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## **Integrating the Site with the Watershed and the Stream**

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A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

# **Part C**

## **Hastings Creek Demonstration Application of a Watershed / Landscape-Based Approach to Community Planning**

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- Celebration of Rain
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### 4. Lynn Valley Town Centre

Figure 7 shows the location of the future Lynn Valley Town Centre in a watershed context. "Situated in the heart of Lynn Valley, it is identified in the OCP as the District's Municipal Town Centre with medium and higher density uses," states Karen Rendek, Policy Planner and the District's project leader for plan development.



"Building on the existing strong commercial core with recreation and civic uses, a mix of new residential, commercial and employment uses, park and community space, and green building design and infrastructure will create a more vibrant and complete community."

#### Watershed / Landscape-Based Approach to Community Planning

The inter-connected Lynn Valley Town Centre and Hastings Creek Watershed Blueprint processes are a demonstration application of what was envisioned when a Metro Vancouver working group produced a guidance document titled *A Watershed / Landscape-Based Approach to Community Planning*, released in 2002. In its simplest expression this approach is aimed at the:

- Protection of people and property from natural hazards.
- Protection and conservation of self-sustaining ecosystems.
- Continuation and growth of resource-based economic activity.
- Provision of an affordable, sustainable and maintainable infrastructure.

The inter-municipal working group was chaired by Susan Haid, now the District's Manager of Sustainable Community Development.

### Celebration of Rain

"A unique aspect of the Draft Implementation Plan for the Lynn Valley Town Centre is that it is very much about rain," continues Karen Rendek.

**Rain is in the Community's DNA:** "Rain is a common occurrence in Lynn Valley. We have approximately 3 metres of rainfall each year. It is part of the community's DNA. You don't have to explain it to people. They get it. Everyone has a story about rain and why they celebrate it. The Draft Implementation Plan recognizes this cultural dimension and celebrates this natural feature."



"We have looked beyond the individual development sites to view their place in a watershed context. Rainwater is a key feature of everything that is proposed. Rainwater is a unifying element, and this extends to integration with public art."

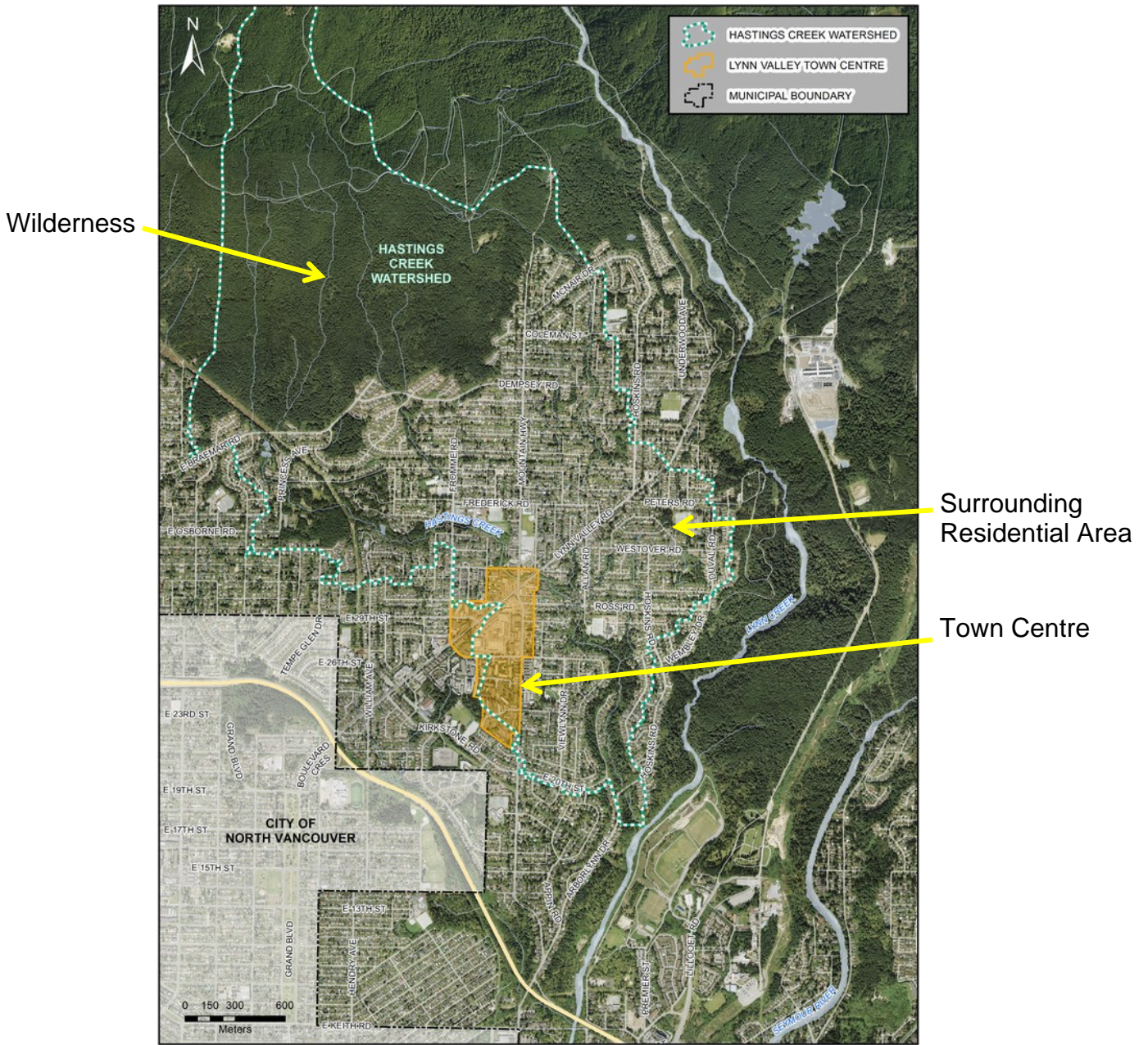
"Our approach is holistic. Every facet of the plan envisions an integrated rainwater system, from rooftops to roads to green spaces to Hastings Creek. We have been guided by this principle: *how will the Town Centre Draft Implementation Plan do its part to improve the overall health of the entire Hastings Creek watershed system?*"

**Collaboration and Integration of Perspectives:** "The Draft Implementation Plan has benefitted from the wisdom of Richard Boase and Ariel Estrada," reports Karen Rendek.

"We are all very passionate about what we do. We are also in tune with the community passion and stewardship ethic for the forested character of the mountainside. Through collaboration, we are sharing and integrating perspectives. As an outcome, the Town Centre and Watershed Blueprint processes are cross-fertilizing each other."

# Integrating the Site with the Watershed and the Stream

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Hastings Creek Location Map

Figure 7

# Integrating the Site with the Watershed and the Stream

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## Integrate Geography, History & Culture

“The Draft Implementation Plan for the Town Centre celebrates Lynn Valley’s natural and cultural setting and strong sense of community. Sustainable rainwater management is one of six ‘key principles’ used to help shape the development of the concept plan,” continues Karen Rendek. Figure 8 shows the extent of redevelopment.

“Yet rainwater management is more than just one of six principles. Rainwater management embodies the integration of geography, history and culture. This is the reason why we have viewed the Town Centre through a rainwater lens, as one of the key lenses. It is integral to the form and character of redevelopment.”

**Getting It Right the Second Time:** “For years, the cumulative impacts of a changing landscape on Hastings Creek have been apparent. We are seeing channel erosion, bank instability and loss of aquatic habitat. These impacts have financial consequences for the District,” states Richard Boase.

“As our understanding of the science behind stream and watershed health has progressed, it has also become clear that redevelopment is an opportunity. We have the tools. We have the understanding. It is a matter of applying both to ‘get it right the second time’. Implement a *design with nature* approach. Install green infrastructure that restores the Water Balance.”

“The opportunities are watershed-wide. The Lynn Valley Town Centre is surrounded by established single family residential development. The average house age is more than 40 years. Redevelopment is resulting in a turnover of the housing stock. The net effect is that small houses on large lots are being replaced by large houses on small lots. This has consequences for the Water Balance.

“The current Town Centre process has created the opportunity for the District to connect the dots and achieve an integrated outcome at three scales: site, neighbourhood and watershed,” concludes Richard Boase.

## KEY PRINCIPLES

1. CREATE A RICH AND VIBRANT CENTRE WITH A SENSE OF PLACE UNIQUE TO LYNN VALLEY



2. PROVIDE A WALKABLE, COMPACT CORE WITH MIXED COMMERCIAL/RESIDENTIAL



3. STRENGTHEN PEDESTRIAN, CYCLING, VEHICULAR AND TRANSIT CONNECTIONS



4. PROVIDE ATTRACTIVE STREETSCAPES AND A LIVELY HIGH STREET WITH ACTIVE STORE FRONTS



5. PROVIDE OPEN, INVITING & SAFE PUBLIC GATHERING SPACES ACCESSIBLE TO ALL



6. INCLUDE SUSTAINABLE DESIGN AND RAINWATER MANAGEMENT



## Integrating the Site with the Watershed and the Stream

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Aerial View of Lynn Valley Town Centre Figure 8

## Integrating the Site with the Watershed and the Stream

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### 5. Partnership with University of BC

For the past decade, the District has benefitted from staff collaboration with Dr. Hans Schreier, Professor Emeritus in the Faculty of Land and Food Systems at the University of British Columbia (i.e. “UBC”). He is internationally recognized for his career accomplishments related to watershed management, land-water interactions, and soil and water pollution.



The benefits have flowed two ways. The District has provided graduate students with opportunities to carry out applied research. This has enabled the District to complete science-based exploration at minimal cost to the District.

#### Mimicking the Water Balance

Collaboration with UBC has enabled District staff to venture into new territory, look at rainfall differently, and advance the understanding and practice of urban drainage. The research has focused on the relationship between building footprints and changes in the Water Balance [as trees are removed and the land surface is hardened], and the resulting consequences for stream and watershed health (i.e. when there is either too much or too little water).

The approach has been incremental as each successive research thesis has built on the preceding work. The findings and insights have informed the understanding of what is needed in the way of changes in land (re)development and servicing practices so that the **Water Balance Goal** can be achieved, that is:

*After re-development, each site will function as it did before, or better!*

An initiative that defines the value of the District’s collaboration with UBC is the *North Shore Tree Canopy Rainfall Interception Project*.

### North Shore Tree Canopy Rainfall Interception Research Project

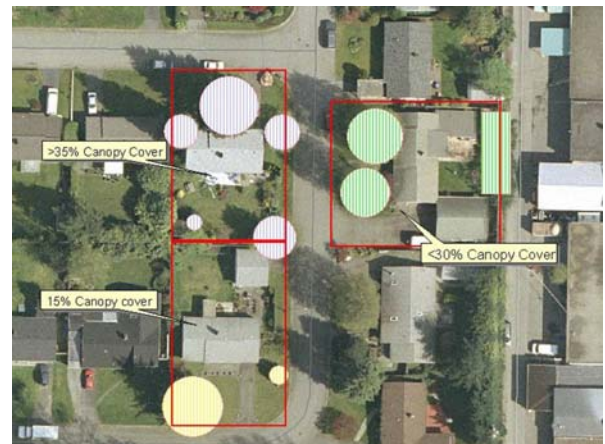
Commencing in 2005, the District partnered with UBC, the City of North Vancouver, West Vancouver, Metro Vancouver, the Province and the Real Estate Foundation. By the beginning of 2007, a network of 60 “tree canopy climate stations” was in place across the North Shore.

