TOWN OF LADYSMITH

Celebrate our Present. Embrace our Future. Honour our Past.

A REGULAR MEETING OF THE TOWN OF LADYSMITH COUNCIL AGENDA 5:30 P.M.

Tuesday, December 17, 2024
Ladysmith Seniors Centre
630 2nd Avenue

Pages

1. OPEN MEETING AND ACKNOWLEDGEMENT

The Town of Ladysmith acknowledges with gratitude that this meeting takes place on the unceded territory of the Stz'uminus First Nation.

Members of the public may attend meetings in person at the Ladysmith Seniors Centre or view the livestream on YouTube: https://www.youtube.com/channel/UCH3qHAExLiW8YrSuJk5R3uA/featured.

2. AGENDA APPROVAL

Recommendation
That Council approve the agenda for this Regular Meeting of Council for December 17, 2024.

3. RISE AND REPORT- Items from Closed Session

4. MINUTES

4.1 Minutes of the Regular Meeting of Council held December 3, 2024 8

Recommendation
That Council approve the minutes of the Regular Meeting of Council held December 3, 2024.

4.2 Minutes of the Special Meeting of Council held December 11, 2024 14

Recommendation
That Council approve the minutes of the Special Meeting of Council held December 11, 2024.

5. DEVELOPMENT APPLICATIONS

5.1 Roundabout Condition 1130 Rocky Creek Road

Recommendation

That Council:

1. Consider the request to amend Covenant CB215820 registered on the title of 1130 Rocky Creek Road and direct staff to:

    a. proceed with scheduling and notification of a public hearing pursuant to section 464(1) of the *Local Government Act; and*

    b. Formally refer the proposal to the Ministry of Transportation and Infrastructure;

2. Require that, as a condition of approval of the request to amend Covenant CB215820 the following conditions to be secured through a covenant also be amended to:

    a. prohibit access from Ludlow Road and limit egress from the site to a single, right out only egress, until the roundabout is constructed;

    b. require the construction of a temporary median in Ludlow Road;

    c. require cash in lieu of frontage improvements along Ludlow Road and Rocky Creek Road at time of building permit issuance;

    d. require the provision of a temporary gravel pathway along the frontage of the property as shown in proposed development permit 3060-24-20;

    e. require the provision of no left turn signs in the Ludlow Road right of way to prevent left hand turns exiting 1010 Ludlow Road; and

    f. require no U-Turn signs to be installed at the Ludlow Road/Rocky Creek Road Intersection;

3. Issue Development Variance Permit 3090-24-08; and

4. Issue Development Permit 3060-24-20.

5.2 Development Variance Permit and Development Permit – 128 Rollie Rose Drive 441

Recommendation
That Council:

1. Issue Development Variance Permit 3090-24-06 to vary the following provisions of "Town of Ladysmith Zoning Bylaw 2014, No. 1860" for a proposed multi-unit residential development at 128 Rollie Rose Drive (Lot 12, District Lot 103, Oyster District, Plan EPP75579; PID: 030-477-620):
    a. Section 7.2.2. (c) to reduce the minimum landscape buffer from 1.5 metres to 0.5 metres; and
    b. Section 10.12.5. (d) to reduce the minimum front parcel line setback from 6.0 metres to 2.7 metres;
2. Issue Development Permit Number 3060-21-10 to allow construction of a three-unit townhouse building and two duplex buildings at 128 Rollie Rose Drive; and
3. Require as a condition of the issuance of Development Permit 3060-21-10 that the applicant provide landscape security in the amount of $23,382.00, as stated in the Development Permit (3060-21-10).

6. BYLAWS- OFFICIAL COMMUNITY PLAN AND ZONING

6.1 Housing Needs Report and Consequential OCP Amendments 765

Recommendation
That Council:

1. Pursuant to sections 585.31 and 790(2) the *Local Government Act,* receive the December 17, 2024 report to Council as the Town's Interim Housing Needs Report;
2. Direct staff to publish the Interim Housing Needs Report to the Town's webpage pursuant to section 790(5) of the *Local Government Act*;
3. Having considered s. 475 of the *Local Government Act*, and in particular the matters set out in subsections (2)(a) and (b), resolve that:
    a. the Stz'uminus First Nation, is the only entity that is appropriate to consult in connection with "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190";
    b. consultation should be early but need not be ongoing;
    c. the consultation process described in the December 17,

2024 staff report to Council is sufficient in respect to the proposed Official Community Plan amendment; and

d. staff be directed to refer "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No.2190 " to the Stz'uminus First Nation as set out in recommendation 3 for consultation in the manner described in the December 17, 2024 report to Council;

4. Give first and second readings to "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190";

5. Consider "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" in conjunction with the Town's Financial Plan, the Town's Liquid Waste Management Plan, and the Cowichan Valley Regional District Solid Waste Management Plan, pursuant to section 477(3) of the *Local Government Act*;

6. Consider "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" in conjunction with the Town's Interim Housing Needs Report and the housing information on which the report is based, pursuant to section 473.1(2) of the *Local Government Act*;

7. Direct staff to refer "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" to School District 68 pursuant to section 476 of the *Local Government Act*; and

8. Pursuant to section 481.7(2) of the *Local Government Act*, review the Interim Housing Needs Report and "Town of Ladysmith Zoning Bylaw 2014, No. 1860" and resolve that further zoning amendments to meet the 20-year total number of required housing units are not necessary; and

9. Direct staff to proceed with scheduling and notification of a public hearing for "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" pursuant to section 464(1) of the *Local Government Act*.

6.2 Proposed Animal Control Bylaw and Consequential Zoning Bylaw Amendments

785

Recommendation

That Council:

1. Give first, second, and third readings to "Town of Ladysmith Animal Control Bylaw 2024, No. 2167";

2. Give first and second readings to "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169";

3. Direct staff to proceed with scheduling and notification of a public hearing for "Town of Ladysmith Zoning Bylaw 2014, No. 1860 Amendment Bylaw 2024, No. 2169" pursuant to section

464(1) of the *Local Government Act*; and

4. Direct staff to forward “Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169 to the Ministry of Transportation and Infrastructure, after third reading of the bylaw, pursuant to section 52 of the *Transportation Act*.

7. COMMITTEE MINUTES

7.1 Accessibility Advisory Committee - October 30, 2024 and November 27, 2024 813

Recommendation
That Council receive the minutes of the Accessibility Advisory Committee meetings held October 30 and November 27, 2024.

8. BYLAWS

8.1 Bylaws for Adoption

8.1.1 "Sanitary Sewer Rate Bylaw 1999, No. 1299, Amendment Bylaw 2024, No. 2198" 817

Recommendation
That Council adopt "Sanitary Sewer Rate Bylaw 1999, No. 1299, Amendment Bylaw 2024, No. 2198".

8.1.2 “Waterworks Regulations Bylaw 1999, No. 1298, Amendment Bylaw 2024, No. 2199" 819

Recommendation
That Council adopt “Waterworks Regulations Bylaw 1999, No. 1298, Amendment Bylaw 2024, No. 2199".

8.1.3 “Garbage, Recycling and Organics Collection Bylaw 2005, No. 1588, Amendment Bylaw 2024 No. 2201” 822

Recommendation
That Council adopt “Garbage, Recycling and Organics Collection Bylaw 2005, No. 1588, Amendment Bylaw 2024 No. 2201”.

8.1.4 “2025 Revenue Anticipation Borrowing Bylaw 2024, No. 2202” 832

Recommendation
That Council adopt “2025 Revenue Anticipation Borrowing Bylaw 2024, No. 2202”.

11. QUESTION PERIOD

- A maximum of 15 minutes is allotted for questions.
- Persons wishing to address Council during "Question Period" must be Town of Ladysmith residents, non-resident property owners, or operators of a business.
- Individuals must state their name and address for identification purposes.
- Questions put forth must be related to items on the agenda.
- Questions must be brief and to the point.
- Questions shall be addressed through the Chair and answers given likewise. Debates with or by individual Council members or staff members are not allowed.
- No commitments shall be made by the Chair in replying to a question. Matters which may require action of the Council shall be referred to a future meeting of the Council.

12. PRESENTATION

Former Mayor Robert Hutchins will be awarded Freedom of the Town, as per Civic Recognition Program Policy 01-0290-A, in honour of his many accomplishments as Mayor of Ladysmith from 1993-2014.

13. ADJOURNMENT

MINUTES OF A REGULAR MEETING OF COUNCIL

Tuesday, December 3, 2024
5:30 P.M.
Ladysmith Seniors Centre
630 2nd Avenue

Council Members Present:

Acting Mayor Tricia McKay
Councillor Ray Gourlay
Councillor Amanda Jacobson
Councillor Duck Paterson
Councillor Marsh Stevens *(joined the meeting at 7:48 p.m.)*

Council Members Absent:

Councillor Jeff Virtanen

Staff Present:

Allison McCarrick
Erin Anderson
Chris Barfoot
Jake Belobaba
Tim Tanton
Chris Geiger
Sue Bouma
Trish McConnell
Nick Pescod
Hayley Young

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1. CALL TO ORDER

Call to Order 5:30 p.m. in Open Session, in order to retire immediately into Closed Session.

2. CLOSED SESSION

CS 2024-282

That, in accordance with section 90(1) of the *Community Charter,* Council retire into closed session in order to consider items related to the following:

- (c) labour relations or other employee relations;
- (g) litigation or potential litigation affecting the municipality;
- (i) the receipt of advice that is subject to solicitor-client privilege, including communications necessary for that purpose; and
- k) negotiations and related discussions respecting the proposed provision of a municipal service that are at their preliminary stages and that, in the

view of the council, could reasonably be expected to harm the interests of the municipality if they were held in public.

Motion Carried

3. OPEN MEETING AND ACKNOWLEDGEMENT (7:00 P.M.)

Acting Mayor McKay called this Regular Meeting of Council to order at 7:00 p.m., recognizing with gratitude that it was taking place on the unceded territory of the Stz'uminus First Nation.

4. AGENDA APPROVAL

CS 2024-283

That Council approve the agenda as amended to replace “Waterworks Regulations Bylaw 1999, No. 1298, Amendment Bylaw 2024, No. 2199” in Item 10.1.2 with an updated version containing measurement corrections in Schedule A, Item 6 (A) and (B).

Motion Carried

5. RISE AND REPORT- Items from Closed Session

Council rose from Closed Session at 6:31 p.m. without report.

The following item from the Closed Meeting of Council held October 15, 2024 was reported:

CE 2024-078

That Council appoint Mayor McKay or her deputy to the Ladysmith Detachment Commander hiring committee.

Motion Carried.

6. MINUTES

6.1 Minutes of the Regular Meeting of Council held November 19, 2024

CS 2024-284

That Council approve the minutes of the Regular Meeting of Council held November 19, 2024.

Motion Carried

7. DELEGATIONS

7.1 Carmen Barclay, Executive Director, Ladysmith Resources Centre Association

Ms. Barclay provided a summary of the 2023-2024 annual report, including program highlights and milestones. She expressed gratitude for the partnership with the Town and thanked the LRCA team, donors, partnerships, volunteers and board of directors for their support and hard work in enriching the community.

Council thanked Ms. Barclay for her presentation and asked questions on the status of youth and housing support services.

8. 2025-2029 FINANCIAL PLAN DISCUSSIONS - INTRODUCTION OF GENERAL CAPITAL PROJECTS

8.1 Public Input and Questions

A member of the public asked a question regarding budget allocation for replacement or expansion of long-term town assets including buildings.

8.2 2025 Budget Deliberations – General Capital and General Operations Update

CS 2024-285
That Council direct staff to:

1. Include the projects presented in the report dated December 3, 2024, from the Director of Financial Services for inclusion in the 2025 – 2029 Financial Plan; and
2. Confirm the general budget municipal tax levy at $8,713,484 or 3.75% budget increase.

Motion Carried

9. REPORTS

9.1 Communications and Social Media Policy 04-1470-A

CS 2024-286
That Council:

1. Rescind Communication Policy 04-1470-A; and
2. Adopt Communications and Social Media Policy No. 04-1470-A.

Motion Carried

9.2 2025 Utility Due Dates

CS 2024-287
That Council approve the following utility billing due dates:

- February 27, 2025 for the period October to December, 2024;
- May 29, 2025 for the period January to March, 2025;
- August 28, 2025 for the period April to June, 2025; and
- November 27, 2025 for the period July to September, 2025.

Motion Carried

9.3 2025 Community Banner Program Theme Selection

CS 2024-288
That Council approve the 2025 theme “Coastal Living, Growing Our Future Together” for the Community Public Banner Program.
Motion Carried

10. BYLAWS

10.1 Bylaws for Introduction

10.1.1 "Sanitary Sewer Rate Bylaw 1999, No. 1299, Amendment Bylaw 2024, No. 2198"

CS 2024-289
That Council give first, second and third readings to "Sanitary Sewer Rate Bylaw 1999, No. 1299, Amendment Bylaw 2024, No. 2198".
Motion Carried

10.1.2 “Waterworks Regulations Bylaw 1999, No. 1298, Amendment Bylaw 2024, No. 2199"

CS 2024-290
That Council give first, second and third readings to “Waterworks Regulations Bylaw 1999, No. 1298, Amendment Bylaw 2024, No. 2199".
Motion Carried

10.1.3 "Garbage, Recycling and Organics Collection Bylaw 2005, No. 1588, Amendment Bylaw 2024 No. 2201"

CS 2024-291
That Council give first, second and third readings to "Garbage, Recycling and Organics Collection Bylaw 2005, No. 1588, Amendment Bylaw 2024 No. 2201".
Motion Carried

10.1.4 "2025 Revenue Anticipation Borrowing Bylaw 2024, No. 2202"

CS 2024-292
That Council give first, second and third readings to "2025 Revenue Anticipation Borrowing Bylaw 2024, No. 2202".
Motion Carried

10.1.5 "Town of Ladysmith Downtown Development Cost Charges Reduction Repeal Bylaw, 2024, No. 2203"

CS 2024-293
That Council give first, second and third readings to "Town of Ladysmith Downtown Development Cost Charges Reduction Repeal Bylaw, 2024, No. 2203".
Motion Carried
OPPOSED: Councillor Paterson.

10.1.6 "Town of Ladysmith Fire Services Bylaw 2023, No. 2147, Amendment Bylaw 2024, No. 2204"

CS 2024-294
That Council give first, second and third readings to "Town of Ladysmith Fire Services Bylaw 2023, No. 2147, Amendment Bylaw 2024, No. 2204".
Motion Carried

10.2 Bylaws for Adoption

10.2.1 "Special Event Bylaw 2024, No. 2196"

CS 2024-295
That Council adopt "Special Event Bylaw 2024, No. 2196".
Motion Carried

10.3 Bylaw Status Sheet

11. QUESTION PERIOD

A member of the public asked about the storage of personal data on foreign servers, what local print media sources are being used for Town communications, and whether discounts are available for garbage tags purchased in bulk.

Another member of the public inquired about the communications team's budget and staff size.

Marsh Stevens joined the meeting at 7:48 p.m.

12. ADJOURNMENT

CS 2024-296
That this Regular Meeting of Council be adjourned at 7:50 p.m.
Motion Carried

CERTIFIED CORRECT

Acting Mayor (T. McKay)

Corporate Officer (S. Bouma)

MINUTES OF A SPECIAL MEETING OF COUNCIL

Wednesday, December 11, 2024
11:31 A.M.
This meeting was held electronically

Council Members Present:

Acting Mayor Tricia McKay
Councillor Ray Gourlay
Councillor Amanda Jacobson
Councillor Duck Paterson
Councillor Marsh Stevens
Councillor Jeff Virtanen (joined the meeting at 11:33 a.m.)

Staff Present:

Allison McCarrick
Jake Belobaba
Sue Bouma
Nick Pescod
Sydney Ianson

Guests:

Bailey Dill, Alternate Director, Ladysmith Harbour Economic Development Corp.

Donna Smith, Consultant

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1. CALL TO ORDER AND ACKNOWLEDGEMENT

Acting Mayor McKay called this Special Meeting of Council to order at 11:31 a.m., recognizing with gratitude that it was taking place on the unceded territory of the Stz'uminus First Nation.

2. AGENDA APPROVAL

CS 2024-297
That Council approve the agenda for this Special Meeting of Council for December 11, 2024.
Motion Carried

3. REPORTS

3.1 Ladysmith Harbour Economic Development Corporation 2024 Update

CS 2024-298
That Council receive for information the report dated December 11, 2024 from the Manager of Corporate Services regarding the 2024 activities and business of the Ladysmith Harbour Economic Development Corporation.
Motion Carried

3.1.1 Public Input and Questions

No questions were submitted by the public.

3.2 Appointment of Chief Election Officer and Deputy Chief Election Officers – 2025 By-Election

CS 2024-299
That Council appoint the following individuals as officers for the Town of Ladysmith 2025 By-Election:

- Donna Smith, Consultant, as Chief Election Officer;
- Sue Bouma, Manager of Corporate Services, as Deputy Chief Election Officer;
- Sydney Ianson, Corporate Services Administrative Assistant, as Deputy Chief Election Officer; and
- Hayley Young, Corporate Services Administrative Coordinator, as Deputy Chief Election Officer.

Motion Carried

Ms. Smith, Chief Election Officer, declared Saturday, March 1, 2025 as the day of the By-election and noted that. Advance Voting opportunities will be held Wednesday, February 19, and Wednesday, February 26, 2025.

She also advised that any Council members intending to run for Mayor must resign from their current Council seats within the next 14 days.

Ms. Smith announced that nomination packages will be available starting Monday, December 16, 2024, and completed packages will be accepted from January 7 to January 24, 2025.

4. ADJOURNMENT

CS 2024-300
That this Special Meeting of Council be adjourned at 11:42 a.m.
Motion Carried

Acting Mayor (T. McKay)

Corporate Officer (S. Bouma)

STAFF REPORT TO COUNCIL

Report Prepared By:	Jake Belobaba, Director of Development Services Ryan Bouma, Consulting Engineer
Reviewed By:	**Allison McCarrick, CAO**
Meeting Date:	December 17, 2024
File No:	3360-23-08
RE:	**Roundabout Condition 1130 Rocky Creek Road**

RECOMMENDATION:

That Council:

1. Consider the request to amend Covenant CB215820 registered on the title of 1130 Rocky Creek Road and direct staff to:
    a. proceed with scheduling and notification of a public hearing pursuant to section 464(1) of the *Local Government Act; and*
    b. Formally refer the proposal to the Ministry of Transportation and Infrastructure;

2. Require that, as a condition of approval of the request to amend Covenant CB215820 the following conditions to be secured through a covenant also be amended to:
    a. prohibit access from Ludlow Road and limit egress from the site to a single, right out only egress, until the roundabout is constructed;
    b. require the construction of a temporary median in Ludlow Road;
    c. require cash in lieu of frontage improvements along Ludlow Road and Rocky Creek Road at time of building permit issuance;
    d. require the provision of a temporary gravel pathway along the frontage of the property as shown in proposed development permit 3060-24-20;
    e. require the provision of no left turn signs in the Ludlow Road right of way to prevent left hand turns exiting 1010 Ludlow Road; and
    f. require no U-Turn signs to be installed at the Ludlow Road/Rocky Creek Road Intersection;

3. Issue Development Variance Permit 3090-24-08; and

4. Issue Development Permit 3060-24-20.

EXECUTIVE SUMMARY:

The purpose of this report is to introduce a request from the developer of 1130 Rocky Creek Road to:

1. reissue a development permit and development variance permit for a commercial development; and
2. remove a condition of approval for a previous rezoning and OCP amendment proposal to construct a roundabout. Removing this condition requires amending Covenant CB215820 (Attachment B), a public hearing, and MOTI approval.

PREVIOUS COUNCIL DIRECTION:

Resolution	Meeting Date	Resolution Details
CS 2022-226	2022-09-20	That Council: 1. Issue Development Variance Permit 3090-22-03 to vary section 5.19.c) of "Town of Ladysmith Zoning Bylaw 2014, No. 1860" to allow for two retaining walls, each up to 4.0 m in height, at 1130 Rocky Creek Road; and 2. Issue Development Permit 3060-20-19 to allow for construction of a commercial plaza at 1130 Rocky Creek Road, subject to the applicant providing a landscape bond in the amount of $104,750.75.
CS 2022-225	2022-09-20	That Council adopt "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw (No. 37) 2021, No. 2069".
CS 2022-224	2022-09-20	That Council adopt "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw (No. 65) 2021, No. 2068".
CS 2021-285	2021-09-07	That Council adopt "Road Closure and Dedication Removal Bylaw 2021, No. 2067".
CS 2021-189	2021-06-15	That Council: 1. Proceed with third reading of "Road Closure and Dedication Removal Bylaw 2021, No. 2067"; and 2. Direct staff to refer Bylaw No. 2067 to the Ministry of Transportation and Infrastructure pursuant to section 41(3) of the Community Charter.
CS 2021-191	2021-06-15	That, subject to any additional matters raised at the Public Hearing, Council: 1. Proceed with third reading of "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw (No. 37) 2021, No. 2069"; and 2. Direct staff to refer Bylaw No. 2069 to the Ministry of Transportation and Infrastructure pursuant to section 52 of the Transportation Act.
CS 2021-190	2021-06-15	That, subject to any additional matters raised at the Public Hearing, Council proceed with third reading of "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw (No. 65) 2021, No. 2068".
CS 2021-182	2021-06-01	That Council: 1. Give first and second readings to "Road Closure and Dedication Removal Bylaw 2021, No. 2067"; 2. Direct staff to deliver notice to the Ministry of Transportation and Infrastructure, Island Corridor Foundation, BC Hydro, Fortis BC, Shaw Communications and Telus, of Council's intention to adopt Bylaw No. 2067, in accordance with section 40(4) of the Community Charter; 3. Give first and second readings to "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw (No. 65) 2021, No. 2068";

Resolution	Meeting Date	Resolution Details
		4. Consider Bylaw No. 2068 in conjunction with the Town's Financial Plan, the Town's Liquid Waste Management Plan, and the Cowichan Valley Regional District Solid Waste Master Plan in accordance with section 477(3) of the Local Government Act; 5. Give first and second readings to "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw (No. 37) 2021, No. 2069" 6. Direct staff to proceed with scheduling and notification for a Public Hearing for Bylaw Nos. 2067, 2068 and 2069 in accordance with section 40(3) Community Charter and section 464 of the Local Government Act; 7. Subject to adoption of Bylaw No. 2067, authorize the sale of the lands that are the subject of that bylaw to the developer for appraised market value; and, 8. Require that the developer, at their cost, complete the following prior to adoption of Bylaw Nos. 2068 and 2069: a. Consolidate the subject property, legally described as Lot A, Districts 24 and 38, Oyster District, Plan VIP71248 (1130 Rocky Creek Road) with the area shown as "road to be closed" in Reference Plan EPP110196, shown in Schedule 1 of Bylaw No. 2067; b. Dedicate to the Town for road, the area shown as "road" on Reference Plan EPP110197, included in the May 18, 2021 staff report to Council as Attachment D; c. Pursuant to Section 507 of the Local Government Act, enter into an agreement with the Town to provide a median on Ludlow Road and a roundabout at the intersection of Rocky Creek Road and Ludlow Road to be built in accordance with the standards established by the Town, with the Town contributing $1 million to the project in accordance with "Town of Ladysmith Development Cost Charges Bylaw 2019, No. 2008"; d. Update Covenant FB234682, registered to the title of the subject property, legally described as Lot A, Districts 24 and 38, Oyster District, Plan VIP71248 (1130 Rocky Creek Road) as follows: i. Replace Sections 2.a) (Green Building Standards and Practices) and b) (Landscaping) with a requirement that the rain water management be designed in accordance with "Stormwater Planning: A Guidebook for British Columbia", requiring that the development be designed to accommodate "HandyDART" buses and that the development include a minimum of two "quick charge" electric vehicle charging stations; ii. Amend Section 2.c) to require landscaping, including a local historical artifact or a public art installation, in the centre of the Ludlow/Rocky Creek Road roundabout; iii. Delete Section 3; and iv. Add a new section requiring that the development and adjacent boulevards be provided with an outdoor electrical supply and outlets which can be used by the Town for special events; and e. Register an easement or statutory right-of-way in favour of BC Hydro on the subject property.

Resolution	Meeting Date	Resolution Details
CS 2020-201	2020-07-07	That Council direct that application 3360-20-02 (1130 Rocky Creek Road) proceed for further consideration, and, a. Having considered s. 475 of the Local Government Act (consultation during OCP development) direct staff to refer application 3360-20-02 to: • Stz'uminus First Nation • School District 68 (Nanaimo Ladysmith) • The Community Planning Advisory Committee • The BC Ministry of Transportation and Infrastructure, BC Transit, and BC Hydro; • The Ladysmith Chamber of Commerce, and the Ladysmith Downtown Business Association; and b. Direct staff to work with the applicant regarding a potential sale of surplus road right-of-way along Rocky Creek Road and Ludlow Road adjacent to 1130 Rocky Creek Road.
CS 2020-202	2020-07-07	That Council direct staff to discuss the following list with the applicant prior to further consideration of application 3360-20-02: • clarity regarding the roundabout and provisions within the development to ensure that it can be accommodated • the possible provision of electric vehicle chargers, particularly fast chargers (not level two) • a request for clarity regarding signage design prior to the application proceeding • ensurance that the trees and buildings in the development have power to accommodate the Town's annual Light Up and other events • a review of the existing covenant regarding the 49th Parallel sign • provision for future hydrogen filling if a gas station is included in the plan • plans to tie in Ladysmith's heritage by installing an artifact • the possibility of a public art installation in keeping with the Town's Public Art Strategy • the possibility of installing a lit community reader board • the Town's request for a simultaneous submission of the Zoning Amendment application with the Development Permit to ensure control of form and character • the Town's request for more than average tree coverage and landscaping standards • the Town's request to incorporate design elements that are of "Gateway to Community" calibre • the possible provision of a transit stop within the development or on the road in front of the development

INTRODUCTION/BACKGROUND:

Subject property

The subject property is approximately 8,740m^2 (94,063 square feet) in size and located at 1130 Rocky Creek Road. The property is currently designated 'Mid-Town' under the OCP, zoned

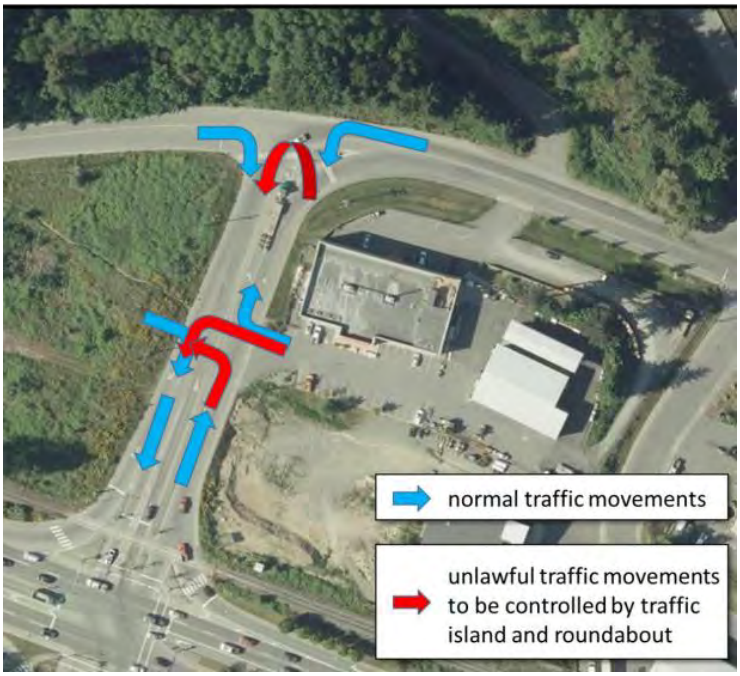
Shopping Centre Commercial (C-5) under the Zoning Bylaw and falls within the DPA 3 Commercial development permit area. The property is currently undeveloped. Adjacent land uses include: the Western Forest Products site to the north, the Island Highway to the south, a combination of undeveloped land and commercial uses to the east (Home Hardware and Ladysmith Motorsports) and undeveloped land to the west.

A map of the subject property is provided in Attachment A.

Previous Development Applications the Roundabout and Related Requirements

The applicant applied for OCP and zoning amendments in April of 2020 and the application was given third reading on June 15, 2021, subject to conditions including a covenant requiring construction of a roundabout at the Ludlow Road and Rocky Creek Road Intersection. The roundabout was recommended by the Town's engineering department because the proposed accesses/egresses increased the potential for unsafe turning movements and U-turns on Ludlow Road and Rocky Creek Road. This is described in greater detail in the June 1, 2021 report to Council and shown in figure 1.

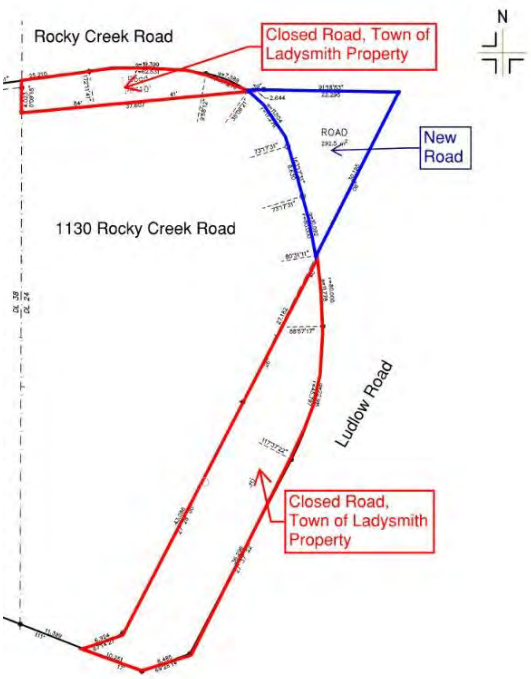
Figure 1: Illustration from June 1, 2021 Council Report



The proposal also included a "land swap" whereby unneeded road allowance was traded for a portion of the subject property needed for the roundabout, as shown in figure 2. Under section 25(1)(a) of the *Community Charter* the Town is prohibited from selling land at less than market value to a private developer. Subsequently, an appraiser hired by the Town determined that the value of the unneeded road exceeded the value of the land to be taken from the subject property, and to lawfully execute the land swap the developer had to pay $170,000 to account for the difference in values.

The first drafts of agreements were provided to the developer on November 19, 2021. However, to finalize them, a final design of the roundabout was needed, meaning executable agreements were not sent to the developer until March 1, 2022. A further three months passed while the Town waited for feedback on the agreements and survey plans[1], and the final agreements were sent to the developer for execution on June 29, 2022. However, the covenant was not registered (i.e. executed by the applicant and charge holders) until September 13, 2022. Subsequently, final approval of the OCP amendment and rezoning application did not occur until September 20, 2022. More information on the OCP and zoning amendment applications can be found in the July 7, 2020 and June 1, 2021 reports to Council.

Figure 2: Land Swap



The applicant applied for a development permit for the property in July of 2020 and a development permit and development variance permit were approved by Council on September 20, 2022, concurrently with the approval of the above-noted Zoning Bylaw and OCP amendments. The development permit authorizes the construction of three large commercial buildings, and the development variance permit varies retaining wall heights. More information on the proposed developments can be found in the September 20, 2022 report to Council. Under section 501(1) of the *Local Government Act*, land must be "developed strictly in accordance with the land use permit or permits issued". Under section 504(1) of the *Local Government Act*, a land use permit expires within two years if construction is not substantially started. Subsequently, the above-noted permits expired on September 20, 2024.

Among other things, Covenant CB215820 requires the developer to construct the Ludlow/Rocky Creek Road Roundabout prior to developing the site. The roundabout is a DCC project, entitling the developer to reimbursement of $1,050,985, $990,000 of which is to come from the DCC Road Reserve. Under the Town's DCC program, which was adopted in 2019, the roundabout project is estimated to cost $1,000,000. Covenant CB215820 requires the full cost of the roundabout to be covered by the developer, regardless of the final cost of the project. However, the reimbursement is capped at $1,050,985, due to the Town's DCC program and provincial rules on the use of DCC funds (see 'Financial Implications').

Additionally, the roundabout project is eligible for latecomer charges under section 508 of the *Local Government Act*. Latecomer charges are mandatory charges, in the form of a tax or fee,

[1] During this period, the Town's lawyer made two revisions to the agreements. Cumulatively, making the requested changes and returning the documents to the applicant took only 2 business days.

whereby benefiting landowners (i.e. landowners that directly connect to or use the infrastructure) contribute to the non-reimbursable cost of infrastructure that a developer has been required to build. The taxes or fees are collected by the local government and paid back to the developer. Latecomers can only be collected for a period of 15 years, commencing from the date the infrastructure is complete. In the case of a fee—which is the latecomer method used for the proposed development—fees are typically charged when benefiting properties are developed or redeveloped and owner approval is not required to impose the fee. As the pace of development in a given area is unpredictable, the amount that will be recovered from a latecomer fee will range from 0-100% of the developer's costs. Taxes to collect latecomers are more certain and can be designed to recover 100% of the developer's costs. However, these taxes must be collected as a local service tax which is subject to an approval process (petition or counterpetition) by the property owners who will be subject to the tax. For this reason, taxes to collect latecomers are rarely used.

Following receipt of the development applications for 1130 Rocky Creek Road, the Town paid for a preliminary design and cost estimate for the roundabout. A Class C estimate obtained in November 2020 (excluding contingency) based on the preliminary design was $1,234,000. A Class A estimate based on the detailed design and obtained in February of 2022 (which also excludes contingency) was $1,776,213. At the time, the Town and developer expected that cost savings could be achieved by combining on-site and off-site works and coordinating the roundabout construction with the sewer line upgrade in Rocky Creek Road. Additionally, the application had already received third reading, and amending the requirement would have required a public hearing and Council reconsideration as described below.

The developer obtained quotes from contractors in July of 2023, which have been provided to the Town. The range of the quotes ranged from roughly $2,200,000 to $2,900,000. Staff have not had these estimates independently verified, nor asked for updated estimates since receiving them.

In September of 2023 the developer contacted staff and requested relief from the requirements of Covenant CB215820 by way of removing the roundabout condition, additional funding from the Town, or reallocating funds from other sources. Options proposed by the developer included:

- Collecting funds as "frontage works" from nearby properties to contribute to the roundabout[2]
- Reallocating property taxes from the subject property to the roundabout[3]

[2] Under section 506.03 of the *Local Government Act* frontage improvements cannot be required from a landowner unless the landowner is developing and can only be required for works that do not front an owners property. Thus, having nearby property owners contribute to the roundabout requires them to develop and pay a latecomer fee or a tax program as described above.

[3] Under the *Community Charter*, taxes rates are set based on the value of the assessment roll and the Town's annual budget. Generally speaking, this scenario would increase the Town's budget, requiring either higher taxes

- Reallocating the $170,000 paid by the developer for the "land swap" noted above to the cost of the roundabout[4]
- Allocating future DCC's payable for the proposed development to the costs of the roundabout[5]

None of the options proposed were legally or financially viable for the Town (see footnotes and 'Financial Implications') and the developer was advised accordingly. Staff also advised that material changes to the covenant required approval of Council, MOTI approval and a public hearing akin to a "reopening" of the previous OCP and zoning amendment applications (see 'Legal Implications'). Staff also advised that the roundabout requirement was based on engineering analyses and staff were therefore unwilling to support a proposal to remove the roundabout condition unless it was accompanied by an engineering report outlining how the Town's concerns about traffic flow and safety resulting from the proposed development could be addressed without the roundabout. The applicant was advised of this at a meeting on September 26, 2023 and by email on September 28, 2023. The applicant submitted an application to change the covenant on November 27, 2023. Engineering staff emailed final detailed parameters for the requested traffic study on January 4, 2024.

levied on all properties or cutting other expenses. In any event, Council approval during annual budget preparation would be required.

[4] Allocating these (or any other) additional funds to the project would require changes to the material terms of the covenant, which in turn requires Council/MOTI approval and a public hearing.

[5] Under section 565(2) of the *Local Government Act*, the development would automatically be eligible for a credit for DCC's payable for roads (approximate max of $102,855.05). DCC's payable for water, sewer etc. (approximately $46,231.02) cannot be allocated to the roundabout.

On March 12, 2024 staff received a draft report from the developer's engineer (Attachment E). The report recommended, among other things, that the Town "work with" Home Hardware to modify Home Hardware's access on Ludlow Road to inbound traffic only, designate a route through the Home Hardware site for exiting, and investigate drive isle widening and/or parking restrictions on the Home Hardware site. Staff advised on April 3, 2024 that staff would not support the solutions proposed in the report. The main reason for this was that, aside from expropriation, the Town had no way of securing the proposed arrangements over the Home Hardware site. The applicant was given the option to proceed to Council without staff support or to independently negotiate with the owners of the Home Hardware site to secure the recommendations in the draft report.

A draft of the report in Attachment F was received on July 19, 2024. Staff responded on August 9, 2024 indicating general support for the report recommendations conditional on:

1. report changes to address parameters in the Town Engineer's January 4, 2024 email that had not been addressed in the report;
2. receipt of a final version of the report sealed by the engineer; and
3. the conditions recommended in this staff report.

The developer was advised that the changes to the proposed Ludlow access would trigger amendments to the development permit and development variance permit under section 501(2) of the *Local Government Act* and the developer confirmed they would submit these applications. The developer was also advised on September 23, 2024 that the development permit and development variance permit had expired which, at that point, was inconsequential because the procedures for reissuing and amending land use permits are identical.

The final version of the report in Attachment F was received on October 15, 2024 and the development permit and development variance permit applications were received on October 29, 2024

Attachment G provides a timeline of the major milestones noted above; summarizing the application and approval process relative to the increases in the estimated costs of the roundabout over time.

PROPOSAL:

Removal of the Roundabout Condition

The developer is requesting that Covenant CB215820 be amended to remove the requirement for the roundabout and a new development variance permit and development permit. The developer's position on the matter is provided in Attachment H. Based on the findings of the traffic engineer's report and design changes, staff are recommending that approval of the requested covenant changes be subject to the following conditions:

- Right out only access onto Ludlow: This was proposed by the developer's engineer as a solution to traffic safety concerns that arise from multiple access and egress points on Ludlow Road which is sloped with multiple lanes (and thus lane change movements) and a nearby signalized highway intersection. This would be in the form of a temporary barrier in the right turning lane off of Ludlow Road, that could be removed once the roundabout is built. Staff are recommending that this be a new requirement of the covenant.

