement for quantitative inventory or monitoring protocols. PFC is meant to complement more detailed methods by providing a way to synthesize data and communicate results" (Prichard, 1998).

[vii] Ray and Judy Galey, personal communication.

[viii] A value of $2-$4 per cubic meter was applied to price out the cost of digging out and shaping a ditch. The higher value of $4 was applied to price out the initial cost of the ditch (using ditch dimensions of 1m deep x 2m wide x 650m long). Furthermore, ditch maintenance would occur every 5 years and was priced at a lower value, due to decreased time to clean out an existing ditch and placing spoils on the side.

[ix] If we had access to the CRD water bills paid by the farmer we could better estimate the value in reduced potable water usage. Unfortunately, this information was not available but was advised that there was an estimated increase in water savings of approximately 7% after the completion of the project. According to the province of BC, in 1996 there were 115,374 ha of irrigated land in BC that used 763 million cubic meters of water that year. This results in an estimated 6,614m3/ha/year. Applying this usage to the Galey property and estimated reduction of 7% of potable water usage per year, we estimate this has resulted in a reduction of

463m^3/ha/year of potable water. Applying this to the current CRD water rate of \$1.31/m^3 and discounting this value at a rate of 5% for 25 years results in a PV value of \$8,548.

[x] The Conservation Partners Program is an initiative of The Land Conservancy which aims to forge a mutually beneficial partnership between Conservation and Agriculture in BC. The purpose of the program is to protect and enhance important habitat on privately owned agricultural lands by providing recognition, incentive and assistance to growers who are committed to conservation of natural habitat on their farm. The program is in no way meant to interfere with the agricultural potential of the property.

[xi] Amount was discounted over a time frame of 25 years, with a nominal realdiscount rate of 53% (Nominal interest rate of 5%, less 2% inflation).5%.

[xii] \$6,632 was calculated by applying the PV formula to the re-occurring 5-year cost to maintain the ditch of \$2600. A discount rate of 5% was applied over a 25-year period.

[xiii] Under the direction of Cliff Warren, Saanich Municipal Engineer

[xiv] Ming *et al.,* (2007) calculated flood benefits, by identifying the capital cost of reservoir construction in \$/m3. The value of \$0.88/m3 was adjusted for time and currency prior to being applied to the Galey Study. Per our conversations with the Galeys, we have been told that the fields flood approximately 60%. Using this value and an average depth of 1m, the flood protection benefit provided annually by the Galey farm is estimated to be \$52,968. Discounted over 25 years at 5% this benefit amounts to \$746,523.

[xv] Increased amount of urbanization (*i.e.,* buildings, roads, and compacted soils) reduce absorptive capacity of the land. "In suburban areas, 20–50% of the land is impervious to precipitation. In inner cities and commercial zones, imperviousness can exceed 80%. According to Schueler, Johnston et al,2006 and the Center for Watershed Protection (2008) the hydrologic functions of streams change with as little as 5–10% imperviousness and they change profoundly when imperviousness approaches 25%). (Braden & Johnston, 2004, pp.1).

[xvi] The CRD purchased approximately 9700ha of land for the purposes of protecting drinking water and park space for \$64.7 million. This amounts to a per hectare value of \$6,670.10. Applied to 18,000m2 of restored creek, the one time social value of this system is valued at \$12,006.19. We anticipate that this is likely the lower value of the system, as it does not account for other social values such as value is derived from the option to preserve ecosystem services for their use in the future by individuals (option value) or by others/heirs (bequest values)

[xvii] Important to note is that the in many of the sampling areas, the vegetation encroached upon the channel , making it to easy to dislodge fine sediment from the surface of the vegetation when accessing the stream channel and therefore difficult to obtain a clean sample.

[xviii] See Rowntree *et al.,* (1991). Quantifying the role of urban forests in removing atmospheric carbon dioxide. We calculated the values using a type 1 tree canopy (young trees less than 10 years) with 7-12 inch diameter breast height using a per tonne carbon value of \$20. To be conservative, we applied a 60% canopy cover value. The sequestration value is discounted at 5% over 25 years.

[xix] Neighbouring Rithet's Bog is a known historical source of cranberries for local bands
http://www.rithetsbog.org/humanhistory/history_fall2004.htm

[xx] When asked to list things they like about Saanich, residents most frequently identify its central location, its quiet, friendly, safe neighborhoods, and its great parks/trails network. Furthermore, over 84% of residents use a Saanich municipal park or trail several times per year or more and give particularly high praise to Saanich's fire fighting, parks, ***trails***, recreation, facilities and programs, and landscaping of public property (District of Saanich, 2004).

[xxi] A more extensive study to understand the health care benefits and link these two community and personal value as well as cost savings and cost avoidance would in our opinion be possible but it goes beyond the scope of this current study. To undertake this, an assessment of the extent of use of the trail would be needed (*i.e.,* analysis of vehicle avoidance, GHG reduction/pricing and quantification of travel use, trail usage pre and post project, and by extension and connection to healthcare studies on health benefits of cycling and walking, estimation of the reduction in provincial health care funding costs).