At the time of project initiation, Dr. Markus Weiler, former Chair of Forest Hydrology at UBC provided this context: “While considerable research has been undertaken in forest stands in the natural environment, very little has been done in an urban setting anywhere in North America.” He and Dr. Schreier developed the project approach and the system for measuring rainfall that is intercepted by the tree canopy (Figure 9).



The research findings were published in 2010; and have informed development of the Tree Canopy Module in the Water Balance Model.

**2012 Tree Protection Bylaw #7671:** The findings are also reflected in the updated tree protection bylaw. “The 20% target for tree canopy protection is a direct outcome of the research,” reports Richard Boase. “We were influenced by the Markus Weiler quote about *the right tree in the right place*. The research looked at the effectiveness of a single tree versus a cluster of trees in intercepting rainfall.”



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Tree Canopy Research Project

Figure 9

## Integrating the Site with the Watershed and the Stream

### A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

#### Nature of Re-Development

Collaboration with UBC culminated in a Master's thesis by Daphné Freudiger, a graduate student from the Swiss Federal Institute of Technology, completed in February 2012. She examined the nature and rates of redevelopment and completed a case study analysis for the Hoskins Creek sub-system. Figure 9 presents two images that capture the highlights of her research.

**Research Quantified Footprint Changes:** "The Hoskins Creek tributary is a predominantly single family residential area. So we looked at the turnover in the housing stock. Our objective was to quantify the impact of redevelopment in hardening the landscape. The research question was to determine

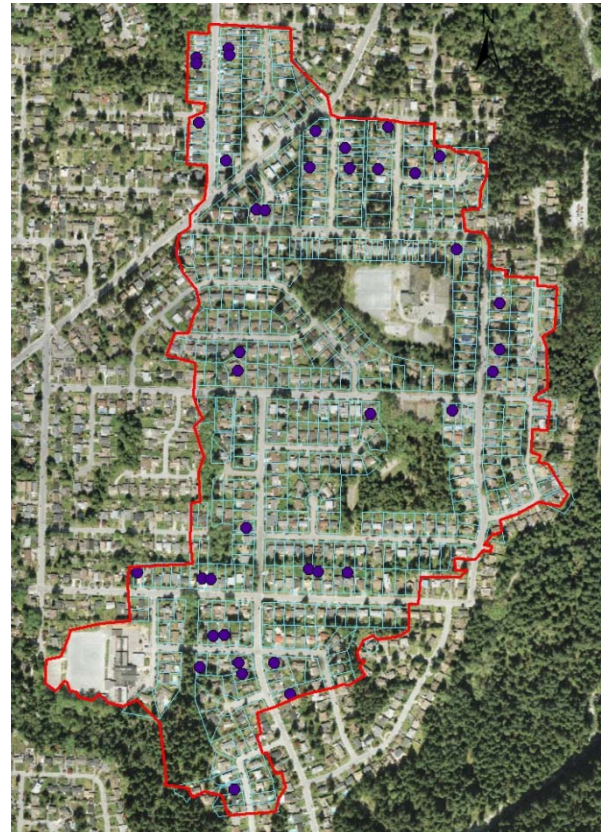


how to turn a water balance problem into a watershed opportunity by requiring rainfall capture on properties as and when they are redeveloped," states Richard Boase, the District's Environmental Protection Officer and the co-lead for the Hastings Creek Blueprint.

"To assess the magnitude of the changing footprint, we compared air photo imagery before and after redevelopment of individual properties. This confirmed that we are observing huge increases in the percentages of hard surfaces due to the housing turnover. The total increase per property can be as much as 66% (refer to Figure 9)."



**Anticipated Housing Turnover by 2030:** "The next question we addressed in the analysis was this: *How slow or fast is change occurring?* To establish the rate of redevelopment, we evaluated using two methods: imagery and house age. There are 535 properties in the watershed study area. The houses on 7% had been replaced during the period 2003 – 2009 (note dots on image below)."



"We developed a relationship between house age and anticipated turnover. The graph (included as Figure 10) is a powerful communication tool. The majority of the housing stock was constructed before 1975. Keeping in mind the notion of the 50-year housing turnover cycle, close to 60% of the housing stock is likely to be replaced by the year 2030. We are currently on the rising limb of the curve, and the peak is only a few years away. So, time is of the essence if the District is to capitalize on the opportunity that redevelopment represents to restore watershed health."



# Integrating the Site with the Watershed and the Stream

## A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### What Are the Changes due to Redevelopment?

Impacts on impervious surface and implications for stream health?



Increase in:

Roof surface: 68%

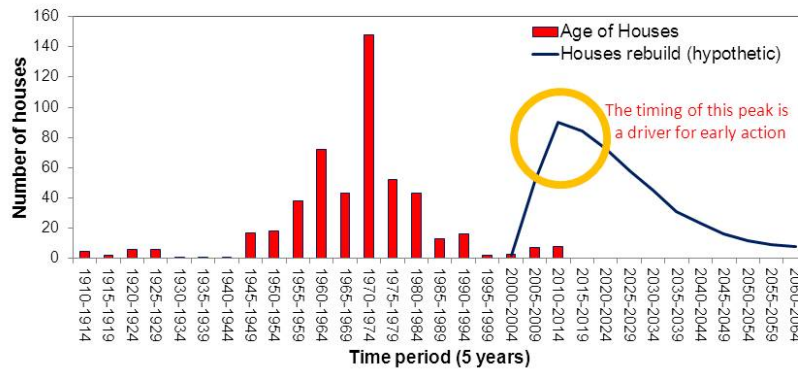
Asphalt surface: 63%

Total impervious surface: 66%

Evaluated by comparing imagery for 2003 and 2009

### Redevelopment of Single Family Neighbourhoods Creates Opportunities for Watershed Restoration

But time is of the essence to catch the peak!



Nature of Re-Development

Figure 10

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### 6. Drainage Infrastructure Screening Tool

The Regional Adaptation Collaboratives (RAC), a federal-provincial program, supports coordinated action towards advancing regional climate change adaptation decision-making by local government. RAC funded development of the *Drainage Infrastructure Screening Tool*. The tool is web-based and can be accessed only from the Water Balance Model website. The Hastings Creek Blueprint is the first validation application.

#### How We Look At Drainage Systems

“A typical situation faced by local governments is this: an existing storm sewer system; some problem areas; limited funding available for system upgrades; and the need to provide flood protection while being fiscally responsible,” observes Ted van der Gulik. “Experience shows that many systems operate without serious problems for many years. Also, the vast majority of the time, the system capacity is only partially utilized for drainage conveyance.”



“Yet many engineering studies recommend plans for pipe replacement and upsizing that would cost tens of millions of dollars, money that local governments do not have; while providing no offsetting stream health benefits. Unaffordable infrastructure plans that cannot be implemented paralyze municipal decision-making. When plans go on a shelf to gather dust, what has been accomplished? And why is this happening?”

“Is an apt analogy that modellers are missing the forest for the trees? Is it time local governments hit the re-set button regarding the way drainage infrastructure is evaluated? The need by our Partners for a new tool spurred development of the Drainage Infrastructure Screening Tool. Now, local governments can focus on what is most important AND save money.”

**Focus on what is Most Important:** Figure 5 introduced the paradigm-shift from a *model-centric* ISMP to a *landscape-based* Watershed Blueprint. The Drainage Infrastructure Screening Tool is at the heart of the paradigm-shift:

- Take a step back.
- Look at the system as a whole.
- Eliminate unnecessary complexity.

Figure 11 synthesizes, on one page, the thought process that is driving the paradigm-shift. Pipe-by-pipe computer simulation of storm sewer performance is expensive. Note the steps in the flow chart that the screening tool eliminates.

**Hastings Creek Validation:** The District has demonstrated how to integrate GIS input, apply the level-of-service methodology (that is embedded in the tool), inexpensively and quickly assess system performance, pinpoint problem areas, and generate relevant information for capital planning:

“Based on detailed modelling experience, we know that ‘problems’ fall within a narrow range. The lesson learned is that one need not model



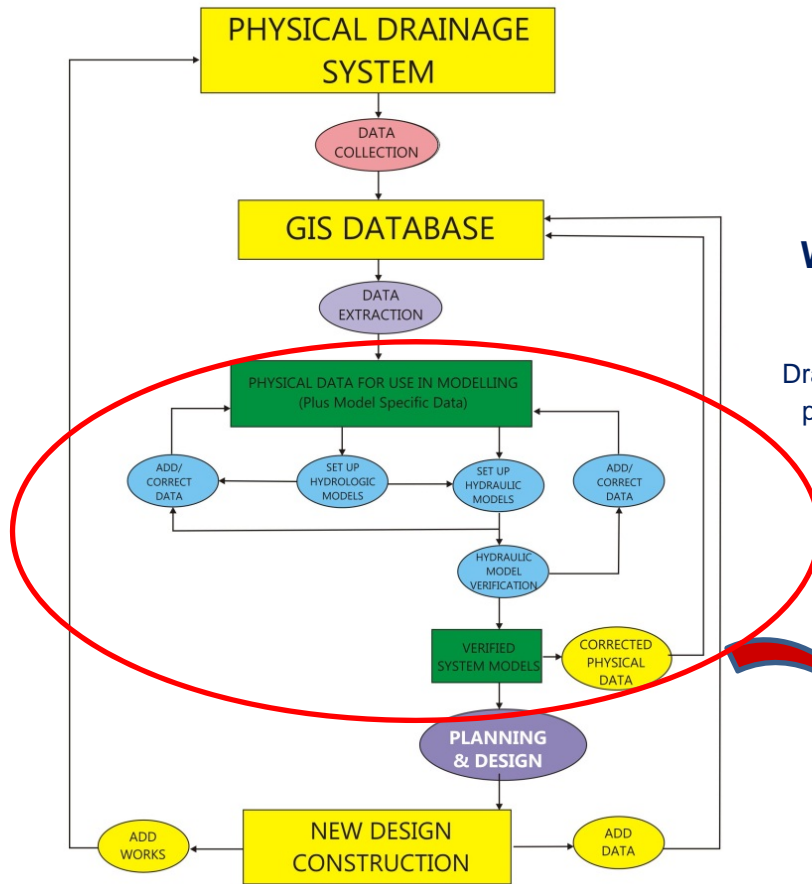
every section of pipe. The level-of-service approach is inexpensive and provides relevant information. It does this without the detailed and expensive simulation of the drainage system,” explains Jim Dumont, Engineering Applications Authority for the Water Balance Model Partnership, and technical advisor to the District. He developed the level-of-service methodology for the screening tool.