- Temporary median and signage: These conditions are recommended by staff to protect against U-turns and illegal or unsafe left-hand turns exiting the Home Hardware site. Such turns become riskier with the new egress onto Ludlow from the subject property. The median would be reconfigured and made permanent once the roundabout is complete and final approach grades are established. Staff are recommending that these conditions be a new requirement of the covenant.

- Cash in lieu of frontage improvements: Under section 2.04 of the Subdivision and Development Bylaw, all developers with projects exceeding $50,000 in value are required to construct frontage improvements—usually curb, gutter, sidewalk, boulevard improvements, etc.—to the centerline of all roads fronting their property. Under the requirements of the covenant, these improvements would have been installed concurrently with construction of the roundabout. The developer's engineer has indicated that these improvements cannot be installed prior to roundabout construction as final grades and road alignments must first be established. To ensure frontage improvements, staff are recommending that cash in lieu be required at the building permit stage. The cash can be collected and used later to cover the cost of frontage improvements when the roundabout is constructed. This condition can be secured through a covenant condition or other method recommended by the Town's lawyer.

- The revised development plans show a gravel path installed in place of a sidewalk until the roundabout is built. Staff are recommending that the installation of this path be a condition of removing the roundabout requirements, as temporary pedestrian and cycling routes will be needed until the roundabout is built.

Issuance of the Development Permit and Development Variance Permit

Aside from the temporary right-out-only exit to Ludlow Road, the proposed development permit and development variance permit are virtually identical to the original permits approved by Council. Notable exceptions include:

1. Bike parking requirements: The Town amended its bike parking standards to align with the OCP prior to the expiry of the original permits. The new standards will apply to the proposed development. However, because bike parking for commercial use is generally based on the number of employees, and tenants have not yet been determined, the permit has been drafted to allow bike parking to be calculated at the tenant improvement stage. Further, the original proposal included bike parking

spaces that align with the new standards and only a few modifications are likely required to bring the bike parking into compliance with the new zoning requirements (e.g. installation of e-bike charging and possibly showers). The developer was advised of the changes and has decided not to seek a variance for them.

2. Temporary Path: The original development permit required that a temporary path through the site be put in place between phases. This requirement has been replaced with the frontage path noted above.

3. Landscaping Bond: The estimate in the original permit is over two years old, so the bond amount has been increased by $4,231.93 based on a 2%/year inflation rate to ensure the bond is sufficient to cover landscaping costs.

ANALYSIS:

Removal of Roundabout Condition and New Covenant Conditions

During the initial review of the development proposal, engineering staff considered and recommended requiring the roundabout for this development based on several findings, including a transportation engineering report by Binnie for the waterfront development. The report recommended the roundabout based on the businesses in the area, traffic volumes, and traffic patterns of the proposed waterfront development. The findings of the report were applied to the proposed development because of anticipated increase in traffic volume, the increased potential for illegal or unsafe turns noted earlier in this report, frontage works and services requirements, the roundabout's inclusion in the DCC program, and relatively high reimbursement rate from existing DCC funds.

Following the developer's request to remove the roundabout condition and receipt of the reports in Attachment F, Infrastructure Services re-evaluated the requirement and the practicality of constructing the roundabout at a later date. In general, although the roundabout will still need to be constructed by the Town at a later time, the recommendations in Attachment F are acceptable to staff from an engineering perspective. If Council agrees to eliminate the roundabout condition from the covenant, staff recommend retaining the roundabout in the Town's DCC program, with construction to occur concurrently with proposed developments in the Waterfront Area Plan.

As noted above, future grade changes resulting from the roundabout construction make it unfeasible to install frontage improvements the developer would otherwise have to install, as any frontage improvements would need to be removed to prepare the grade for the roundabout installation. The recommended cash payment equal to the value of the frontage improvements can be used to secure the frontage improvements concurrently with construction of the roundabout.

Issuance of the Development Permit and Development Variance Permit

Aside from the new bike parking requirements, and modified pedestrian path requirements, which will likely have little effect on the proposed development permit, the permits provide the same authorizations and variances as the previous permits. Staff recommend issuing the permits as drafted, for the reasons outlined in the September 20, 2022 report to Council. However, if Council wishes to consider alternatives that may result in design changes to the proposed development, Council should defer final consideration of the permits as noted below.

ALTERNATIVES:

Council can choose to:

1. Deny the request to remove the roundabout condition.
2. Defer consideration of the request and refer the proposal to a subsequent meeting of Council.
3. Refer the application back to staff for further review, as specified by Council.
4. Refer the application back to the Community Planning Advisory Committee for additional comment.

5. Direct that funding be allocated for the Town to cover a greater percentage of the roundabout cost, with the funding source specified by Council.
6. Direct that staff initiate the process for a local service tax to recover all or some of the cost of constructing the roundabout.
7. Require additional covenant stipulations as a condition of removing the roundabout condition as specified by Council.
8. Require a third-party review of the developer's traffic engineering report at the cost of the developer.
9. Any combination of alternatives 2-8.

FINANCIAL IMPLICATIONS:

If Council approves removing the roundabout condition, funding for building the roundabout will revert to the DCC program, which is likely inadequate to cover the cost of roundabout construction. Currently, no other funds apart from the $990,000 are designated to cover the cost of the roundabout construction.

The contribution from the DCC road reserve for the roundabout is capped at $990,000 and the Town would need to amend its DCC program (an extensive process requiring consultation and provincial approval) to increase this amount. Developments that make application within 1 year of the new DCC rates being adopted pay the old (reduced) DCC rates.

Staff note that Council has budgeted funds to commence a review of the Town's DCC program in 2025 and the cost of constructing the roundabout (as well as all the other DCC projects) are expected to be evaluated as part of this project. If the DCC contribution for the roundabout project increases as a result of the DCC review, more DCC funds can be allocated to the project, though there may not be enough funds in the respective DCC categories to fund cost increases.

The $170,000 from the sale of the unneeded road allowance land was placed into the Real Property Reserve. Council could direct that funds (if available) from the real property reserve be used to fund the roundabout

The only other available Town sources of funding to pay for the roundabout is amending the financial plan to cancel another project or increase taxation, either in the form of increased general taxation or local service taxes (see Alternatives 5 and 6). Alternatively, the developer could be required to pay a fixed, one-time contribution towards the cost of the roundabout (Alternative 7). In this case, the developer's contribution would be capped, and the Town would be responsible for any cost overruns.

LEGAL IMPLICATIONS:

The roundabout condition was a condition of approval of OCP and Zoning Amendments; applications that required a public hearing. The Town's lawyer has advised that a significant amendment to Covenant CB215820 (i.e. removing the roundabout condition), triggers the need for a public hearing as it could be viewed by a court as altering the substance of the original bylaws subject to a public hearing requirement. The lawyer has advised that the appropriate

course of action is to hold a public hearing prior to removing the roundabout condition. This is the commonly applied approach for major changes to conditions of zoning and OCP amendments.

Staff note that the roundabout condition was a requirement of an OCP and zoning amendment proposal, both discretionary decisions of Council. Subsequently, Council is under no obligation to grant the request. If Council denies the request to amend the Covenant (Alternative 1) zoning rights will not be taken away and the status quo will remain in place (i.e. developer can build, but must also build the roundabout). Similarly, Council can impose additional conditions (Alternative 7) which would give the developer a choice between the original conditions and new conditions imposed by Council.

As zoning has already been approved and would be unaffected should Council deny the request to remove the roundabout condition, the development permit and development variance permit can be approved immediately; hence the atypical recommendation to approve these permits prior to the public hearing. However, if Council wishes to leave the door open to consider conditions that may affect the issuance of these permits (such as design changes) deferring approval of these permits is recommended.

The Town's lawyer has also advised that due to section 52 of the *Transportation Act*, the proposal to remove the roundabout condition must also be sent to the Ministry of Transportation and Infrastructure for formal comment.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:

Consultation requirements for zoning and OCP amendments were met when the original applications were considered. As noted under 'Legal Implications', the only requirement for additional public consultation is another public hearing.

INTERGOVERNMENTAL REFERRALS:

The proposal was referred to appropriate government agencies when it was originally considered by Council. Aside from the referral to MOTI noted under 'Legal Implications' no further intergovernmental referrals are required.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:

The proposal was referred to appropriate departments when it was originally considered by Council. Engineering, Finance and Planning have worked jointly on the review of the request to remove the roundabout condition. The revised designs were referred to the Fire Department to determine if the changes to the proposed access/egress on Ludlow Road would compromise emergency access and the Fire Department determined the proposed access/egress was acceptable. No additional departmental referrals were deemed necessary.

COMMUNITY PLANNING ADVISORY COMMITTEE (CPAC) REVIEW:

The proposal was referred to CPAC when it was originally considered by Council. Under CPAC Terms of Reference a CPAC review of the request to remove the roundabout condition is not required. However, Council has the option of referring the request to CPAC (Alternative 4).

ALIGNMENT WITH STRATEGIC PRIORITIES:

☐ Core Infrastructure ☐ Economy
☐ Official Community Plan Implementation ☐ Leadership
☐ Waterfront Area Plan ☒ Not Applicable

I approve the report and recommendation(s).

Allison McCarrick , Chief Administrative Officer

ATTACHMENTS:

A. Subject Property Map
B. Covenant CB215820
C. Development Variance Permit 3090-24-08
D. Development Permit 3060-24-20
E. Draft Addendum to Traffic Study
F. Final Traffic Study
G. Application/Cost Estimation Timeline
H. Developer's letter

1130 Rocky Creek Road: Subject Property Map

11/29/2024, 11:36:55 AM

1:2,500

0 0.01 0.03 0.05 mi

0 0.02 0.04 0.08 km

DECLARATION(S) ATTACHED

Land Title Act
Charge
General Instrument – Part 1

VICTORIA LAND TITLE OFFICE
SEP 13 2022 13:44:46.013
CB215820

1. Application

Document Fees: $76.32

James H. McBeath
Owen Bird Law Corporation
Suite 2900 - 595 Burrard Street
Vancouver BC V7X 1J5
6046880401

39498-0000 / OYSTER HARBOUR DEVELOPMENT CORP.
Rocky Creek Covenant

2. Description of Land

PID/Plan Number	Legal Description
EPP110197	**LOT 1 DL 24 AND 38 OYSTER DISTRICT PLAN EPP110197**

3. Nature of Interest

Type	Number	Additional Information
COVENANT		

4. Terms

Part 2 of this instrument consists of:

(b) Express Charge Terms Annexed as Part 2

5. Transferor(s)

OYSTER HARBOUR DEVELOPMENT CORP., NO.BC1242155

COWICHAN VALLEY MORTGAGES LTD., NO.BC0361391 , (AS TO PRIORITY ONLY)

6. Transferee(s)

TOWN OF LADYSMITH
410 ESPLANADE, PO BOX 220
LADYSMITH BC V9G 1A2

7. Additional or Modified Terms

Land Title Act
Charge
General Instrument – Part 1

8. Execution(s)

This instrument creates, assigns, modifies, enlarges or governs the priority of the interest(s) described in Item 3 and the Transferor(s) and every other signatory agree to be bound by this instrument, and acknowledge(s) receipt of a true copy of the filed standard charge terms, if any.

Witnessing Officer Signature	Execution Date	Transferor / Transferee / Party Signature(s)
_____ **James H. McBeath** **Barrister & Solicitor** Owen Bird Law Corporation Suite 2900 - 595 Burrard Street Vancouver BC V7X 1J5	YYYY-MM-DD **2022-07-04**	**OYSTER HARBOUR DEVELOPMENT CORP.** By their Authorized Signatory _____ **Print Name: Ashley Garib**

Officer Certification

Your signature constitutes a representation that you are a solicitor, notary public or other person authorized by the *Evidence Act*, R.S.B.C. 1996, c.124, to take affidavits for use in British Columbia and certifies the matters set out in Part 5 of the *Land Title Act* as they pertain to the execution of this instrument.

Witnessing Officer Signature	Execution Date	Transferor / Transferee / Party Signature(s)
_____ **Sue Bouma** **Commissioner for Taking Affidavits for British Columbia** 410 Esplanade Ladysmith BC V9G 1A2	YYYY-MM-DD **2022-09-07**	**TOWN OF LADYSMITH** By their Authorized Signatory _____ **Print Name: Donna Smith, Corporate Officer, Town of Ladysmith**

Officer Certification

Your signature constitutes a representation that you are a solicitor, notary public or other person authorized by the *Evidence Act*, R.S.B.C. 1996, c.124, to take affidavits for use in British Columbia and certifies the matters set out in Part 5 of the *Land Title Act* as they pertain to the execution of this instrument.

Land Title Act
Charge
General Instrument – Part 1

Witnessing Officer Signature	Execution Date	Transferor / Transferee / Party Signature(s)
_____	YYYY-MM-DD **2022-08-30**	**COWICHAN VALLEY MORTGAGES LTD.** By their Authorized Signatory _____ **Print Name: Barrie Winton Aldrich** **(AS TO PRIORITY)**

Elizabeth L. Robinow
Barrister & Solicitor
200-44 Queens Road
Duncan BC V9L 2W4

Phone: 250-746-7121 Fax: 250-746-4070

Officer Certification

Your signature constitutes a representation that you are a solicitor, notary public or other person authorized by the *Evidence Act*, R.S.B.C. 1996, c.124, to take affidavits for use in British Columbia and certifies the matters set out in Part 5 of the *Land Title Act* as they pertain to the execution of this instrument.

Electronic Signature

Your electronic signature is a representation that you are a designate authorized to certify this document under section 168.4 of the *Land Title Act*, RSBC 1996 c.250, that you certify this document under section 168.41(4) of the act, and that an execution copy, or a true copy of that execution copy, is in your possession.

James Hamilton McBeath SX41M4

Digitally signed by James Hamilton McBeath SX41M4
Date: 2022-09-12 17:53:01 -07:00

TERMS OF INSTRUMENT

WHEREAS:

A. The Transferor is the registered owner in fee simple of:

Lot 1 DL 24 and 38 Oyster District Plan EPP110197

(the "**Lands**");

B. The Transferee is the Town of Ladysmith;

C. The Transferor has applied to amend the Town of Ladysmith Zoning Bylaw 2014, No. 1860 and Official Community Plan Bylaw No. 2003, No. 48 to permit a commercial plaza and drive-thru coffee shop, as per Town of Ladysmith Zoning Bylaw 2014, No. 1860 Amendment Bylaw (No. 37), 2021 and Official Community Plan Bylaw 2003, No. 1468 Amendment Bylaw (No. 63) 2021 No. 2068 (the "Amending Bylaw");

D. The Transferee has given third reading to the Amending Bylaw;

E. The Transferor and the Transferee acknowledge that it is in the public interest that development and use of the Lands be limited and that certain development requirements, which the Transferor has freely agreed to grant, be secured by agreement, and the Transferor has determined to grant and has agreed to enter into this Covenant and to register it against the title to the Lands as a covenant and indemnity under Section 219 of the Land Title Act;

F. Section 219 of the Land Title Act provides that a covenant, whether of negative or positive nature, may be granted in favour of the Town and may be registered as a charge against title to the land, and may contain provisions respecting the following:

- the use of land or the use of a building on or to be erected on land;
- that land is to be built on in accordance with the covenant;
- that land is not to be built on or subdivided except in accordance with the covenant; and
- that land is not to be used, built on or subdivided.

NOW THEREFORE, in consideration of the payment of the sum of $10.00 by the Transferee to the Transferor and the premises and the covenants herein contained and for other valuable consideration, receipt and sufficiency of which is hereby acknowledged by the parties, the parties hereto covenant and agree with each other as follows:

1. In this Agreement, the following words have the following corresponding meanings:

    a. "Approved Rainwater Drainage Works" means rainwater drainage works that have been approved in accordance with section 2 of this Agreement;

b. "Electric Vehicle" means a vehicle, propelled by one or more electric motors, and designed to carry two or more passengers;

c. "Electric Vehicle Quick Charging Station" means a level 2 electric vehicle charging station;

d. "HandyDART Bus" means a public transit bus designed to be accessible for people with permanent or temporary disabilities;

e. "HandyDART" Minimum Requirements meansLi the requirements contained in Schedule "A" to this Agreement;

f. "Landscape Architect" means a member of the British Columbia Society of Landscape Architects;

g. "Outdoor Electrical Supply Outlet Plan" means a plan substantially similar to the plan attached as Schedule "B" hereto,, showing the location of outdoor electrical supply outlets on the Lands and any adjacent boulevards at regular intervals;

h. "Rainwater Drainage Management Plan" means a plan prepared and certified by a registered professional as having been designed in accordance with Stormwater Planning: A Guidebook for British Columbia;

i. "Stormwater Planning: A Guidebook for British Columbia" means the document attached as Schedule "D" to this Agreement;

2. The Transferor covenants and agrees with the Transferee that it shall not use or permit the use of the Lands or any building on the Lands for any purpose, construct any building on the Lands or subdivide the Lands except in strict accordance with this Agreement.

3. The Transferor shall not build on or develop the Lands, or permit building or development on the Lands, unless the Transferor has first:

   a. entered into a servicing and latecomers agreement with the Transferee in the form substantially contained in Schedule "C" to this Agreement; and
   b. provided to the Transferee the security required under the Latecomers Agreement.

4. The Parties recognize that the Security, the Excess and Extended Services Cost, the Maintenance Security and the Latecomers Charges (as defined in the Latecomers Agreement) are based upon the cost of providing the Excess and Extended Services determined as of the date of registration of this Agreement.

5. The Parties agree that prior to execution and finalization of the Latecomers Agreement, the Transferee's Director of Engineering may require the Transferor to obtain an updated estimate of the costs of installing and constructing the Excess and Extended Services. The Director of Engineering may approve the updated estimate in their reasonable discretion. If the Director Engineering requires and approves an updated estimate, the Parties agree that Director of Engineering may revise the Security, the Excess and Extended Services Cost, the Maintenance Security and the Latecomers Charges shall to reflect the updated estimate.

6. The Transferor shall not build on or develop the Lands, or permit building or development on the Lands, unless such building or development complies with the following:

Rainwater Management Plan

(a) the Transferor:

i. has provided to the Transferee a Rainwater Drainage Management Plan;

ii. has been notified in writing by the Transferee that the Rainwater Drainage Management Plan meets the requirements of this Agreement;

iii. installs rainwater drainage works that are in accordance with the Rainwater Drainage Management Plan, to the satisfaction of the Transferee's Director of Infrastructure Services, acting reasonably; and

iv. provides to the Transferee certification from a Registered Professional that the Rainwater Drainage Management Plan has been installed in accordance with the Rainwater Drainage Management Plan.

Landscaping

v. the Transferor has provided to the Transferee for its approval in its absolute discretion both a landscaping plan for the roundabout to be constructed at the intersection of Ludlow Road and Rocky Creek Road, prepared by a Landscape Architect, that includes the provision of landscaping in the centre of the roundabout, such landscaping to include the placement of a local historical artifact or a public art installation and a cost estimate for that landscaping (the "**Roundabout Landscaping**"); and in the Transferee's option, to be exercised in its sole and absolute discretion, either:

i. installed the Roundabout Landscaping, to the satisfaction of the Town's and Director of Infrastructure Services, acting reasonably; or

ii. provided to the Transferee an amenity contribution in the amount of the cost estimate.

HandyDART Plan

(b) the Transferor:

i. has provided to the Transferee for its approval in its absolute discretion a public transit plan for the Lands that ensures the development of the Lands in a manner that will accommodate the use of HandyDART Buses for public transit purposes, including the installation of curbs that will accommodate the safe loading and unloading of passengers. Without limiting the generality of the foregoing, such plan shall meet the HandyDart Minimum Requirements;

ii. has developed the Lands in accordance with the public transit plan, to the satisfaction of the Town's Director of Infrastructure Services, acting reasonably;

Electric Vehicle Charging Station

(c) the Transferor constructs at least two fully operational Electric Vehicle Quick Charging Stations on the Lands for use by members of the public.

Special Event Electric Outlets for Town Use

(d) the Transferor:

i. has provided to the Transferee an Outdoor Electric Supply Outlet Plan for its approval, acting reasonably, providing the same number of electric sockets available for use during the Transferee's annual Light Up festival as shown on the plan attached as Schedule"C"; and

ii. installs outdoor electric outlets on the Lands and adjacent boulevards in accordance with the Outdoor Electric Supply Outlet Plan, to the satisfaction of the Town's Director of Infrastructure Services, acting reasonably.

7. After installation of the Rainwater Management Works, the Transferor shall only discharge or permit the discharge of surface water from the Lands through the Approved Rainwater Drainage Works.

8. After installation of the Electric Vehicle Quick Charging Stations, the Transferor shall at all times keep the Electric Vehicle Quick Charging Stations in good repair, and make them available for use by the public.

9. After installation of outlets in accordance with the Outdoor Electric Supply Outlet Plan, the Transferor shall:

a. keep the outlets supplied with electricity and maintain them in good repair; and

b. permit the Transferee to connect to and use such outlets for lighting during the Transferee's annual Light Up festival, which generally runs from the last Thursday in November until the end of January, at no cost to the Transferee.

10. The Transferor covenants and agrees that the Transferee may withhold permits or approvals as necessary to ensure compliance with the covenants in this Agreement, and that the issuance of any permits or approvals do not act as a representation or warranty by the Transferee that the covenants in this Agreement have been satisfied.

11. The Transferor and the Transferee agree that the enforcement of this Agreement shall be entirely within the discretion of the Transferee and that the execution and registration of this covenant against title to the Land shall not be interpreted as creating any duty on the part of the Transferee to the Transferor or to any other person to enforce any provision or the breach of this Agreement.

12. Nothing contained or implied herein shall prejudice or affect the rights and powers of the Transferee in the exercise of its functions under any public or private statutes, bylaws, orders and regulations, all of which may be fully executed and effectively exercised in relation to the Land as if the Agreement had not been executed and delivered by the Transferor.

13. The Transferor hereby releases and forever discharges the Transferee, its officers, employees and agents, of and from any claim, cause of action, suit, demand, expenses, costs and expenses, and legal fees whatsoever which the Transferor can or may have against the said Transferee for any loss or damage or injury, including economic loss or deprivation, that the Transferor may sustain or suffer arising out of this Agreement, or the limitations on the use of the Lands resulting from this Agreement.

14. The Transferor covenants and agrees to indemnify and save harmless the Transferee, its officers, employees and agents, from any and all claims, causes of action, suits, demands, expenses, costs and expenses, and legal fees whatsoever that anyone might have as owner, occupier or user of the Land, or by a person who has an interest in or comes onto the Land, or by anyone who suffers loss or injury, including economic loss, loss or damage to his person or property, that arises out of this Agreement, or the limitations on the use of the Lands resulting from this Agreement.

15. It is mutually understood, acknowledged and agreed by the parties hereto that the Transferee has made no representations, covenants, warranties, guarantees, promises or agreements (oral or otherwise) with the Transferor other than those contained in this Agreement.

16. This Agreement shall be registered as a first charge against the Land and the Grantor agrees to execute and deliver all other documents and provide all other assurances necessary to give effect to the covenants contained in this Agreement.

17. The Transferor shall pay the legal fees of the Transferee in connection with the preparation and registration of this Agreement. This is a personal covenant between the parties.

18. The Transferor covenants and agrees for itself, its heirs, executors, successors and assigns, that it will at all times perform and observe the requirements and restrictions hereinbefore set out and they shall be binding upon the Transferor as personal covenants only during the period of its respective ownership of any interest in the Land.

19. The restrictions and covenants herein contained shall be covenants running with the Land and shall be perpetual, and shall continue to bind all of the Lands when subdivided, and shall be registered in the Victoria Land Title Office pursuant to Section 219 of the Land Title Act as covenants in favour of the Transferee as a first charge against the Land.

20. This Agreement shall enure to the benefit of the Transferee and shall be binding upon the parties hereto and their respective heirs, executors, successors and assigns.

21. Wherever the expressions "Transferor" and "Transferee" here used herein, they shall be construed as meaning the plural, feminine or body corporate or politic where the context or the parties so require.

22. The Transformer agrees to execute all other documents and provide all other assurances necessary to give effect to the covenants contained in this Agreement.

23. Time is of the essence in this Agreement.

24. If any part of this agreement is found to be illegal or unenforceable, that part will be considered separate and severable and the remaining parts will not be affected thereby and will be enforceable to the fullest extent of the law.

{02560516;1}

25. Cowichan Valley Mortgages Ltd., the registered holder of a charge by way of mortgage and rent charge against the Lands and registered under Nos. CA8158028 and CA8158029 respectively (collectively the "Charge") in the Land Title Office at Victoria, British Columbia, for and in consideration of the sum of One ($1.00) Dollar paid by the Transferee to the said Chargeholder (the receipt whereof is hereby acknowledged), agrees with the Transferee, its successors and assigns, that the within section 219 Covenant shall be an encumbrance upon the Lands in priority to the Charge in the same manner and to the same effect as if it had been dated and registered prior to the Charge.

IN WITNESS WHEREOF the parties hereto hereby acknowledge that this Agreement has been duly executed and delivered by the parties executing the Form C (pages 1 and 2) attached hereto.

END OF DOCUMENT

Schedule "A"

HandyDART Minimum Requirements

1. The passenger loading and unloading area must not involve nose-in parking;

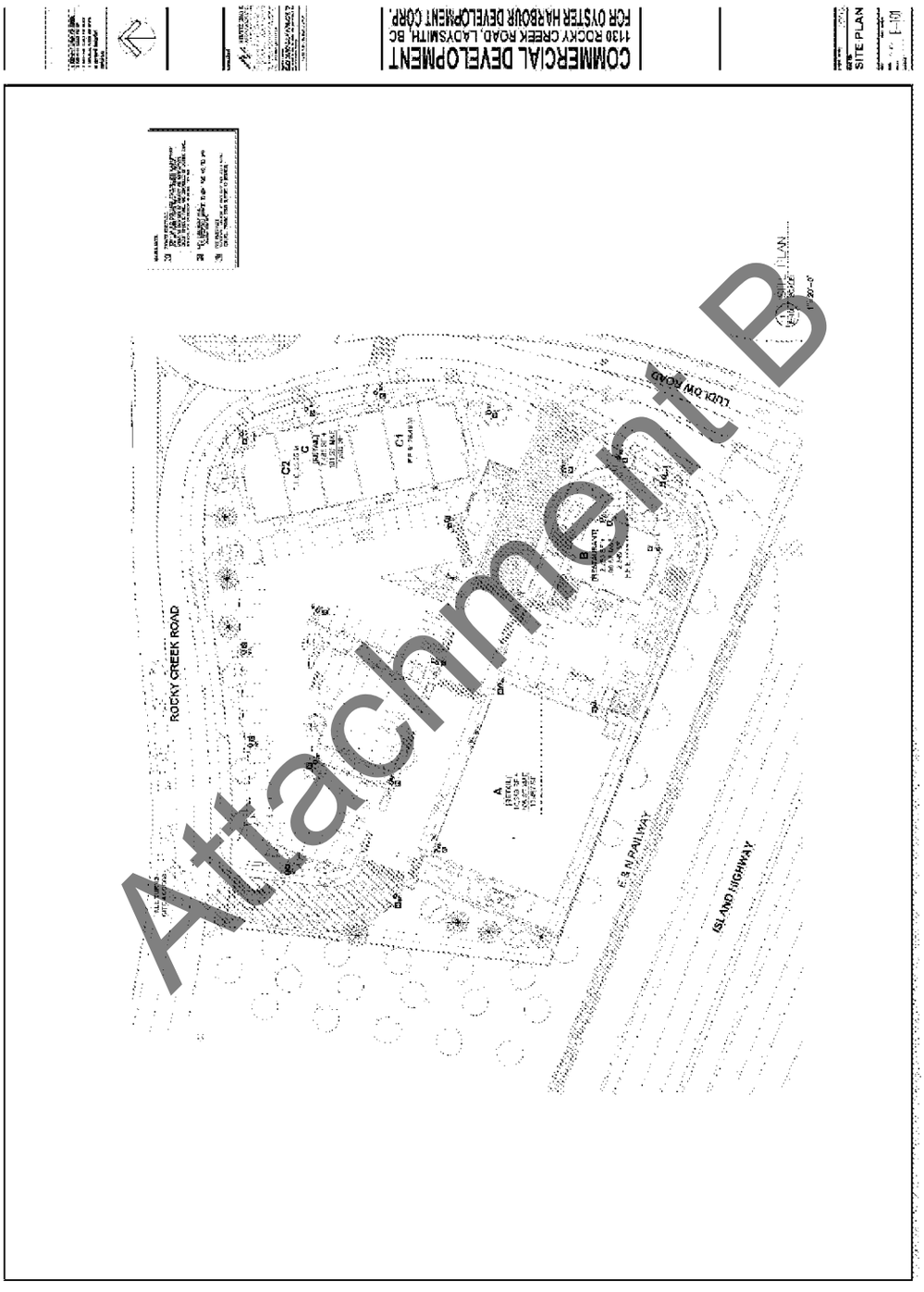
2. The passenger loading and unloading area must be adjacent to a sidewalk with curb for its full length;

3. There must be a pull out area to ensure that any rear loading of HandyDART busses does not occur into traffic;

4. The area must provide outdoor covered seating to be maintained by the Transferor.

Schedule "B"

Outdoor Electrical Supply Outlet Plan



{02560516;1}

Schedule "C"

Latecomers Agreement

SERVICING AND LATECOMERS AGREEMENT

THIS AGREEMENT made this day of , 2022.

BETWEEN:

TOWN OF LADYSMITH
410 Esplanade, PO Box 220
Ladysmith, B.C. V9G 1A2

(the "**Town**")

OF THE FIRST PART

AND:

OYSTER HARBOUR DEVELOPMENT CORP.
Inc. No. BC1242155
3790 St. Pauls Avenue
North Vancouver, B.C. V7N 1T3

(the "**Developer**")

OF THE SECOND PART

WHEREAS:

A. The Developer intends to develop certain lands within the Town more particularly described in Schedule "A" to this Agreement (the "**Land**");

B. In accordance with section 507 of the *Local Government Act*, the Town has required the Developer, as the owner of the Land, to provide a highway system that serves the Land and land other than the Land, as depicted in the drawings and specifications attached to this Agreement as Schedule "B" (the "**Excess and Extended Services**");

C. The Town considers that its costs to provide the Excess and Extended Services, in whole or in part, are excessive, and in accordance with section 507(3)(b) of the *Local Government Act* the Town requires the Developer, as owner of the Land being developed to pay a portion of the costs of the Excess and Extended Services;

D. The Town and the Developer wish to enter into this Agreement to confirm in writing the Town's requirements for the Developer's construction of the Excess and Extended Services, and with respect to the Town's obligation to collect latecomer charges under section 508 of the *Local Government Act*.

{02499873;1} 173 221 / Latecomers Agreement / 22 03 01 / RB-ce

NOW, THEREFORE, THIS AGREEMENT WITNESSES that in consideration of the mutual covenants and agreements made by each of the parties to the other as set out herein, and for other valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Town and the Developer covenant and agree as follows:

1. **INTERPRETATION**

In this Agreement:

"Benefitting Lands" means the parcels of land that, in addition to the Land, will be served by the Excess and Extended Services, as listed in Schedule "D" to this Agreement.

"**Complete**" or "**Completion**" or any variation of these words when used with respect to the Excess and Extended Services means completion to the satisfaction of the Town Engineer on the date certified by the Town Engineer in writing.

"**Development**" includes the proposed development of the Land as generally shown on the plan attached to this Agreement as Schedule "C".

"Latecomer Charge" means the charges to be imposed under section 8 of this Agreement;

"Town Contribution" means the amount specified in section 7(2) of this Agreement;

"Town Engineer" means the person appointed by the Town Council as its Director of Infrastructure Services, or any other person from time to time duly authorized by the Town Council or the Town Engineer to act on their behalf.

2. **TIME FOR COMPLETION**

The Developer shall complete the Excess and Extended Services to the satisfaction of the Engineer by the _____ day of_____, 202_____.

3. **SECURITY**

(1) As security for the due and proper performance of all of the covenants and agreements contained in this Agreement and the Excess and Extended Services contemplated, the Developer has deposited with the Town an automatically renewing, irrevocable letter of credit in the amount of Nine Hundred and Two Thousand Eight Hundred and Forty Nine ($902,849) Dollars as a bond within the meaning of Section 940 of the Local Government Act (the "Security").

(2) The Developer agrees that if the Excess and Extended Services are not Completed by the date stated in Section 2, the Town may complete the Excess and Extended Services, at the cost of the Developer, and for that purpose may draw down upon the Bond up to the full amount of the Security.

(3) If when combined with the Town Contribution, there are insufficient monies contained in the Security to Complete the Excess and Extended Services the Developer shall pay the balance of the insufficiency forthwith upon invoice for it sent by the Town.

(4) The Town may Complete the Excess and Extended Services either by itself or by contractors employed by it.

(5)

(6) If the Developer Completes the Excess and Extended Services or if the Completion of the Excess and Extended Services costs less than the amount of the Security , then the Security or a proportional part of it, not required to pay for Completion shall be released by the Town to the Developer

(7) An administration fee in the amount of 2 percent of the amount of the Bond, to a maximum of $2,000.00 shall be made payable to the Town at the time the Security is provided.

4. **RIGHTS-OF-WAY**

Upon Completion of the Excess and Extended Services, the Developer shall transfer and register in the Land Title Office the easements and rights-of-way prescribed by Schedule "B" to the person or corporations requiring them.

5. **STANDARDS OF WORKS**

(1) The Excess and Extended Services must be designed and constructed in compliance with the plans and specifications set out in Schedule "B" to this Agreement, and as required by the Town's Subdivision and Development Servicing Bylaw No. 1834, in force as at the date of this Agreement, and to the satisfaction of the Town's Engineer.

(2) If the Excess and Extended Services prove to be in any way defective then the Developer shall, at the expense of the Developer, modify and reconstruct them so that they function to the satisfaction of the Town's Engineer prior to the issuance of the Certificate of Completion in section 5(3) below.

(3) Upon completion of the Excess and Extended Services to the satisfaction of the Town's Engineer a Certificate of Completion signed by the Town's Engineer shall be issued.

6. **LANDS SERVED**

The Town and Developer agree that in addition to servicing the Land, the Excess and Extended Services will serve those Benefitting Lands listed in Schedule "D" to this Agreement.

7. **COST**

(1) The Parties agree that the total cost of providing the Excess and Extended Services, that will benefit the Benefitting Lands and not the Land, as determined by the Town, is One Million Eight Hundred Forty Nine Thousand Three Hundred and Ninety Nine (**$1,849,399.00**) Dollars. (the "Excess and Extended Services Cost"

(2) The Town shall pay the Developer One Million Fifty Thousand, Nine Hundred and Eighty Five (**$1,050,985.00**) Dollars toward the cost of the Excess and Extended Services once the Developer has constructed the Excess and Extended Services and construction is complete (the "**Town Contribution**"), less any amount it has expended pursuant to section 3(3) of this Agreement that has not been reimbursed by the Developer.

8. **LATECOMER CHARGE**

(1) The Town shall, under section 508(3) of the Local Government Act, impose a Latecomer Charge against each parcel of the Benefitting Lands, calculated in accordance with Schedule "E" of this Agreement as a condition of an owner either obtaining a building permit where the value of the construction is over $50,000, as determined in accordance with the Town's Building and Plumbing Bylaw 1994, No. 1119, or of subdividing their land.

(2) The Town shall pay to the Developer those Latecomer Charges collected under section 8(1).

(3) Included in the charges imposed under section 8(1) of this Agreement shall be interest calculated annually at the rate prescribed by the Subdivision and Development Servicing Bylaw, 2013 No. 1834 payable for the period commencing when the Excess and Extended Services are completed, as certified under section 8(4), up to the date that the connection is made, or the use commences.

(4) No Latecomer Charges under section 8(1) of this Agreement shall be charged beyond a period of fifteen (15) years commencing on the date of completion of the Excess and Extended Services as certified by the Town's Engineer.

(5) The Developer accepts the risk that if insufficient Latecomer Charges are collected from the owners of the Benefitting Lands within the time period referred to in subsection (4), no further monies shall be payable by the Town to the Developer in respect of the Excess and Extended Services.

(6) The Parties agree that if the actual total cost of the Developer in providing the Excess and Extended Services, as certified by the Town Engineer, is ten percent more or less than the amount specified in section 8(1) of this Agreement, then the Latecomer Charges specified in sections 1.1 and 1.2 of Schedule "E" shall be adjusted by an amount that permits the Developer to recover no more than its total actual cost.

9. **COMPLY WITH REGULATIONS**

(1) The Developer must comply with the provisions of all Town bylaws throughout the construction of the Excess and Extended Services.

(2) In the event that any material or debris should be left upon any road after the construction of the Excess and Extended Services, the Developer covenants and agrees that the Town may forthwith remove the material or debris at the expense of the Developer, and the cost of the removal shall be determined by the Town Engineer.

(3) In the event that any invoice of the Town, for the removal of material or debris, remains unpaid after 30 days of its receipt by the Developer, the Town may deduct the amount of the invoice from the amount to be paid to the Developer by the Town under section 8(2) of this Agreement.

(4) In the event that, while constructing the Excess and Extended Services, any damage is done to the adjacent properties or to any roads, Town services or works or to any water course or drainage system, the Developer shall, within seven (7) days of such damages, repair or replace or clean them up, or if the repair or replacement will take more than seven (7) days to complete the Developer shall take diligent steps to complete the repair or replacement as soon as reasonably practical, and upon failure to do so the Town will deduct from the amount to be paid to the Developer by the Town under section 8(2) of this Agreement the amount necessary to do such repairs or replacement or clean up.

(5) Any portion of the cost of the repairs, replacement and cleanup set out in 9(4) above that is greater than the amount to be paid to the Developer by the Town under section 8(2) of this Agreement is a debt due to the Town

and must be paid by the Developer to the Town within 30 days of being invoiced.

10. **DEVELOPER'S ENGINEER**

(1) At all times during the design and construction of the Excess and Extended Services, the Developer must employ a professional engineer, registered under the *Engineers and Geoscientists Act* to practice in the Province of British Columbia, to design and oversee the construction of the Excess and Extended Services.

(2) The Developer's professional engineer must have the authority to act on behalf of the Developer.