[xxii] On their famous train-ride surrounding the property, the tour-guide shares an educational story about how the creek was once a ditch, and the benefits from its restoration.

[xxiii] "Under Department of Federal Fisheries, the fisheries act applies to all Canadian waters that provide or are capable of providing habitat for fish during any life stage. This includes wetlands, ditches, streams, rivers, lakes, coastal waters, estuaries and marine offshore areas. The act also applies to areas that are not permanently wetted but may provide habitat opportunities when wetted. These areas include shorelines, riverbanks, mudflats and floodplains and manmade fish habitat that is intentionally or unintentionally created. The provisions of the Fisheries Act apply to publicly and privately owned land" (Section 3.1.1 Fisheries Act Fisheries and Oceans Canada, 2008). Although Blenkinsop Creek (prior to the project) had little (if any) neither ecological habitat, nor any fish, the ditch in question was connected to a fish bearing system and was therefore regulated by the Fisheries Act. The infilling of the ditch is considered a HADD (harmful alteration, disruption or destruction) of a salmon bearing system and therefore falls under Section 35(1) of the Fisheries Act upon which "No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat," and the Water Act regulated by the Ministry of the Environment (MOE). Thus the land owner (the Galeys) had to file for a Section 9 authorization that under section 35(2) of the Federal Fisheries Act and the Water Act that would

allow for such work to be completed. Although it is not documented, if a HADD does occur, DFO normally requests a habitat compensation ratio of 3:1.

[xxiv] The RAR is intended to protect riparian areas and the natural features and functions that support fish life processes and to facilitate intergovernmental cooperation among the Ministry of Environment (MOE), Department of Fisheries and Oceans (DFO) and Union of British Columbia Municipalities (UBCM). The RAR applies to industrial, residential and commercial developments, and to ancillary activities planned, at least in part, within the "riparian assessment area" (RAA) alongside a stream. The RAR does not apply to agricultural or institutional development or to reconstruction or repair of a building if the structure remains on its original foundation (Riparian Areas Regulation, Ministry of the Environment, 2008).

[xxv] This calculation is only an estimate using a proxy from another study and is not representative of the true costs of downstream flooding. The purpose of the exercise was to show that there is a value associated with the service provided.

[xxvi] If a conservative loan was provided by government at a 5% rate over a 25-year term, the project cost could have been financed at an annual expense of approximately $26,607. Given the relative certainty of the project and asset security, a low rate is considered suitable for finance, discount and reversionary (*i.e.,* residual) capitalization.

[xxvii] Such systems are designed to contain and hold stormwater, subsequently releasing the water at a low volume to reduce downstream flooding. It is estimated that the system would enable some particulates to settle prior to discharge, but there would be little if any nutrient or heavy metals treatment prior to being discharged into Swan Creek.

[xxviii] We accessed BC Assessments website to determine the value of the homes. BC Assessment is an independent Crown corporation, established in 1974 by the *Assessment Authority Act and the Assessment Act*, with the main to classify and assess the market value of all property in British Columbia. BC Assessment defines market value as the price that would be expected if a property were to sell on the open market, and that both the buyer and the seller are properly informed about the property's features. The Assessment Act requires that properties be assessed at their actual value as of July 1st of the year proceeding the tax year. For example, valuation day for 2006 assessments was July 1, 2005. Furthermore, actual value means market value and it is the most probable price at which a property would sell in a competitive market, if it had been listed long enough to become generally known to real estate agents and prospective purchasers. It also assumes that both the buyer and seller are willing (*i.e.,* it is not a forced sale), that both parties are prudent and knowledgeable and that the parties are considering only factors that most other buyers and sellers would consider (BC Assessment, 2008). As such, since the properties adjacent to the parkland have not sold, their actual market value has not been properly assessed for the anticipated increase in green space value.

[xxix] "Corridors of Green and Gold" by Hamilton & Quayle, Department of Fisheries and Oceans, April 1999. Both Professor Hamilton and Dr. Quayle were UBC Faculty Deans at the time of writing. Dr. Quayle is currently Deputy Minister of Advanced Education, government of British Columbia.

[xxx] None of the reviews identified in our research pointed clearly to a specific adjustment that could be made for proximity to riparian zone. The range of adjustments was from 0% (no difference) to 20% higher value, and some studies even suggested no difference in value for riparian frontage (as appears to be the case in the Willowbrook study), but an increase in value if living further away from the riparian zone. Some studies considered this logical anomaly to be due to insufficient differentiation between the multiple characteristics of riparian proximity.