#### A guiding principle for the Drainage Infrastructure Screening Tool is to ....

“Provide an equal **Level-of-Service** or access to the drainage system for all properties within a drainage catchment or watershed”

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## What is a 'Model-Centric' Drainage Approach?

Drainage modelling is an *output-oriented* process... such that it is fairly easy to "miss the forest for the trees"!

*Screening tool eliminates unnecessary complexity!*

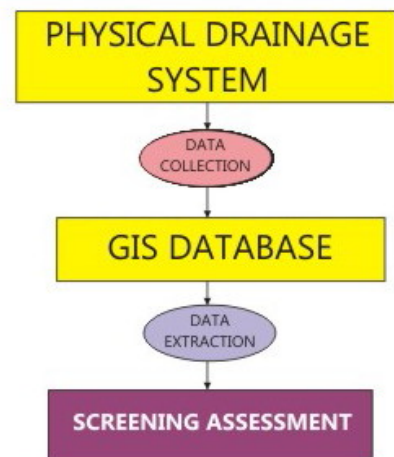
### The "paradigm-shift" starts with how we look at drainage systems

**THE ISSUE:** A "model-centric" approach spends a disproportionate share of scarce resources in time-intensive and hence costly computer modelling that is frequently unnecessary

**AN UNINTENDED CONSEQUENCE:** Unaffordable capital plans that cannot be implemented are "unfunded liabilities"

**THE NEED:** An inexpensive screening tool for prioritization and budgeting that results in affordable solutions

**A BENEFIT:** Can reallocate scarce resources to tackle pressing environmental concerns and needs



## Paradigm-Shift from 'Model-Centric' to 'Landscape-Based'

Figure 11

# Integrating the Site with the Watershed and the Stream

## A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### Ask Four Questions

Four questions provided the decision framework for application of the *Drainage Infrastructure Screening Tool* to evaluate the adequacy of storm sewer systems draining into Hastings Creek:

1. What is the existing level of drainage service within each tributary catchment?
2. What will be the effect of climate change?
3. What will be the effect of redevelopment?
4. How will climate change affect redevelopment?

**Level-of-Service:** “Good engineering is all about knowing when and how to ask the right questions before diving into technical analyses,” reflects Ariel Estrada. “Having a clear decision framework got us off to a good start and kept us on track. Because a level-of-service approach is actually common-sense engineering, everything fell into place.”



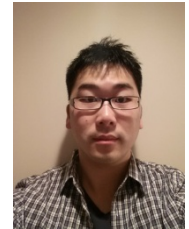
“A guiding principle in applying the screening tool is to examine the pipe system that is tributary to each drainage outlet or creek outfall (Figure 12). We examined every catchment. We evaluated every pipe in each catchment. We compared **installed capacities** to unit runoff discharges. We defined uniform levels-of-service. We identified potential weak links under different scenarios.”

### Level-of-Service Methodology

- For each section of pipe estimate:
  - ✓ Catchment area and capacity (Lps/ha)
  - ✓ Actual Level of Service
  - ✓ Design Discharge
- Compare design discharge to installed pipe capacity
- Identify problem areas ( $Q_{\text{capacity}} < Q_{\text{design}}$ )
- Modelling is optional

**Extract and Integrate GIS Output:** “One of the keys to carrying out the analysis efficiently and cost-effectively was the valuable supporting role played by the GIS department,” continues Ariel Estrada. “A critical input to the analysis is pipe data – identity, diameter, length and grade. This requires data extraction from GIS and creation of a spreadsheet for each and every catchment. Then the file is imported into the Screening Tool.”

“This is a labour intensive and time consuming process. With project schedule and cost constraints, it was not an option to hire a consultant. Our in-house solution was to hire Raymond Lee, a graduating student from BCIT. He has done great work.”



“Because Hastings Creek is a success, we have had Raymond carry on with data extraction for the rest of the District storm sewer system. As the need arises, we are now positioned to apply the Screening Tool District-wide.”

### Assess the Impacts of Land Use Densification and Climate Change Using a Single Tool:

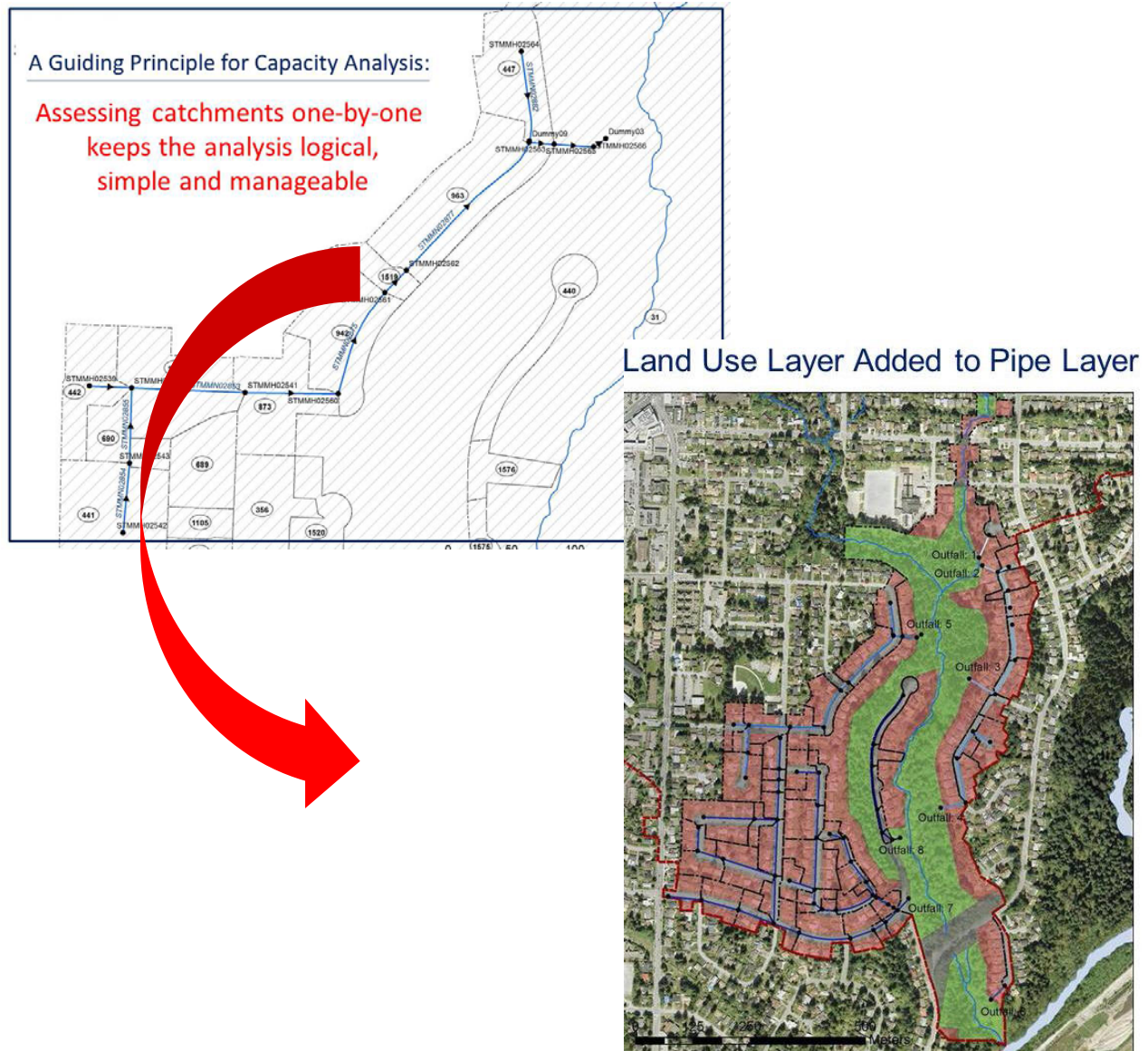
“We imported the spreadsheets prepared by Raymond into the Screening Tool and carried out level-of-service scenario comparisons. We assessed climate change and land use change at the same time. Think about what that means – one tool does both! Having that capability is invaluable.”

“The climate change scenarios were developed at by the Pacific Institute for Climate Solutions (PICS) at the University of Victoria for use in the Water Balance Model. It is quick and easy to check and verify the relative impact of a changing climate on conveyance capacity throughout the Hastings Creek storm sewer system.”

“The tool has made it possible to quantify the resiliency of each catchment. A key finding is that there is no reason to be alarmed by climate change. The Screening Tool also made it easy to assess the relative significance of densification in the Town Centre area.” (Refer to next page)

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Screening Tool Integrates Land Use Information

Figure 12

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### Application to Town Centre

Figure 13 presents a plan and sample output to illustrate the results of the screening tool analysis for the storm sewer system in the Lynn Valley core. Four notes on the bottom image highlight relevant information that became timely input to inform the District's decision process.

**Timely Evaluation and Response:** "A developer submitted a redevelopment proposal for one of the parcels in the Town Centre. A quick response on the part of the District was necessary to assess the potential impact on the existing storm sewer system," reports Richard Boase.

"We applied the Screening Tool, quickly identified that there was a 'weak link' on East 27<sup>th</sup> Street, and determined that the capacity shortfall would be addressed as conditions of approval for the land redevelopment process. Staff then informed the proponents that they would be responsible for assessing options for infrastructure renewal and doing the detailed design," adds Ariel Estrada.

### Validation of Level-of-Service Methodology:

"There is no history of operational problems in the Hastings Creek storm sewer system. Manholes do not surge and overflow during storm events. In a sense, application of the Screening Tool has confirmed the obvious. And that is precisely the point. We did not get sidetracked by a computer modelling exercise," reflects Richard Boase.

"Because we were hands-on, we learned a lot and understand how pipes in the Hastings Creek drainage area perform," continues Ariel Estrada. "This outcome contrasts with the typical situation when a municipality hires a consultant to build a detailed and expensive computer model. After a period of time, we will receive a report. The model is a black box. From our municipal perspective, we often have little feel for what has been done."

"The Hastings Creek process has demonstrated the immediate payback of a small investment in applying the Screening Tool. The District has saved money, both now and in the future, and avoided the pitfalls that other municipalities have experienced," concludes Richard Boase.