(3) Any explanations, orders, instructions, directions and requests given by the Town to the Developer's professional engineer are deemed to have been given to the Developer.

11. **FINAL AS-BUILT DRAWINGS**

The Developer covenants and agrees to submit to the Town final as-built drawings, in a form satisfactory to the Town Engineer of all Excess and Extended Services as constructed and as approved by the Town Engineer.

12. **CHANGES IN STANDARDS**

The Developer, pursuant to Section 511 of the *Local Government Act*, covenants and agrees to comply with any changes in standards established by bylaw under Part 14 of the *Local Government Act* that relate to the design or construction of the Excess and Extended Services, and that are made prior to the substantial commencement of the Excess and Extended Services.

13. **DUTIES OF THE DEVELOPER**

The Developer covenants and agrees, prior to final approval of the development, to:

(1) submit to the Town final as-built drawings, including 2 complete sets of prints, 5 additional copies of the overall design plan (key plan), and 1 set of mylar transparencies of all Excess and Extended as constructed and as approved by the Engineer;

(2) pay all arrears of taxes outstanding against the Land;

(3) pay all current taxes levied or to be levied on the Land on the basis and in accordance with the assessment and collector's roll entries; and

(4) pay to the Town, in addition to the Bond required by Section 3 and 14, all inspection fees, administration fees, engineering fees, non-refundable levies and charges, legal costs incurred by the Town directly attributable to this Agreement, and the cost of connecting all utilities to service the development.

14. MAINTENANCE OF WORKS

The Developer covenants and agrees to:

(a) maintain the Excess and Extended Services in complete repair for a period of one year from the Completion Date except for where required as a result of reasonable wear and tear, negligence of the Town, its servants or agents, acts of God, vehicular damage, or vandalism proven;

(b) remedy any defects in the Excess and Extended Services appearing within a period of one year from the Completion Date, save and except for defects caused by reasonable wear and tear, negligence of the Town, its servants or agents, acts of God, or vandalism proven to have been committed after the Completion Date;

(c) as security for the Developer's obligations under section 14(a) and (b), leave with the Town for a period of one year from the Completion Date the sum of One Hundred Ninety Five Thousand Five Hundred Thirty Eight (**$195,538.00**) dollars, by way of a letter of credit (the "Maintenance Security"); and

(d) if the Developer fails to maintain the Excess and Extended Services, remedy any defect or pay for any damage resulting from the Excess and Extended Services, as required under this Agreement, the Town may deduct from the amount deposited pursuant to Section 14(c), the cost of maintaining any Excess and Extended Services, remedying any defect or paying the damage from the security.

15. INDEMNITY

The Developer covenants to save harmless and indemnify the Town against:

(a) all actions, proceedings, costs, damages, expenses, claims and demands (collectively "Claims") whatsoever and by whomsoever brought by reason of the Development or construction of the Excess and Extended Services, to the extent that the Claim is caused by the Town's specifications for the Excess and Extended Services;

(b) all expenses and costs which may be incurred by reason of this Agreement resulting in damage to any property owned in whole or in part by the Town or which the Town by duty or custom is obliged, directly or indirectly, in any way or to any degree, to construct, repair or maintain; and

(c) all expenses and costs which may be incurred by reason of liens, nonpayment of labour or materials, Worker's Compensation assessments, unemployment insurance, Federal and Provincial Tax, or union dues check off.

16. **DECLARATION OF DONATIVE INTENT, WAIVER AND RELEASE**

(1) To the extent that any of the works to be provided by the Developer are determined by an arbitrator or court of competent jurisdiction not to be excess or extended services for the purposes of section 507 of the Local Government Act ("**Amenities**"), the Developer:

a. acknowledges that the Town does not have the statutory authority to compel the Developer to provide them as a condition of development of the Land. The Developer further acknowledges that the Town, its officials, employees and agents, have not stated, held out or implied any expectation or requirement that the Amenities must be provided in order for the Developer's development to be approved; and

b. without detracting from the obligations of the Town pursuant to Section 7(2) hereof, hereby expresses its intention to donate the Amenities to the Town as a gift, as amenities for the use and enjoyment of the public, without any expectation of payment or reward of any kind.

(2) The Developer further releases, waives and forever discharges the Town from and against any claims, actions, or causes of action, whether based in contract, tort or equity, for damages or losses, for the recovery of costs incurred, including legal expenses, or for unjust enrichment, in connection with the provision of those Amenities.

17. **CERTIFICATE OF COMPLETION**

(1) The Town agrees to provide the Developer with a Certificate of Completion of the Excess and Extended Services signed by the Town Engineer upon satisfactory completion by the Developer of all of the covenants and conditions in this Agreement.

(2) Notwithstanding anything provided in this Agreement to the contrary, the parties agree that the Town will not be required to collect the Latecomer

Charge from any development which is in existence prior to the date of this Agreement, or for which the Town has approved a subdivision or issued a building permit prior to the date hereof.

18. **ENTIRE AGREEMENT**

This Agreement when executed will set forth the entire agreement and understanding of the parties as at the date hereof with respect to the subject matter hereof and supersede all prior agreements and understandings among the parties with respect to the subject matter hereof and there are no oral or written agreements, promises, warranties, terms, conditions, representations or collateral agreements whatsoever, express or implied, other than those contained in this Agreement.

19. **TIME**

Time is to be the essence of this Agreement.

20. **LAW APPLICABLE**

This Agreement is to be construed in accordance with and governed by the laws applicable in the Province of British Columbia.

21. **TOWN'S PROPERTY IN WORKS**

Upon issuance of the Certificate of Completion the Excess and Extended Services shall become the property of the Town, free and clear of any claim by the Developer or any person claiming through the Developer, and the Developer shall indemnify and save harmless the Town from any such claims.

22. **TERMINOLOGY**

Wherever the singular or the masculine are used in this Agreement, they shall be construed as meaning the plural or the feminine or body corporate or politic where the context or the parties require.

23. **BINDING EFFECT**

This Agreement shall enure to the benefit of and be binding upon the parties hereto, their respective successors and permitted assignees.

24. **HEADINGS**

The headings in this Agreement are inserted for convenience only and shall not be construed as part of this Agreement for the purpose of interpretation.

IN WITNESS WHEREOF the parties have hereto affixed their hands and seals the day, month and year first above written.

TOWN OF LADYSMITH)
by its authorized signatory(ies):)
)
)
)
)
_____)
Name:)
)
)
)
_____)
Name:)

OYSTER HARBOUR DEVELOPMENT CORP.)
by its authorized signatory(ies):)
)
)
)
_____)
Name:)
)
)
)
_____)
Name:)

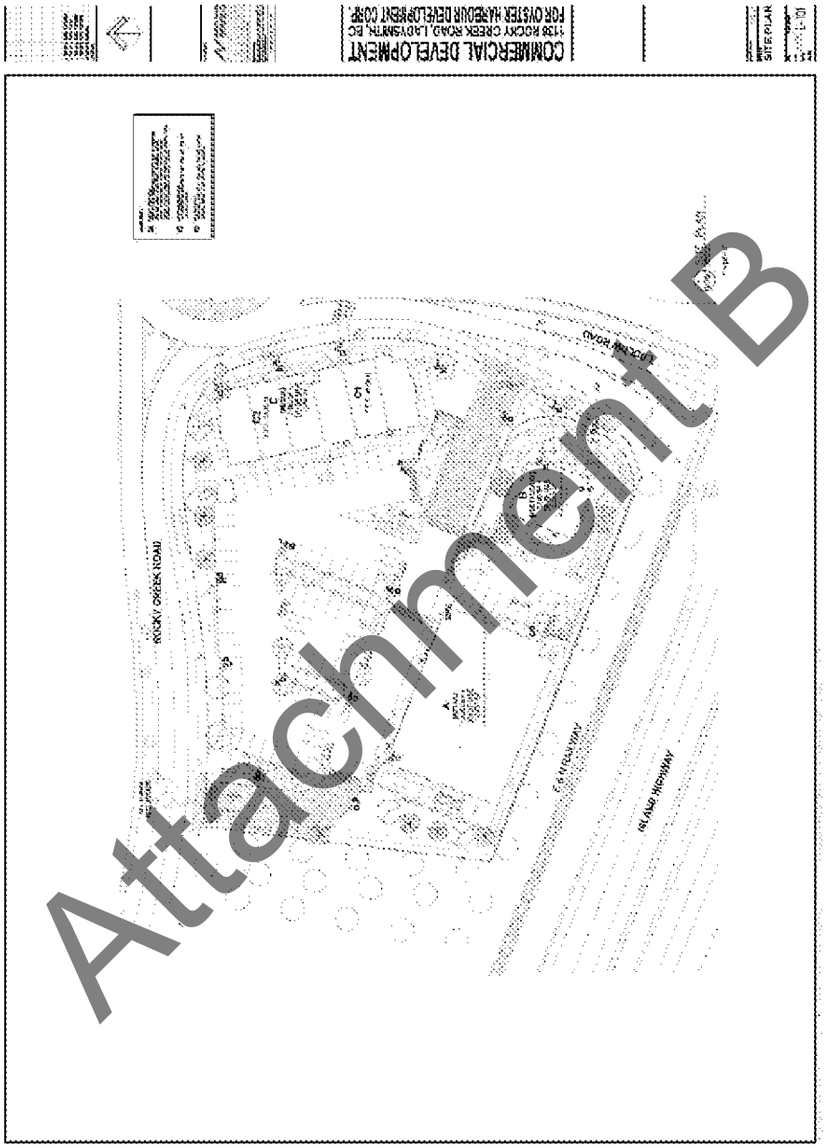
SCHEDULE "A"

The Land

Parcel Identifier	Legal Description
024-839-370	LOT A DISTRICT LOTS 24 AND 38 OYSTER DISTRICT PLAN VIP71248

12

SCHEDULE "B"
DRAWINGS AND SPECIFICATIONS



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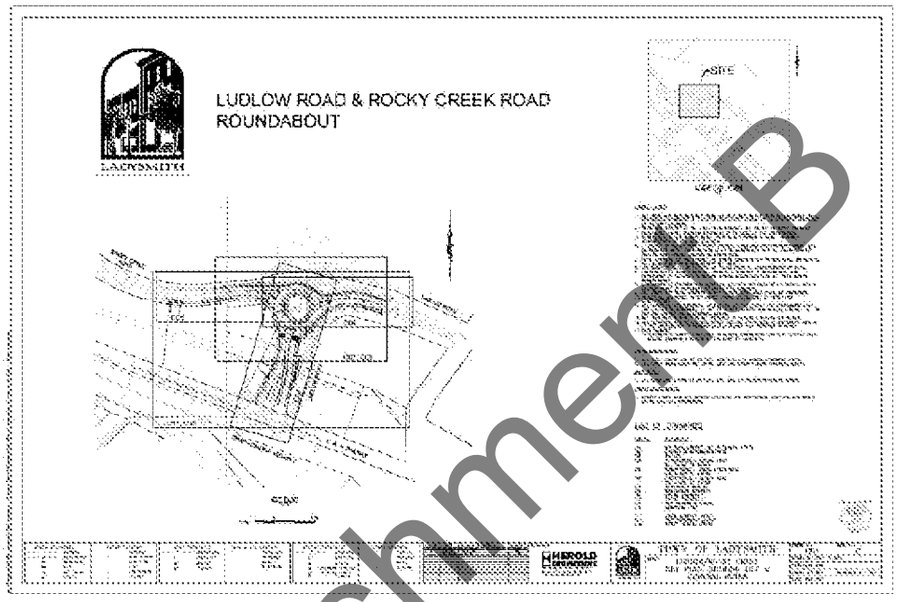
SCHEDULE "C"
DEVELOPMENT
PLAN



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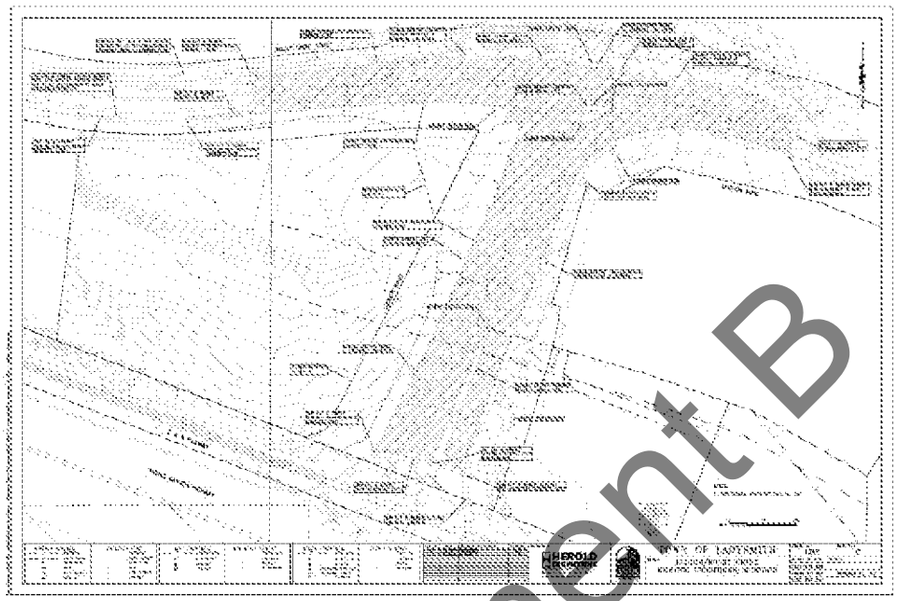

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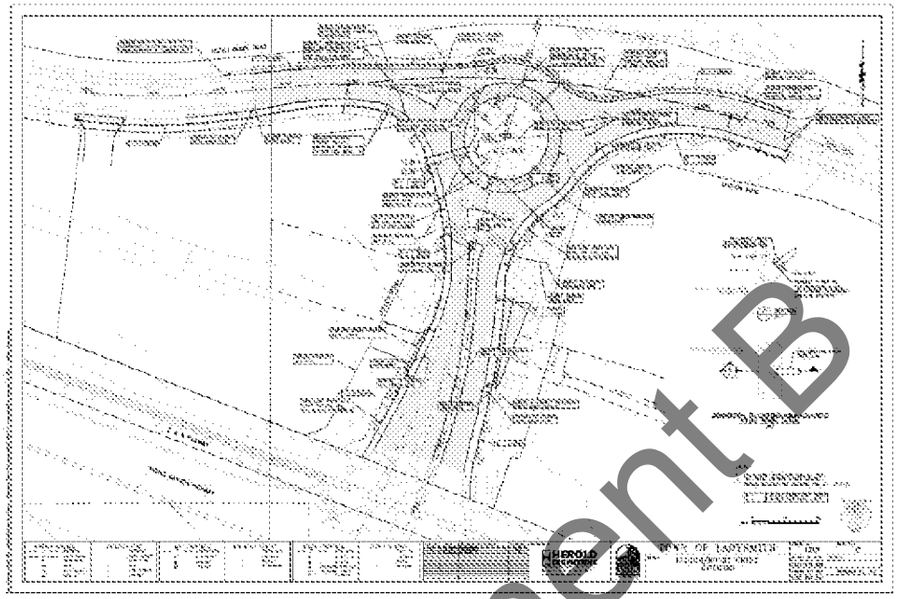

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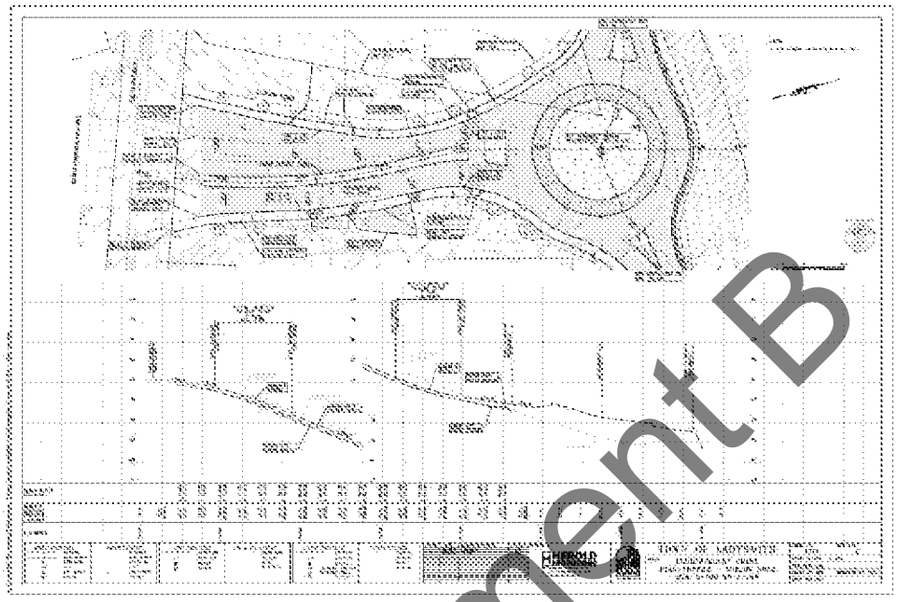

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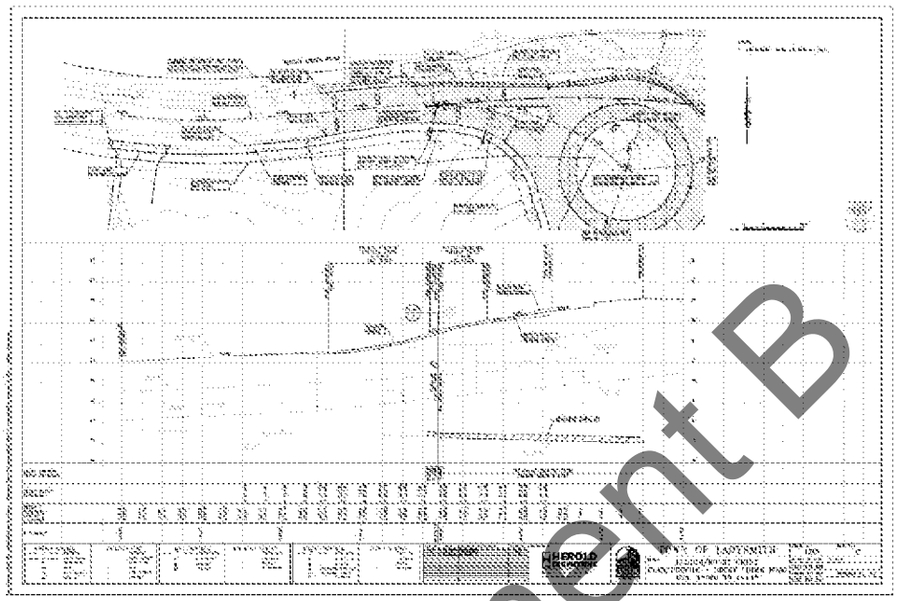

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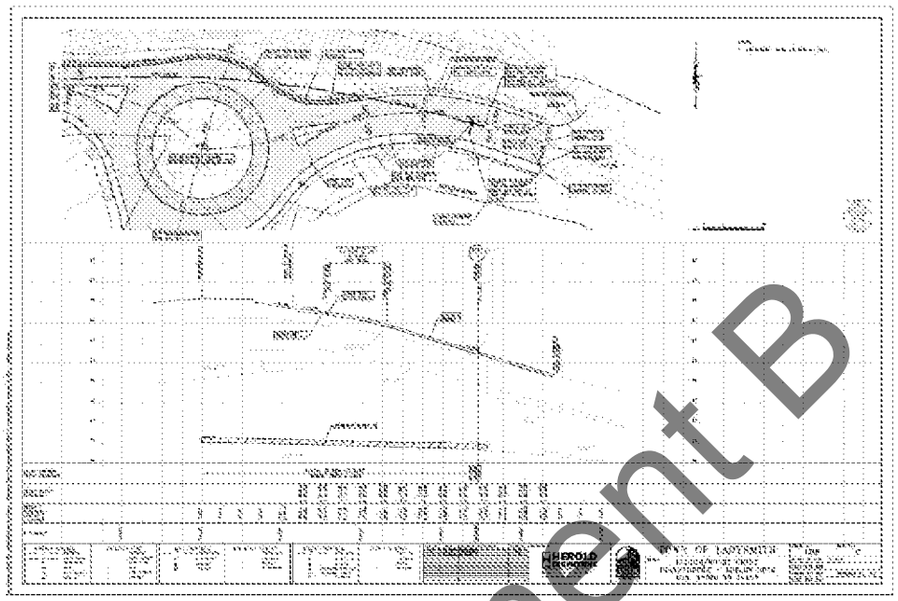

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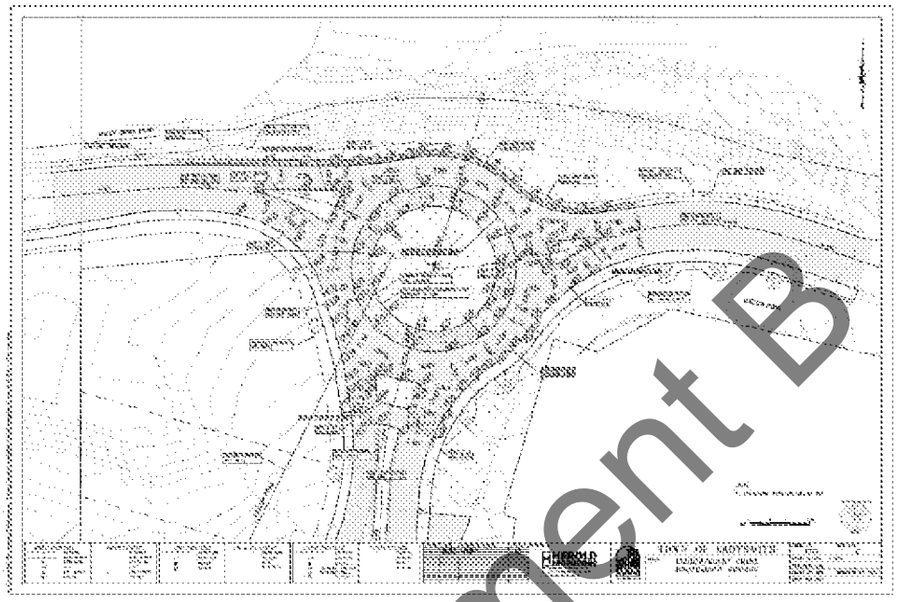

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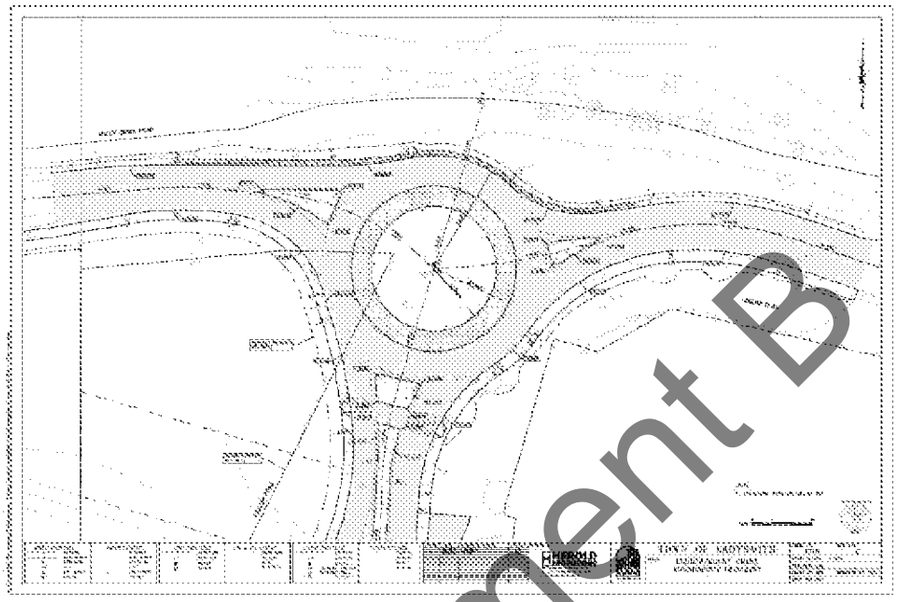

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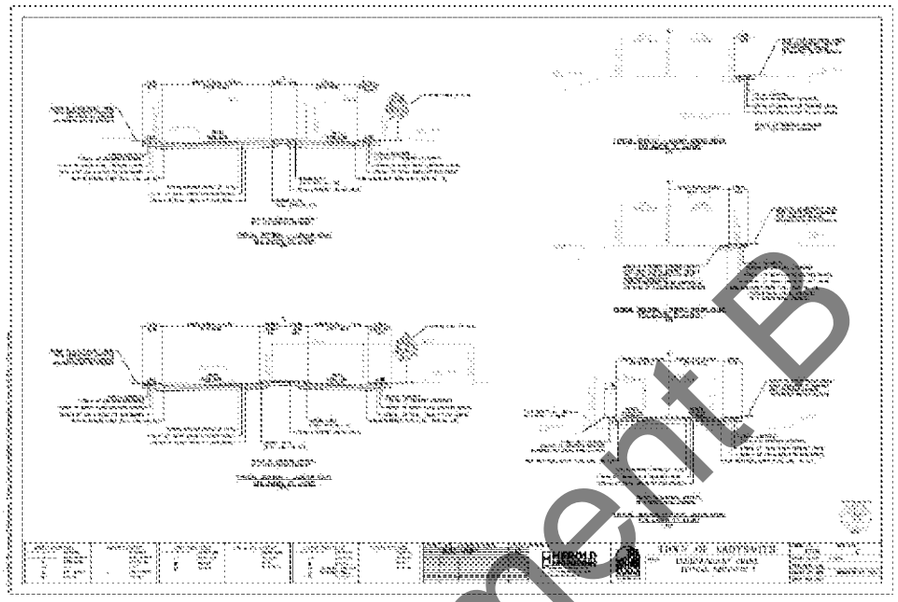

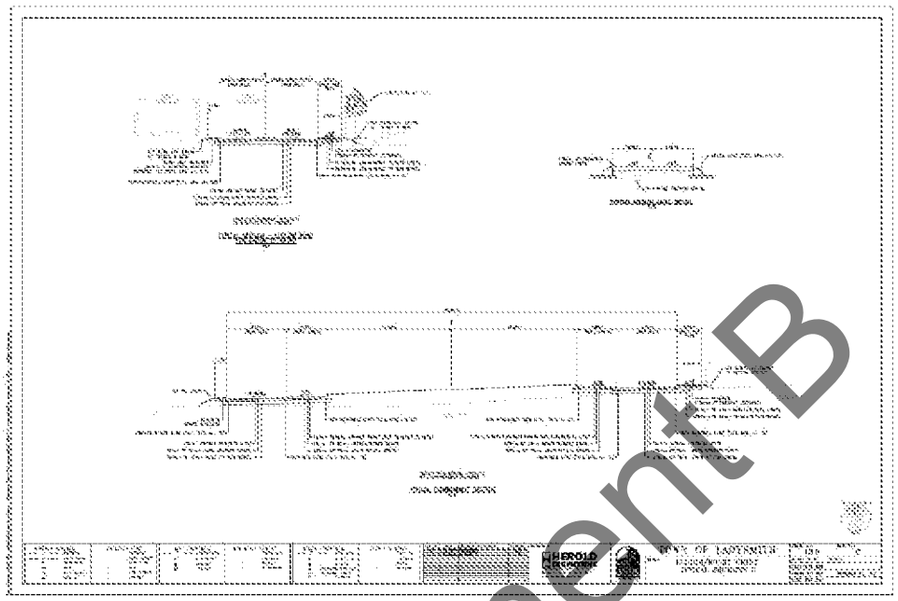

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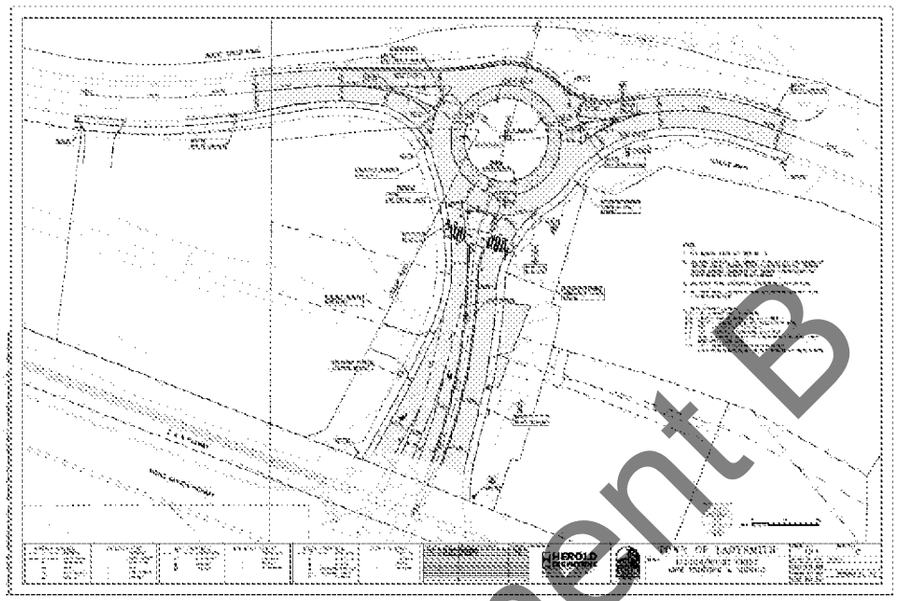

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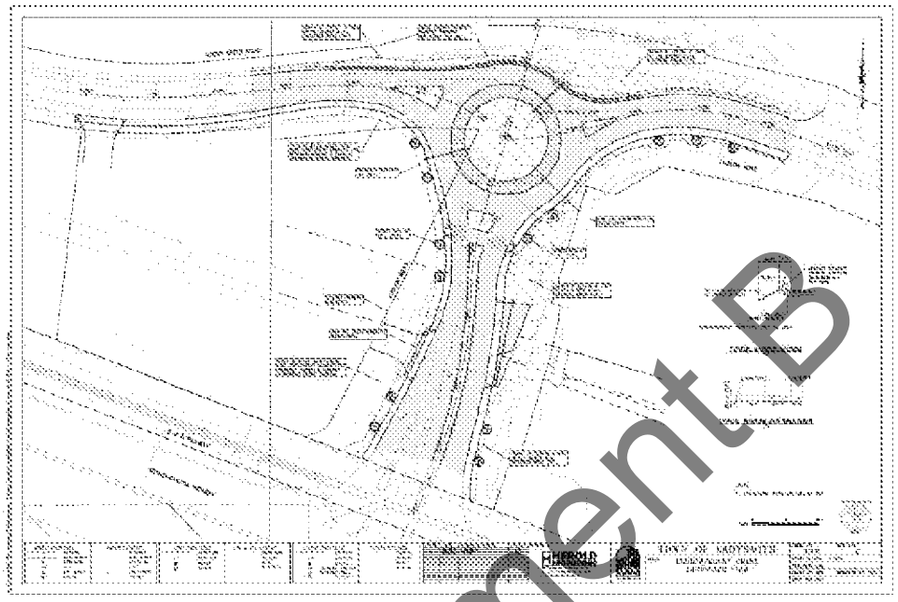


SCHEDULE "D"

Benefitting Lands

Area 1

Parcel Identifier	Legal Description
027-329-135	LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP84189
027-329-143	Lot 2 DL 38 Oyster District Plan VIP84189
027-329-151	Lot 3 DL 38 Oyster District Plan VIP84189
027-329-160	Lot 4 DL 38 VIP84189
027-329-178	Lot 5 DL 38 VIP84189
024-839-370	Lot A District Lots 24 and 38 Oyster District Plan VIP71248
027-236-986	Lot 1 DL 24 VIP83837
030-721-083	Lot A DL 24 Oyster District Plan EPP86590
030-721-091	Lot B DL 24 Oyster District Plan EPP86590
026-789-990	Lot 1 DL 24 VIP81464
027-104-770	Lot A DL 24 Oyster District Plan VIP83303, except part in plan VIP83837
027-104-788	Lot B DL 24 Oyster District Plan VIP83303
010-208-682	Lot 2 DL 24 Oyster District Plan 45800 except that part in Plan VIP73654 & Plan EPP71248
030-553-164	Lot A DL 24 Oyster District Plan EPP71248
010-208-712	Lot 3 DL 24 Oyster District Plan 45800
90048005	DL 2059 Cowichan District 7TU1947 - Crown

Area 2

Parcel Identifier	Benefiting Lands Civic address and/or legal
009-449-914	PARCEL A (DD 2853N) OF DISTRICT LOTS 24 AND 38, OYSTER DISTRICT, EXCEPT PARTS IN PLANS 398 RW, 423 RW, 17025 AND VIP68020
025-202-341	1300 Rocky Cr Rd - LOT 8 SECTION 6 AND DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
025-202-332	1280 Rocky Cr Rd - Lot 7 District Lot 38 Oyster District Plan VIP73070
025-202-324	1260 Rocky Cr Rd -Lot 6 District Lot 38 Oyster District Plan VIP73070
025-202-316	LOT 5 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
025-980-688	1200 Rocky Cr Rd - LOT A (EW89248) DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
025-202-278	1160 Rocky Cr Rd - LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
030-801-460	Lot A DLs 81, 86 & 98 Oyster District Plan EPP87265
030-801-478	Lot B DLs 86, 87 & 98 Oyster District and DL 2054 Cowichan District Plan EPP87265
028-404-645	1221 Rocky Cr Rd - Lot 4 DLs 84 & 87 Oyster District Plan VIP88459
024-644-650	1181 Rocky Cr Rd - Lot 1 District Lot 84 Oyster District Plan VIP69584
009-579-541	DISTRICT LOT 84, OF DISTRICT LOT 38, OYSTER DISTRICT, EXCEPT PARCEL A (DD

	9912N), PARCEL B (DD 6616N) AND PARCEL C (DD 11418N) AND EXCEPT THAT PART IN PLAN VIP70167
009-579-630	DISTRICT LOT 87, OF DISTRICT LOT 38, OYSTER DISTRICT, EXCEPT PART IN PLAN 19015, VIP70166 AND VIP88459
009-450-068	District Lot 104 Oyster District Except part in plan 398RW
000-879-100	THAT PART OF DISTRICT LOT 104, OYSTER DISTRICT, SHOWN OUTLINED IN RED ON PLAN 398 RW, CONTAINING .19 OF AN ACRE MORE OR LESS EXCEPT PART IN PLAN VIP69582
027-764-958 027-764-966 027-764-974 027-764-982 027-764-991 027-765-008 027-765-016 027-765-024 027-845-460 027-846-067 027-846-075 027-846-083 027-846-091 027-846-105 027-846-113 027-846-121 027-846-130 027-846-148 027-846-156 027-846-164 027-846-172 027-846-181 027-846-199 027-846-202 027-846-211 027-846-229 027-846-237 027-846-245	(Strata Lot 1 to Strata Lot 28) Plan VIS6726 District Lot 38 Land District 43 TOGETHER WITH AN INTEREST IN THE COMMON PROPERTY IN PROPORTION TO THE UNIT ENTITLEMENT OF THE STRATA LOT AS SHOWN ON FORM V (1156 to 1158 Rocky Creek Road)
027-764-893	LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP86027 EXCEPT PART IN STRATA PLAN VIS6726 (PHASES 1 AND 2) AND PLAN EPP23810
030-552-893	PARCEL E (BEING A CONSOLIDATION OF LOTS A AND B, SEE CA7024627) DISTRICT LOT 38 OYSTER DISTRICT PLN EPP36585
029-272-751	LOT C DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585
029-272-769	LOT D DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585
010-208-828	Transfer Beach - LOT 4 DISTRICT LOTS 8G, 11G, 24 AND 56 OYSTER DISTRICT PLAN 45800 EXCEPT PLANS VIP64405, VIP71943, VIP72131 AND EPP100459

SCHEDULE "E"

CALCULATION OF LATECOMER CHARGES

1.0 Benefitting Lands

1.1 Subject to an adjustment under section 8(6) of this Agreement, Benefitting Lands located in Area 1 shall pay a charge of **$19,310.43** per hectare at the earlier of the time of subdivision or at the time of building permit application for construction with a value of over $50,000, as determined in accordance with the Town's Building Bylaw.

1.2 Subject to an adjustment under section 8(8) of this Agreement, Benefitting Lands located in Area 2 shall pay a charge of **$14,482.82** per hectare at the earlier of the time of subdivision or at the time of a building permit application for construction with a value of over $50,000, as determined in accordance with the Town's Building Bylaw.

The following tables summarize the latecomer charts payable by the owner of the Benefitting Lands in accordance with sections 1.1 to 1.2 of this Schedule "E".