[xxxi] Saanich 2006 citizen survey. http://www.saanich.ca/municipal/docs/pdfs/citsurv_complete2006.pdf

[xxxii] There is no question however, that the wetland was very effective at trapping sediments historically, because the flap gate over the inlet structure is nearly buried in sediment, highlighting the need to clean out the accumulated material so that the wetland can resume trapping material. At present, it would appear that the stormwater is mobilizing accumulated sediment from the wetland into the creek. The Willowbrook wetland generally exported metals during the rainy winter months, and acted as a sink for metals during low flow periods. Arsenic, copper, lead, mercury, sodium, tin and zinc were all lower at the outlet than at the inlet in the fall of 2006. While the wetland continued to take up sodium, with the onset of winter rains, metals values at the outlet began to exceed the inlet. In January and February 2007, lead and arsenic were not detectable in the water at the inlet, but were present at the outlet, suggesting mobilization from the wetland sediments. It is therefore apparent that the wetland is effective at sediment removal provided the system is ***maintained on a regular basis*** by the municipality.

[xxxiii] Using the cost to maintain ditches in the Blenkinsop Study, we estimate that ditch maintenance of 750 meters of Swan Creek would have accrued a cost of $3,000 every 6 years (we expect that this is an underestimate of actual cost). This maintenance value discounted over 25 years at 5% results in a present value of $7,651.95.

[xxxiv] "LID is comprised of a set of approaches and practices that are designed to reduce runoff of water and pollutants from the site at which they are generated. By means of infiltration, evapotranspiration, and reuse of rainwater, LID techniques manage water and water pollutants at the source and thereby prevent or reduce the impact of development on rivers, streams, lakes, coastal waters, and ground water" (United States Environmental Protection Agency, 2007).

[xxxv] A French drain system usually underlies a GravelPave system so that if the soils become too saturated, the perforated pipe collects the excess water and carries it to a roadside bioswale.

[xxxvi] Per a discussion with a municipal engineer, homes need to be protected and therefore perimeter drains connected. In addition, the normal return period for stormwater management systems is to manage the more frequent storms (6 month to a year return period) and the higher intensity less frequent (10 year, 25 year and up to 200 year return period) storms. Typically, engineers must design systems

that can ensure a 10-year storm (25 year on a trunk) event can be accommodated without any flooding, and a 200 year return period has access to enough overland flow routes that eliminate or at least minimize the extent of flooding. It seems than on certain sites a combination of traditional infrastructure and ecological infrastructure may be the best way to protect homes whilst keeping the freshwater aquatic ecosystem functional. Other sites (depending on climate, geomorphology, soils, slopes, vegetation, access to flood plain, etc) may not require such traditional infrastructure.

[xxxvii] These will vary by community and we have thus not researched this item in detail but repeat the facts as stated by District of Saanich staff.

[xxxviii] Municipal planners largely evaluate development proposals on the density applied for and what is reported by a registered Professional Biologist (R.P.Bio.) under an environmental assessment. If there is a aquatic system (*i.e.,* creek, stream, wetland, bog, ditch, etc) on the landscape proposed for development the developer must adhere to the federal or provincial (depending on whether Salmon habitat is involved) regulations surrounding (*i.e.,* setbacks, etc). These regulations are prescriptive, and apply a regular "cookie-cutter" approach to what setbacks are required. These regulations do not take into account on whether or not the regulatory setbacks may inhibit any or all development (and whether this is a benefit to all stakeholders involved), nor do they measure the level of function of the system or how the system can be enhanced using the development permit process. Furthermore, municipal policy tends to favour more traditional methods of stormwater solutions, rather than applying ecological solutions (*i.e.,* wetlands to manage stormwater) or low impact development techniques (*i.e.,* porous pavement, smaller road and trail widths, etc).

[xxxix] An Economic Rationale for Integrated Stormwater Management
http://www.env.gov.bc.ca/epd/epdpa/mpp/stormwater/case_studies/pdfs/54.pdf

[xl] We estimate that approximately 2.5 – 3 cubic yards of sediment was captured by Baxter pond over a 1-year interval.

[xli] These would now lose LEED® points and today it could be speculated on whether LEED® Gold certification would be achieved without the permeable paving.

[xlii] We were provided a cost estimate by a local contractor to recap the parking lot ($20/m2). To develop our estimate, we assumed the parking lot would last 25 years. With regard to the GrassPave/GravelPave maintenance, we were advised by a supplier of the product that a reasonable estimate of maintenance would be 2 man hours per week. Maintenance involves raking bare areas of the parking lot to redistribute the gravel on a weekly basis. In order to calculate the present value cost we used $15/man hour, discounted at 5% for 25 years.

[xliii] Considerable effort is required to ensure considerable similarity between the two sites (*i.e.,* wetland type, nature and extent of use) so that the transfer of values makes logical sense and is defensible. Furthermore, benefit transfer may not be accurate, except for making gross estimates of recreational values, unless the sites share all of the site, location, and user specific characteristics.

[xliv] Ministry of Community Development. http://www.cd.gov.bc.ca/ministry/whatsnew/irm.htm

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