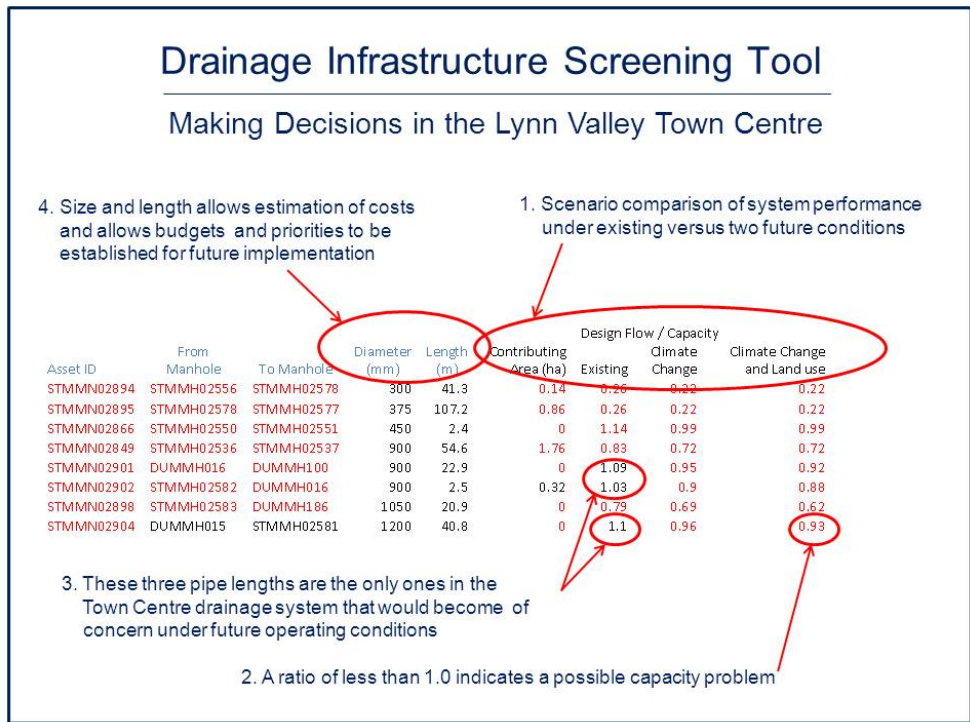
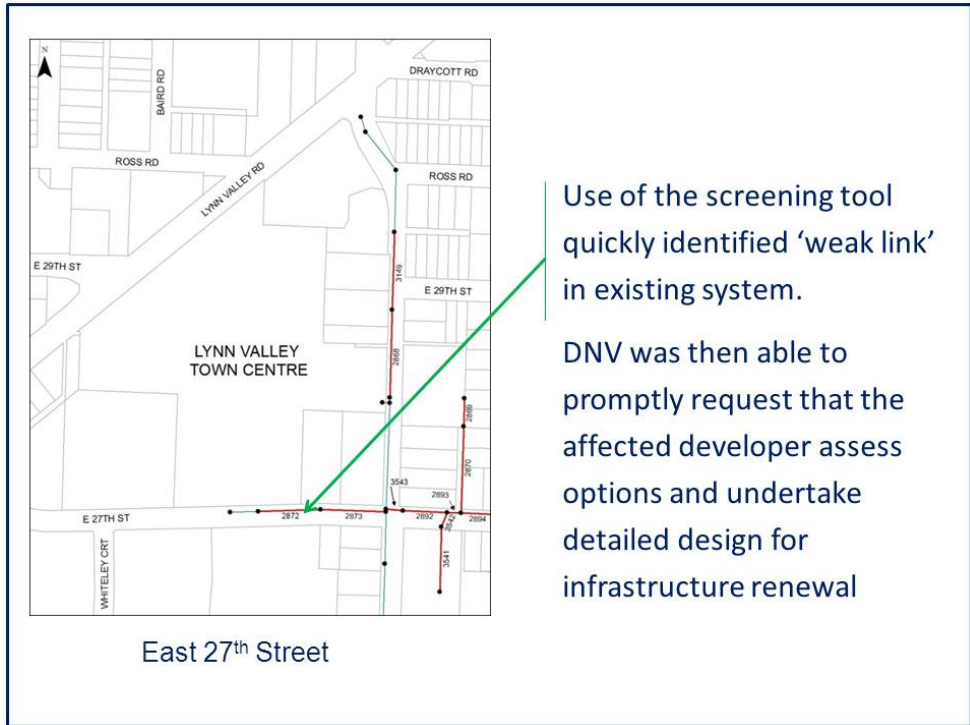
### Drainage Infrastructure Screening Tool

Hastings Creek demonstration application has validated the level-of-service methodology

- **KEY FINDING** is that the "90-10 Rule" applies:
  - ✓ "Do Nothing" in the 90% of system that is adequate
  - ✓ Investigate possible "Weak Links" in the other 10%
  
- **AND FURTHERMORE**, municipality can now:
  - ✓ Do analyses in-house
  - ✓ Generate immediate answers
  - ✓ Establish capital budgets quickly
  - ✓ Assign financial responsibilities
  - ✓ AND → *Focus effort on environmental opportunities!*

# Integrating the Site with the Watershed and the Stream

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## Application of Screening Tool to Make Decisions

Figure 13

## Integrating the Site with the Watershed and the Stream

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### 7. Geomorphology and Ecological Opportunities Assessment

There is an important connection between the *Drainage Infrastructure Screening Tool* and the *Geomorphology and Ecological Opportunities Assessment*. Simply put, the Screening Tool has facilitated the Opportunities Assessment. It has done this because it enabled District staff to focus on what is important and most relevant. This has resulted in an effective deployment of resources, both human and financial, and a better return on investment when compared to a 'model-centric' drainage approach.

#### An Outcome-Oriented Process

Figure 14 brings forward the right-hand side of the paradigm-shift graphic introduced as Figure 5. This has provided a frame-of-reference for the Opportunities Assessment. By embracing an outcome-oriented approach, the District has embarked upon a process that has resulted in considerable progress in tackling three questions:

- What Do We Have?
- What Do We Want?
- How Do We Put This Into Action?

This outcome-oriented approach has two parallel yet interconnected lines of investigation. There is the question of what is happening within and to the creek channel system. And then there is the question of how a changing watershed landscape is impacting on the channel system, either directly or indirectly. The Opportunities Assessment is now enabling District staff to 'connect the dots'.

"Because we have a better understanding of what needs to be fixed and protected in creek zones, the District can look for opportunities to do business differently in the surrounding watershed. This integrated approach should lead to multiple beneficial outcomes," observes Richard Boase.

**Approach to Field Investigations:** "Our vision in undertaking the Opportunities Assessment was that an aquatic habitat biologist and an engineer with experience in creek erosion processes would walk the creek together. Our thinking was that this would be the most efficient and effective way to cross-fertilize their experience and expertise while their observations were fresh," continues Richard Boase.

"We saw this approach to inter-disciplinary teaming as a way to streamline the inventory and assessment process. We wanted their focus to be on identifying implementable solutions so that in future the District can capitalize on opportunities to stabilize and enhance Hastings Creek as and when those opportunities arise."



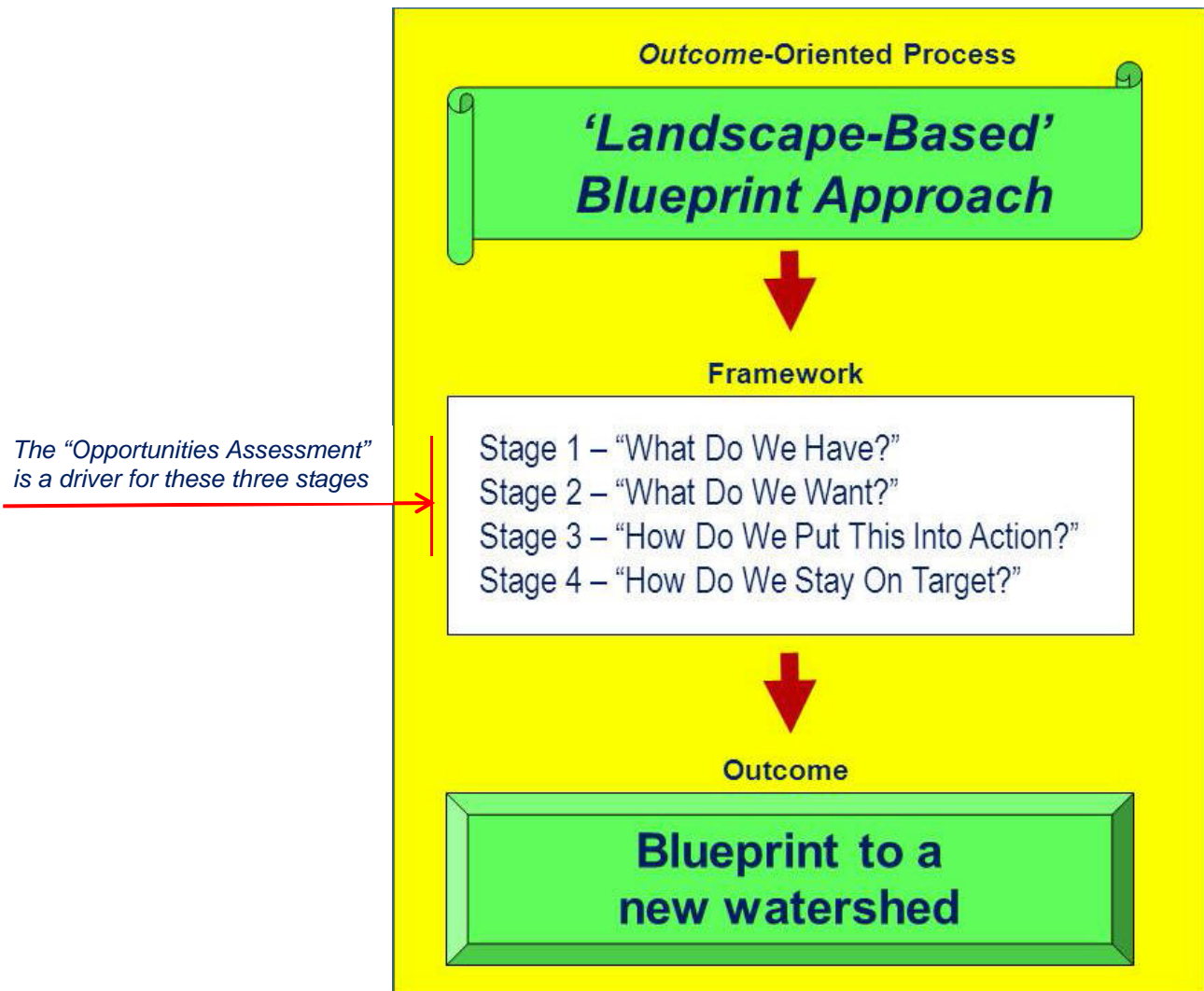
**Approach to Presentation of Results:** "We also decided that the Watershed Blueprint would be an interactive map. We are building on what we learned from the Bowker Blueprint precedent and taking what they did to another level," adds Ariel Estrada. "While the Bowker Blueprint is a paper-based set of reach-by-reach tables and maps, the Hastings Blueprint is GIS-enabled. This means we can turn layers of information ON or OFF."

"This interactive capability is a key to information sharing and comparing. When we are in the same room with our colleagues, this will then help us integrate our inter-departmental perspectives so that together we can solve problems holistically."



## Integrating the Site with the Watershed and the Stream

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Application of 'Landscape-Based' Blueprint Approach

Figure 14

## Integrating the Site with the Watershed and the Stream

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### GIS-Enabled, Interactive Map

Two images included as Figure 15 illustrate the use of GIS to both support and enhance the decision process. The top image identifies erosion and instability locations in all reaches of the Hastings Creek channel system. The flip side of a problem is an opportunity. Hence, each 'dot' is clickable in order to access the findings of the Opportunities Assessment. The bottom image is an example of restoration opportunities within an important reach of Hastings Creek.