Maximum Latecomer Charges for Benefitting Lands in Area 1

Benefiting Lands Civic address and/or legal	Parcel Identifier	Parcel Area in Hectares	Total Latecomer Charge ($19,310.43 per Hectare)
1142 Rocky Creek Rd - LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP84189	027-329-135	0.15	$ 2,857.94
1140 Rocky Creek Rd - Lot 2 DL 38 Oyster District Plan VIP84189	027-329-143	0.15	$ 2,857.94
Lot 3 DL 38 Oyster District Plan VIP84189	027-329-151	0.16	$ 3,031.74
1134 Rocky Creek Rd - Lot 4 DL 38 VIP84189	027-329-160	0.16	$ 3,089.67
1132 Rocky Creek Rd - Lot 5 DL 38 VIP84189	027-329-178	0.17	$ 3,321.39
1130 Rocky Creek Rd - Lot A District Lots 24 and 38 Oyster District Plan VIP71248	024-839-370	0.81	$ 15,641.45
1010 Ludlow Rd - Lot 1 DL 24 VIP83837	027-236-986	0.74	$ 14,212.48
Lot A DL 24 Oyster District Plan EPP86590	030-721-083	0.29	$ 5,619.34
Lot B DL 24 Oyster District Plan EPP86590	030-721-091	0.30	$ 5,715.89
940 Ludlow Rd - Lot 1 DL 24 VIP81464	026-789-990	0.35	$ 6,720.03
1031 Oyster Bay Dr - Lot A DL 24	027-104-770	0.53	$ 10,215.22

Oyster District Plan VIP83303, except part in plan VIP83837			
941 Oyster Bay Dr - Lot B DL 24 Oyster District Plan VIP83303	027-104-788	0.34	$ 6,623.48
940 Ludlow Rd - Lot 2 DL 24 Oyster District Plan 45800 except that part in Plan VIP73654 & Plan EPP71248	010-208-682	1.06	$ 20,546.30
Lot A DL 24 Oyster District Plan EPP71248	030-553-164	0.60	$ 11,566.95
Lot 3 DL 24 Oyster District Plan 45800	010-208-712	0.11	$ 2,201.39
DL 2059 Cowichan District 7TU1947 - Crown	90048005	1.49	$ 28,772.55

Maximum Latecomer Charges for Benefitting Lands in Area 2

Benefiting Lands Civic address and/or legal	Parcel Identifier	Parcel Area in Hectares	Total Latecomer Charge ($14,482.82 per Hectare)
PARCEL A (DD 2853N) OF DISTRICT LOTS 24 AND 38, OYSTER DISTRICT, EXCEPT PARTS IN PLANS 398 RW, 423 RW, 17025 AND VIP68020	009-449-914	16.60	$ 240,414.89
1300 Rocky Cr Rd - LOT 8 SECTION 6 AND DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-202-341	0.35	$ 5,011.06
1280 Rocky Cr Rd - Lot 7 District Lot 38 Oyster District Plan VIP73070	025-202-332	0.35	$ 5,011.06
1260 Rocky Cr Rd -Lot 6 District Lot 38 Oyster District Plan VIP73070	025-202-324	0.20	$ 2,925.53
LOT 5 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-202-316	0.20	$ 2,925.53
1200 Rocky Cr Rd - LOT A (EW89248) DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-980-688	0.61	$ 8,776.59
1160 Rocky Cr Rd - LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-202-278	0.20	$ 2,925.53
Lot A DLs 81, 86 & 98 Oyster District Plan EPP87265	030-801-460	4.69	$ 67,924.45
Lot B DLs 86, 87 & 98 Oyster District and DL 2054 Cowichan District Plan EPP87265	030-801-478	3.36	$ 48,662.29
1221 Rocky Cr Rd - Lot 4 DLs 84 & 87 Oyster District Plan VIP88459	028-404-645	1.25	$ 18,103.53
1181 Rocky Cr Rd - Lot 1 District Lot 84 Oyster District Plan VIP69584	024-644-650	0.21	$ 3,041.39
DISTRICT LOT 84, OF DISTRICT LOT 38,	009-579-541	3.06	$ 44,317.44

OYSTER DISTRICT, EXCEPT PARCEL A (DD 9912N), PARCEL B (DD 6616N) AND PARCEL C (DD 11418N) AND EXCEPT THAT PART IN PLAN VIP70167			
DISTRICT LOT 87, OF DISTRICT LOT 38, OYSTER DISTRICT, EXCEPT PART IN PLAN 19015, VIP70166 AND VIP88459	009-579-630	0.69	$ 9,993.15
District Lot 104 Oyster District Except part in plan 398RW	009-450-068	2.34	$ 33,889.81
THAT PART OF DISTRICT LOT 104, OYSTER DISTRICT, SHOWN OUTLINED IN RED ON PLAN 398 RW, CONTAINING .19 OF AN ACRE MORE OR LESS EXCEPT PART IN PLAN VIP69582	000-879-100	0.08	$ 1,115.18
1156 to 1158 Rocky Creek Road	027-764-958 027-764-966 027-764-974 027-764-982 027-764-991 027-765-008 027-765-016 027-765-024 027-845-460 027-846-067 027-846-075 027-846-083 027-846-091 027-846-105 027-846-113 027-846-121 027-846-130 027-846-148 027-846-156 027-846-164 027-846-172 027-846-181 027-846-199 027-846-202 027-846-211 027-846-229 027-846-237 027-846-245	0.48	$ 6,951.76
LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP86027 EXCEPT PART IN STRATA PLAN VIS6726 (PHASES 1 AND 2) AND PLAN EPP23810	027-764-893	0.15 ha	$ 2,172.42

PARCEL E (BEING A CONSOLIDATION OF LOTS A AND B, SEE CA7024627) DISTRICT LOT 38 OYSTER DISTRICT PLN EPP36585	030-552-893	0.411 ha	$ 5,952.44
LOT C DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585	029-272-751	0.146 ha	$ 2,114.49
LOT D DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585	029-272-769	0.137 ha	$ 1,984.15
Transfer Beach - LOT 4 DISTRICT LOTS 8G, 11G, 24 AND 56 OYSTER DISTRICT PLAN 45800 EXCEPT PLANS VIP64405, VIP71943, VIP72131 AND EPP100459	010-208-828	9.745 Ha	$ 141,207.54

Schedule "D"

Stormwater Planning: A Guidebook for British Columbia

Schedule Begins on Next Page

SERVICING AND LATECOMERS AGREEMENT

THIS AGREEMENT made this day of , 2022.

BETWEEN:

TOWN OF LADYSMITH
410 Esplanade, PO Box 220
Ladysmith, B.C. V9G 1A2

(the "**Town**")

OF THE FIRST PART

AND:

OYSTER HARBOUR DEVELOPMENT CORP.
Inc. No. BC1242155
3790 St. Pauls Avenue
North Vancouver, B.C. V7N 1T3

(the "**Developer**")

OF THE SECOND PART

W H E R E A S:

A. The Developer intends to develop certain lands within the Town more particularly described in Schedule "A" to this Agreement (the "**Land**");

B. In accordance with section 507 of the Local Government Act, the Town has required the Developer, as the owner of the Land, to provide s highway system that serves the Land and land other than the Land, as depicted in the drawings and specifications attached to this Agreement as Schedule "B" (the "**Excess and Extended Services**");

C. The Town considers that its costs to provide the Excess and Extended Services, in whole or in part, are excessive, and in accordance with section 507(3)(b) of the Local Government Act the Town requires the Developer, as owner of the Land being developed to pay a portion of the costs of the Excess and Extended Services;

D. The Town and the Developer wish to enter into this Agreement to confirm in writing the Town's requirements for the Developer's construction of the Excess and Extended Services, and with respect to the Town's obligation to collect latecomer charges under section 508 of the Local Government Act.

NOW, THEREFORE, THIS AGREEMENT WITNESSES that in consideration of the mutual covenants and agreements made by each of the parties to the other as set out herein, and for other valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Town and the Developer covenant and agree as follows:

1. **INTERPRETATION**

In this Agreement:

"Benefitting Lands" means the parcels of land that, in addition to the Land, will be served by the Excess and Extended Services, as listed in Schedule "D" to this Agreement.

"**Complete**" or "**Completion**" or any variation of these words when used with respect to the Excess and Extended Services means completion to the satisfaction of the Town Engineer on the date certified by the Town Engineer in writing.

"**Development**" includes the proposed development of the Land as generally shown on the plan attached to this Agreement as Schedule "C".

"Latecomer Charge" means the charges to be imposed under section 8 of this Agreement;

"Town Contribution" means the amount specified in section 7(2) of this Agreement;

"Town Engineer" means the person appointed by the Town Council as its Director of Infrastructure Services, or any other person from time to time duly authorized by the Town Council or the Town Engineer to act on their behalf.

2. **TIME FOR COMPLETION**

The Developer shall complete the Excess and Extended Services to the satisfaction of the Engineer by the _____ day of_____, 202_____.

3. **SECURITY**

(1) As security for the due and proper performance of all of the covenants and agreements contained in this Agreement and the Excess and Extended Services contemplated, the Developer has deposited with the Town an automatically renewing, irrevocable letter of credit in the amount of Nine Hundred and Two Thousand Eight Hundred and Forty Nine ($902,849) Dollars as a bond within the meaning of Section 940 of the Local Government Act (the "Security").

(2) The Developer agrees that if the Excess and Extended Services are not Completed by the date stated in Section 2, the Town may complete the Excess and Extended Services, at the cost of the Developer, and for that purpose may draw down upon the Bond up to the full amount of the Security.

(3) If when combined with the Town Contribution, there are insufficient monies contained in the Security to Complete the Excess and Extended Services the Developer shall pay the balance of the insufficiency forthwith upon invoice for it sent by the Town.

(4) The Town may Complete the Excess and Extended Services either by itself or by contractors employed by it.

(5) If the Developer Completes the Excess and Extended Services or if the Completion of the Excess and Extended Services costs less than the amount of the Security , then the Security or a proportional part of it, not required to pay for Completion shall be released by the Town to the Developer

(6) An administration fee in the amount of 2 percent of the amount of the Bond, to a maximum of $2,000.00 shall be made payable to the Town at the time the Security is provided.

4. **RIGHTS-OF-WAY**

Upon Completion of the Excess and Extended Services, the Developer shall transfer and register in the Land Title Office the easements and rights-of-way prescribed by Schedule "B" to the person or corporations requiring them.

5. **STANDARDS OF WORKS**

(1) The Excess and Extended Services must be designed and constructed in compliance with the plans and specifications set out in Schedule "B" to this Agreement, and as required by the Town's Subdivision and Development Servicing Bylaw No. 1834, in force as at the date of this Agreement, and to the satisfaction of the Town's Engineer.

(2) If the Excess and Extended Services prove to be in any way defective then the Developer shall, at the expense of the Developer, modify and reconstruct them so that they function to the satisfaction of the Town's Engineer prior to the issuance of the Certificate of Completion in section 5(3) below.

(3) Upon completion of the Excess and Extended Services to the satisfaction of the Town's Engineer a Certificate of Completion signed by the Town's Engineer shall be issued.

6. **LANDS SERVED**

The Town and Developer agree that in addition to servicing the Land, the Excess and Extended Services will serve those Benefitting Lands listed in Schedule "D" to this Agreement.

7. **COST**

(1) The Parties agree that the total cost of providing the Excess and Extended Services, that will benefit the Benefitting Lands and not the Land, as determined by the Town, is One Million Eight Hundred Forty Nine Thousand Three Hundred and Ninety Nine (**$1,849,399.00**) Dollars. (the "Excess and Extended Services Cost"

(2) The Town shall pay the Developer One Million Fifty Thousand, Nine Hundred and Eighty Five (**$1,050,985.00**) Dollars toward the cost of the Excess and Extended Services once the Developer has constructed the Excess and Extended Services and construction is complete (the "**Town Contribution**"), less any amount it has expended pursuant to section 3(3) of this Agreement that has not been reimbursed by the Developer.

8. **LATECOMER CHARGE**

(1) The Town shall, under section 508(3) of the Local Government Act, impose a Latecomer Charge against each parcel of the Benefitting Lands, calculated in accordance with Schedule "E" of this Agreement as a condition of an owner either obtaining a building permit where the value of the construction is over $50,000, as determined in accordance with the Town's Building and Plumbing Bylaw 1994, No. 1119, or of subdividing their land.

(2) The Town shall pay to the Developer those Latecomer Charges collected under section 8(1).

(3) Included in the charges imposed under section 8(1) of this Agreement shall be interest calculated annually at the rate prescribed by the Subdivision and Development Servicing Bylaw, 2013 No. 1834 payable for the period commencing when the Excess and Extended Services are completed, as certified under section 8(4), up to the date that the connection is made, or the use commences.

(4) No Latecomer Charges under section 8(1) of this Agreement shall be charged beyond a period of fifteen (15) years commencing on the date of completion of the Excess and Extended Services as certified by the Town's Engineer.

(5) The Developer accepts the risk that if insufficient Latecomer Charges are collected from the owners of the Benefitting Lands within the time period referred to in subsection (4), no further monies shall be payable by the Town to the Developer in respect of the Excess and Extended Services.

(6) The Parties agree that if the actual total cost of the Developer in providing the Excess and Extended Services, as certified by the Town Engineer, is ten percent more or less than the amount specified in section 8(1) of this Agreement, then the Latecomer Charges specified in sections 1.1 and 1.2 of Schedule "E" shall be adjusted by an amount that permits the Developer to recover no more than its total actual cost.

9. **COMPLY WITH REGULATIONS**

(1) The Developer must comply with the provisions of all Town bylaws throughout the construction of the Excess and Extended Services.

(2) In the event that any material or debris should be left upon any road after the construction of the Excess and Extended Services, the Developer covenants and agrees that the Town may forthwith remove the material or debris at the expense of the Developer, and the cost of the removal shall be determined by the Town Engineer.

(3) In the event that any invoice of the Town, for the removal of material or debris, remains unpaid after 30 days of its receipt by the Developer, the Town may deduct the amount of the invoice from the amount to be paid to the Developer by the Town under section 8(2) of this Agreement.

(4) In the event that, while constructing the Excess and Extended Services, any damage is done to the adjacent properties or to any roads, Town services or works or to any water course or drainage system, the Developer shall, within seven (7) days of such damages, repair or replace or clean them up, or if the repair or replacement will take more than seven (7) days to complete the Developer shall take diligent steps to complete the repair or replacement as soon as reasonably practical, and upon failure to do so the Town will deduct from the amount to be paid to the Developer by the Town under section 8(2) of this Agreement the amount necessary to do such repairs or replacement or clean up.

(5) Any portion of the cost of the repairs, replacement and cleanup set out in 9(4) above that is greater than the amount to be paid to the Developer by the Town under section 8(2) of this Agreement is a debt due to the Town

and must be paid by the Developer to the Town within 30 days of being invoiced.

10. **DEVELOPER'S ENGINEER**

(1) At all times during the design and construction of the Excess and Extended Services, the Developer must employ a professional engineer, registered under the Engineers and Geoscientists Act to practice in the Province of British Columbia, to design and oversee the construction of the Excess and Extended Services.

(2) The Developer's professional engineer must have the authority to act on behalf of the Developer.

(3) Any explanations, orders, instructions, directions and requests given by the Town to the Developer's professional engineer are deemed to have been given to the Developer.

11. **FINAL AS-BUILT DRAWINGS**

The Developer covenants and agrees to submit to the Town final as-built drawings, in a form satisfactory to the Town Engineer of all Excess and Extended Services as constructed and as approved by the Town Engineer.

12. **CHANGES IN STANDARDS**

The Developer, pursuant to Section 511 of the Local Government Act, covenants and agrees to comply with any changes in standards established by bylaw under Part 14 of the Local Government Act that relate to the design or construction of the Excess and Extended Services, and that are made prior to the substantial commencement of the Excess and Extended Services.

13. **DUTIES OF THE DEVELOPER**

The Developer covenants and agrees, prior to final approval of the development, to:

(1) submit to the Town final as-built drawings, including 2 complete sets of prints, 5 additional copies of the overall design plan (key plan), and 1 set of mylar transparencies of all Excess and Extended as constructed and as approved by the Engineer;

(2) pay all arrears of taxes outstanding against the Land;

(3) pay all current taxes levied or to be levied on the Land on the basis and in accordance with the assessment and collector's roll entries; and

(4) pay to the Town, in addition to the Bond required by Section 3 and 14, all inspection fees, administration fees, engineering fees, non-refundable levies and charges, legal costs incurred by the Town directly attributable to this Agreement, and the cost of connecting all utilities to service the development.

14. MAINTENANCE OF WORKS

The Developer covenants and agrees to:

(a) maintain the Excess and Extended Services in complete repair for a period of one year from the Completion Date except for where required as a result of reasonable wear and tear, negligence of the Town, its servants or agents, acts of God, vehicular damage, or vandalism proven;

(b) remedy any defects in the Excess and Extended Services appearing within a period of one year from the Completion Date, save and except for defects caused by reasonable wear and tear, negligence of the Town, its servants or agents, acts of God, or vandalism proven to have been committed after the Completion Date;

(c) as security for the Developer's obligations under section 14(a) and (b), leave with the Town for a period of one year from the Completion Date the sum of One Hundred Ninety Five Thousand Five Hundred Thirty Eight (**$195,538.00**) dollars, by way of a letter of credit (the "Maintenance Security"); and

(d) if the Developer fails to maintain the Excess and Extended Services, remedy any defect or pay for any damage resulting from the Excess and Extended Services, as required under this Agreement, the Town may deduct from the amount deposited pursuant to Section 14(c), the cost of maintaining any Excess and Extended Services, remedying any defect or paying the damage from the security.

15. INDEMNITY

The Developer covenants to save harmless and indemnify the Town against:

(a) all actions, proceedings, costs, damages, expenses, claims and demands (collectively "Claims") whatsoever and by whomsoever brought by reason of the Development or construction of the Excess and Extended Services, to the extent that the Claim is caused by the Town's specifications for the Excess and Extended Services;

(b) all expenses and costs which may be incurred by reason of this Agreement resulting in damage to any property owned in whole or in part by the Town or which the Town by duty or custom is obliged, directly or indirectly, in any way or to any degree, to construct, repair or maintain; and

(c) all expenses and costs which may be incurred by reason of liens, nonpayment of labour or materials, Worker's Compensation assessments, unemployment insurance, Federal and Provincial Tax, or union dues check off.

16. DECLARATION OF DONATIVE INTENT, WAIVER AND RELEASE

(1) To the extent that any of the works to be provided by the Developer are determined by an arbitrator or court of competent jurisdiction not to be excess or extended services for the purposes of section 507 of the Local Government Act ("**Amenities**"), the Developer:

a. acknowledges that the Town does not have the statutory authority to compel the Developer to provide them as a condition of development of the Land. The Developer further acknowledges that the Town, its officials, employees and agents, have not stated, held out or implied any expectation or requirement that the Amenities must be provided in order for the Developer's development to be approved; and

b. without detracting from the obligations of the Town pursuant to Section 7(2) hereof, hereby expresses its intention to donate the Amenities to the Town as a gift, as amenities for the use and enjoyment of the public, without any expectation of payment or reward of any kind.

(2) The Developer further releases, waives and forever discharges the Town from and against any claims, actions, or causes of action, whether based in contract, tort or equity, for damages or losses, for the recovery of costs incurred, including legal expenses, or for unjust enrichment, in connection with the provision of those Amenities.

17. CERTIFICATE OF COMPLETION

(1) The Town agrees to provide the Developer with a Certificate of Completion of the Excess and Extended Services signed by the Town Engineer upon satisfactory completion by the Developer of all of the covenants and conditions in this Agreement.

(2) Notwithstanding anything provided in this Agreement to the contrary, the parties agree that the Town will not be required to collect the Latecomer Charge from any development which is in existence prior to the date of this

Agreement, or for which the Town has approved a subdivision or issued a building permit prior to the date hereof.

18. **ENTIRE AGREEMENT**

This Agreement when executed will set forth the entire agreement and understanding of the parties as at the date hereof with respect to the subject matter hereof and supersede all prior agreements and understandings among the parties with respect to the subject matter hereof and there are no oral or written agreements, promises, warranties, terms, conditions, representations or collateral agreements whatsoever, express or implied, other than those contained in this Agreement.

19. **TIME**

Time is to be the essence of this Agreement.

20. **LAW APPLICABLE**

This Agreement is to be construed in accordance with and governed by the laws applicable in the Province of British Columbia.

21. **TOWN'S PROPERTY IN WORKS**

Upon issuance of the Certificate of Completion the Excess and Extended Services shall become the property of the Town, free and clear of any claim by the Developer or any person claiming through the Developer, and the Developer shall indemnify and save harmless the Town from any such claims.

22. **TERMINOLOGY**

Wherever the singular or the masculine are used in this Agreement, they shall be construed as meaning the plural or the feminine or body corporate or politic where the context or the parties require.

23. **BINDING EFFECT**

This Agreement shall enure to the benefit of and be binding upon the parties hereto, their respective successors and permitted assignees.

24. **HEADINGS**

The headings in this Agreement are inserted for convenience only and shall not be construed as part of this Agreement for the purpose of interpretation.

IN WITNESS WHEREOF the parties have hereto affixed their hands and seals the day, month and year first above written.

TOWN OF LADYSMITH
by its authorized signatory(ies):

_____
Name:

_____
Name:

OYSTER HARBOUR DEVELOPMENT CORP.
by its authorized signatory(ies):

_____
Name:

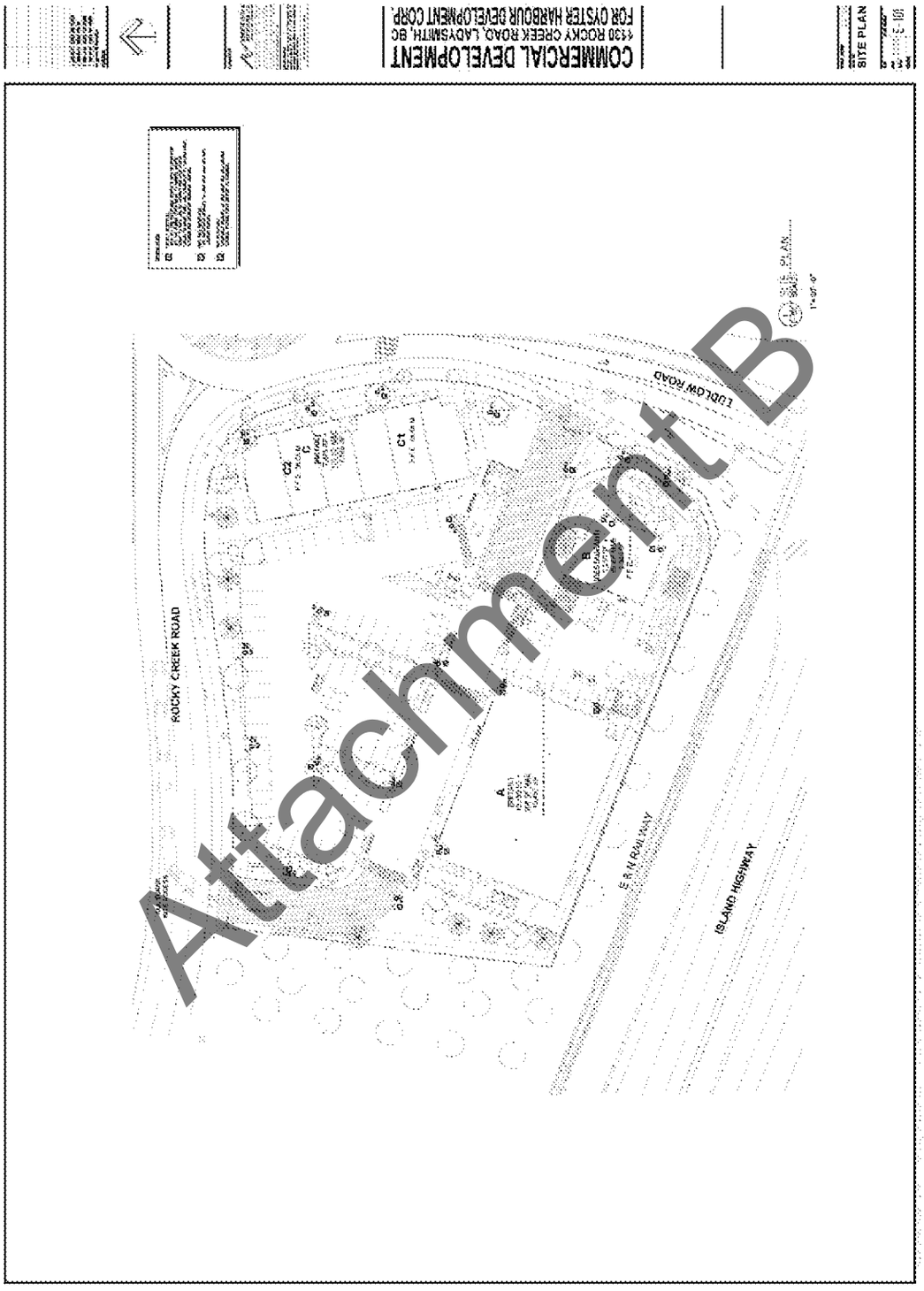
_____
Name:

SCHEDULE "A"

The Land

Parcel Identifier	Legal Description
024-839-370	LOT A DISTRICT LOTS 24 AND 38 OYSTER DISTRICT PLAN VIP71248

SCHEDULE "B"
DRAWINGS AND SPECIFICATIONS



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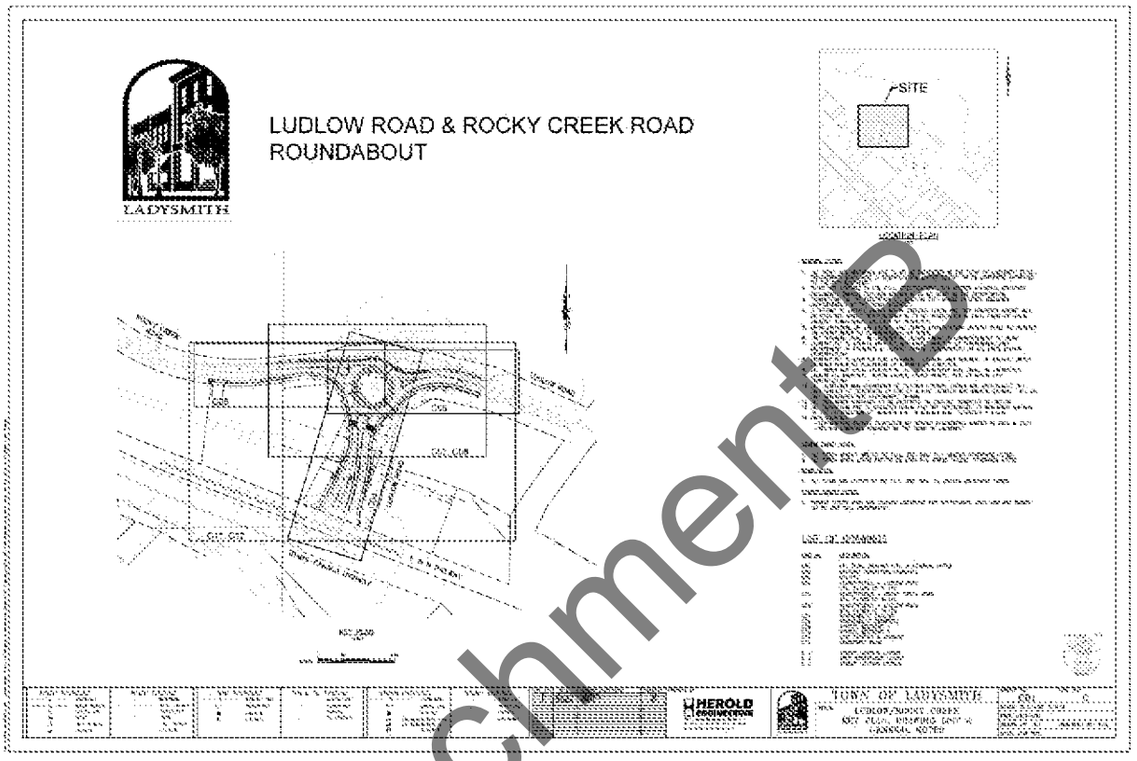
SCHEDULE "C"
DEVELOPMENT
PLAN



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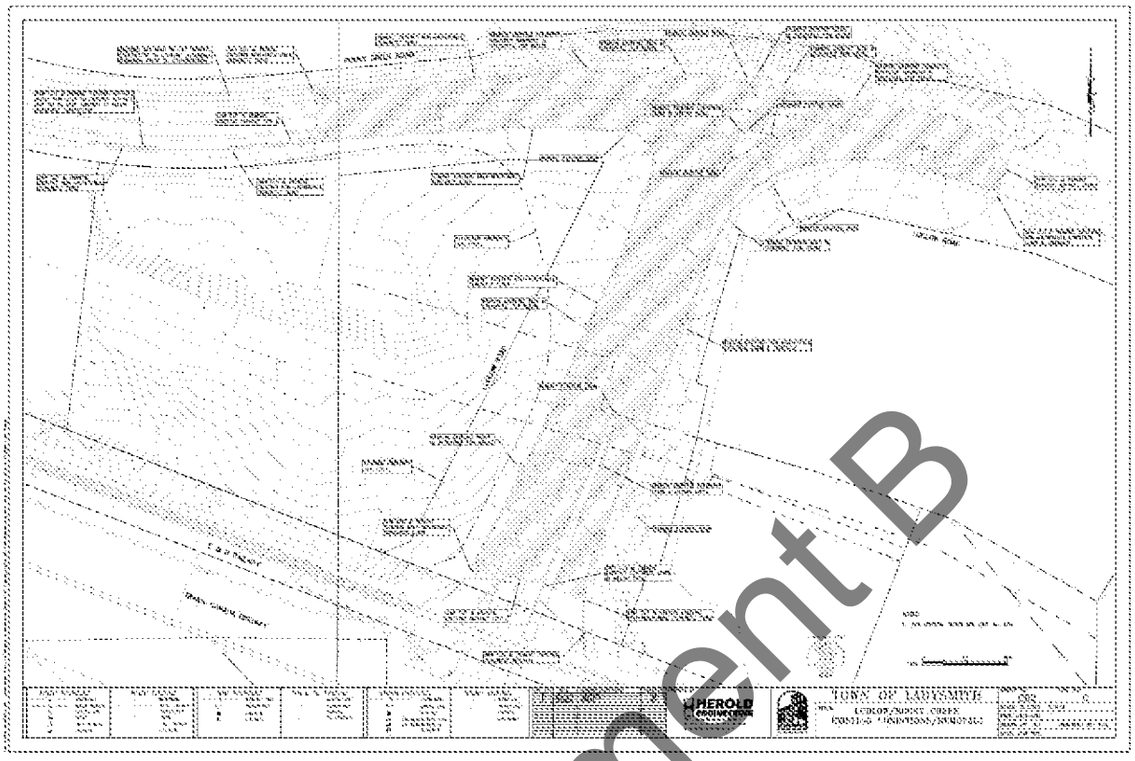

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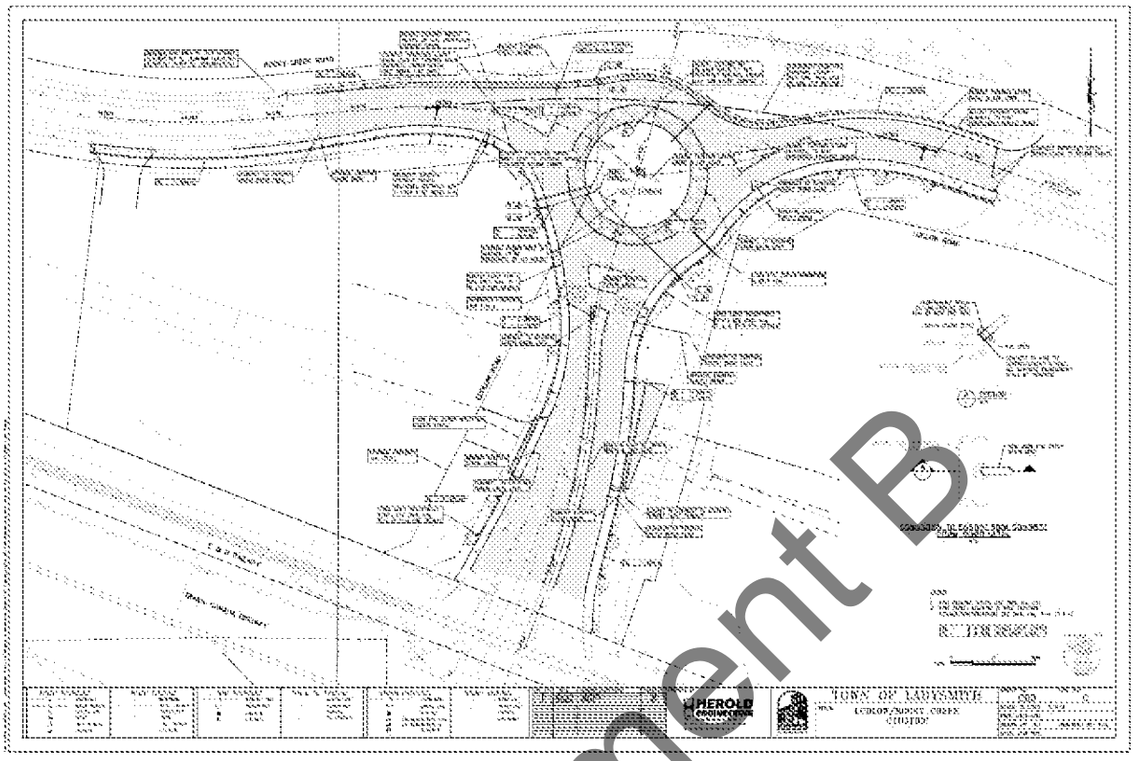

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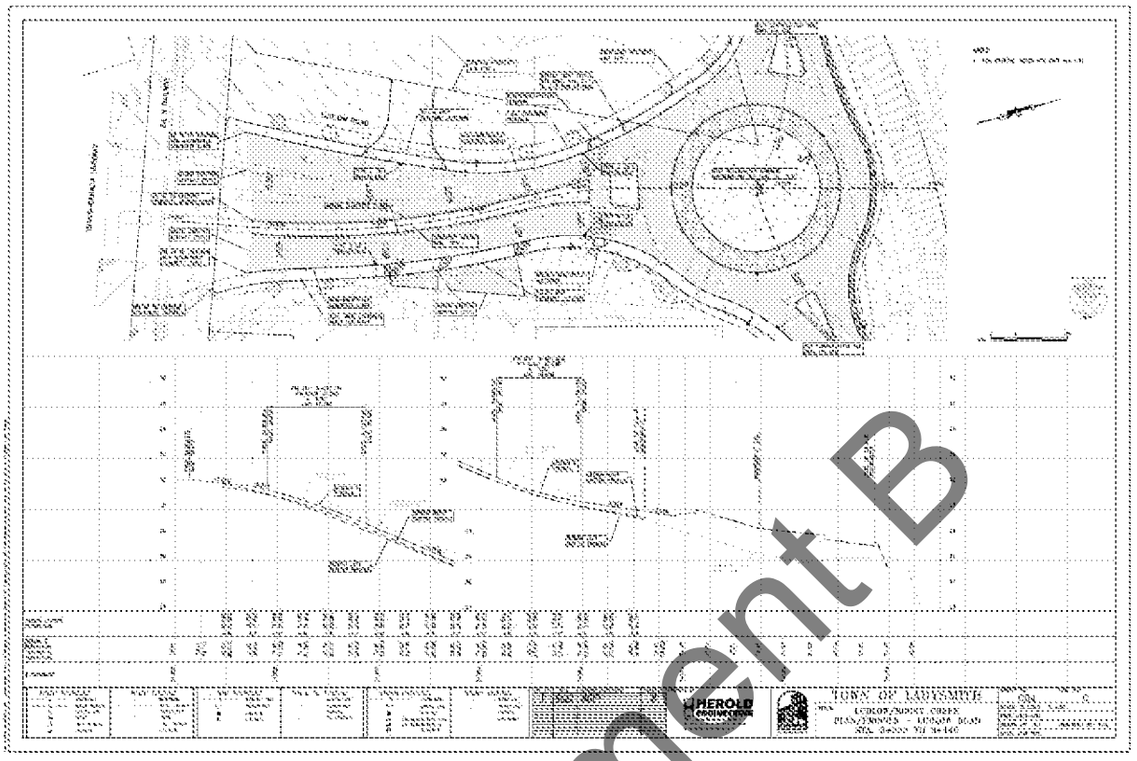

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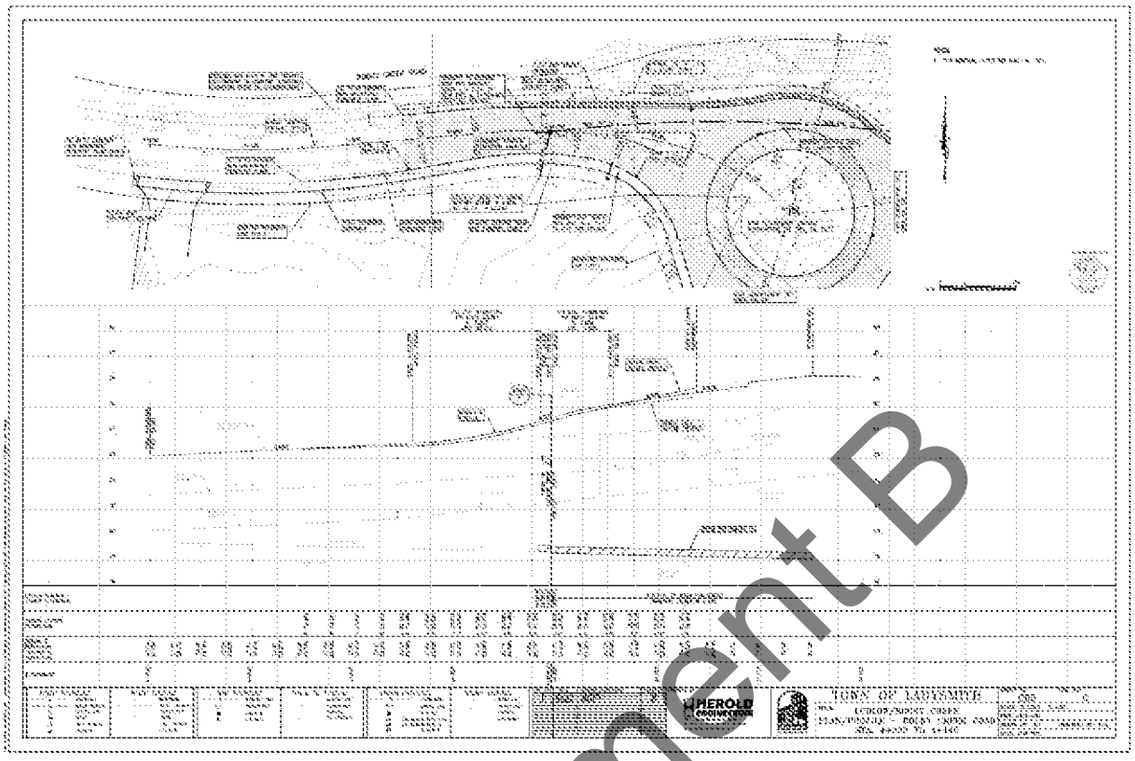