**A Starting Point for Action:** "A watershed vision integrates what we do on the landscape to what we want to accomplish in the stream corridor. The Opportunities Assessment has provided us with a 'report card' which is both a baseline and a starting point for action. This task also represents a substantial portion of the total work effort to develop the foundation for the Hastings Creek Watershed Blueprint," states Richard Boase.

"With a clear vision and Blueprint in place, the District will be able to incorporate desired actions into operational work plans and work with the development community to restore watershed function over a period of decades. Couple what we've learned from the Opportunities Assessment with a land redevelopment strategy that strives to mimic the water balance, add the Screening Tool findings, and then set out on a new path towards sustainable planning for infrastructure and public works," summarizes Ariel Estrada.



**Quantitative Assessment Matrix:** "The District commissioned the Opportunities Assessment because we wanted to know 'what are the current conditions in the watershed'. And much like the Bowker Blueprint, we also wanted the opportunities assessment to be site-specific when identifying reach-by-reach enhancements that could be put into a watershed plan and help bring the Blueprint vision for watershed restoration to fruition," explains Richard Boase.

"Also, our vision for a GIS-enabled and interactive map is that we will have the ability to turn layers ON-OFF and ultimately be able to compare scenarios that take into account things such as sewer infrastructure, ecological enhancements, and tree canopy targets."

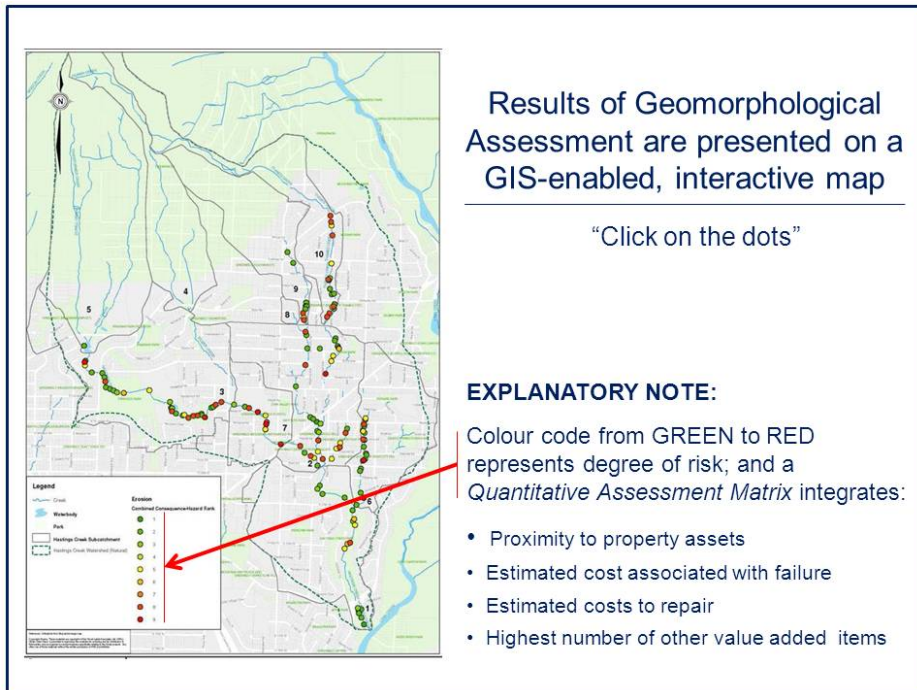
**Click on the Dots:** "A risk assessment has been completed for locations experiencing significant erosion and the results are presented in a *Quantitative Assessment Matrix*," continues Ariel Estrada. "The matrix will help us map out the future of the watershed."

"As we look ahead, we envision a process where the objective is to allocate resources to fix channel erosion problems on a ranked priority basis. Now, for example, we can call up those locations colour-coded red. Then, by turning on other GIS layers, we can look at other work items that the District may want to do in the general vicinity. With this picture in mind, we can determine whether and how we might combine, add and/or otherwise piggy-back different projects to achieve several outcomes."

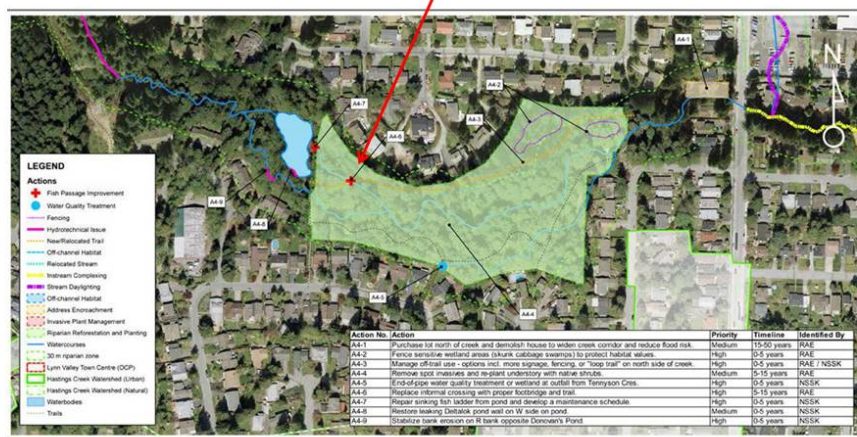
**Restoration Opportunities:** "We have also identified and mapped restoration opportunities," adds Ariel Estrada. "Each will be linked to a plan that explains the opportunity, has an approximate cost, identifies who would be involved in implementing the plan, and elaborates on issues to be resolved in order to proceed to implementation. In short, our vision is to make it easy to connect dots."

# Integrating the Site with the Watershed and the Stream

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A GIS file is linked to every restoration opportunity



District has identified 'Restoration Opportunities' and is connecting dots to 'Mimic the Water Balance'

Application of GIS-Enabled, Interactive Map

Figure 15

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### Connecting Dots & Early Action

Two images included as Figure 16 illustrate how the Opportunities Assessment is informing and influencing development of the work-in-progress Watershed Blueprint. Because the landscape-based approach is grounded in the details, the work-in-progress is already enabling the District to connect dots, make decisions and incorporate early actions into operational work plans.

**Impact of Invasive Species:** “We mapped out the areas where the watershed is being impacted by invasive species plant colonization. That was when a picture of cause-and-effect emerged – for example, there is a particularly nasty occurrence of Japanese knotweed in the main stem of Hastings Creek. When we used GIS to overlay the sanitary sewer infrastructure layer on the invasive species occurrence map layer, we had an Ah-Ha Moment,” recalls Richard Boase.

“There is a sewage lift station adjacent to the knotweed site. The station is in constant need of maintenance. We concluded that our practices initiated knotweed colonization due to root rhizomes being imported on truck tires, etc. The mapping shows that the knotweed is migrating down the creek channel as the high flows pick it up and deposit. Because we understood the source of the knotweed problem, we now had a basis for operational action.”



**Implementation of Maintenance Protocol:** “The value of the interactive mapping was validated when we met with the operations group. A picture is worth a thousand words. So we could show them exactly what is happening at the lift station location. As an outcome of this inter-departmental collaboration, they have now implemented a maintenance protocol,” continues Ariel Estrada.

“This protocol involves inspection, pressure washing and treating of equipment and materials before they are brought into these sensitive work sites. It sounds simple, but until we put the two layers together, we had no idea of either the cause of the knotweed occurrence or how we were going to tackle and manage the problem.”

### Benefit of Water Quality Monitoring Program:

“A second example of how a knowledge-based approach informs the decision process is




provided by the water quality monitoring program for Hastings Creek. We identified a pollution spike and determined that it originated from the one storm sewer outfall that serves the Lynn Valley Town Centre,” reports Richard Boase.

“This finding is informing development of design guidelines for the Town Centre. Re-development creates the opportunity to improve watershed conditions by eliminating problems at the source. The pollution spike has emphasized the need for green infrastructure that both reduces volume and improves quality of rainwater runoff.”

“Through the Opportunities Assessment, we have established that ‘green infrastructure’ solutions such as rain gardens should generally take precedence over engineering-based measures such as rainwater storage vaults. The guidelines are clear in recognizing that landscaped-based green infrastructure provides both volume and quality benefits,” concludes Ariel Estrada.

# Integrating the Site with the Watershed and the Stream

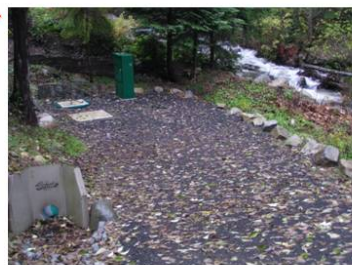
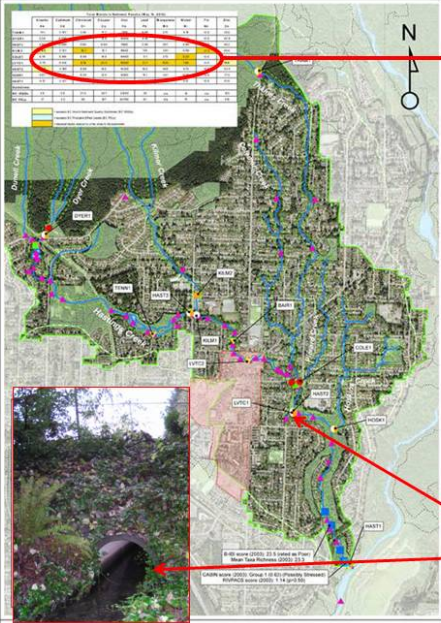
## A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver



Action No.	Action	Priority	Timeline	Identified By
A1.1	Work with landowners to address past waste dumping and manage invasive plants (e.g., yellow birch) extending down main slope into riparian areas	Medium	5-10 years	DNV
A1.2	Plan and implement riparian revegetation in riparian and adjacent riparian areas. Explain management actions including herbicide treatment (if an acceptable riparian stream channel)	High	3-5 years	DNV
A1.3	Review environmental impact of proposed structures and facilities located within the creek reach	Medium	5-10 years	DNV
A1.4	Install fencing where Hastings Creek Trail is adjacent to creek and/or relocate trail to reduce bank erosion and improve stream habitat	Medium	5-10 years	DNV

Because the Hastings Creek Blueprint is GIS-enabled and interactive, turning on the infrastructure layer resulted in an "Ah-Ha Moment"

District staff connected the dots between maintenance of a sewage lift station and spread of invasive knotweed; and this understanding led to implementation of a maintenance protocol

Station	Date	Parameter	Value
Lynn Valley Town Centre	2018-08-15	Temperature	15.2
		Dissolved Oxygen	8.5
		pH	7.8
		Turbidity	120

Water quality monitoring program drew attention to a pollution spike that originated from the Lynn Valley Town Centre

Multi media and sampling parameters have informed the DNV as to long-term & short-term objectives for the watershed:

1. Immediate opportunity with Lynn Valley Town Centre development
2. Long term opportunity to improve substrate to support ↑ benthics

Location of Hastings Creek Outfall serving Lynn Valley Town Centre

## Interactive Map Facilitates Connecting Dots & Early Action

Figure 16

## Integrating the Site with the Watershed and the Stream

### A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

#### Creating a Watershed Legacy

The Watershed Blueprint is a work-in-progress, yet the process is already having a significant influence because it is the catalyst for a range of early actions (described on previous page), ideas and initiatives listed below. Together they would create a watershed legacy. Figure 17 illustrates the first two. They are 'flagship' opportunities.