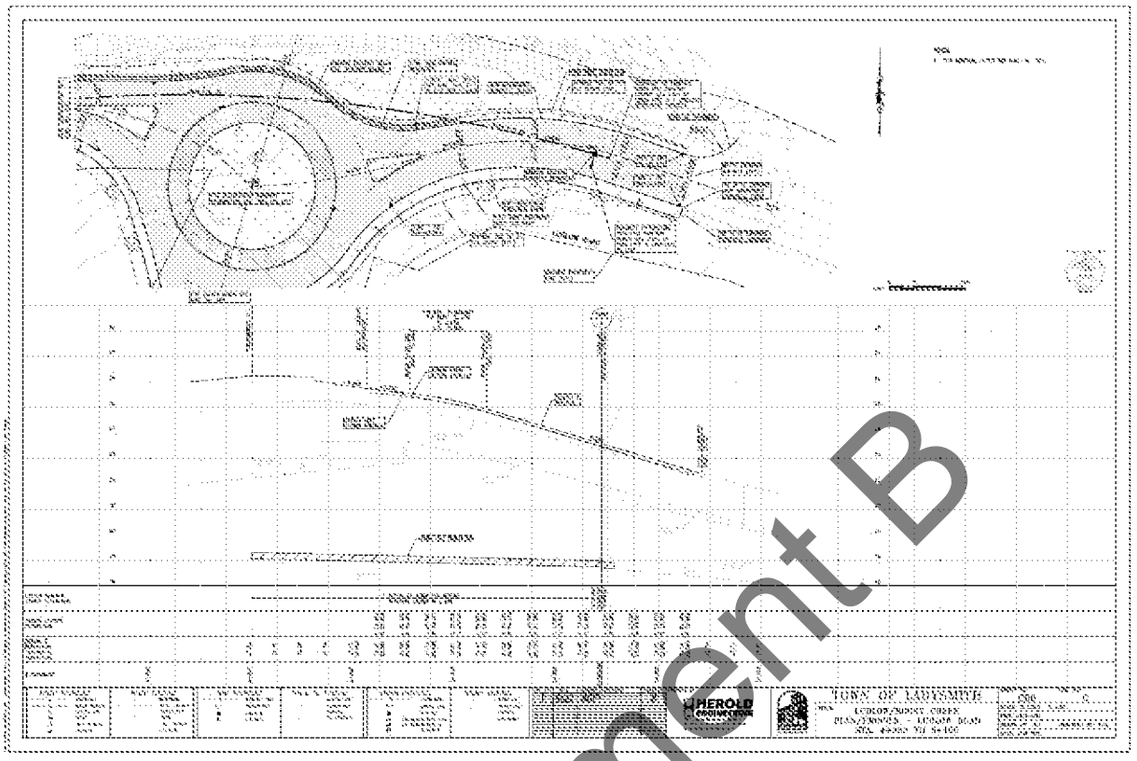

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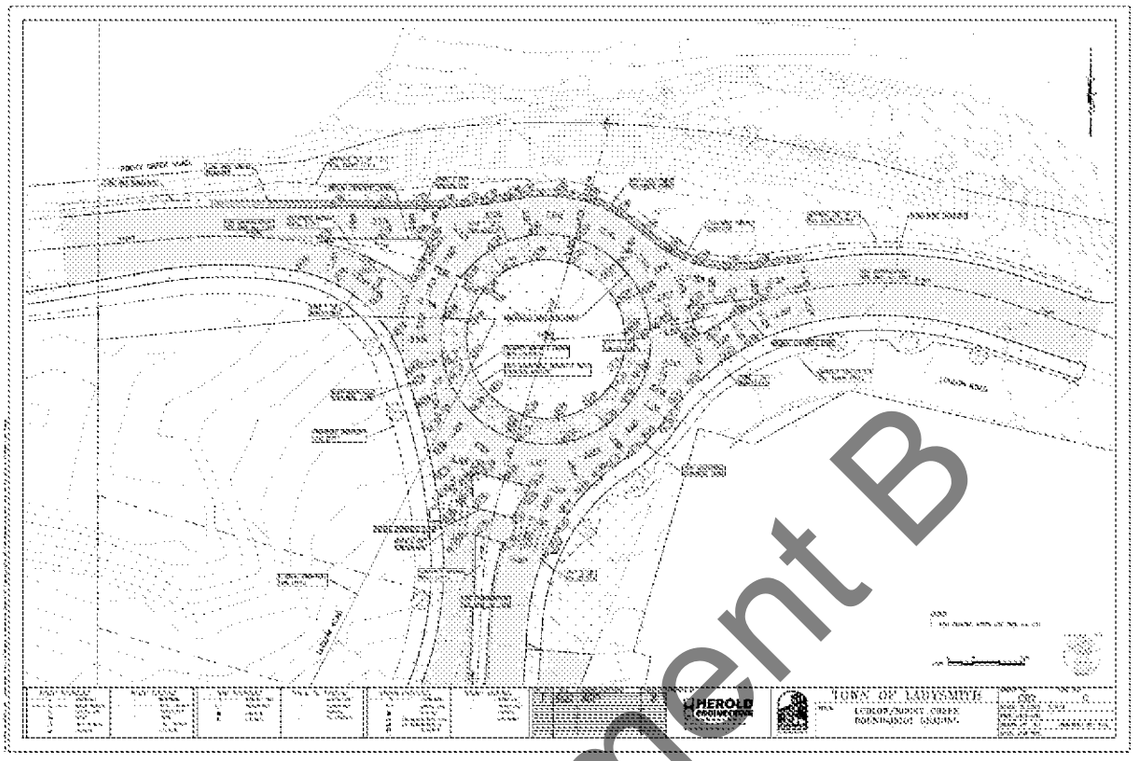

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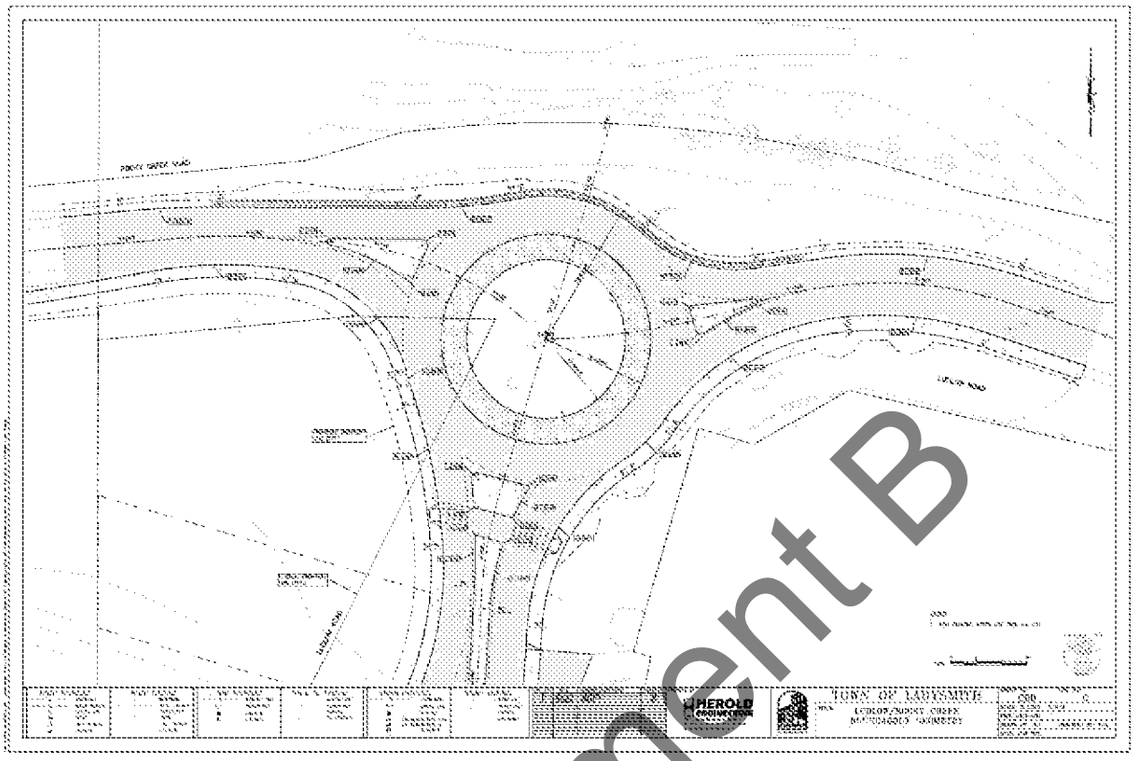

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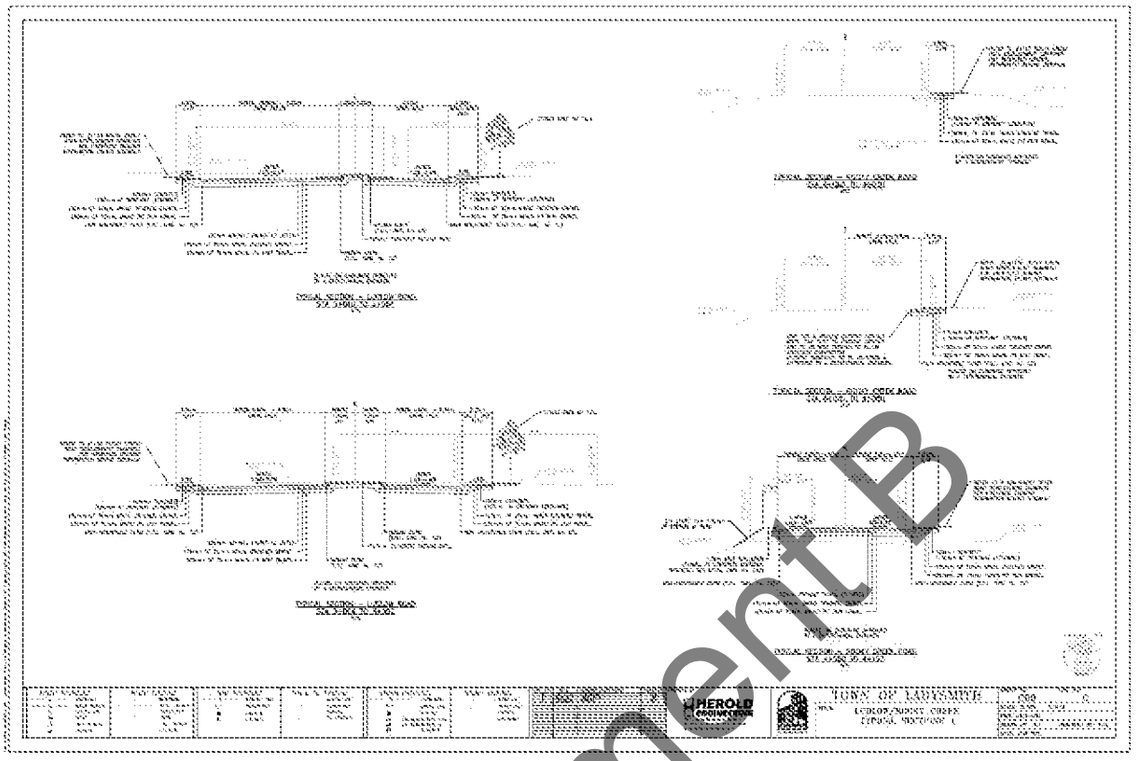

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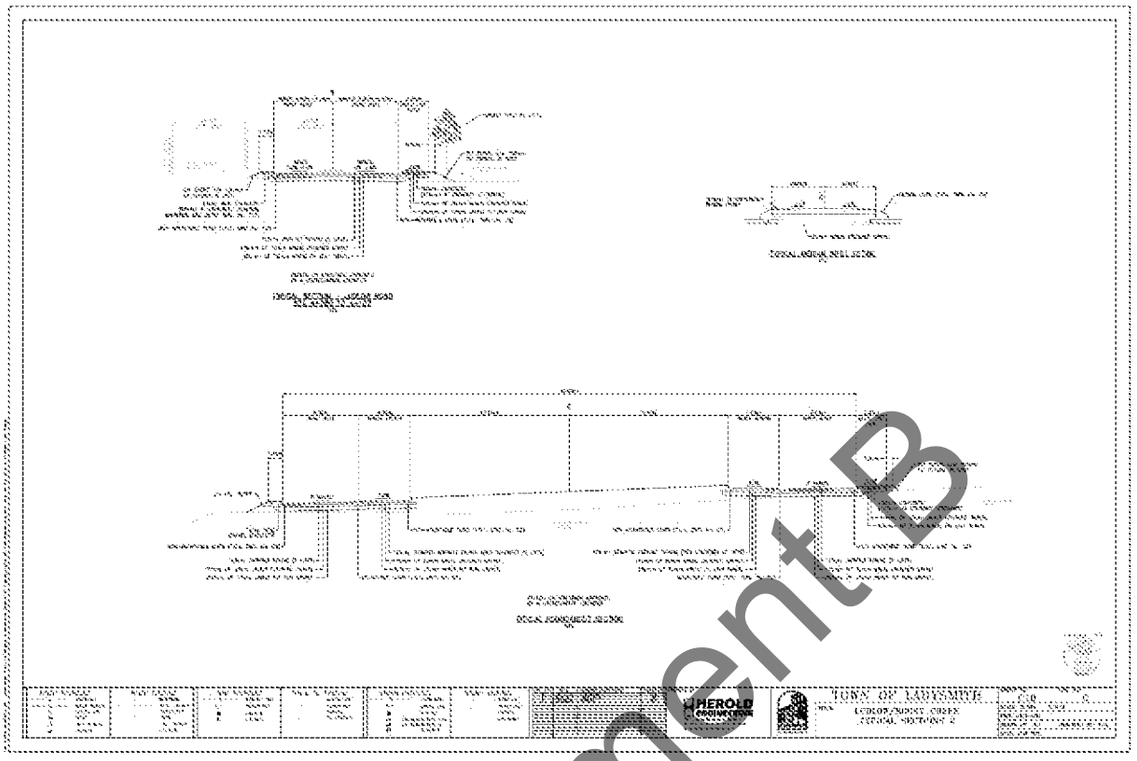

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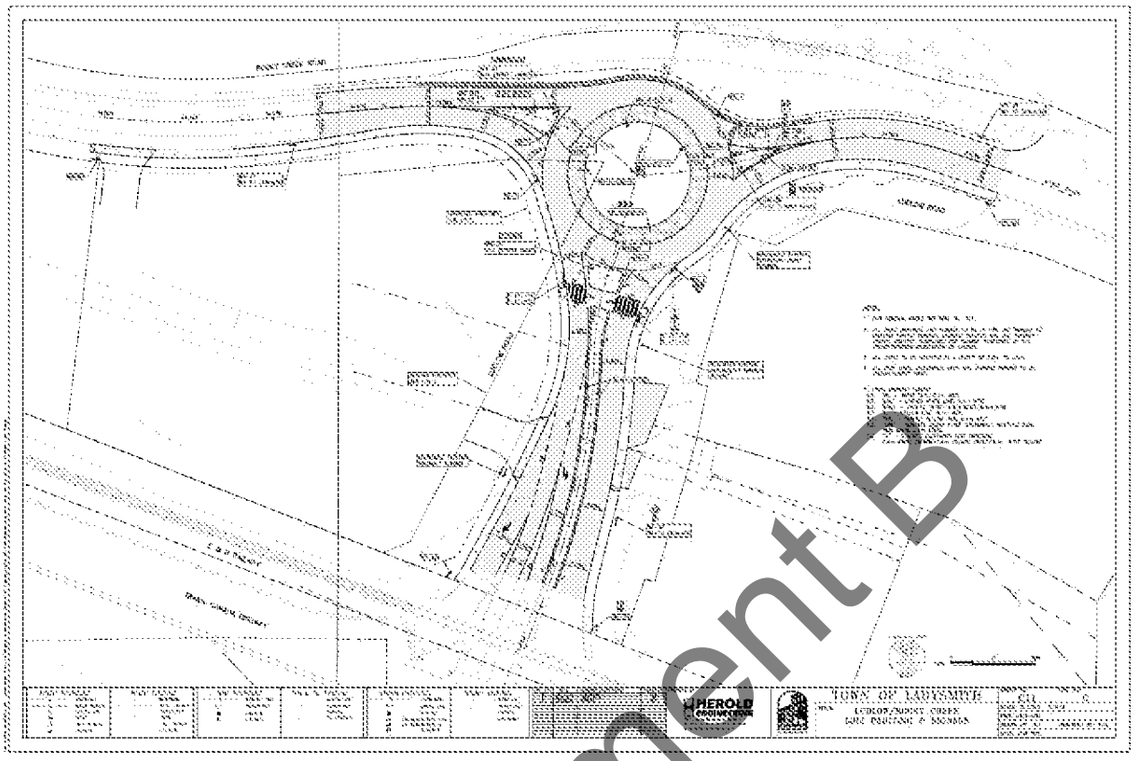

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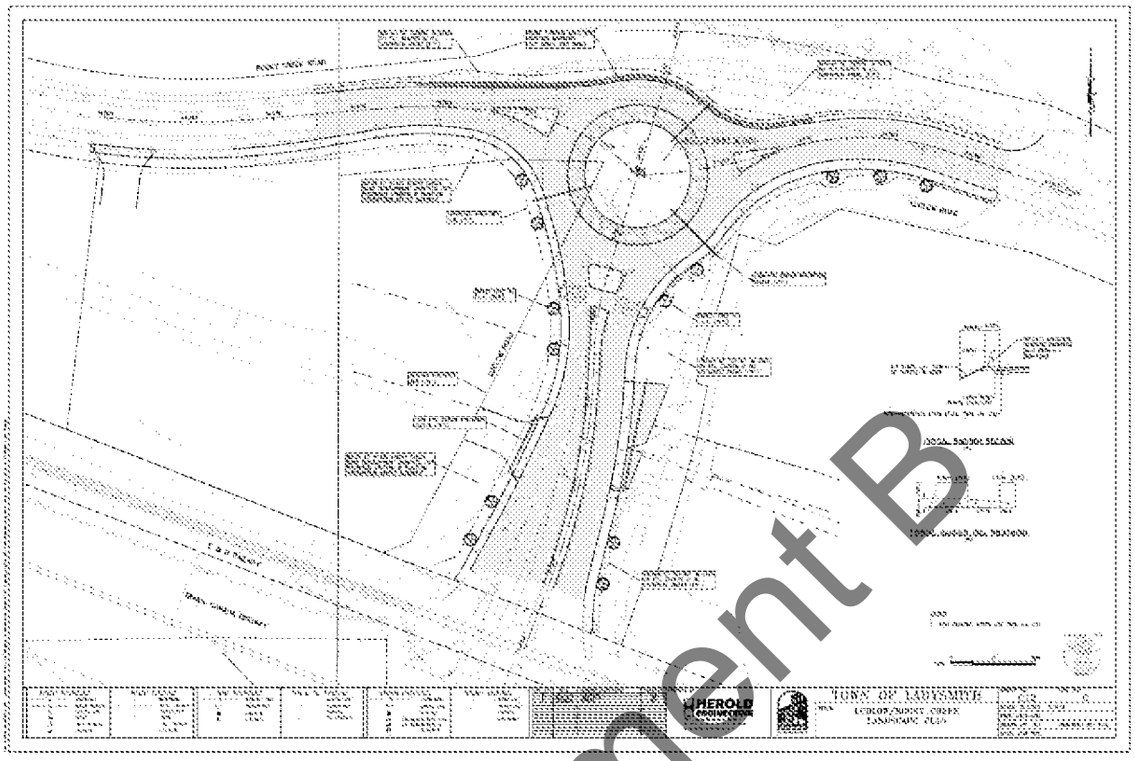


SCHEDULE "D"

Benefitting Lands

Area 1

Parcel Identifier	Legal Description
027-329-135	LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP84189
027-329-143	Lot 2 DL 38 Oyster District Plan VIP84189
027-329-151	Lot 3 DL 38 Oyster District Plan VIP84189
027-329-160	Lot 4 DL 38 VIP84189
027-329-178	Lot 5 DL 38 VIP84189
024-839-370	Lot A District Lots 24 and 38 Oyster District Plan VIP71248
027-236-986	Lot 1 DL 24 VIP83837
030-721-083	Lot A DL 24 Oyster District Plan EPP86590
030-721-091	Lot B DL 24 Oyster District Plan EPP86590
026-789-990	Lot 1 DL 24 VIP81464
027-104-770	Lot A DL 24 Oyster District Plan VIP83303, except part in plan VIP83837
027-104-788	Lot B DL 24 Oyster District Plan VIP83303
010-208-682	Lot 2 DL 24 Oyster District Plan 45800 except that part in Plan VIP73654 & Plan EPP71248
030-553-164	Lot A DL 24 Oyster District Plan EPP71248
010-208-712	Lot 3 DL 24 Oyster District Plan 45800
90048005	DL 2059 Cowichan District 7TU1947 - Crown

Area 2

Parcel Identifier	Benefiting Lands Civic address and/or legal
009-449-914	PARCEL A (DD 2853N) OF DISTRICT LOTS 24 AND 38, OYSTER DISTRICT, EXCEPT PARTS IN PLANS 398 RW, 423 RW, 17025 AND VIP68020
025-202-341	1300 Rocky Cr Rd - LOT 8 SECTION 6 AND DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
025-202-332	1280 Rocky Cr Rd - Lot 7 District Lot 38 Oyster District Plan VIP73070
025-202-324	1260 Rocky Cr Rd -Lot 6 District Lot 38 Oyster District Plan VIP73070
025-202-316	LOT 5 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
025-980-688	1200 Rocky Cr Rd - LOT A (EW89248) DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
025-202-278	1160 Rocky Cr Rd - LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070
030-801-460	Lot A DLs 81, 86 & 98 Oyster District Plan EPP87265
030-801-478	Lot B DLs 86, 87 & 98 Oyster District and DL 2054 Cowichan District Plan EPP87265
028-404-645	1221 Rocky Cr Rd - Lot 4 DLs 84 & 87 Oyster District Plan VIP88459
024-644-650	1181 Rocky Cr Rd - Lot 1 District Lot 84 Oyster District Plan VIP69584
009-579-541	DISTRICT LOT 84, OF DISTRICT LOT 38, OYSTER DISTRICT, EXCEPT PARCEL A (DD

	9912N), PARCEL B (DD 6616N) AND PARCEL C (DD 11418N) AND EXCEPT THAT PART IN PLAN VIP70167
009-579-630	DISTRICT LOT 87, OF DISTRICT LOT 38, OYSTER DISTRICT, EXCEPT PART IN PLAN 19015, VIP70166 AND VIP88459
009-450-068	District Lot 104 Oyster District Except part in plan 398RW
000-879-100	THAT PART OF DISTRICT LOT 104, OYSTER DISTRICT, SHOWN OUTLINED IN RED ON PLAN 398 RW, CONTAINING .19 OF AN ACRE MORE OR LESS EXCEPT PART IN PLAN VIP69582
027-764-958 027-764-966 027-764-974 027-764-982 027-764-991 027-765-008 027-765-016 027-765-024 027-845-460 027-846-067 027-846-075 027-846-083 027-846-091 027-846-105 027-846-113 027-846-121 027-846-130 027-846-148 027-846-156 027-846-164 027-846-172 027-846-181 027-846-199 027-846-202 027-846-211 027-846-229 027-846-237 027-846-245	(Strata Lot 1 to Strata Lot 28) Plan VIS6726 District Lot 38 Land District 43 TOGETHER WITH AN INTEREST IN THE COMMON PROPERTY IN PROPORTION TO THE UNIT ENTITLEMENT OF THE STRATA LOT AS SHOWN ON FORM V (1156 to 1158 Rocky Creek Road)
027-764-893	LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP86027 EXCEPT PART IN STRATA PLAN VIS6726 (PHASES 1 AND 2) AND PLAN EPP23810
030-552-893	PARCEL E (BEING A CONSOLIDATION OF LOTS A AND B, SEE CA7024627) DISTRICT LOT 38 OYSTER DISTRICT PLN EPP36585
029-272-751	LOT C DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585
029-272-769	LOT D DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585
010-208-828	Transfer Beach - LOT 4 DISTRICT LOTS 8G, 11G, 24 AND 56 OYSTER DISTRICT PLAN 45800 EXCEPT PLANS VIP64405, VIP71943, VIP72131 AND EPP100459

SCHEDULE "E"

CALCULATION OF LATECOMER CHARGES

1.0 Benefitting Lands

1.1 Subject to an adjustment under section 8(6) of this Agreement, Benefitting Lands located in Area 1 shall pay a charge of **$19,310.43** per hectare at the earlier of the time of subdivision or at the time of building permit application for construction with a value of over $50,000, as determined in accordance with the Town's Building Bylaw.

1.2 Subject to an adjustment under section 8(8) of this Agreement, Benefitting Lands located in Area 2 shall pay a charge of **$14,482.82** per hectare at the earlier of the time of subdivision or at the time of a building permit application for construction with a value of over $50,000, as determined in accordance with the Town's Building Bylaw.

The following tables summarize the latecomer charts payable by the owner of the Benefitting Lands in accordance with sections 1.1 to 1.2 of this Schedule "E".

Maximum Latecomer Charges for Benefitting Lands in Area 1

Benefiting Lands Civic address and/or legal	Parcel Identifier	Parcel Area in Hectares	Total Latecomer Charge ($19,310.43 per Hectare)
1142 Rocky Creek Rd - LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP84189	027-329-135	0.15	$ 2,857.94
1140 Rocky Creek Rd - Lot 2 DL 38 Oyster District Plan VIP84189	027-329-143	0.15	$ 2,857.94
Lot 3 DL 38 Oyster District Plan VIP84189	027-329-151	0.16	$ 3,031.74
1134 Rocky Creek Rd - Lot 4 DL 38 VIP84189	027-329-160	0.16	$ 3,089.67
1132 Rocky Creek Rd - Lot 5 DL 38 VIP84189	027-329-178	0.17	$ 3,321.39
1130 Rocky Creek Rd - Lot A District Lots 24 and 38 Oyster District Plan VIP71248	024-839-370	0.81	$ 15,641.45
1010 Ludlow Rd - Lot 1 DL 24 VIP83837	027-236-986	0.74	$ 14,212.48
Lot A DL 24 Oyster District Plan EPP86590	030-721-083	0.29	$ 5,619.34
Lot B DL 24 Oyster District Plan EPP86590	030-721-091	0.30	$ 5,715.89
940 Ludlow Rd - Lot 1 DL 24 VIP81464	026-789-990	0.35	$ 6,720.03
1031 Oyster Bay Dr - Lot A DL 24	027-104-770	0.53	$ 10,215.22

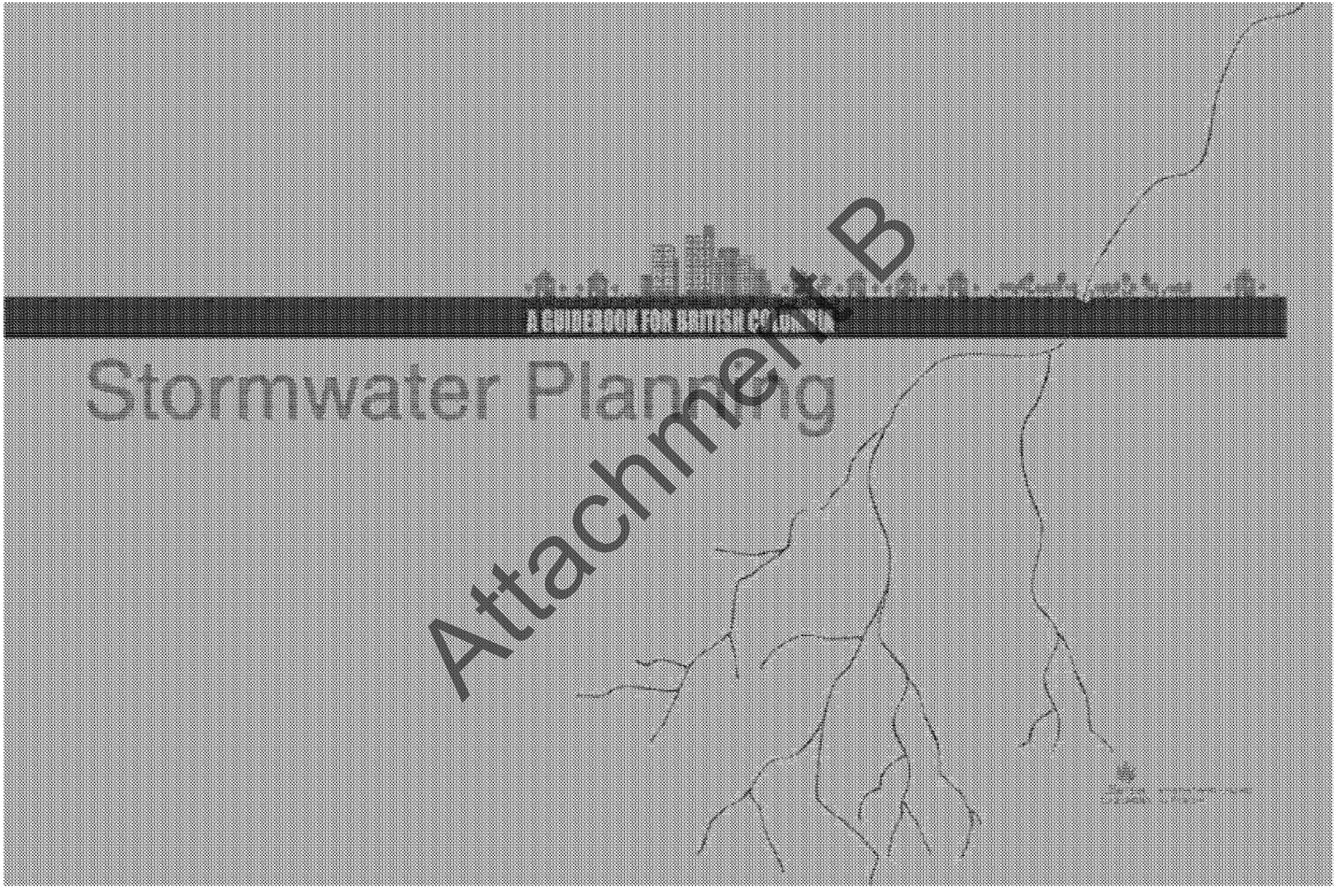
Oyster District Plan VIP83303, except part in plan VIP83837			
941 Oyster Bay Dr - Lot B DL 24 Oyster District Plan VIP83303	027-104-788	0.34	$ 6,623.48
940 Ludlow Rd - Lot 2 DL 24 Oyster District Plan 45800 except that part in Plan VIP73654 & Plan EPP71248	010-208-682	1.06	$ 20,546.30
Lot A DL 24 Oyster District Plan EPP71248	030-553-164	0.60	$ 11,566.95
Lot 3 DL 24 Oyster District Plan 45800	010-208-712	0.11	$ 2,201.39
DL 2059 Cowichan District 7TU1947 - Crown	90048005	1.49	$ 28,772.55

Maximum Latecomer Charges for Benefitting Lands in Area 2

Benefiting Lands Civic address and/or legal	Parcel Identifier	Parcel Area in Hectares	Total Latecomer Charge ($14,482.82 per Hectare)
PARCEL A (DD 2853N) OF DISTRICT LOTS 24 AND 38, OYSTER DISTRICT, EXCEPT PARTS IN PLANS 398 RW, 423 RW, 17025 AND VIP68020	009-449-914	16.60	$ 240,414.89
1300 Rocky Cr Rd - LOT 8 SECTION 6 AND DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-202-341	0.35	$ 5,011.06
1280 Rocky Cr Rd - Lot 7 District Lot 38 Oyster District Plan VIP73070	025-202-332	0.35	$ 5,011.06
1260 Rocky Cr Rd -Lot 6 District Lot 38 Oyster District Plan VIP73070	025-202-324	0.20	$ 2,925.53
LOT 5 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-202-316	0.20	$ 2,925.53
1200 Rocky Cr Rd - LOT A (EW89248) DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-980-688	0.61	$ 8,776.59
1160 Rocky Cr Rd - LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP73070	025-202-278	0.20	$ 2,925.53
Lot A DLs 81, 86 & 98 Oyster District Plan EPP87265	030-801-460	4.69	$ 67,924.45
Lot B DLs 86, 87 & 98 Oyster District and DL 2054 Cowichan District Plan EPP87265	030-801-478	3.36	$ 48,662.29
1221 Rocky Cr Rd - Lot 4 DLs 84 & 87 Oyster District Plan VIP88459	028-404-645	1.25	$ 18,103.53
1181 Rocky Cr Rd - Lot 1 District Lot 84 Oyster District Plan VIP69584	024-644-650	0.21	$ 3,041.39
DISTRICT LOT 84, OF DISTRICT LOT 38,	009-579-541	3.06	$ 44,317.44

OYSTER DISTRICT, EXCEPT PARCEL A (DD 9912N), PARCEL B (DD 6616N) AND PARCEL C (DD 11418N) AND EXCEPT THAT PART IN PLAN VIP70167			
DISTRICT LOT 87, OF DISTRICT LOT 38, OYSTER DISTRICT, EXCEPT PART IN PLAN 19015, VIP70166 AND VIP88459	009-579-630	0.69	$ 9,993.15
District Lot 104 Oyster District Except part in plan 398RW	009-450-068	2.34	$ 33,889.81
THAT PART OF DISTRICT LOT 104, OYSTER DISTRICT, SHOWN OUTLINED IN RED ON PLAN 398 RW, CONTAINING .19 OF AN ACRE MORE OR LESS EXCEPT PART IN PLAN VIP69582	000-879-100	0.08	$ 1,115.18
1156 to 1158 Rocky Creek Road	027-764-958 027-764-966 027-764-974 027-764-982 027-764-991 027-765-008 027-765-016 027-765-024 027-845-460 027-846-067 027-846-075 027-846-083 027-846-091 027-846-105 027-846-113 027-846-121 027-846-130 027-846-148 027-846-156 027-846-164 027-846-172 027-846-181 027-846-199 027-846-202 027-846-211 027-846-229 027-846-237 027-846-245	0.48	$ 6,951.76
LOT 1 DISTRICT LOT 38 OYSTER DISTRICT PLAN VIP86027 EXCEPT PART IN STRATA PLAN VIS6726 (PHASES 1 AND 2) AND PLAN EPP23810	027-764-893	0.15 ha	$ 2,172.42

PARCEL E (BEING A CONSOLIDATION OF LOTS A AND B, SEE CA7024627) DISTRICT LOT 38 OYSTER DISTRICT PLN EPP36585	030-552-893	0.411 ha	$ 5,952.44
LOT C DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585	029-272-751	0.146 ha	$ 2,114.49
LOT D DISTRICT LOT 38 OYSTER DISTRICT PLAN EPP36585	029-272-769	0.137 ha	$ 1,984.15
Transfer Beach - LOT 4 DISTRICT LOTS 8G, 11G, 24 AND 56 OYSTER DISTRICT PLAN 45800 EXCEPT PLANS VIP64405, VIP71943, VIP72131 AND EPP100459	010-208-828	9.745 Ha	$ 141,207.54


Stormwater Planning
Attachment B

Acknowledgements

From the outset, the production of this Guidebook has been a cooperative project involving several agencies and local governments who are challenging traditional stormwater management practices in British Columbia. The Project Steering Committee included: Peter Law (project manager), Laura Maclean, Chris Jenkins, Helene Roberge, Eric Bonham, John Finnie, Sean DePol and Brigid Reynolds.

The primary authors of the document are: Kim A. Stephens M.Eng., P.Eng. (CH2M Hill Canada Ltd.), Patrick Graham B.A.Sc., M.R.M. (CH2M Hill Canada Ltd.) and David Reid B.C.S.L.A. Landscape Architect, Planner (Lanarc Consultants).

We wish to acknowledge financial support from the following organizations; B.C. Ministry of Community, Aboriginal and Women's Services, Municipal Engineering Section; B.C. Ministry of Water, Land and Air Protection, Environmental Stewardship Division, Biodiversity Branch and Vancouver Island Region; Environment Canada through the Georgia Basin Ecosystem Initiative and the Regional District of Nanaimo.

BRITISH COLUMBIA
Ministries of Community, Aboriginal and Women's Services and Water, Land and Air Protection

REGIONAL DISTRICT OF NANAIMO

Environment Canada Environnement Canada

Georgia Basin Ecosystem Initiative
Working Together for the Georgia Basin

We also wish to thank the Project Advisory Committee who reviewed and contributed to various drafts of this document: Megan Sterling and Melody Farrell, Department of Fisheries and Oceans; Ted van der Gulik, Ministry of Agriculture, Fisheries and Food; Graham Savage, City of Nanaimo; Gary O'Rourke, City of Parksville; Bob Weir, Town of Qualicum Beach; Bob Cook, Ministry of Sustainable Resource Management; and Erik Karlsen, Ministry of Community, Aboriginal and Women Services.

Appreciation is extended to more than 50 local government engineers, planners, technicians and biologists from across the Province, who reviewed and commented on the 2nd draft of this document.

The Guidebook draws heavily on case study experience from various local governments and developers in BC. We wish to thank the following local governments for allowing us to use their material and benefit from their experience.

City of Chilliwack

City of Coquitlam

District of Maple Ridge

Greater Vancouver Regional District

Regional District of Nanaimo

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Environment Canada
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Email: Laura.Maclean@ec.gc.ca

How to Use the Guidebook

The Stormwater Planning Guidebook is structured to meet the information needs of different audiences: from senior managers and elected officials… to those professional planning and engineering staff who are tasked with implementing early action… to land developers and the consulting community.

The Guidebook is Structured in Three Parts:

- ***Part A – The Problem and Principles*:** written for senior managers, elected officials and those wanting a general introduction to integrated stormwater management.
- ***Part B – The Solutions*:** written mainly for engineers and planners, this part provides examples of how to achieve integrated stormwater management at both planning and site levels.
- ***Part C – The Process*:** written for administrators and the complete range of stakeholders who will be involved in making the move from planning to action, this part defines roles, methods, means and timing for integrated stormwater management.

For readers who are new to integrated stormwater management, Part A is required reading.

Readers looking for a sense of what integrated stormwater management means on the ground will enjoy the examples in Part B.

Those wanting to start or fund an integrated stormwater management plan or program will find organizational advice in Part C.

The Guidebook draws heavily on case study experience by leading local governments and developers in BC. The illustrations are adapted from projects by the authors.

The overall objective of this Guidebook is to offer a common sense, effective and affordable approach to integrated stormwater management.