Opportunities Assessment is the catalyst for a range of early actions, ideas and initiatives:

1. Argyle Secondary / Kilmer Creek Legacy Project
2. Green Infrastructure Roadscape & Boulevard Requirements for Lynn Valley Town Centre
3. Invasive Species Action Plan
4. Recreation Pathway and Trail Management Plan
5. Water Balance Restoration Strategy

#### **Vision for an Argyle Secondary / Kilmer Creek Legacy Project:**

"We have learned from the success of the Bowker Creek Blueprint; and have observed the importance in having a flagship project to make a plan real to people," states Richard Boase. "Replacement of the Oak Bay High School with a new facility will transform a degraded section of Bowker into a community amenity and outdoor classroom. This project is an excellent example of how collaboration between a school district and three levels of government can produce a legacy for the community."

"We have an almost identical opportunity in Hastings Creek. It was only when we went into the watershed to look for restoration opportunities that we realized the watershed significance of a plan to replace Argyle Secondary. It just so happens that there is a 200-metre section of the Kilmer Creek tributary that is currently piped under the existing school building. Day-lighting this section to create Coho-accessible habitat could really galvanize community awareness."

#### **Green Infrastructure Roadscape & Boulevard Requirements for Lynn Valley Town Centre:**

"The Lynn Valley community identifies with rain because the total rain each year exceeds 3 metres. So, we have developed the concept for "Rain Street" that would bisect the Town Centre and showcase the application of green infrastructure to mimic the water balance," explains Richard Boase.

**Invasive Species Action Plan:** "The invasive species issue seems overwhelming. Yet the Hastings Creek experience shows that the problem is manageable. Application of a map-based approach has led to a framework for action."

"Most problems are being generated by over-the-fence dumping of green waste. Now we have a starting point for implementing an outreach and education program that would target creek-side property owners," comments Richard Boase.



#### **Recreation Pathway & Trail Management Plan:**

"Through the Opportunities Assessment, we learned that informal trail uses along Hastings Creek and many of the tributaries are significant and are impacting on riparian ecology. As a result, we are initiating an interdisciplinary team to develop a Hastings Creek watershed recreational land use strategy. The purpose of the strategy is to incorporate plans for safe and sustainable public access to our natural environment into the watershed blueprint," explains Richard Boase.

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

The Opportunities Assessment is the catalyst  
for a range of initiatives and early actions:

Making Decisions in the Lynn Valley Town Centre



"Rain Street" will bisect the Town Centre.  
It will feature green infrastructure that  
demonstrates how to capture rain, where it falls



What it might look like



*Vision for restoring Kilmer Creek tributary open channel in conjunction with future replacement of existing Argyle Secondary School and culvert removal*

## Opportunities to Create a Watershed Legacy

Figure 17

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### Water Balance Restoration Strategy

The Opportunities Assessment encompassed the 57 drainage culverts installed at road crossings within the Hastings Creek watershed area. Short-circuiting of the 'Water Balance' due to hardening of the landscape surface creates risks at culverts. Because culverts are 'choke points' in a drainage system, risk results from channel erosion and the potential for blockage of culvert inlets.



**Culvert Improvement Program:** "Because of the risks associated with peak flows, the District has an ongoing *Culvert Improvement Program*. We are responsible for 350 culverts where roads cross streams. Their combined lengths total ~10,000 metres. In 2008, every location was inventoried and inspected (using closed circuit television), and the condition of every culvert pipe was assessed," explains Ariel Estrada

"In the Hastings Creek watershed area alone, the program identified that: 14 of 57 culverts require structural repairs or rehabilitation using trenchless technology; 19 locations would benefit from an increase in conveyance capacity, the addition of fish-friendly passage and channel stabilization measures upstream and/or downstream; and 10 installations are in need of inlet and/or outlet upgrades. These culverts have been prioritized based on condition and consequence of failure."

**Mimic the Water Balance:** The top image in Figure 18 contrasts a reactive engineering with a proactive 'design with nature' approach to managing the Water Balance, that is: mitigate consequences vs eliminate sources of problems.

"The culvert program illustrates that the flip-side of a problem is an opportunity," continues Richard Boase. "In the past, fish passage through culverts was not a design consideration; and prime habitat upstream would often be cut off. Now, restoring fish passage is an important priority. Doing this type of enhancement work in conjunction with culvert renewal work (see Figure 18) has become a focus of my collaboration with Ariel."

"The long-term effectiveness of these culvert renewal and habitat enhancement projects ultimately depends on what we can do to restore the Water Balance in the surrounding watershed. The science tells us that we must manage stream energy if we are to reduce or limit stream erosion. This is the reason why it is necessary that developed areas mimic their natural contributions of rainwater runoff, and hence flow into streams."

"The recently adopted OCP provided the impetus to start a conversation about a vision to restore the rainfall absorptive capacity of the single family residential landscape. This vision is the essence of a *Water Balance Restoration Strategy*."





## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

Protect / restore the 'water balance' to reduce risk



*Flow conveyance solutions deal with consequences after water balance is short-circuited*



*Landscape-based solutions capture and absorb rain where it falls, and mimic the water balance*



*Triple culverts at stream crossing - new pipes were installed inside the old pipes and a fish ladder added to access upstream habitat*

### Capitalize on Opportunities to Restore Water Balance

Figure 18

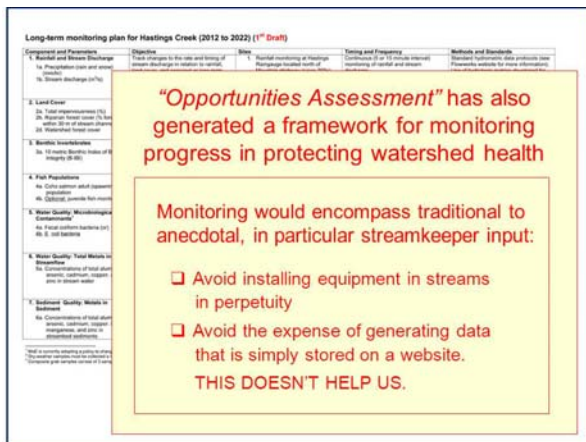
# Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

## Adaptive Framework for Monitoring Progress

“The Opportunities Assessment has generated a framework for data collection to monitor progress in protecting watershed health,” states Richard Boase. “Now it is a matter of tempering what the technical people have suggested. Suffice to say, it does not help the watershed if all we do is spend money to generate data that are simply stored on a website.”

“Our goal is to implement a balanced approach. We recognize the need for some traditional forms of data collection. At the same time, we are cautious about committing the District to costs in perpetuity. Our concern has to do with collecting data for the sake of collecting data, and then never using it.”



**Partner with the Stewardship Community:** “To assess change and keep us on track, a long-term monitoring plan must be effective and affordable. As we see it, the key is to involve those who have local knowledge and a passion for Hastings Creek. Then we have a feedback loop that is immediate and informed,” states Richard Boase.

“The streamkeepers are walking the creek all the time – for example, to count spawning salmon. We foresee formalizing their data gathering so that every year we would incorporate their information and data into the GIS-enabled Hastings Blueprint. In this way, we would measure progress and be both adaptive and proactive if issues or trends of concern are identified.”

## Role of Stewardship Community

“Streamkeeper participation in the process and the local knowledge captured in the Opportunities Assessment has taken the community to a whole new level of collaboration with the District. This is a significant outcome. It sets the stage for taking collaboration to yet another level,” states ZoAnn Morten, Executive Director at the Pacific Streamkeepers Federation, and a resident of the Hastings Creek Watershed.



“It means a lot to the Hastings Creek Streamkeepers Group that the District values and respects our local knowledge. We sure do appreciate that the District instructed their consultants to involve us in the Opportunities Assessment. The process was hugely valuable. We feel that our long-term commitment has been validated. Once the consultants have gone home, however, only the community can take the vision for a Watershed Blueprint forward.”

**Historical Context:** “Hastings has historically been the most productive creek system in North Vancouver. But the health of the creek has been compromised over the past 50 years. Hence, we believe an appropriate mantra for the Watershed Blueprint would be **don’t compromise what has been compromised**,” continues ZoAnn Morten.

“Local knowledge is the key to reversing this trend. Local understanding is so important. You have to walk a creek to understand it. Putting fish back in the creek took 14 years of knowledge to identify a hole in the 4-year salmon return cycle; and then know how to address the issue.”

“The North Shore is a place of innovation. The work of North Shore Streamkeepers has been the key to test-driving new approaches and protocols that have then gone province-wide.

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

**Streamkeeper Protocols:** “We take average citizens who are passionate, we inform them and we train them in how to apply rigorous and proven Streamkeeper Protocols. The protocols are intense. The training process takes 1½ years. Being informed then allows experimentation to prove out workable solutions.”

“I speak from experience when I say that there is nothing as thorough as the protocols in the *Streamkeepers Handbook and Modules*. They are so detailed that they provide a really solid grounding in data collection and field testing. The protocols were developed by Fisheries and Oceans Canada two decades ago.”

“The long-term value of the Streamkeeper Protocols is reliability when comparing year-to-year survey results,” emphasizes ZoAnn Morten.

**Building on a Knowledge-Based Foundation:** “The stewardship community needs a win in Hastings Creek, and we believe we can get it from the Opportunities Assessment.”

“The Opportunities Assessment by the District is founded on streamkeeper knowledge. Now we can work with the District to inform the broader community. We can open eyes and minds. We can open doors so that together we can make the changes necessary to achieve the vision for the Watershed Blueprint.”

“It is the Streamkeepers who have the on-the-ground knowledge needed to establish restoration priorities within the Hastings Creek watershed. That is the key to benefitting from local input,” concludes ZoAnn Morten.



Monitoring Progress

Figure 19

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### 8. Water Balance Model Express for Landowners

In 2012, the Metro Vancouver Regional Board provided a grant to help fund development of the Water Balance Model Express. The Board recognized that the 'WBM Express' will help Metro Vancouver members better deliver on regulatory compliance (reference: Figure 6), and in particular the Minister's conditions of approval.

"The \$50,000 from Metro Vancouver leveraged over \$250,000 in cash and in-kind contributions," reports Ted van der Gulik. "A key to a successful outcome is the critically important part that North Vancouver is playing. The Hastings Blueprint is the demonstration application for implementing *watershed-based* performance targets at the site scale as individual properties redevelop."

"The WBM Express represents a bold leap forward in the practice of urban drainage. At last local governments have a tool that integrates the SITE with the WATERSHED and the STREAM. The Express strips the challenge of setting and implementing targets to its essence."



#### **Watershed Health is a Shared Responsibility:**

"The calculation engine in the Express integrates three performance targets that are pre-set by the District," explains Richard Boase. "These targets link rainfall to stream health. This frees users to focus solely on selecting rainfall capture measures that will achieve the pre-set targets. The WBM Express is a tool that will enable every landowner to do their part to protect and restore watershed health over time. Achieving the Water Balance Goal is a shared responsibility."

### WBM Express is an Interactive Tool

"The WBM Express solves the vast majority of common problems faced by a landowner exploring ways to implement rainfall capture in accordance with a watershed plan, and without requiring use of tools designed for more complex situations," states the Florida-based Dr. Charles Rowney.

Charles Rowney is a Canadian and is the internationally recognized Scientific Authority for the Water Balance Model Partnership. In the mid-



1980s, he developed the QUALHYMO hydrologic calculation engine for the Ontario Ministry of Environment. This public domain engine powers the continuous simulation Water Balance Model. Charles Rowney and Jim Dumont collaborated to develop the Express.

**Colourful, Effective and Fast:** "The calculation engine in the WBM Express integrates three pre-set performance targets using a science-based methodology developed by Jim Dumont, Engineering Applications Authority specifically for the WBM Express. The underlying technical approach is precedent-setting."

"The Express interface is also innovative (Figure 20). It uses modern web technologies to guide the landowner through a simple and visually oriented set of sizing options, with outcomes displayed in real time."

"The interface is colourful, effective, fast and no more complex than the dash board of a typical car, stripping the problem down to a few sliders that drive gauges (or dials). We anticipate that both homeowners and professionals will find this interactive tool to be an efficient and enjoyable way to rapidly test alternative rainwater control types and sizes," concludes Charles Rowney.

# Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

The screenshot displays the 'WATER Balance MODEL express' interface. On the left, three circular dials show 'Stream' (0.45), 'Site Volume' (7.06), and 'Site Infiltration Area' (8.11). The 'Site Builder' section offers components like Building, Hard Surface, Landscaping, Infiltration Swale, Rain Garden, and Planter Box. A project for '3828 Hoskins Rd' shows a total area of 388 m² and a base conditions area of 0 m². A list of site components includes a replacement house, 2-car wide paths, lawns, and rain gardens. A detailed view of a 'Rain Garden - With Storage' shows sliders for volume (2.13), infiltration area (30), soil type (River Sand), soil depth (50 mm), base material (Clean Sand), and base material depth (150 mm). A 'Device Connections' section is also visible.

'Click and drag' to define a property

User choices drive the dial readings

Sliders dynamically and instantly drive the dials in response to user selections

Make Choices that Mimic the Water Balance  
Figure 20

# Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

## WBM Express Integrates Three Performance Targets

Figure 21 presents the Water Balance Targets that have been developed for Hastings Creek. There are three design parameters: volume of rainwater retained on a site; rate at which some of that volume infiltrates into the ground; and rate at which the remaining volume is slowly released to the pipe system to maintain stream baseflow.

### **Prevent Erosion and Protect Stream Health:**

“Under natural conditions, flow in a stream reaches the stream through several pathways and over different time scales. The process starts with the ability of the landscape to absorb rainfall. It continues with movement of water through the ground. Replicating these conditions in an integrated manner holds the key to restoring the Water Balance over time,” explains Jim Dumont.

“In engineering terms, the design objective is to manage stream energy to reduce or limit stream erosion, while at the same time protecting water quality. Erosion is caused by the combination of volume and flow duration. The cause-and-effect relationship boils down to this equation: *less volume equals less erosion*. However, too little flow means no fish.”



“The desired outcome in implementing Water Balance Targets for the Hastings Creek drainage system is that redeveloping areas would restore their natural contributions of flow to the many tributary streams that pass through Lynn Valley. This would be achieved one property at a time, over time. Redevelopment is an opportunity to achieve cumulative benefits. This contrasts with the cumulative impacts that are currently being experienced,” continues Richard Boase.



## WBM Express is Aligned with Other Regulatory Tools

“DNV’s Development Servicing Bylaw provides a relevant frame of reference for implementing the WBM Express. The bylaw references use of the Water Balance Model. The bylaw also contains language that clearly identifies that flood risk and erosion be maintained at rates that approximate the natural forested watershed,” observes Steve Ono, Deputy General Manager (Engineering Services).



“It is implicit in the bylaw language that the Water Balance of developed conditions should also meet that of the natural forested watershed. This means that both infiltration to ground and flows in the stream should be maintained, or restored. The proposed targets (Figure 21) would do this.”

### **Policy Framework in Official Community Plan:**

“The WBM Express is a tool that both supports and enables implementation of the environmental and infrastructure policy framework that is laid out in the OCP,” reports Richard Boase.

“The OCP contains language that describes desired outcomes that are embodied in a **Water Balance Restoration Strategy** – for example, in Section 9 on Environmental Management, rainwater interception is recognized as an ecological service and: ‘*The District’s objective is to protect and improve the ecological health of our natural systems*’. Clear policy direction related to protection of soil, trees and hydrologic function means the Water Balance Goal can be achieved.”



“The rainwater management framework for the Lynn Valley Town Centre demonstrates how planning, engineering and environment can align our efforts to achieve the Water Balance Goal. We have science-based understanding. We have technically solid policies. We have practical tools to restore the Water Balance.”


## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

Water Balance Model Express for Landowners

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**INNOVATION:** Calculator *integrates* three watershed-specific performance targets



*The targets for each ZONE are pre-set by the District:*

**Baseflow Release Rate**  
*(i.e. Interflow Replicator Rate)*  
(litres per second per hectare)

**Storage Volume**  
*(i.e. Interflow Storage Replicator)*  
(cubic metres per hectare)

**Infiltration Area**  
*(i.e. Groundwater Storage Recharge)*  
(is a function of area of contact with native ground)

Target Parameter	Lynn Valley Town Centre	Rest of Watershed
Baseflow <i>(Lps per hectare)</i>	0.5	0.5
Volume <i>(m<sup>3</sup> per hectare)</i>	1150	280
Area	3%	3%

**Water Balance Targets for Hastings Creek Watershed**  
Figure 21

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### 9. Reflect and Look Ahead

The District's approach has been systematic. Five blocks of major work provide the technical foundation and the Hastings Creek Watershed Blueprint is progressing to completion. The stage is now set for synthesis of relevant information and actions in a concise, colourful and reader-friendly Executive Summary.

#### Hastings Blueprint: A Demonstration Application of At-Risk Methodology

In Chapter 5 of the Stormwater Guidebook, the *At-Risk Methodology* (ARM) is presented. The Guidebook Steering Committee developed and tested a common-sense approach that will help local governments establish priorities at both the municipality-wide and watershed scales (e.g. decide which watershed to do first; and select the priority tributaries within the priority watershed).

"A decade ago, the District was a case study contributor to the Guidebook. Now, we have applied the ARM way-of-thinking in first selecting Hastings Creek as our demonstration ISMP; and then undertaking the Opportunities Assessment to identify likely priorities," notes Richard Boase.

"The At-Risk Methodology creates an early focus on areas that need priority attention to avoid pending impacts," states Peter Law, Guidebook Chair. Formerly with the Ministry of Environment, he is a founding Director of the Partnership for Water Sustainability.



"In the Guidebook, we emphasized the need to focus priority action on at-risk drainage catchments where there is both high pressure for land use change and a driver for action. The Guidebook states that the latter can be either a high-value resource that is threatened, or an unacceptable drainage problem. The Guidebook further states that it is important to focus on areas of land use change because this is where problems can be turned into opportunities."

#### Implementation: Internal Conversations Have Started

The District has arrived at a 'watershed moment' in terms of determining how best to inform and educate all the players (Council, staff, developers and community) about the Hastings Creek Vision. The objective is to springboard from awareness to implementation over time. Figure 22 brings forward the paradigm-shift graphic once more to highlight the essence of what is meant by the phrase *'Blueprint to a new watershed'*. "Internal conversations about the Blueprint have started. There is excitement," reports Ariel Estrada.

**Infrastructure Screening Tool:** "Hastings Creek experience has demonstrated the payback and effectiveness of the *Level-of-Service* approach that is embedded in the *Drainage Infrastructure Screening Tool*. It is about treating all users of the system equitably. Now that we have an in-house capability, we are carrying on with GIS database processing so that we will be ready to apply the screening tool to other areas of the District as the need for analysis arises," adds Ariel Estrada.

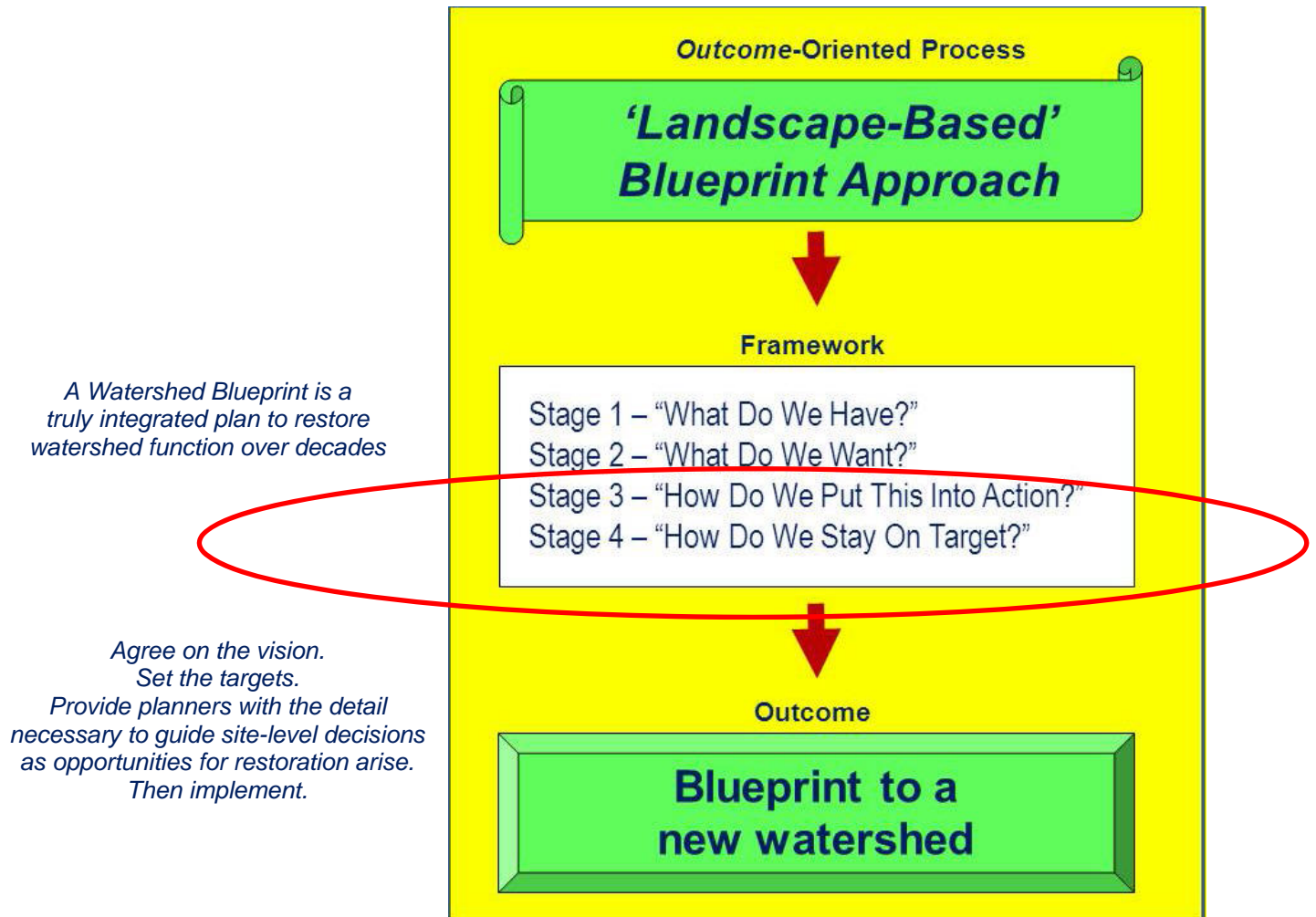
**Opportunities Assessment:** "Similarly, we have demonstrated the payback in collaborating with the stewardship community," continues Richard Boase. "We know what to look for and we have a clear picture of where ecological values can be restored. Also, the *Opportunities Assessment* has been the catalyst for inter-municipal collaboration with North Van City on common watersheds. We have a standard methodology for assessment. Each of us can follow-up in our own way."