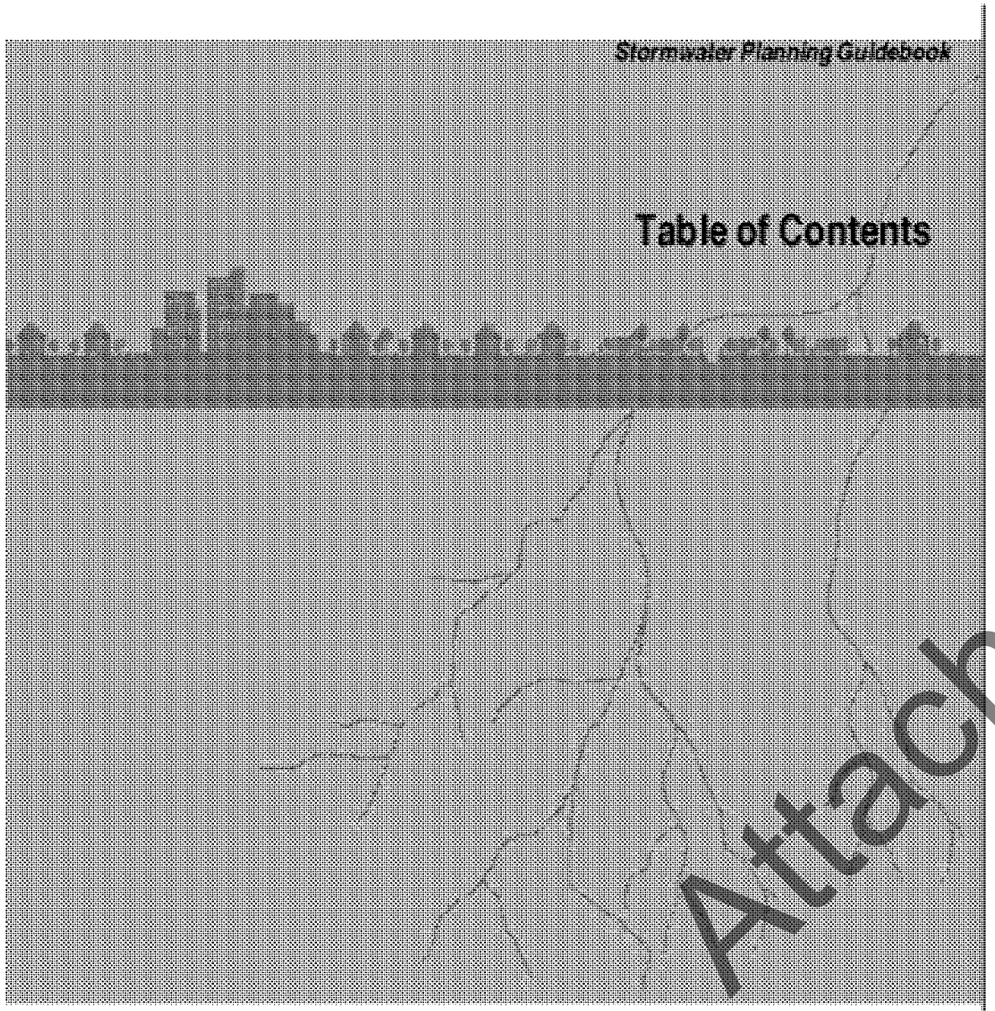


Table of Contents

LIST OF FIGURES

LIST OF TABLES

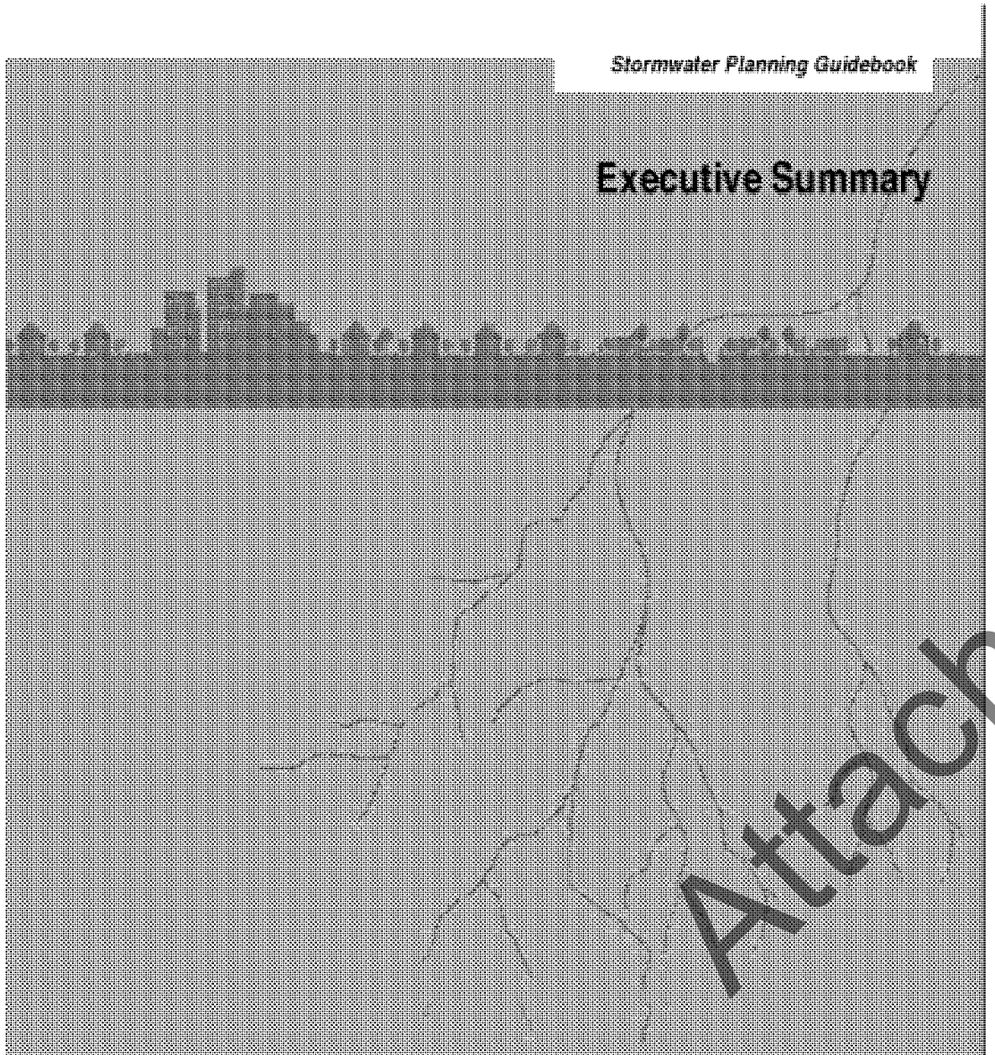


Table of Contents

Executive Summary

Stormwater management in British Columbia is a key component of protecting quality of life, property and aquatic ecosystems.

The science and practice of stormwater management is constantly evolving, in British Columbia and around the world. Within BC, the range of stormwater management activity varies from completely unplanned in many rural areas, to state-of-the-art in some metropolitan centres. The purpose of this Guidebook is to provide a framework for effective stormwater management that is usable in all areas of the province.

The Guidebook presents a methodology for moving from planning to action that focuses the limited financial and staff resources of governments, non-government organizations and the development community on implementing early action where it is most needed.

The Guidebook is organized in three parts: Part A defines the problem, Part B provides solutions and Part C defines the process.

The Guidebook provides a comprehensive understanding of the issues and a framework for implementing an integrated approach to stormwater management. Case study experience underpins the approaches and strategies that are presented in the Guidebook.

Stormwater Component of Liquid Waste Management Plans

In British Columbia, the *Local Government Act* has vested the responsibility for drainage with municipalities. With the statutory authority for drainage, local governments can be held liable for downstream impacts that result from changes to upstream drainage patterns – both volume and rate. The *Act* also enables local governments to be proactive in implementing stormwater management solutions that are more comprehensive than past practice.

Furthermore, a stormwater component is a requirement for approved *Liquid Waste Management Plans* (LWMPs). Guidelines for developing a LWMP were first published in 1992. LWMPs are created by local governments under a public process in co-operation with the Province.

An OCP Provides the Foundation for a LWMP

There is a clear link between the land use planning required of local governments in the *Local Government Act* and the LWMP process. In most cases where an *Official Community Plan* (OCP) is in place, the local government planning statement (bylaw) will form the basis for a LWMP. The purposes of a LWMP are to minimize the adverse environmental impact of the OCP and ensure that development is consistent with Provincial objectives.

OCPs tend to be led by planners, with input from engineers on infrastructure sections. LWMPs tend to be led by engineers, with little or no input from planners. Both processes involve approval by a Local Council or a Regional Board.

In some cases, a LWMP process may be a trigger that focuses attention on stormwater management. Public concern related to flooding or habitat loss may be the trigger. Or an OCP public process may communicate public interest in raising local environmental and habitat protection standards.

Whatever the driver, at the end of the process an OCP should include goals and objectives for stormwater management. These goals and objectives, or a variant of them, might first reside in a LWMP, and then be adapted to the OCP in the next review process. Or they may originate in the OCP process, and then be detailed through a LWMP. Either way is entirely acceptable.

Integrated Stormwater Management Planning

In British Columbia, the term *Integrated Stormwater Management Plan* (ISMP) has gained widespread acceptance by local governments and the environmental agencies to describe a comprehensive approach to stormwater planning. The purpose of an ISMP is to provide a clear picture of how to be proactive in applying land use planning tools to protect property and aquatic habitat, while at the same time accommodating land development and population growth.

Part A – Why Integrated Stormwater Management?

Part A identifies problems associated with traditional stormwater management and provides the rationale for a change from traditional to integrated stormwater management. Some guiding principles of integrated stormwater management are introduced.

Part A also builds a science-based understanding of how natural watersheds function and how this function is affected by land use change.

Part B – Integrated Stormwater Management Solutions

Part B outlines the scope and policy framework for integrated stormwater management, and presents a cost-effective methodology for developing stormwater solutions.

Step #1 - Identify At-Risk Drainage Catchments

A methodology is presented for identifying at-risk drainage catchments to focus priority action. The methodology relies on a roundtable process that brings together people with knowledge about future land use change, high-value ecological resources and chronic flooding problems. The key is effective integration of planning, engineering and ecological perspectives.

Step #2 - Set Preliminary Performance Targets

A methodology is presented for:

- Developing watershed performance targets based on site-specific rainfall data, supplemented by streamflow data (if available) and on-site soils investigations
- Translating these performance targets into design guidelines that can be applied at the site level to mitigate the impacts of land development

The Guidebook documents British Columbia case studies of stormwater policies and science-based performance targets applied to both greenfield and urban retrofit scenarios.

Step #3 - Select Appropriate Stormwater Management Site Design Solutions

Guidance is provided for selecting appropriate site design solutions to meet performance targets. Examples include:

- Design and performance of stormwater source controls for various land uses
- Watershed scale modeling of the effectiveness of site design solutions

British Columbia case studies are examined for greenfield and urban retrofit scenarios. A 'Water Balance Model' is also applied for linking performance targets to design guidelines for source control and runoff conveyance.

Part C – Moving from Planning to Action

Part C describes a process that will lead to better stormwater management solutions.

The role and design of action plans are introduced to bring a clear focus to what needs to be done, with what priority, by whom, with related budgets.

Tips are provided on processes that produce timely and high-quality decisions.

Part C also provides guidance for organizing an administrative system and financing strategy for stormwater management.

A final section on building consensus and implementing change describes how to develop a shared vision and overcome barriers to change.

Two acronyms provide a useful summary of the principles and elements of integrated stormwater management:

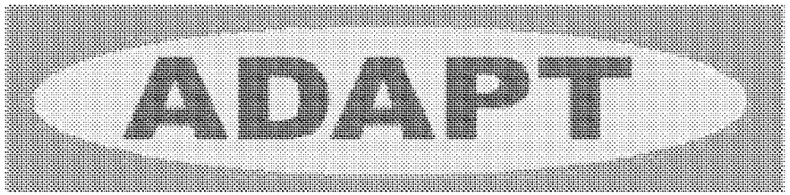
A D A P T

to the

C U R E

ADAPT –
The Guiding Principles of Integrated Stormwater Management

The acronym **ADAPT** summarizes five guiding principles for integrated stormwater management. The Guidebook is based upon these five principles.



Agree that stormwater is a resource

Design for the complete spectrum of rainfall events

Act on a priority basis in at-risk drainage catchments

Plan at four scales – regional, watershed, neighbourhood & site

Test solutions and reduce costs by adaptive management.

Guiding Principle 1 - Agree that Stormwater is a Resource

Stormwater is no longer seen as just a drainage or flood management issue but also a resource for:

- fish and other aquatic species
- groundwater recharge (for both stream summer flow and for potable water)
- water supply (e.g. for livestock or irrigation)
- aesthetic and recreational uses

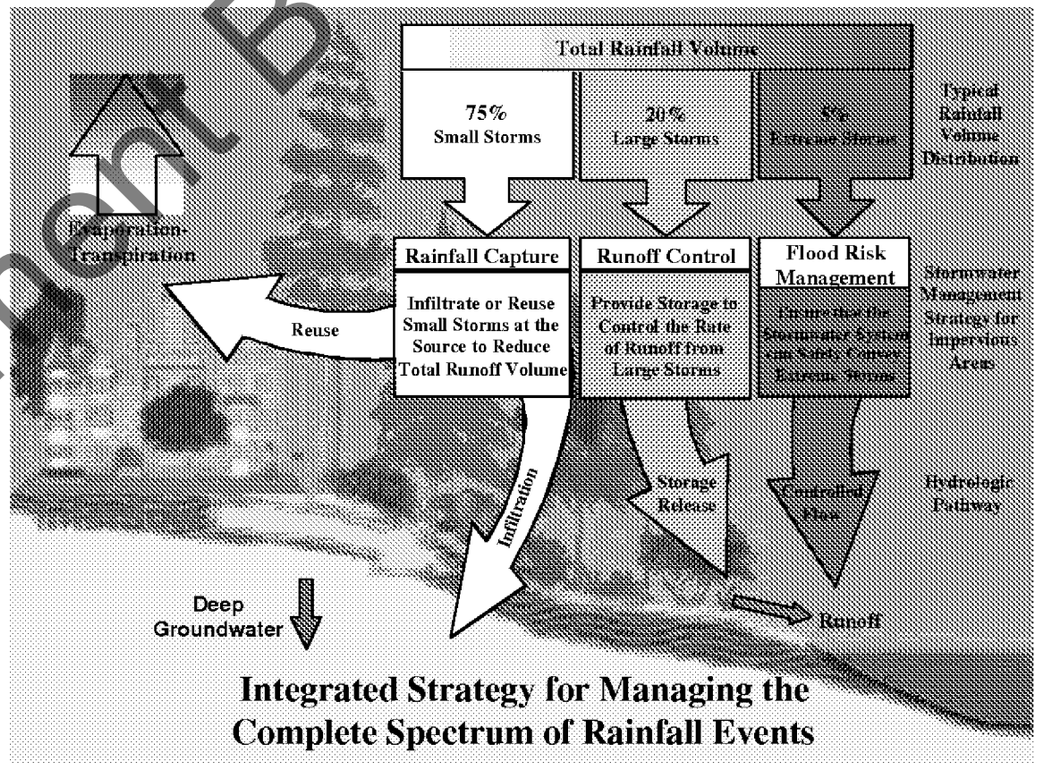
Guiding Principle 2 - Design for the Complete Spectrum of Rainfall Events

Integrated stormwater solutions require site design practices that provide:

- **Rainfall Capture for Small Storms (runoff volume reduction and water quality control)** –
  Capture the small frequently occurring rainfall events at the source (building lots and streets) for infiltration and/or re-use.
- **Runoff Control for Large Storms (runoff rate reduction)** –
  Store the runoff from the infrequent large storms (e.g. a mean annual rainfall), and release it a rate that approximates the natural forested condition.
- **Flood Risk Management for the Extreme Storms (peak flow conveyance)** –
  Ensure that the drainage system can safely convey extreme storms (e.g. a 100-year rainfall).

The Integrated Strategy

Guiding Principle 2 forms the foundation of integrated stormwater solutions that mimic the most effective stormwater management system of all - a naturally vegetated watershed. This means that rainfall from frequent small events must be infiltrated into the ground or re-used within the watershed, as illustrated below.



Comparison with Conventional Stormwater Management

Conventional 'flows-and-pipes' stormwater management is limited because it focuses only on the fast conveyance of the extreme storms and often creates substantial erosion and downstream flooding in receiving streams.

Similarly, a detention-based approach is only a partial solution because it allows the small storms that comprise the bulk of total rainfall volume to continue to create erosion and impacts on downstream aquatic ecosystems.

Neither of these approaches fully prevents the degradation of aquatic resources or flooding risks to property and public safety.

In contrast, the Guidebook approach is to eliminates the root cause of ecological and property impacts by designing for the complete spectrum of rainfall events. Solutions described in the Guidebook include conventional, detention, infiltration and re-use approaches for rainfall capture, runoff control and flood risk management.

Guiding Principle 3 - Act on a Priority Basis in At-Risk Drainage Catchments

Priority action should be focused in at-risk drainage basins where there is both high pressure for land use change and a driver for action. The latter can be either:

- a high-value ecological resource that is threatened, or
- an unacceptable drainage problem

The stormwater management policies and techniques implemented in at-risk catchments become demonstration projects.

Guiding Principle 4 - Plan at Four Scales – Regional, Watershed, Neighbourhood and Site

Integrated stormwater management must be addressed through long-term planning at each of the regional, watershed, neighbourhood and site scales.

- **At the Regional and Watershed Levels** – Establish stormwater management objectives and priorities
- **At the Neighbourhood Level** – Integrate stormwater management objectives into community and neighbourhood planning processes
- **At the Site Level** – Implement site design practices that reduce the volume and rate of surface runoff and improve water quality

Guiding Principle 5 - Test Solutions and Reduce Costs by Adaptive Management

Performance targets and stormwater management practices should be optimized over time based on:

- monitoring the performance of demonstration projects
- strategic data collection and modeling

As success in meeting performance targets is evaluated, the stormwater management program can be adjusted as required.

CURE – The Elements of an Action Plan

The acronym **CURE** focuses attention on the four key types of actions that must all work together to implement integrated stormwater management solutions:

- **C**APITAL INVESTMENT – Short-term capital investment will be needed to implement early action in at-risk drainage basins. Improvements to existing drainage system are often the most significant capital investments required. A financing plan should provide an ongoing source of funds for watershed improvements.

- **U**NDERSTANDING SCIENCE – Improved understanding of a watershed, the nature of its problems, and the effectiveness of technical solutions is key to an adaptive approach. Stormwater management practices can be optimized over time through the monitoring of demonstration projects, combined with selective data collection and modeling.

- **R**EGULATORY CHANGE – Changes in land use and development regulations are needed to achieve stormwater performance targets. Changes to land use planning and site design practices are needed to eliminate the root cause of stormwater related problems. These changes must be driven by regulation.

- **E**DUCATION AND CONSULTATION – Changes to land use planning and site design practices can only be implemented by building support among city staff, the general public and the development community through education and consultation.

Translating a Vision into Action

It is important to establish a long-term shared vision at the start of any watershed planning initiative. A vision that is shared by all stakeholders provides direction for a long-term process of change. The vision becomes a destination, and an action plan provides a map for getting there.

Actions plans must be long-term, corresponding to the time frame of the vision. Action plans must also evolve over time.

Ongoing monitoring and assessment of progress towards a long-term vision will improve understanding of the policy, science and site design components of integrated stormwater management. This improved understanding will:

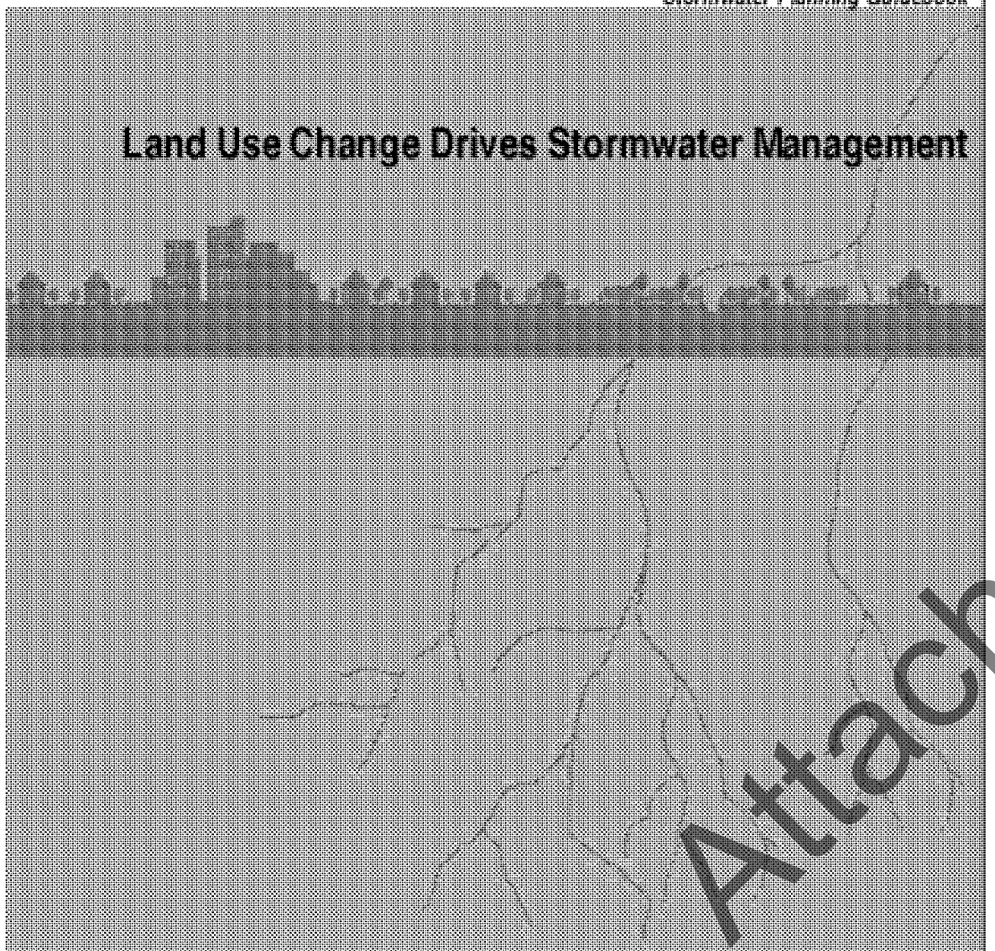
- Lead to the evolution of better land development and stormwater management practices
- Enable action plans to be adjusted accordingly

An adaptive management approach to changing stormwater management practices is founded on learning from experience and adjusting for constant improvement.

Building Blocks

The Guidebook elaborates on three fundamental objectives that become building blocks for a long-term process of change:

- **Achievable and Affordable Goals -** Apply a science-based approach to create a shared vision for improving the health of individual watersheds over time.
- **Participatory Decision Process** - Build stakeholder consensus and support for implementing change, and agree on expectations and performance targets.
- **Political Commitment** – Take action to integrate stormwater management with land use planning.



Chapter One

1.1 Impacts Flow Down the Watershed

- Stormwater
- Changes to the Natural Water Balance
- Property Impacts
- Ecological Impacts on Species at Risk
- Water Quality Impacts
- Financial Impacts
- Lessons Learned

1.2 Potential Stormwater Impacts will Accelerate Due to Population Growth Pressure and Climate Change

- Population Growth Pressure
- Climate Change

1.3 Integrating Stormwater Solutions with Land use Change

- Recent Approaches Have Only Provided Partial Solutions
- Preventing History from Repeating Itself

1.4 Local Government Responsibility for Drainage

- Liability for Downstream Impacts Due to Changes in the Water Balance
- Authority to Implement Integrated Solutions

1.5 History and Evolution of Stormwater Management

- North American Context
- British Columbia Context

1.1 Impacts Flow Down the Watershed

Figure 1-1 illustrates schematically how water is recycled in nature. Water evaporates from lakes, rivers and oceans. It then becomes water vapour and forms clouds. It falls to the earth as precipitation, then it evaporates again. This 'hydrologic al cycle' never stops. Water keeps moving and changing phases from solid to liquid to gas, over and over again. In this Guidebook, this process is described as the natural 'Water Balance'.

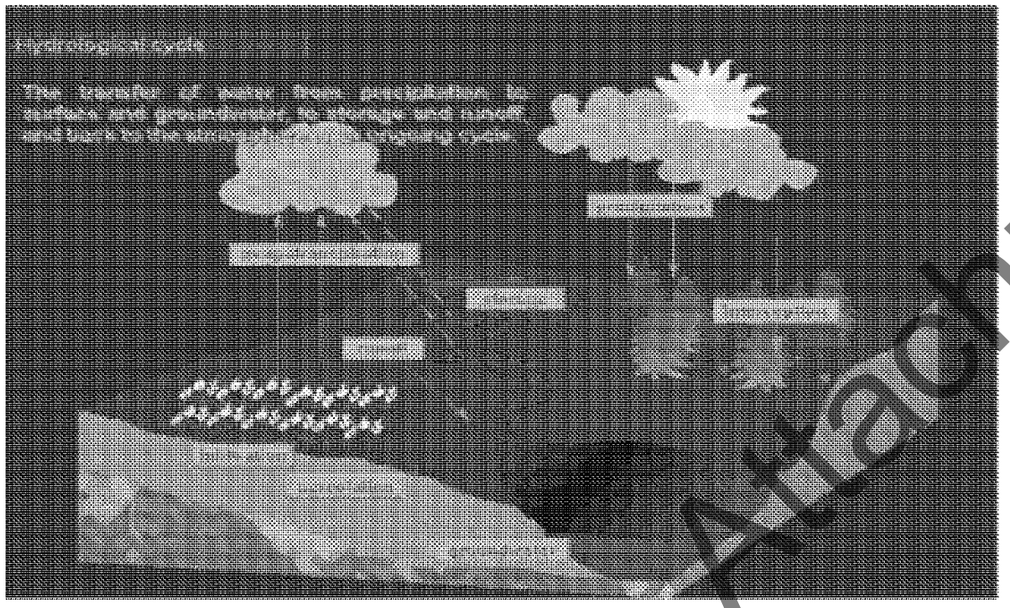


Figure 1-1 Components of the Natural Water Balance

Stormwater

Stormwater is the component of runoff that is generated by human activities. Stormwater is created when land development alters the natural Water Balance. When vegetation and soils are replaced with roads and buildings, less rainfall infiltrates into the ground, less gets taken up by vegetation and more becomes surface runoff.

The biggest increments of change - to the Water Balance in general, and to the surface runoff component in particular - occur when forested land is first cleared, then ditched, and finally paved or roofed over.

Until recently, the traditional approach to drainage has been to remove runoff as quickly as possible from developed areas. As a result, traditional urban design is very efficient in collecting, concentrating, conveying and discharging stormwater to receiving waters.

In British Columbia, stormwater management has traditionally been a function of local government or highway engineers, who have developed an expertise in conveying stormwater efficiently. Increasingly, stormwater management is becoming a shared responsibility with land use planners.

Guidebook Context

To mitigate the cumulative impacts of stormwater resulting from changes to the natural Water Balance, the British Columbia Ministry of Water, Land and Air Protection has developed this Guidebook to assist local governments, engineers and planners in clearly understanding the broader issues and the strategies currently available to correct stormwater-related problems.

A stormwater management component is a requirement for approved *Liquid Waste Management Plans* (LWMPs). The Ministry will encourage any progressive steps a local government may want to take to incorporate stormwater planning into their existing LWMP.

A core concept is that stormwater is a resource to be protected. Achieving this goal requires full integration of stormwater management with land use planning.

Changes to the Natural Water Balance

Runoff volume increases in proportion to impervious area (hard, non-absorbent surfaces). Land uses with extensive roof and paving areas create more runoff than land uses with extensive areas of absorbent soils and forest cover. Figure 1-2 illustrates the Water Balance for a natural forest. The examples on Figures 1-3 and 1-4 then illustrate what happens to the Water Balance when the forest is developed for residential and/or commercial uses, respectively.

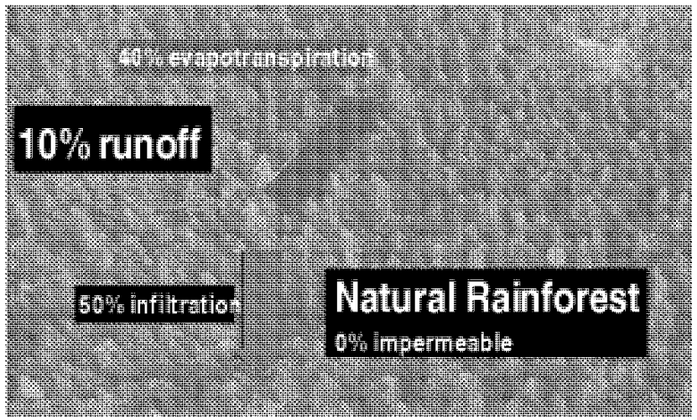


Figure 1-2 Natural Rainforest

Traditional ditch and pipe systems have been designed to remove runoff from impervious surfaces as quickly as possible and deliver it to receiving waters. The resulting stormwater arrives at the receiving waters much faster and in greater volume than under natural conditions. Changes in the natural Water Balance result in four categories of impacts: property, ecological, water quality and financial/political. An overview of each category is provided in the pages that follow.

Failure to manage stormwater resulting from land use change can cause flooding, loss of aquatic habitat and water pollution in downstream receiving waters.

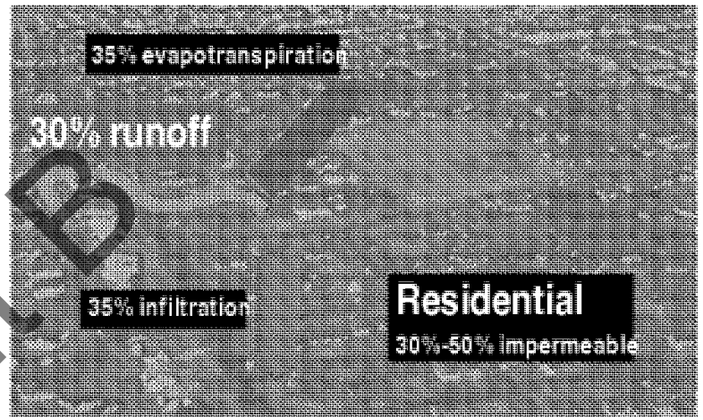


Figure 1-3 Single Family Development

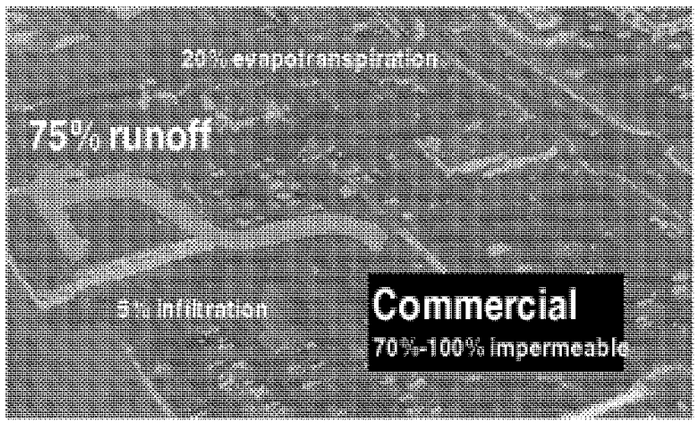


Figure 1-4 Commercial Development

Property Impacts

The width and depth of a stream are determined by the volume and rate of water that it conveys. Therefore, increases in flow volume and peak flow rates resulting from land development cause erosion on the sides and bottom of the channel. Figure 1-5 shows how additional culverts have been installed at a road crossing in order to handle the increased volume after upstream land clearing and ditching has occurred.

The material from these eroding banks (as shown on Figure 1-6) moves downstream as 'bedload', and settles out on the more gentle grades in the stream (Figure 1-7). These gentle grades are often located in the floodplain. These changes in stormwater flows and stream morphology often create both loss of property where erosion takes place, and increased flooding in the floodplain as it is filled in by sediments. This often results in damage to private property and agricultural land, and can pose a potential threat to public safety.

The most common property impact resulting from the increase in runoff is the accumulation of nuisance water on private property and public spaces downstream of development areas.

Figure 1-5 Multiple Drainage Culvert Installations

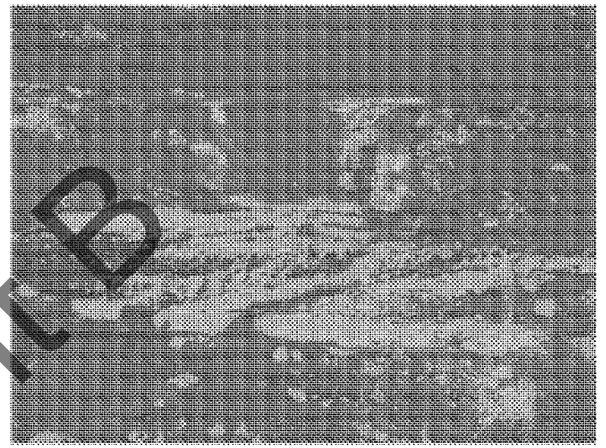


Figure 1-6 Channel Down-Cutting (due to increased volume)

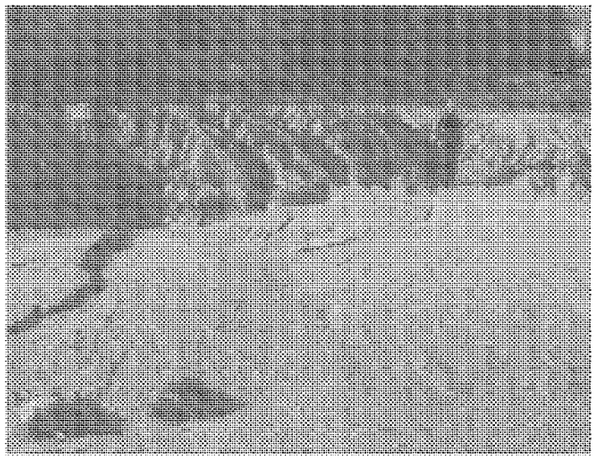


Figure 1-7 Habitat Destruction (due to bedload deposition)

Ecological Impacts on Species at Risk

Figure 1-8 illustrates how:

- The cumulative effects of increasing impervious area in a watershed combined with loss of riparian corridor integrity (as shown in the first two rows), alter the natural Water Balance and impact stream corridor ecology (as shown in the last two rows).
- The resulting increase in runoff volume causes watercourse erosion and progressive degradation of the channel cross-section (refer to middle row).
- The consequence of these cumulative changes is a progressive decline in stream corridor biodiversity and abundance for cold-water fish and clear water indicators, and a progressive transition to warm-water species and pollutant indicators (as shown in the last two rows).

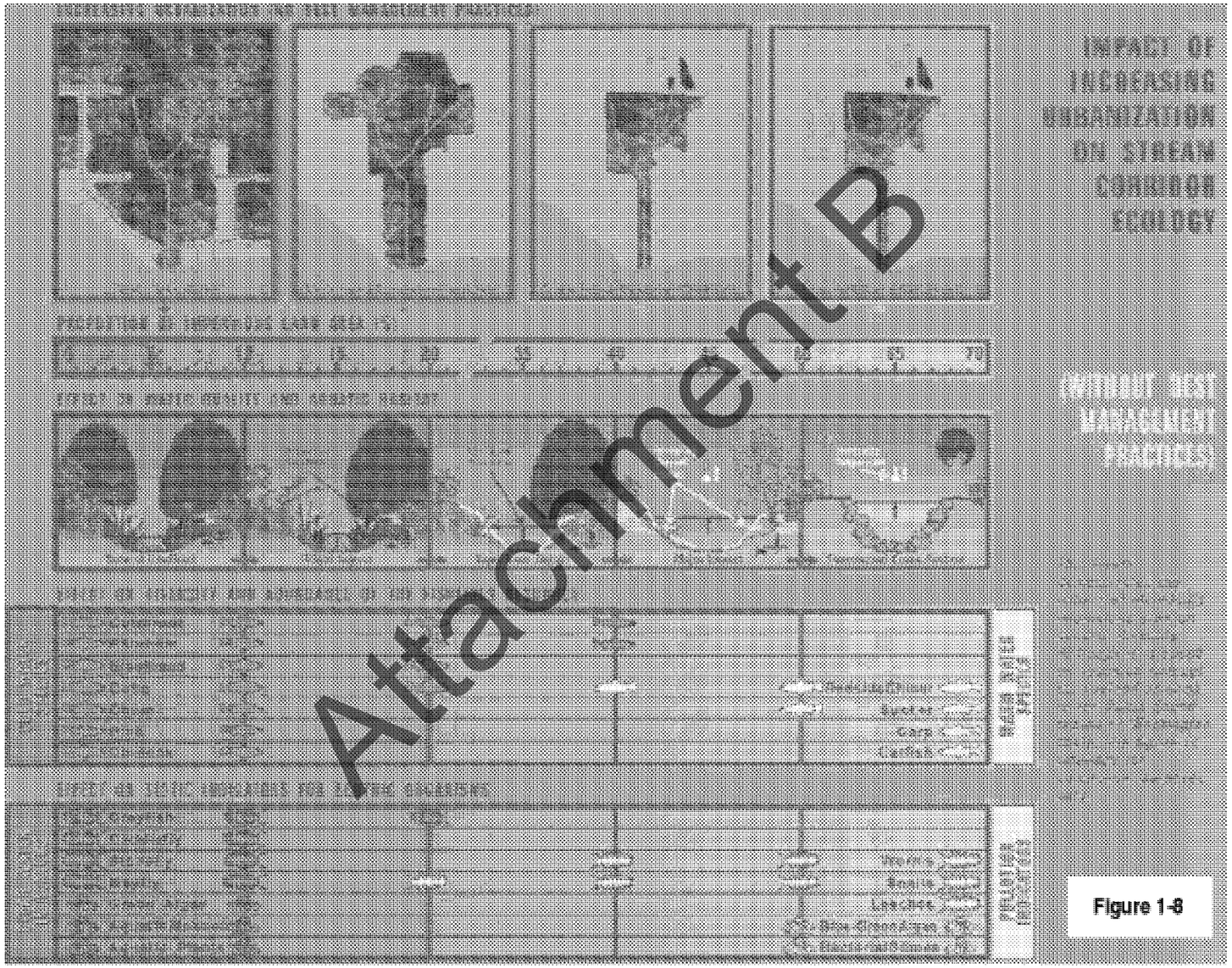
Eroded material (Figure 1-6) creates turbidity, or dirty water, that can irritate fish gills and make it difficult for fish to find their food. Eroded sediments can cover spawning beds, smothering fish eggs and young that reside in the gravel and possibly blocking access to spawning areas for the next generation (Figure 1-7).

The decrease in infiltration (due to replacement of soil and vegetation with hard surfaces) can also have impacts on fish because it reduces the slow, constant groundwater supply that keeps streams flowing in dry weather. This can lead to water levels that are inadequate to provide fish with access to their spawning areas, and can even cause streams to dry up in the summer.

Driving Force for New Approaches

Stemming and reversing the decline of wild salmon populations has led to questioning of the most basic assumptions that used to guide – and in many communities still guide – how we plan and manage development. This questioning has resulted in new approaches to land development and stormwater management. These new approaches are being advanced and implemented throughout the Pacific Northwest, and especially in the Georgia Basin.

The decline of wild fish populations is not limited to the Georgia Basin. In Okanagan Lake, for example, degradation of tributary streams and loss of aquatic habitat have similarly contributed to the decline of the kokanee fishery.



Water Quality Impacts

Although of BC's water quality is generally good, people are increasingly aware that the province is experiencing localized water pollution problems. Every year there are reports of public beach closures, contaminated sediments, algal blooms, aquatic weed infestations, fish kills, shellfish harvesting closures, boil-water advisories, outbreaks of waterborne diseases, and contaminated groundwater. BC's efforts to protect water quality by regulating 'end-of-pipe' point discharges from municipal and industrial outfalls have generally been successful.

It is now recognized that the major remaining cause of water pollution is from non-point sources (NPS), including stormwater runoff. Stormwater contains contaminants such as hydrocarbons and heavy metals derived from vehicle exhaust, brakes and leaked fluids, as well as nutrients, pesticides and bacteria from urban and agricultural land uses. When stormwater flows over large paved surfaces on warm days, it can increase to temperatures that are unsuitable for cold-water fish like salmon and trout. The result can be immediate fish kills in receiving streams, or chronic, long-term impairment of fish and other aquatic species.

Financial Impacts

Local governments and developers are finding that drainage costs are becoming a major portion of their capital outlay. The capital cost of land development with traditional piped solutions can be a significant detriment to affordable housing. In recent years, this has been one of the drivers for change. Reducing costs is providing an incentive for innovation. An example of this change in thinking is presented below:

> Although the Greater Vancouver region is spending about $33 million annually on stormwater management, "....in many areas of the region, current approaches to stormwater management and land development do not adequately protect the environment of small streams in watersheds experiencing significant population growth."
>
> *Source: page 1 of Executive Summary*
> *Stage 2 Liquid Waste Management Plan, 1999*
> *Greater Vancouver Regional District*

Finding a Better Way

Installation of drainage pipes without mitigating measures often creates erosion problems and/or flooding downstream in receiving watercourses. These risks can create threats to property and public safety, resulting in exposure to litigation.

To avoid further impacts and litigation, local governments are now beginning to address the cumulative erosion and flooding impacts resulting from development. This creates a further cost burden for additional drainage infrastructure, and for increased staff time devoted to maintenance of at-risk culverts and degraded floodplains.

In many cases, solving downstream problems by piping or armouring creeks is no longer environmentally acceptable, either to senior agencies or to the public.

This set of problems creates both financial and political imperatives to find a better way to develop land.

Lessons Learned

The essence of the foregoing discussion is captured below. These two 'lessons learned' provide a framework for developing land differently:

- **Universal Drivers for Change -** The risks and the impacts associated with stormwater have become drivers for change in the way stormwater is managed in British Columbia and in other jurisdictions around the world (e.g. the United States, Australia and New Zealand). It has been recognised that dealing with flooding and aquatic habitat issues must be integrated with decisions on land use change.
- **Complementary Objectives –** Integrated approaches to stormwater management acknowledge that protection of property, protection of aquatic resources, and protection of water quality are complementary objectives. Integrated approaches address each of these objectives.

1.2 Potential Stormwater Impacts will Accelerate Due to Population Growth Pressure and Climate Change

In the future, there will be more runoff volume to manage due to the combination of:

- **Population Growth** – resulting in more land development plus re-development / densification of existing urbanized areas
- **Climate / Weather Change** – resulting in both increased seasonal rainfall and more frequent 'cloudbursts'

Population Growth Pressure

Only about 5% of BC is suitable and/or available for human development. The majority of the land area – about 90% - is owned by the Crown and is mostly mountainous terrain. The balance (5%) is protected within the Agricultural Land Reserve. The limited supply of developable (and available) land is a driving force for change. The majority of the developable land in BC is located in the southwestern portion of the province.

As regional populations grow, more and more people will need to be accommodated in existing development areas. This will result in some rural areas becoming increasingly suburban. Similarly, suburban municipalities that are close to the major population centres will become more urban as they densify. The rate and scale of development in the 1990s has already transformed most suburban development areas, especially in southern BC.

Population-driven changes are most noticeable in the Georgia Basin, throughout the Okanagan, and in many parts of the Kootenays. The Georgia Basin is a bio-region that includes Greater Vancouver, the lower Fraser Valley east to Hope, and the East Coast of Vancouver Island. The total population has reached 3 million, or about 75% of the provincial total of 4 million, and is projected to double within the next 50 years.

If there were no change in the way that land development addressed stormwater, this increase in population would lead to an increase in impervious area, with resulting stormwater impacts.

The pending land use change brings into focus the need for more effective strategies to reduce stormwater-related impacts on property and aquatic ecosystems.

Need for Early Action

BC is 'land short'. Population growth pressure will lead to increased impervious area and will place pressure on species at risk. For these reasons, there is a need to accelerate the rate of change so that stormwater management is integrated with land use planning sooner rather than later. Figure 1-9 illustrates the potential for flooding in the urban environment.

Figure 1-9 Flooding in the Urban Environment

Climate Change

Rain gauge data for southwestern British Columbia suggest that precipitation frequency, intensity and duration are changing compared to the mid-20th century. Research by the University of British Columbia and Environment Canada implicate global climate change as the primary contributor to these observed trends.

Environment Canada models project increasing fall and winter precipitation, decreasing late spring-early summer precipitation, and more intense rainstorms (i.e. 'cloudbursts').

1.3 Integrating Stormwater Solutions with Land use Change

Many existing older urban areas in BC have been developed without stormwater management, and have suffered the related property and ecological impacts. Local governments in these areas are facing extraordinary costs and difficulties to reduce the impacts.

Recent Approaches Have Only Provided Partial Solutions

Emphasis in recent years has been on provision of community detention storage ponds in new developments. Although these ponds provide a partial solution, they only treat the consequences of increased impervious area, not the source.

Recent research by the University of Washington has shown that, in most cases, detention ponds mitigate flooding but do not prevent the ongoing channel erosion that creates property and fisheries impacts. Detention solutions also often do not support the sustained stream base flow that is critical to many fish populations in dry months.

In some areas of BC, especially in regional districts outside of the Greater Vancouver Regional District and the Capital Regional District, there is as yet little coordinated stormwater planning, even though urbanization and related impacts are accelerating.

Preventing Stormwater History from Repeating Itself

By examining past experience, it is evident that the contemporary approach to drainage is changing, from being reactive to being proactive. Now, the focus is on preventing problems at the source, by integrating stormwater management with land use planning so that:

- Decisions about land use change are made with a full awareness of the potential consequences for stormwater management
- Conversely, stormwater management principles influence the details of land use and site planning

The Stormwater Management Dilemma

Figure 1-10 illustrates the stormwater management dilemma – how can stormwater managers facilitate population growth and land development, while preserving the natural environment and preventing flooding in urban areas at the same time?

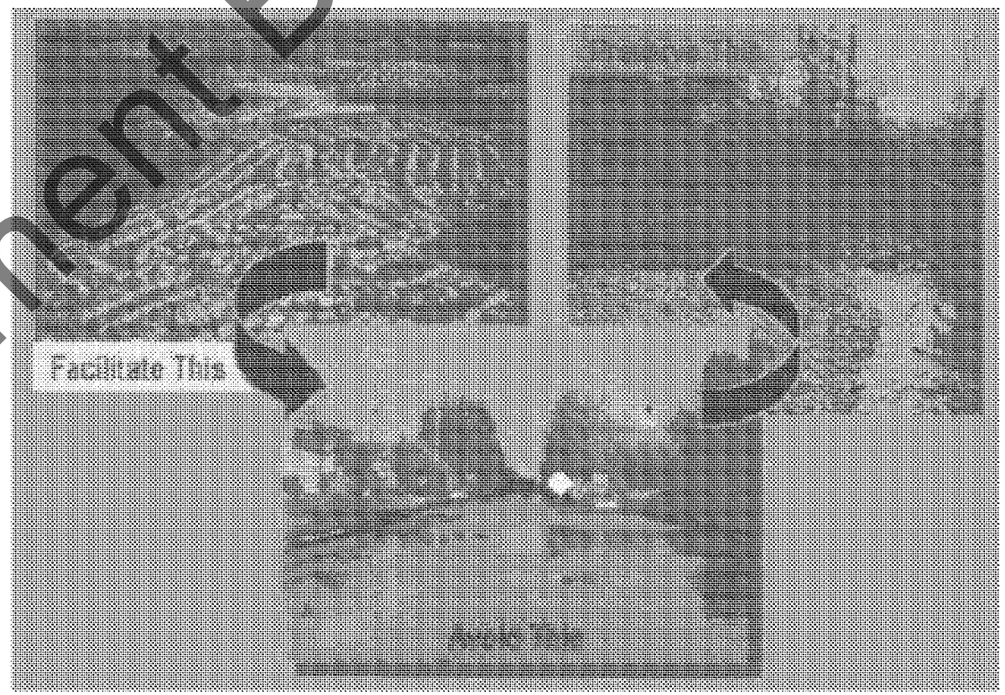


Figure 1-10 The Stormwater Dilemma

1.4 Local Government Responsibility for Drainage

The courts see the impact of drainage on property as a 'nuisance', where a landowner's use and enjoyment of his or her lands are interfered with as a result of actions or conduct on neighbouring lands. The courts have established precedents concerning the following:

- Right to drain land (allowing surface water to escape in a way provided by nature)
- Right to block drainage (surface water draining from higher land, as opposed to water in a natural stream)
- Measures of damages (damages will be awarded where liability is established)

In British Columbia, the *Local Government Act* has vested the responsibility for drainage with municipalities. This *Act* also enables local governments to address stormwater management much more comprehensively than in the past. The challenge is to use this legislation to achieve comprehensive goals and objectives in appropriate and effective ways. Division 6 of the Act (Sections 540 – 549) gives local government the direct power to manage stormwater: http://www.qp.gov.bc.ca/statreg/stat/L/96323_15.htm#part15_division6

Liability for Downstream Impacts Due to Changes in the Water Balance

With the statutory authority for drainage, local governments can be held liable for the nuisance caused by drainage to downstream property owners. To assist in understanding the scope of local government liability, three relatively recent cases are presented here. In all three cases, the Court of Appeal in the Province of BC has upheld the decisions. These cases underscore the responsibility of local government for stormwater volume management.

Case 1 - Indexed as: Kerlenmar Holdings v. Matsqui (District) and District of Abbotsford

Judgement - June 1991 (From British Columbia Law Reports 56 B.C.L. R. (2d) p. 377 – 387.)

A creek running through the plaintiff's farmland flooded regularly, and after 1971 the agricultural capacity of the land deteriorated as a result. The plaintiff brought an action in nuisance, attributing the flooding to increased urbanization in the two defendant municipalities, whose storm drains were releasing more and more water into the creek.

The trial judge awarded damages for loss of income and the municipality was required to purchase the plaintiff's lands.

Case 2 - Indexed as: Medomist Farms Ltd. v. Surrey (District)

Judgement – December 1991 (From British Columbia Law Reports 62 B.C.L. R. (2d) p. 168-177.)

The defendant municipality held a road allowance across the plaintiff's land, along which ran a drainage ditch. In 1979, the municipality permitted residential development on lands to the west of and above the plaintiff's land. The development reduced the surface area available to absorb water, causing more runoff into the drainage ditch.

Although the ditch previously overflowed during winter wet weather periods, it now occasionally overflowed during the growing season as well as a result of the upstream residential development. The trial judge awarded damages for crop losses and ordered construction of a permanent pumping station.

Case 3 - Indexed as: Peace Portal Properties Ltd. v. Corporation of the District of Surrey

Judgement - May 1990 (From Dominion Law Reports 70 D.L. R. (4th) p. 525-535.)

The plaintiff operated a golf course in the defendant municipality. A creek bisected the course. The municipality had incorporated the creek into its' drainage system. Because of increased urbanization there was a substantial increase in the flow in the creek, which caused erosion.

The plaintiff attempted to resolve the problem by replacing the natural channel of the creek with a concrete flume in the 1960s. This worked for a time, but with further urbanization and increased flow, new erosion occurred which also damaged the flume. The plaintiff proposed certain remedial work and sought contribution from the defendant. The defendant rejected the request.

The plaintiff completed the remedial work, in the process raising some of the greens and fairways. He then brought action against the municipality to recover the cost. The trial judge concluded that the evidence amply supported that nuisance of the increased flow caused the erosion and the municipality was held responsible.

Authority to Implement Integrated Stormwater Solutions

Local governments have extensive and very specific tools available to them. They also have the discretion to use them or not. Decisions about a local government's appropriate level of involvement in stormwater and stream corridor management must therefore be guided by a set of clear, broadly agreed-upon objectives, as well as an understanding of the need for balance with other competing objectives and interests.

Some key *Local Government Act* planning, regulation, development approval and servicing provisions applicable to stormwater management are summarized below:

Regional Growth Strategy and Official Community Plan Goals

Section 849 (2) provides goal statements for:

- Protecting environmentally sensitive areas
- Reducing and preventing air, land and water pollution
- Protecting the quality and quantity of groundwater and surface water

Prohibition of Pollution

Section 725.1 enables local governments to enact bylaws prohibiting water pollution and to impose penalties for contravening these.

Soil Deposit and Removal (Erosion Control)

Section 723 enables local governments to include erosion control and sediment retention requirements associated with soil deposition and removal.

Zoning

Section 903 enables the prohibition or siting of regulated land uses that, for instance, generate non-point source pollution.

Environmental Policies

Section 879 enables *Official Community Plans* (OCPs) to include "policies of the local government relating to the preservation, protection and enhancement of the natural environment, its ecosystems and biological diversity".

Development approval information areas or circumstances (Section 879.1) enable the designation of areas or circumstances, or areas for which in specified circumstances, development approval information may be required.

Runoff Control

Section 907 enables local governments to set maximum percentages of areas that can be covered by impermeable material and to set requirements for ongoing drainage management.

Landscaping

Section 909 enables local governments to set standards for and regulate the provision of landscaping for the purposes of preserving, protecting, or restoring and enhancing the natural environment (e.g. requiring streamside vegetation).

Development Permit Areas

Development permit areas designated in an Official Community Plan (see Section 919.1) cannot be altered, subdivided, or built on without a development permit. The permit can contain conditions for the protection of the environment.

Subdivision Servicing Requirements

Section 938 enables a local government to "require that, within a subdivision"… "a drainage collection or a drainage management system be provided, located and constructed in accordance with the standards established in the bylaw".

In addition to the above, other stormwater management powers can be found in provisions dealing with building regulations, contaminated sites, development cost charges, ditches and drainage, dikes, development works agreements, flood protection, farming, highways, improvement districts and specified areas, park land, regional district services, sewage systems, subdivision, temporary commercial and industrial use, tree cutting, utilities, water and waste management.

(Note: The section references quoted above are expected to change over time. Some of these changes will result from implementation of the Community Charter process in the near future.)

1.5 History and Evolution of Stormwater Management

The evolution of stormwater practice in North America is set against the backdrop of social change, and changes in stormwater management philosophy.

North American Context

Modern urban stormwater infrastructure was born in the post-World War I era, consisting of efficient drainage systems with catch basins and pipes leading to the nearest stream.

Some time after World War II it became apparent to engineers throughout North America that the fruit of an efficient stormwater system was downstream flooding and channel erosion. By the early 1970s, this resulted in a new idea to solve flooding forever: on-site detention.

In the 1970s, the literature began to reflect a new concept: stormwater master planning. The idea was that engineers could construct a hydrology model (how much water, how often?) and a hydraulic model (how fast and high does the water from the hydrology model go?) of a watershed and then analyze scenarios until they found the perfect solution to flooding problems – whether current problems or those only imagined.

By the mid-1980s, literally hundreds of master plans had been developed. But few were being implemented the way they were planned. The cycle was one where local governments typically proceeded from flooding to panic to planning, and then to procrastination and the next flood.

In the late 1980s, a new breed of approaches emerged as water quality and bio-assessment were added to the mix. Each solved the immediate problem of the past paradigm and created a more insidious problem of its own. Knowledge and technology created a real or perceived need for higher, more demanding levels of stormwater management – and regulation.

The 1990s saw the introduction of 'watershed-based' approaches and 'low impact development'.

Being aware of the changes in approach makes it increasingly less acceptable to do business as usual. The challenge ahead is to define and then actually demonstrate that a healthy watershed approach produces the full range of effective results in an efficient manner.

British Columbia Context

Before the 1970s, comprehensive urban drainage planning was a rarity in British Columbia, in part because there was no senior government funding for drainage projects. By the 1970s, however, drainage had emerged as an issue in the suburban areas because of flooding problems and resulting litigation. In the mid-1970s, the cities of Surrey, Nanaimo, West Vancouver (because of the July 1972 flooding that resulted in a catastrophic washout of the Upper Levels Highway during construction), and Kelowna were among the first municipalities to undertake major municipality-wide drainage studies. The history of modern stormwater management in British Columbia is summarized as follows:

- **A Flows-and-Pipes Approach**
  Master Drainage Plan (MDP) and Stormwater Management Plan (SMP) have tended to be used interchangeably in British Columbia over the past 25-plus years. A number of suburban municipalities (e.g. City of Surrey) continue to use the term MDP. The term SMP became popular in the late 1970s as 'management' became a catch-phrase for all infrastructure planning activities. The basic engineering approach did not materially change. Typically, an MDP was the 'flows-and-pipes' product resulting from a stormwater management strategy.

- **An Environmental Approach**
  In the 1989 through 1990 period, the City of Burnaby was the first municipality to apply what was initially called an 'environmental approach' to master drainage planning. This characterization reflected the evolution from a strictly engineering to an interdisciplinary team approach over a 6-year period for the Western versus Eastern Sectors, respectively, of the Big Bend Area in the Fraser River floodplain. The drivers for change were the impact of construction of the Marine Way arterial highway on existing market gardens, and the landfilling and conversion of undeveloped wetlands to industrial park uses.

- **A Stream Stewardship Approach**
  In 1992, the District of Maple Ridge adapted the Burnaby model in developing both a Stormwater Management Strategy and a Master Drainage Plan for the Cottonwood Area. At about the same time, the federal/provincial *Land Development Guidelines* and the provincial *Urban Runoff Quality Control Guidelines* were both published. Completed in 1994, the Cottonwood process showed how to make both sets of guidelines workable. The environmental agencies described it as a 'stewardship template' because it applied the concepts in the federal/provincial document titled *Stream Stewardship: A Guide for Planners and Developers*, also published in 1994.

- **Higher Levels of Interdisciplinary Integration**
  Integrated, ecosystem-based and watershed-based are terms that came into vogue at the end of the 1990s, and are interchangeable. Table 1-1 describes four case studies that took the Cottonwood template to successively higher levels of integration in terms of an interdisciplinary team approach.

  These case studies illustrate the transition from early environmental drainage to fully integrated stormwater management. They have given meaning to a comprehensive process for addressing hydrotechnical and environmental concerns in order to develop integrated solutions for the protection of property and habitat.

Integrated Stormwater Management Planning

In British Columbia, the term *Integrated Stormwater Management Plan* (ISMP) has gained widespread acceptance by local governments and the environmental agencies to describe a comprehensive, ecosystem-based approach to stormwater planning.

The purpose of an ISMP is to provide a clear picture of how to be proactive in applying land use planning tools to:

- protect property from flooding, and
- protect aquatic habitat from erosion and sedimentation

Use of the ISMP term is unique to British Columbia. The City of Kelowna first used the term in 1998 to make a clear distinction between 'suburban watershed management' and the Province's existing 'integrated watershed management' process for natural resource management in wilderness watersheds. This is an important distinction. Local government typically has control over stormwater in residential, commercial and industrial land uses. It does not necessarily have control over watersheds.

Local governments in British Columbia are changing. Those that are changing are providing models for others to adapt and further evolve.

Table 1-1 Origin and Evolution of Integrated Stormwater Management in British Columbia

Year	Municipality	Project Name and Relevance
1996	City of Kelowna	***Environmental Component of an Integrated Strategy for Stormwater and Stream Corridor Management:*** The term 'integrated stormwater management' originated with the Kelowna study. This distinction was important to the City. It captured the essence of what the City was trying to accomplish through its 'environmental approach' to watershed protection. In the Kelowna context, 'integrated' referred to the linkages between watershed actions and stream corridor consequences. The study was comprehensive in developing a science-based framework for broadly defining watershed management objectives for the City's nine drainage basins.
1997	City of Surrey	***Integrated Stormwater Management Strategy & Master Drainage Plan for the Bear Creek Watershed*** The Bear Creek study was undertaken in parallel with Kelowna. It considered all the runoff events comprising the annual hydrograph. The emphasis was on how to integrate the range of hydrologic criteria for sizing of stormwater control facilities that have different functional objectives. Two components were defined: 'hydro-technical' described the conventional engineering approach to conveyance of large runoff events; while 'enhanced hydro-technical' captured the environmental objectives in restoring the natural hydrology characteristic of the small runoff events.
1998	G.V.R.D. City of Burnaby City of Coquitlam City of Port Moody	***Integrated Stormwater Management Strategy for Stoney Creek Watershed*** The Stoney Creek study was an inter-municipal pilot project, and built on the base provided by the Kelowna and Bear Creek experiences. The emphasis was on consensus-building (through a workshop process) to develop a shared vision that integrated a range of diverse viewpoints on the 10-person Steering Committee that also included a community representative. The foundation for strategy development was an assessment of the natural resources to be protected. The deliverables included a 20-Year Vision Plan and a 50-Year Vision Plan for stream preservation and watershed enhancement, respectively. These plans established targets for impervious area reduction.
2000	City of Coquitlam	***Como Creek Integrated Stormwater Management Plan – Flood Risk Management and Watershed Restoration*** Como Creek took the Stoney process to the next level of detail. Como is the first urban drainage study in the Greater Vancouver region to truly integrate the engineering, planning and ecological perspectives through an inter-departmental, interdisciplinary and inter-agency process that was guided by a Steering Committee of senior managers, and that included community involvement in development of the resulting plan. The goal was to develop an integrated plan that resolved a chronic flooding problem while over time restoring aquatic habitat. The focus was on how to implement changes in land use regulation that achieve the 50-year vision for impervious area reduction as the existing housing stock is replaced.

Provincial Enabling Initiatives

In 1992, the (then) Ministry of Environment, Lands and Parks published the *Urban Runoff Quality Guidelines* and the *Guidelines for Developing a Liquid Waste Management Plan* (LWMP).

In February 1994, the Ministry issued a policy statement to local government regarding the need to incorporate a stormwater component in LWMPs.

In July 1997, the Provincial Government enacted both the *Local Government Amendments Act* and the *Fish Protection Act* to give local governments new and improved tools to restore and enhance, as well as to protect, the natural environment.

In 1998, the Ministry published a document titled *Tackling Non-Point Source Water Pollution in British Columbia - An Action Plan*, which identified a series of tools and strategies available to reduce and prevent non-point source pollution in rural and urban areas.

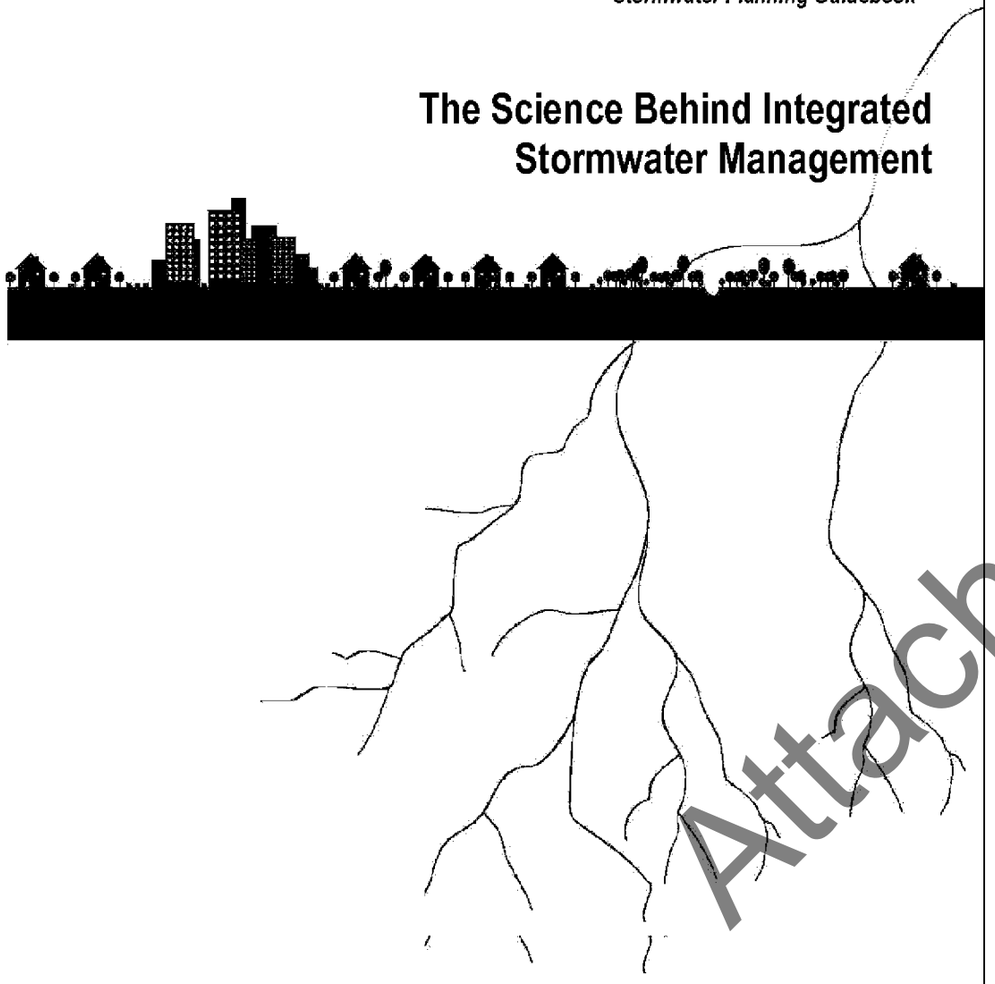
The 1998 Non-Point Source Pollution (NPS) Action Plan

The 1998 Action Plan comprises six initiatives. The one that is particularly relevant to this Guidebook is *Land Use Planning, Coordination, and Local Action.* This initiative addresses both stormwater management and streamside protection. Local governments that have LWMPs are required to incorporate a stormwater management component. LWMPs may themselves be required in critical areas where, for example, NPS pollution affects aquatic resources.

Initiatives at the Regional Level

The Capital Regional District was the first jurisdiction to address stormwater quality in an LWMP for the Saanich Peninsula in 1996.

The Greater Vancouver Regional District formally embraced stormwater management in November 1994. This eventually led to formation of the inter-municipal and inter-agency Stormwater Task Group in 1997 to tackle stormwater quantity and quality issues. The ongoing role of this group is to formulate and guide implementation of a consistent regional approach to stormwater management planning as part of its LWMP.



The Science Behind Integrated Stormwater Management

Chapter Two

2.1 Developing a Common Understanding

- ❑ Research on the Effects of Urbanization on Fish
- ❑ A Science-Based Understanding

2.2 The Natural versus Urban Water Balance

- ❑ Where Rainfall Goes Before and After Development
- ❑ Distribution of Rainfall Over a Year
- ❑ Role of Soil, Vegetation and Trees in Capturing Rainfall

2.3 Understanding Changes in Hydrology

- ❑ Relationship Between Impervious Area and Runoff Volume
- ❑ Other Hydrology-Based Relationships
- ❑ Hydrology and Water Quality Objectives for Protection of Watershed Health

2.4 Factors that Limit the Health of Aquatic Resources

- ❑ Ranking of Limiting Factors
- ❑ Reference Impervious Area Levels for Land use Planning
- ❑ Measuring the Environmental Health of Creek Systems
- ❑ Other Washington State Research Findings

2.5 Managing Complexity

- ❑ Eliminate the Source of Problems
- ❑ What the Science is Telling Us
- ❑ What Can be Done at the Site Level to Protect Watershed Health
- ❑ Objectives for Protecting Watershed Health in an Urban Environment

2.1 Developing a Common Understanding

A science-based understanding of how land development impacts watershed hydrology and the functions of aquatic ecosystems provides a solid basis for making decisions to guide early action where it is most needed.

This chapter provides an overview of the science. It presents graphics that have helped diverse audiences reach a common understanding about hydrology and the factors limiting the ecological values of streams.

An understanding of the science is a critical underpinning of strategies to predict and manage the potential impacts of stormwater related to land use change.

Research on the Effects of Urbanization on Fish

Aquatic habitats that influence the abundance of salmon and trout are the outcome of physical, chemical and biological processes acting across various scales of time and space. The environmental conditions that result from these processes provide the habitat requirements for a variety of species and life history stages of fish and other stream organisms.

Decline of Wild Salmon

Whether in pristine or heavily urbanized watersheds, the basic requirements for survival of salmon and trout are the same. These basic requirements include: cool, flowing water free of pollutants and high in dissolved oxygen; gravel substrates low in fine sediment for reproduction; unimpeded access to and from spawning and rearing areas; adequate refuge and cover; and sufficient invertebrate organisms (insects) for food.

Over the past century, salmon have disappeared from over 40% of their historical range, and many of the remaining populations are severely depressed (Nehlsen *et al.* 1991). There is no one reason for this decline. The cumulative effects of land use practices, including timber harvesting, agriculture and urbanization have all contributed to significant declines in salmon abundance in British Columbia (Hartman *et al.* 2000)

Puget Sound Findings

In Puget Sound, a series of research projects have been underway for over 10 years to identify the factors that degrade urban streams and negatively influence aquatic productivity and fish survival. The streams and sites under examination represent a range of development intensities from nearly undisturbed watershed conditions to watersheds that are almost completely developed in residential and commercial land uses (Horner 1998).

For each watershed, detailed continuous simulation hydrologic models were prepared and calibrated to rainfall and runoff data. Physical stream habitat conditions, water quality, sediment composition, sediment contamination, and fish and benthic organism abundance and diversity were measured and documented for each site.

The studies found that stream channel instability is a result of the urbanization of watershed hydrology. The alteration of a natural stream's hydrograph is a leading cause of change in instream habitat conditions. The physical and biological measures generally changed most rapidly during the initial phase of watershed development, as total impervious area changed from 5% to 10%. With more intensive urban development in the watershed, habitat degradation and loss of biological productivity continues, but at a slower rate (Horner 1998).

The role of large woody debris in streams was recognized as a key factor in creating complex channel conditions and habitat diversity for fish. Both the prevalence and quality of large woody debris declined with increasing urbanization. In addition, development pressure has had a negative impact on streamside (riparian) forests and wetlands, which are critical to natural stream functioning.

The impacts of poor water quality and concentrations of metals in sediments did not show significant impact to aquatic biological communities until urbanization increased above approximately 50% total impervious area.

Instream habitat conditions had a significant influence on aquatic biota. Streambed quality, including fine sediment content and channel stability, affected the benthic macro invertebrate community (as measured by the multi-metric Benthic Index of Biological Integrity (B-IBI) developed by Karr (1991)). Negative impacts to fish and fish habitat from sedimentation related to urban development have been documented (Reid *et al.* 1999). The composition of the salmonid community was also influenced by a variety of instream physical and chemical attributes.

Summary of Puget Sound Findings

Alterations in the biological community of urban streams are a function of many variables representing conditions that are a result of both immediate and remote environmental conditions in a watershed. The research findings clearly demonstrate that the most important impacts of urbanization that degrade the health of streams, in order of importance, are:

- Changes in hydrology
- Changes in riparian corridor
- Changes in physical habitat within the stream, and
- Water quality

Further discussion of these impacts is contained in Section 2.4.

Georgia Basin Findings

Within the Georgia Basin, population pressures have caused urban sprawl, resulting in habitat loss (B.C. MELP 2000). Freshwater fish population declines in this region are a partial result of rapidly expanding urban development (Slaney 1996).

The aquatic ecosystems most directly affected by urbanization are the small streams and wetlands in the lowlands of the Georgia Basin and lower Fraser River Valley. These ecosystems are critical spawning and rearing habitat for several species of native salmonids (both resident and anadromous). In the Lower Fraser Valley, 71% of streams are considered threatened or endangered, and a further 15% have been lost altogether as a result of urban growth (B.C. MELP 2000).

A Science-Based Understanding

The widespread changes in thinking about stormwater impacts that began in the mid to late 1990s reflect new insights in two areas:

- Hydrology, and
- Aquatic ecology

These new insights are the result of improved understanding of the causes-and-effects of changes in hydrology brought about by urban development, and the consequences for aquatic ecology. As we gain new knowledge and understanding of what to do differently, a central issue for watershed protection becomes:

- What is the proper balance of science and policy that will ensure effective implementation and results?

King County in Washington State addressed this question in 1999 as part of the Tri-County response to the listing of chinook salmon as an endangered species in Puget Sound. A significant finding was that scientists and managers think and operate differently. This led to the following recommendations:

- An interface is needed to translate the complex products of science into achievable goals and implementable solutions for practical resource management. This interface is what we now call a science-based understanding.
- A reality for local government is that management decisions need to be made in the face of significant scientific uncertainties about how exactly ecosystems function, and the likely effectiveness of different recovery approaches.
- The best path forward is a dynamic, adaptive management approach that will allow local governments to monitor the effectiveness of their regulatory and management strategies and make adjustments as their understanding grows.
- In a co-evolving system of humans and nature, surprises are the rule, not the exception; hence, resilience and flexibility will need to be built into the management system.

Through a science-based understanding of the relationship between hydrology and aquatic ecology, this chapter derives a comprehensive set of watershed protection objectives that provide an over-arching framework for Parts B and C of this Guidebook.

2.2 The Natural versus Urban Water Balance

Rainfall landing on a site travels in four directions:

- Soaking into shallow ground and moving slowly through soils to streams - *interflow*
- Percolating vertically into *deep groundwater*
- Back up into the air – evaporation from surfaces and transpiration from leaves - *evapotranspiration*
- Flowing over the ground – *surface runoff*

Because the total volume of rainfall equals the sum of the four components, this relationship is known as the 'Water Balance'. It is a core hydrologic concept.

Urban drainage has traditionally focused on managing surface runoff. It is only recently that the other three components have begun to receive serious attention, with the emphasis on interflow. Although interflow was first defined in the 16th century, its significance has been largely ignored for over 400 years. It is now recognized that all four components need to be considered as part of a comprehensive and integrated approach to stormwater volume management.

Where Rainfall Goes Before and After Development

Figure 2-1 illustrates how the Water Balance changes when natural vegetated cover is replaced by suburban development. By providing example percentages, this drawing highlights the magnitude of the additional volume of water that must be handled by a drainage system after land is cleared. The actual percentages will vary from region to region, but the relationships are universal.

On an annual basis, surface runoff from a forested or naturally vegetated watershed in the Pacific Northwest is minimal as a proportion of total water volume. Before development, the flow that we observe in streams is actually interflow. After development, flow in streams typically originates as surface runoff.

As a watershed is cleared, surface runoff volume increases in proportion to the percentage of impervious surface area, defined as non-infiltrating surfaces (e.g. concrete, asphalt, rooftops, hard landscaping and exposed rock). Once a pipe system is installed to drain these impervious areas, almost every rainfall results in runoff.

Example Annual Water Balance

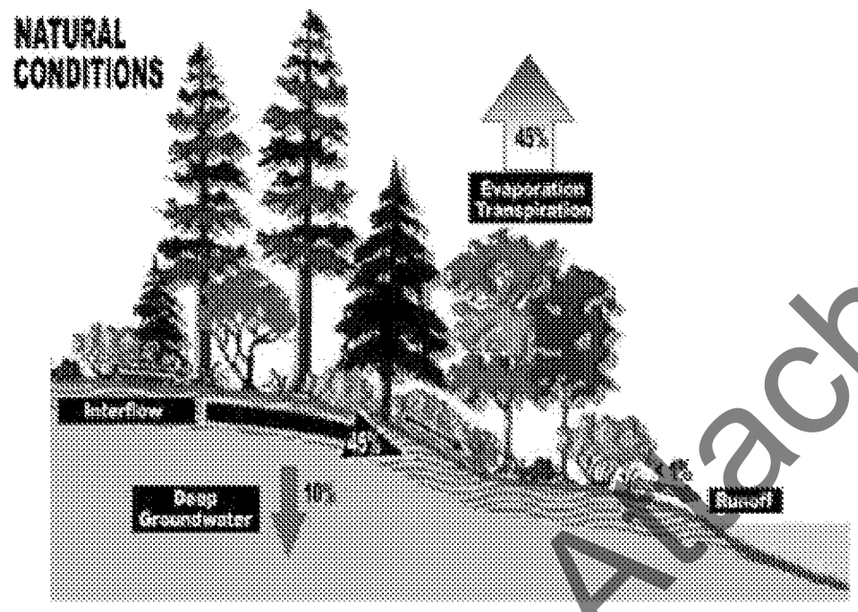


Figure 2-1

Distribution of Rainfall Over a Year

Understanding how rain falls over the course of a year is fundamental to understanding the Water Balance and how to manage its components. Figure 2-2 is an example of a typical distribution of annual rainfall volume. While total rainfall can vary significantly between regions, the distribution pattern is universal for British Columbia.