**WBM Express for Landowners:** "There is now a regulatory requirement that connects lands use and stream health. How the District implements the *WBM Express* to achieve performance targets for rainfall capture in single family areas needs to be a joint effort of engineering and planning. We are now poised to have the internal conversation about how to do this," concludes Richard Boase.



## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver



Implementation of 'Landscape-Based' Blueprint Approach

Figure 22

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### Integration of Engineering, Planning and Environmental Perspectives

“When the Ministry of Environment released the Guidebook in 2002, the objective was to broaden the traditional drainage engineering approach to one that fully integrates hydrologic, planning and environmental concerns,” reflects Peter Law. “By 2010, however, the consistent lack of integration in ISMPs was a catalyst for the ‘ISMP Course Correction’.”

“The ‘course correction’ was initially informed by the Bowker Creek Blueprint and by City of Surrey experience. Now, the regional importance of the Hastings Creek precedent is that we anticipate that it too will influence other local governments in the Georgia Basin and beyond. Those who wish to develop truly integrated solutions can learn from the District’s *outcome-oriented* approach.”

### Things Changed with the Hastings Blueprint:

“Before Hastings Creek, the notion of ISMPs seemed too big to tackle; as well, it was disconnected from the District’s priorities,” reflects Susan Haid, Manager of Sustainable Community Development. “Despite our awareness and support for integration, there was still a disconnect between engineers and planners on this initiative, largely due to us having different priorities. We did not realize it at first, but our thinking began to change after we completed the *Official Community Plan Update* and commenced development of implementation plans for five Town Centres.”



“Richard Boase, Ariel Estrada and Karen Rendek are the three individuals in the trenches who drove our change in thinking. Their collaboration on the Lynn Valley Town Centre demonstrates what integration of environmental, engineering and planning perspectives looks like in practice. They showed us that the pathway to an ISMP is through an *integrated project*.”

**Land Ethic Drives ‘New Business As Usual’:** “As I reflect on my career in local government, there has been a lot of learning that has raised awareness and driven changes in land planning practice. A defining moment for me was the *Salmon in the City Conference* in 1998. It was a memorable event.”

“Salmon in the City changed our understanding of the relationship between land use planning and the consequences for stream health. Fifteen years later, what were new ideas in 1998 are now embedded in how we do business in the District in 2013. We have to reflect that Salmon in the City ‘land ethic’ in going forward with the planning for all five Town Centres.”

### We Have the Information to Make Decisions:

“The Hastings Creek Blueprint has helped us figure out the context for the Lynn Valley Town Centre. In the process, we have demonstrated how to move back and forth between scales. We have also learned how to work with imperfect information and work towards a solution. We have enough information to make decisions,” states Susan Haid.

“As I reflect on why the Hastings Creek process is proving successful, it reinforces in my mind the value of *charrettes* to solve problems. You bring together the right people with the right knowledge. You share what you know. You identify what you don’t know. You try things because it is all about getting the right puzzle pieces. You start to fit the pieces together and build integrated solutions.”

### Transferability to Other Town Centre Projects:

“Integrated community design is very much about a *sense of place* and, in the case of Lynn Valley Town Centre, weaving nature into the urban fabric. The Hastings Creek tributaries are the skeleton of the system. They are affected and influenced by everything that we do on the land. Hence, it boils down to focussing on areas of change and issues related to ecological threats.”

“The Hastings Blueprint is enabling us to develop principles. These will be transferable to integrated planning for the other town centres. Furthermore, our watershed-based approach means the District can demonstrate that we are fulfilling our ISMP commitments,” concludes Susan Haid.

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### View the Watershed through a 'Sustainable Service Delivery' Lens

"Linkages between the Water Balance, watershed and stream health, and infrastructure liability have emerged as important pieces in ensuring 'sustainable drainage infrastructure' in BC, both fiscally and ecologically. The Province's branding for this holistic approach is *Sustainable Service*



*Delivery*," states Glen Brown, Deputy Inspector of Municipalities.

"Asset management usually commences after something is built. The challenge is to think about what asset management entails BEFORE the asset is built. Cost-avoidance is a driver for this 'new business as usual'. This paradigm-shift starts with land use and watershed-based planning, to determine what services can be provided affordably over time."

**An Incentive to Do Business Differently:** "Local governments are faced with a financial challenge: the initial capital cost of infrastructure is about 20% of the life-cycle cost; the other 80% largely represents a future unfunded liability. Each year, the funding shortfall grows as infrastructure ages. This fiscal reality creates the incentive to prevent



additional financial impacts," continues Gavin Joyce, the District's General Manager for Engineering, Parks and Facilities.

"While developers and new home purchasers pay the initial capital cost of municipal infrastructure, it is local government that assumes responsibility for the long-term cost associated with operation, maintenance and replacement of infrastructure assets. In addition, local governments bear the entire financial burden to stabilize and restore watercourses impacted by increased rainwater runoff volume AFTER land is developed or redeveloped."

**Effective, Affordable and Timely:** "The District has ten major watersheds. In fulfilling the regulatory requirement for ISMPs, we must be strategic in how we invest our limited resources. Whatever work we undertake must be completed in an effective, affordable and timely manner. The process cannot be an extended or drawn out one. This means we are stressing the need for, and value of, innovative approaches that lead to integrated solutions and thereby achieve multiple objectives," continues Gavin Joyce.

**Re-Building of Core Technical Capability:** "The District is a mature municipality, and is facing two types of challenges: an aging infrastructure and redevelopment. Our ability to respond effectively depends on having a core technical capability. In recent years, it has been a District priority to rebuild this capability. We are fortunate that our staff include long-term professionals like Ariel Estrada and Richard Boase to provide leadership."

"These individuals have a long-term corporate history and memory. Furthermore, they have valuable local knowledge. They have lived through changes and events. This provides them with an informed perspective: they know what works and what does not," emphasizes Gavin Joyce.

**Implementation of Hastings Creek Blueprint:** "The Blueprint work has resulted in a balance of science-based understanding and practicality at the watershed scale. Next, engineering and planning will drill down to the individual site scale to implement changes in land development and infrastructure servicing practices."

"Integration of the Lynn Valley Town Centre and Watershed Blueprint processes has yielded invaluable understanding. We now have the opportunity to put in place the right tools to restore watershed health. The process starts with good policies that cascade down in order to produce action on the ground. We have a plan; there is agreement about the goals; we are developing tools for use by staff, developers and homeowners; and we have a schedule of opportunities. Everything that we need is in play," concludes Gavin Joyce.

## Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

### Outreach is a Powerful Tool

The Bowker Creek Initiative has identified seven distinguishing characteristics that capture the essence of lessons learned and experience gained in developing the Bowker Creek Blueprint between 2004 and 2010. This experience can inform implementation of the Hastings Blueprint.

#### **Transferability of Bowker Creek Experience:**

“There is a story behind each ‘learning’, and the Bowker Steering Committee is interested in sharing these stories,” states Jody Watson, Chair. She is with the Capital Regional District, the coordinating agency. “These stories are central to the founding of the Bowker Creek Initiative and development of the Blueprint.”



“The top three are: 1) community values drive the Initiative and Blueprint; 2) the coordinator role is crucial; and 3) outreach is a powerful tool.”

“For the first four years, outreach was our focus because we recognized that community buy-in would ultimately engender political and staff support for restoration of the watershed. Community groups and individuals have taken ownership and responsibility for ‘telling the story’ of the Bowker Creek Initiative.”

#### **Generate Awareness of Watershed Vision:**

“Currently, we face a communications challenge. The public is unaware that there is a regulatory requirement to develop ISMPs. And the Hastings Creek Streamkeepers is the only community group that is proactively involved and contributing to Blueprint development,” states Susan Haid.

“The consultation process around ‘form options’ for the Lynn Valley Town Centre therefore provides the District with a timely opportunity to connect dots. We have a magic moment when we can generate awareness of how all the puzzle pieces in the Watershed Vision fit together.”

#### **Capture Attention & Engage the Community:**

“The Hastings Creek Blueprint provides the tools to tell a story and share information with our residents. This is important because there are so many items competing for people’s time which is a finite resource. We want to be able to share information and engage the community”, continues Julie Pavey, Section Manager for Environmental Sustainability.



“One of the ways to foster more sustainable behavior and the protection of watersheds such as Hastings Creek is to engage residents so that they feel connected personally to their watershed. It is not a matter of only saying what the District can do for the watershed. Rather, it must be all the stakeholders. We have started the process with collaboration with the Streamkeepers who are already engaged.”

“Looking forward, the District has established policies which will enable development review and approval processes to play a key role in implementing the Water Balance Model Express. If we get the big picture right, we can all work together through a series of smaller actions that over time will make the vision for Hastings Creek watershed a reality,” concludes Julie Pavey.

#### **Tell the Story of the Hastings Creek Blueprint:**

“It is important that we seize opportunities to tell the Hastings Creek story,” notes Gavin Joyce. “It is also essential that we communicate why and how we are being successful. Then others will leverage what has been accomplished to date by Ariel Estrada, Richard Boase and Karen Rendek. If we all tell the story, then people will become energized in the re-telling.”

“In telling the Hastings Creek story, a key message is that redevelopment of the watershed represents an opportunity to make things better and restore hydrological and ecological functions. Through our commitment to a landscape-based approach, the District can show how to mimic the water balance; improve watershed health; and comply with regulatory requirements (Figure 23),” concludes Susan Haid.

# Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

## A Truly Integrated Plan of Action

The Planning PROCESS

Produces a SHARED VISION

Implemented by...



an ACTION PLAN with Four Components

Mimic the WATER BALANCE to Reduce Risk, Improve Watershed Health and Comply with Regulatory Requirements



Water Balance METHODOLOGY integrates Sites with the Watershed and the Stream

### Source:

Stormwater Planning: A Guidebook for British Columbia, 2002  
(Chapter 3)

Hastings Creek Watershed Blueprint:  
A Starting Point for A Truly Integrated Plan of Action

Figure 23