Example Distribution of Annual Rainfall

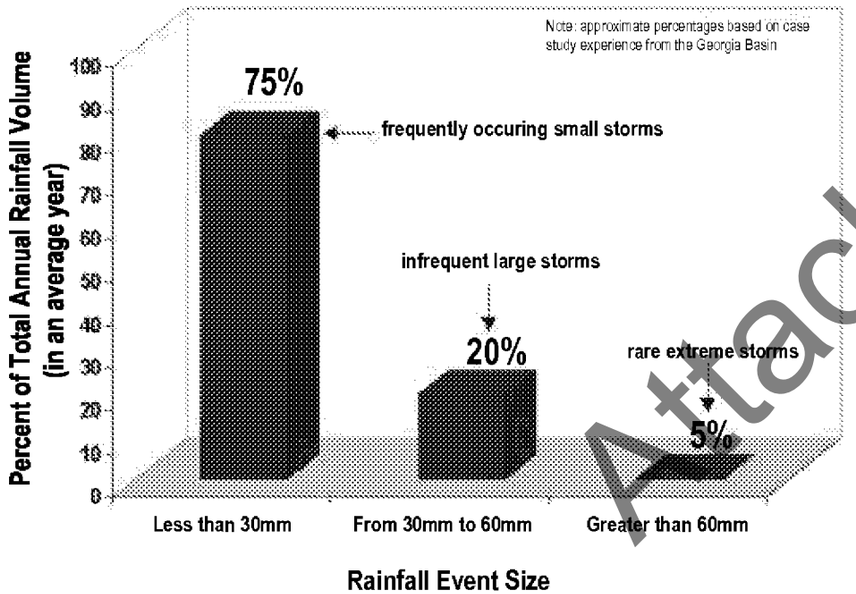


Figure 2-2

Role of Soil, Vegetation and Trees in Capturing Rainfall

The relevance of Figure 2-2 is in making the case that the frequently occurring small rainfall events hold the key to protecting the Water Balance in the urban environment. Small rainfall events typically account for 75% of the annual rainfall volume.

Because the majority of rain falls in small amounts, soil and vegetation are generally able to absorb and infiltrate it as it falls – this is why interflow and evapotranspiration are maximized and surface runoff is minimized in a forested environment.

In a natural condition, vegetated surface soil layers are highly permeable. As surface plants die and decompose, they provide a layer of organic matter which is stirred and mixed into the soil by earthworms and microbes. This soil ecosystem provides high infiltration rates and a basis for interflow.

Trees contribute to the soil ecosystem in two ways: the root zone creates a permeable environment; and the buildup of forest litter creates an absorbent layer.

In an urban situation, preservation and/or restoration of soil, vegetation and trees can help to:

- Recharge interflow
- Protect baseflow
- Minimize runoff

Water Balance Objectives for Protecting Watershed Health

In terms of preventing land development and related human settlement activities in the urban environment from impacting the Water Balance, British Columbia case study experience has resulted in identification of the following objectives for a truly healthy watershed:

- **Objective 1** - Preserve and protect the water absorbing capabilities of soil, vegetation and trees.
- **Objective 2** - Prevent the frequently occurring small rainfall events from becoming surface runoff.

2.3 Understanding Changes in Hydrology

Stormwater management practitioners now commonly use the phrase 'changes in hydrology'. Figure 2-3 presents a basic definition of this phrase:

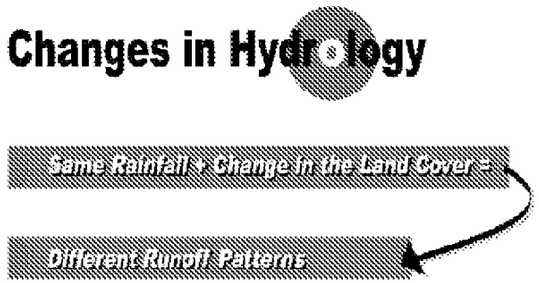


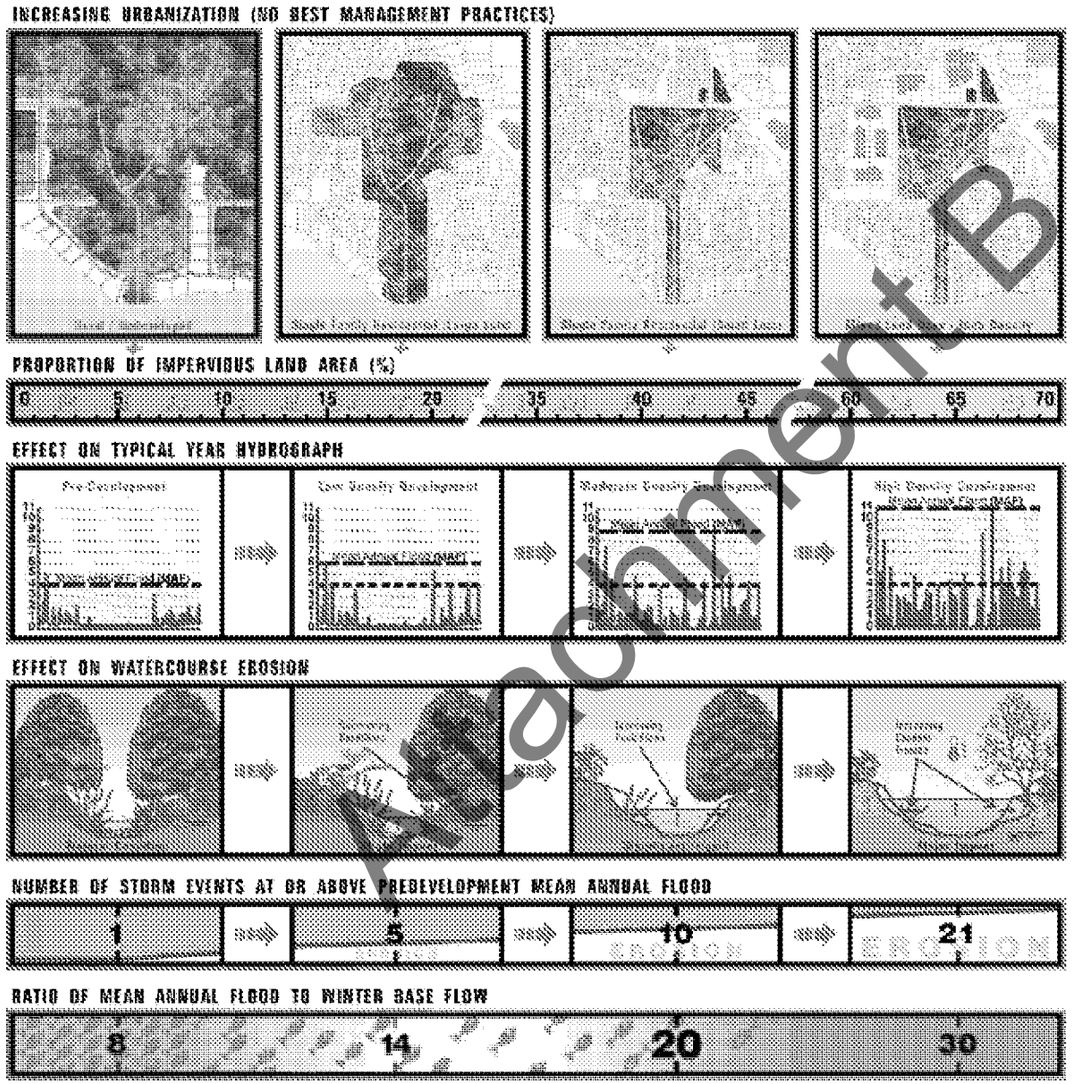
Figure 2-3

Relationship Between Impervious Area and Runoff Volume

Figure 2-4 illustrates the progressive changes in hydrology that result when land use change alters the Water Balance. Replacement of natural vegetation and soil with impervious surfaces reduces infiltration and evapotranspiration. The total runoff volume increases (as shown in red), and so does the Mean Annual Flood (MAF), a statistical rating of the annual peak flows in a creek system.

The MAF is defined as the channel-forming event because the cross-sections of stream channels tend to reach equilibrium with the MAF. When the MAF increases, the channel erodes to expand its cross-section. A critical parameter for watercourse erosion is the number of runoff events per year that equal or exceed the natural MAF. The more frequently the natural MAF is exceeded, the greater the channel instability, leading to habitat degradation as a result of erosion and sedimentation.

A second critical parameter is the ratio of the MAF to the winter baseflow. Washington State research indicates that 20:1 is a threshold ratio for coastal fisheries biodiversity and abundance.



IMPACT OF CHANGES IN HYDROLOGY ON WATERCOURSE EROSION AND BASE FLOW RELATIONSHIPS

(WITHOUT BEST MANAGEMENT PRACTICES)

This figure demonstrates the impact of increasing impervious area on the number of erosion-causing events, and increased peak flow impacts on channel stability.

Figure 2-4

Other Hydrology-Based Relationships

Impervious Area and Water Quality

Not only does more impervious surfaces mean more runoff volume, it also means there is more surface area (e.g. roads, parking lots) available to collect pollutants which then wash off into receiving streams when it rains. Most stormwater runoff receives no treatment before it is discharged to streams.

More runoff volume also means there will be more instream erosion and more frequent turbidity (or dirty water).

Another measure of changes in hydrology is the level of total suspended solids (TSS) in a creek system. TSS comprises the direct wash-off from impervious surfaces, plus sediment that erodes from stream bottoms and sides. TSS acts as a carrier of other pollutants such as organics, hydrocarbons and metals.

Interflow and Baseflow

Yet another measure of changes in hydrology is the Mean Annual Discharge (MAD). This is the average flow over the year. MAD is applied when assessing the relative magnitude of summer baseflows.

The interflow component of the Water Balance sustains baseflow. In fact, interflow can keep creeks flowing for months after winter rainfall stops. Interflow recharge depends on the integrated hydrologic function of soil, vegetation and trees. If interflow is reduced, baseflow is reduced.

When considering both community water supply and fisheries needs during periods of prolonged dry weather, a generally accepted criterion in British Columbia for Water Balance assessment purposes is that minimum baseflows should equal 10% of MAD.

Hydrology and Water Quality Objectives for Protecting Watershed Health

In terms of mitigating the impacts of impervious area on watershed hydrology, British Columbia case study experience has resulted in identification of the following hydrology-based objectives for a truly healthy watershed:

- **Objective 3** – Provide runoff control so that the Mean Annual Flood (MAF) approaches that for natural conditions.
- **Objective 4** – Minimize the number of times per year that the flow rate corresponding to the natural MAF is exceeded after a watershed is urbanized.
- **Objective 5** – Establish a total suspended solids (TSS) loading rate (i.e. kilograms per hectare per year) that matches pre-development conditions.
- **Objective 6** – Maintain a baseflow condition equal to 10% of the Mean Annual Discharge (MAD) in fisheries-sensitive systems.

2.4 Factors that Limit the Health of Aquatic Resources

A science-based understanding of the factors that limit the health of aquatic resources leads to reference levels of impervious area for planning purposes. This understanding provides the basis for setting performance targets and developing site design criteria.

Ranking of Limiting Factors

Research by the University of Washington (Horner and May 1996) clearly demonstrated that the factors limiting the ecological values of urban streams are, in order-of-priority:

1. **Changes in Hydrology** –
   Greater volume and rate of surface runoff caused by increased impervious area and densification of the road network.

2. **Disturbance and/or Loss of Integrity of the Riparian Corridor** –
   Clearing and removal of natural vegetation in riparian (streamside) areas.

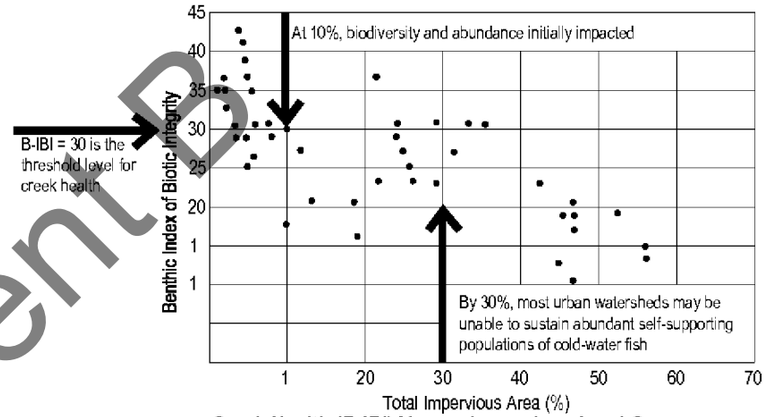
3. **Degradation and/or Loss of Aquatic Habitat within the Stream** –
   Caused by erosion and sedimentation processes, bank hardening, and removal of large organic debris; aquatic habitat degradation is a direct result of changes in hydrology (Factor #1).

4. **Deterioration of Water Quality** –
   Increased sediment load due to more runoff volume causing channel erosion. Pollutant wash-off from land uses, deliberate waste discharges and accidental spills.

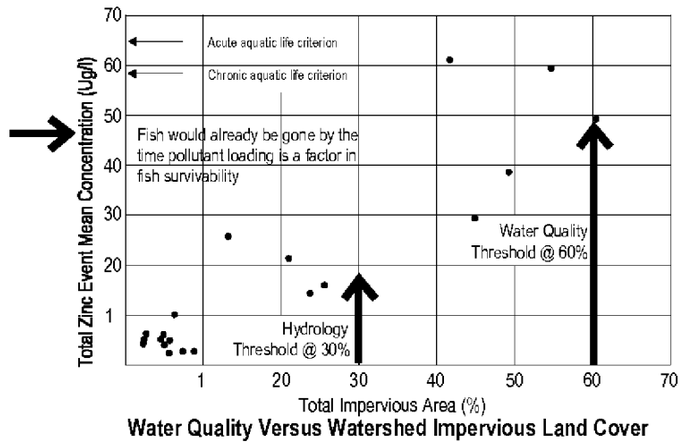
Figure 2-5 illustrates the research findings for two of these factors: changes in hydrology (#1) and deterioration in water quality (#4).

The work of Horner and May has had a profound impact in changing the way stormwater professionals view the relationship between watershed impervious area and stream health. Their work has also resulted in a science-based understanding that, in turn, has enabled the definition of reference levels for land use planning.

Reference Levels for Land Use Planning



Creek Health (B-IBI) Versus Impervious Land Cover



Water Quality Versus Watershed Impervious Land Cover

Figure 2-5

Reference Impervious Area Levels for Land use Planning

The scientific correlations presented on Figure 2-5 are simplified in the table below. The objective is to provide points of reference for integration of stormwater management with land use planning. This simplification will at least enable informed decision making. In reality, land use and stream health changes occur along a continuum.

Impervious Percentage	Biophysical Significance of the Reference Level
10%	Fisheries biodiversity and abundance are initially and significantly impacted
30%	Most urban watersheds in the Pacific Northwest may be unable to sustain abundant self-supporting populations of cold-water fish
60%	Pollutant loading would theoretically be a significant factor in fish survival, except cold-water fish would likely already have been extirpated because of hydrological changes and related degradation of the aquatic habitat

Measuring the Environmental Health of Creek Systems

Figure 2-5 refers to a Benthic Index of Biological Integrity (B-IBI) score as an indicator of creek health. B-IBI is a multimetric benthic macroinvertebrate index designed and calibrated for use in the Pacific Northwest. Each of the metrics it incorporates (e.g. total number of taxa, number of pollution tolerant taxa) was chosen for its consistency in responding to several types of human disturbance, including urbanization, forestry, agriculture and recreation. B-IBI is also useful because it is very sensitive to slight changes in a watershed.

Benthic invertebrates are used because anadromous fish species in the Pacific Northwest are subject to significant environmental pressures unrelated to their home watershed. These outside influences affect their distribution, diversity and abundance, making it difficult to use fish population measures as indicators of stream health.

Other Washington State Research Findings

Riparian Corridor Integrity

In any given watershed or at any given site, any one of the four factors can limit biologic health. Research by the University of Washington (Karr and Morley 1999) as well as a series of studies summarized by Millar (1997) demonstrate the importance of healthy riparian corridors. The presence or absence of healthy riparian forest greatly affects a stream's biologic integrity in otherwise similar watersheds with similar total imperviousness.

A healthy, forested riparian corridor can partially compensate for impervious surfaces in a watershed. In contrast, a cleared riparian corridor results in a damaged stream even in a watershed with low impervious area.

Density of Road Networks

Another significant finding is that the density of road networks also provides an excellent way to closely track total impervious area and associated impacts. This is because of the drainage system pattern associated with nearly all roads.

Drainage ditches collect surface water and interflow and transport it immediately to streams. Resulting changes in stream-system hydrology are similar to the effects of increased impervious surfaces.

Biophysical Objectives for Protecting Watershed Health

In terms of preventing changes in hydrology from impacting aquatic resources, Washington State research has resulted in identification of four objectives for defining a truly healthy watershed – that is, one that can support self-sustaining populations of wild salmon:

- **Objective 7 -** Limit impervious area to less than 10% of total watershed area.
- **Objective 8 -** Retain 65% forest cover across the watershed.

2.5 Managing Complexity

There is a logical link between changes in hydrology and impacts on watershed health, whether those impacts are in the form of flooding or aquatic habitat degradation. The link is the volume of surface runoff that is created by human activities as the result of alteration of the natural landscape (i.e. through removal of soils, vegetation and trees).

Eliminate the Source of Problems

The key to protecting watershed health is to maintain the Water Balance as close to the natural condition as is achievable and feasible. But protecting the interflow and evapo-transpiration components requires major changes in the way we develop land (i.e. if we are to preserve and/or restore soils, vegetation and trees). Understanding the cause-and-effect relationship between hydrology and biology provides credibility for a change in approach from only dealing with consequences, to also eliminating the source of problems. This shift in thinking is illustrated by Figure 2-6 below.

Science-based credibility helps people accept new ways of thinking. But to maintain credibility, it is important to apply common sense to the science.

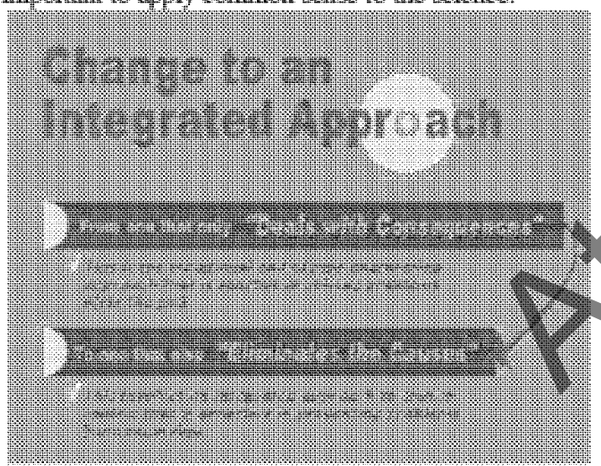


Figure 2-6

What the Science is Telling Us

The science is explicitly telling us that major biophysical changes occur once the impervious percentage of a watershed reaches about 10%. Beyond this threshold, the change in the Water Balance triggers watercourse erosion, which in turn degrades and/or eliminates aquatic habitat.

The science is implicitly telling us that where urban land use densities are produced, the focus should be on what needs to be done at the site level to effectively mimic a watershed with only 10% impervious area, and in doing so reduce runoff volume to the same 10% level.

The science is also implicitly telling us that capturing rainfall at the source for the frequent small events will in large part maintain or restore the natural Water Balance.

What Can be Done at the Site Level to Protect Watershed Health

The financial and staff resources of local government are limited. Therefore, those resources must be invested wisely to maximize the return-on-effort. Common sense says that the best return will be at the site level where local government exerts the most influence, and can therefore make a cumulative difference at the watershed scale.

A Starting Point for Early Action

Common sense says that we now have sufficient science-based knowledge and understanding for local government to make some decisions, and to get on with implementing early action in at-risk areas. More data to refine the science is desirable when there is time and resources, however, there will be situations where excessive data collection becomes a barrier to effective action in the face of an immediate risk.

Strategic data collection required is to understand the historic Water Balance, the current Water Balance if the watershed is partially developed, and the proposed changes to land use in the watershed.

Looking ahead to the discussion in Parts B and C, the objectives of most ISMPs will include trying to maintain or restore the natural Water Balance as development or re-development proceeds. Improved understanding of how to do that will evolve through demonstration projects that test and refine solutions to aquatic habitat and receiving water quality challenges.

A Starting Point for Early Action

Common sense says that we now have sufficient science-based knowledge and understanding for local government to make some decisions, and to get on with implementing early action in at-risk areas. More data to refine the science is desirable when there is time and resources, however, there will be situations where excessive data collection becomes a barrier to effective action in the face of an immediate risk.

Strategic data collection required is to understand the historic Water Balance, the current Water Balance if the watershed is partially developed, and the proposed changes to land use in the watershed.

Looking ahead to the discussion in Parts B and C, the objectives of most ISMPs will include trying to maintain or restore the natural Water Balance as development or re-development proceeds. Improved understanding of how to do that will evolve through demonstration projects that test and refine solutions to aquatic habitat and receiving water quality challenges.

Objectives for Protecting Watershed Health in the Urban Environment

The three sets of objectives for a truly healthy urban watershed are brought forward from the previous sections and consolidated below. The purpose is to provide an integrated framework for guiding the actions of local governments within their sphere of responsibility and influence.

Water Balance

- **Objective 1** - Preserve and protect the water absorbing capabilities of soil, vegetation and trees.
- **Objective 2** - Prevent the frequently occurring small rainfall events from becoming surface runoff.

Hydrology / Water Quality

- **Objective 3** – Provide runoff control so that the Mean Annual Flood (MAF) approaches that for natural conditions.
- **Objective 4** – Minimize the number of times per year that the flow rate corresponding to the natural MAF is exceeded after a watershed is urbanized.
- **Objective 5** – Establish a total suspended solids (TSS) loading rate (i.e. kilograms per hectare per year) that matches pre-development conditions.
- **Objective 6** – Maintain a baseflow condition equal to 10% of the Mean Annual Discharge (MAD) in fisheries-sensitive systems.

Biophysical

- **Objective 7** - Limit impervious area to less than 10% of total watershed area.
- **Objective 8** - Retain 65% forest cover across the watershed.
- **Objective 9** - Preserve a 30-metre wide intact riparian corridor along all streamside areas.
- **Objective 10** - Maintain B-IBI (Benthic Index of Biological Integrity) score above 30.

The Scope of Integrated Stormwater Management

Chapter Three

3.1 Overview and Context

- Connecting the Natural and Built Environments
- Integration Means Tackling Water Quantity and Water Quality
- Blending Policy, Science and Site Design

3.2 The Transition from Traditional to Integrated Stormwater Management

- Evolution of the Integrated Approach
- Change in Approach: from Reactive to Proactive
- Volume Reduction is the Key to Property and Environmental Protection
- The Evolving Role of Governments in Integrated Stormwater Management

3.3 Plan at Four Scales – Regional, Watershed, Neighbourhood and Site

- What the Cell is to the Body, the Site is to the Region
- Cascading Hierarchy of Integrated Solutions

3.4 Integrated Stormwater Management Planning

- Producing a Shared Vision
- An Action Plan with Four Components

3.5 The Relationship between Stormwater and Land Use

- Ten Principles

3.6 A Guide to Part B

- Case Studies

3.1 Overview and Context

An integrated approach recognizes that land use changes outside a stream corridor result in changes within the corridor. The impact of land development in changing both stormwater quantity and quality can trigger progressive loss of biodiversity and abundance of aquatic species within the corridor.

Connecting the Natural and Built Environments

Integrated, or watershed-based, stormwater management recognizes the relationships between the natural environment and the built environment, and manages them as integrated components of the same watershed. These relationships are illustrated in Figure 3-1. Traditional drainage practices concentrated on peak flow rates and overlooked the importance of volume management. Integrated solutions manage both volume and flow rates.

Integration Means Tackling both Stormwater Quantity and Quality

Integrated stormwater management includes attention to both stormwater quality and quantity. Water quality impairments correlate with increased watershed percent imperviousness, as well as with increased population density. Rainfall washes fine sediment from hard surfaces into piped systems that discharge into receiving waters. As an area develops, the total volume of sediment loading increases.

The majority of trace metals and hydrocarbons, for example, are associated with suspended sediment. Hence, it is common sense that reducing stormwater volume will also reduce sediment loading and reduce aquatic pollution. When stormwater is infiltrated through soil, many sediment-bound contaminants are removed by filtration. Similarly, constructed wetlands can also act as settling ponds to remove and treat suspended sediments in runoff. Other stormwater treatment technologies are available commercially and may become important as development intensifies.

Programs that increase public awareness of common non-point source pollutants in the home and business will also contribute to reduced pollutant loads. Other more rigorous source control programs (e.g. bylaws) may also become necessary as land use intensifies.

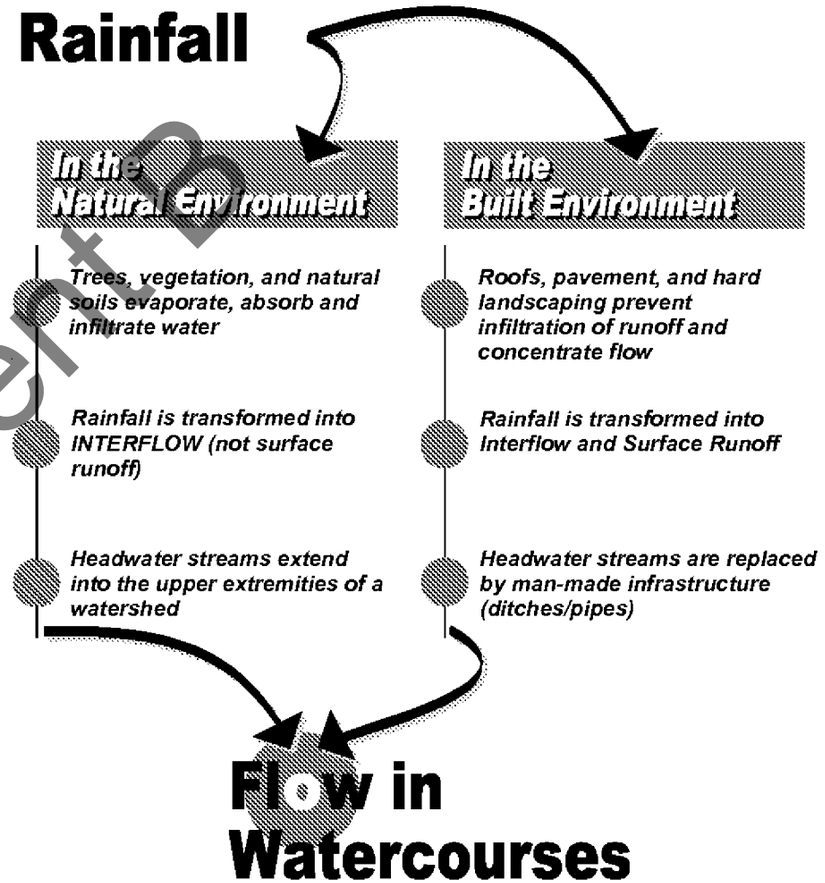


Figure 3-1

Blending Policy, Science and Site Design

Integrated stormwater management blends policy, science and site design through an integrated approach. Key steps are:

- **Policy** –
  Identify goals, objectives, locations and guidelines for both land use development and stormwater management. Organize priorities and financial and administrative support.

- **Science** –
  Build a science-based understanding of the link between urban development impacts, stream degradation, and other policy objectives. This understanding leads to realistic performance targets and design criteria for each watershed catchment.

- **Site Design** –
  Identify site design practices that support the policy objectives and meet the performance targets. Once identified, these site design practices must be allowed and supported at the policy level. Changes to development standards and regulations are also needed to enable better site design practices.

Policy, science and site design are blended through a participatory and interactive process where technical products are developed and presented at a series of working sessions with stakeholders. The objective is to reach consensus on a shared vision that is practical and achievable, and that will be supported by the community. Community support is the key to moving from planning to action. Chapter 11 elaborates on this topic.

3.2 The Transition from Traditional to Integrated Stormwater Management

Evolution of the Integrated Approach

Stormwater management has evolved over the decades, and continues to evolve. The following comparison captures the key elements of the transition from a traditional, 1980s approach, to an integrated approach in the 2000s. The integrated approach still incorporates the traditional scope of engineering work, but builds on it to achieve environmental as well as drainage objectives, as the following table demonstrates:

TRADITIONAL is defined as:		INTEGRATED is defined as:
✓ Drainage Systems	⇒	✓ Ecosystems
✓ Reactive (Solve Problems)	⇒	✓ Proactive (Prevent Problems)
✓ Engineer-driven	⇒	✓ Interdisciplinary Team-driven
✓ Protect Property	⇒	✓ Protect Property and Resources
✓ Pipe and Convey	⇒	✓ Mimic Natural Processes
✓ Bureaucratic Decisions	⇒	✓ Consensus-based Decisions
✓ Local Government Ownership	⇒	✓ Partnerships with Others
✓ Narrow Scope of Work (drainage focus only)	⇒	✓ Holistic Scope of Work (stormwater integrated with land use)

An integrated approach to stormwater planning is inter-departmental, interdisciplinary and inter-agency. It also involves community representatives in the planning process. These elements and their significance are explained in later chapters in Part C.

Change in Approach: from Reactive to Proactive

Integrated stormwater solutions ensure protection of both property and ecosystems. Past drainage practices only dealt with the consequences of land development. An integrated approach also attempts to eliminate the source of problems.

Figure 3-2 illustrates what is involved in moving from an 'end-of-pipe' approach that solves problems after the fact, to one that is proactive in preventing problems from occurring.

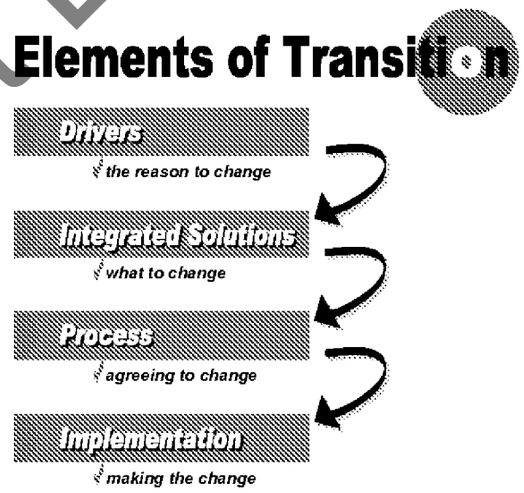


Figure 3-2

Volume Reduction is the Key to Property and Environmental Protection

To avoid aquatic habitat and water quality impacts and protect property, it is necessary to ***decrease the volume of runoff that flows to streams***, thereby creating a situation that mimics or approximates a naturally vegetated watershed. Past stormwater management practices did not accomplish this because they focused only on the conveyance and/or detention of the extreme storms.

Extreme storms occur rarely. Because the small, frequently occurring rainfall events represent the bulk of total rainfall, the key to ***runoff volume reduction*** is to capture those events at the source. If they can be captured and restored to their natural hydrologic pathways (through infiltration and re-use within a development site), then the majority of the total annual rainfall will be managed in a manner approximating a natural system.

Strategies to Reduce Runoff Volume and Flow Rate

Integrated solutions reduce the volume and the rate of surface runoff from the built environment by a combination of three strategies:

- Minimize creation of impervious area, e.g. by using pervious surfaces, narrower roads, skinny buildings, etc.
- Install hydraulic disconnects that return local runoff from impervious surfaces back into the ground or re-use it within the development site.
- Store runoff and release it slowly. Ideally this storage would discharge to an infiltration device prior to discharge to a watercourse.

In summary, integrated stormwater management recognizes that flood control, protection of aquatic habitat and improvement of water quality are all complementary objectives. They all have the same starting point – increased impervious area leads to increases in runoff.

The Evolving Role of Governments in Integrated Stormwater Management

The goal in BC is to develop integrated stormwater solutions that will ensure protection of life, property, aquatic habitat and water quality. Achieving this goal requires alignment of the roles and responsibilities of the different levels of government.

Local government has responsibility for land use decisions. Local government is also responsible for protection of property. Because of the direct relationship between land use development and stormwater impacts, local government must play a primary role in aquatic habitat protection and restoration related to stormwater management.

Recent changes to the *Local Government Act* have expanded the mandate for municipalities and regional districts to manage runoff and impervious area.

In view of the expanding role of local governments in stormwater management, a key objective of the Guidebook is to provide a pragmatic, integrated and science-based approach to stormwater planning. This will enable local governments and landowners to make long-term land use and development decisions with more confidence.

Providing Economy and Certainty During a Period of Transition

During this period of transition from traditional drainage practice to integrated stormwater management, there is uncertainty as to what roles various levels of government and the private sector should play in stormwater management, and who pays.

Part C of the document suggests partnerships among various levels of government. Senior governments recognize the importance of being proactive in developing strong and lasting partnerships with local governments.

The Guidebook presents an adaptive methodology for moving from planning to action. This methodology focuses the limited financial and staff resources of governments on implementing early action where it is needed most. It explains how to select conservative strategies to guide early action. It also provides a framework for reducing the costs of these strategies through ongoing monitoring and evaluation.

3.3 Plan at Four Scales – Regional, Watershed, Neighbourhood and Site

What the Cell is to the Body, the Site is to the Region

Just as the health of the human body is dependent on the health of the individual cells in it, so too is the health of the suburban region dependent on the health of the individual site – this is an over-arching theme.

A guiding principle is to plan at four scales to ensure that solutions are both integrated and cascading. The scales are the region, watershed, neighbourhood and site, as shown in the adjacent table.

Cascading Hierarchy for Integrated Solutions

The objectives for stormwater management are referenced to, and defined by, the cascading hierarchy shown to the right. Each successive level provides more specific details as to what is to be accomplished, and how to achieve a shared community vision for the region and/or watershed.

The planning scales are not mutually dependent. However, they work best when undertaken together. In the context of this Guidebook, watershed-based planning means that resource, land use, and community design decisions are made with an eye towards their potential impact on the watershed or drainage catchment. Therefore, what happens at the scale of the individual parcel and street affects what happens at the watershed scale.

Planning Scale	Description of Initiative	Opportunity for Implementing Stormwater Management
Regional	Regional Growth Strategy	Provide local government with enabling tools
Regional	Stormwater Component of Liquid Waste Management Plans (LWMPs)	Prioritize limited resources on key environmental stewardship issues
Regional	Official Community Plan (OCP)	Define over-arching community goals and objectives
Watershed	Watershed-Based Land Use Planning Process	Develop a stewardship-based 'watershed vision' that reflects OCP
Watershed	Integrated Stormwater Management Plan (ISMP)	Protect property, aquatic habitat and water quality
Neighbourhood	Neighbourhood Community Plan (NCP), or Local Area Plan (LAP)	Establish performance targets for subdivisions and site design
Site	Subdivision and Single Lot Development Plans	Implement performance targets for site design

3.4 Integrated Stormwater Management Planning

The evolving science of stormwater management has broadened the traditional engineering approach to one that integrates hydrologic and environmental concerns, and that is also proactive in managing risk. Hence, the term *Integrated Stormwater Management Plan* (ISMP) is gaining widespread acceptance in BC because it addresses two categories of risk management:

- Flood Risk – to protect life and property
- Environmental Risk – to protect habitat and property

Producing a Shared Vision

To address stormwater issues, it is critical that key stakeholders have a shared vision of the science and the appropriate solutions for the watershed under consideration. Stakeholders must understand that land use change alters the natural Water Balance, that the result is more surface runoff, and that the increase in both volume and flow rates has consequences.

The purpose of an ISMP is to create a clear picture of a desired outcome that will facilitate a broad understanding of integrated solutions – why they are needed, what they are, and how they can be practically and affordably accomplished. An ISMP implementation program will organize a transition from existing to revised standards that achieve the desired outcome.

An Action Plan with Four Components

Figure 3-3 illustrates how a process produces a shared vision that results in an action plan with four component plans. Chapter 10 elaborates on the concepts presented in this section.

The effectiveness of flood risk and environmental risk management depends on a ***Land Development Action Plan*** that integrates decisions about land use and on-site stormwater best management practices to protect and/or restore the natural Water Balance.

The purpose of a ***Flood Risk Mitigation Plan*** is to protect life and property. This is achieved by containing and conveying the floodflows that result from the extremely large rainstorms that rarely occur. This component has historically been called a Master Drainage Plan.

The purpose of a ***Habitat Enhancement Plan*** is to address environmental risk (to aquatic habitat and water quality). This means protecting stream corridor ecosystems from being progressively degraded by the erosion and sedimentation that result from the small rainfall events that occur all the time. This is achieved through a combination of retention (rainfall capture at the source) and detention (runoff control) strategies. This combination also indirectly addresses risks to water quality.

The purpose of a ***Financial and Implementation Plan*** is to provide cost sharing and control, funding and organization of the stakeholders to ensure effective implementation, monitoring, operating and maintenance.

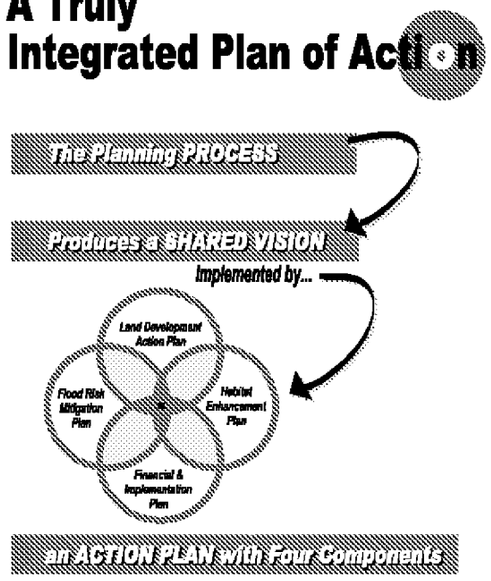


Figure 3-3

3.5 The Relationship between Stormwater and Land Use

As introduced in Chapter 2, the impacts of increasing impervious area on stream flows and fish habitat are cumulative. Changes in land use designations and zoning should consider how much change to effective impervious area is encouraged by the proposed land use.

Table 3-1 shows a typical, generalized relationship between imperviousness and land use, without mitigation by best management practices (BMPs). This illustrates how the area per dwelling unit decreases with density. For example, the impervious area per dwelling unit for a high-density multi-family development is about 1/8 of the per unit area for a 1960s suburban residential development.

Table 3-1 Presumed Relationship between Impervious Area and Land Use (1)

Land Use	Density (units / acre)	TIA (percent)	EIA (percent)	Land/1000 Dwellings (acres)	EIA / 1000 Dwellings (acres)
Rural Residential	0.5	10	4	2000	80
Estate Residential	1	20	10	1000	100
1960s Suburban	4	35	24	250	60
1990s Suburban*	5	55	45	200	90
Low Multi-family	8	60	48	125	60
High Multi-family** (underground parking)	50	60	48	20	10
Commercial/Industrial	n/a	90	86	n/a	n/a

(1) Extracted from Dinicola, 1989, Jackson and Booth, 1997

TIA = total impervious area and EIA = effective impervious area (i.e. directly connected to drainage system)
Refer to Chapter 6 for additional explanation regarding TIA versus EIA

* Source: Como Creek watershed, City of Coquitlam – airphoto interpretation
** Source: Burnaby Mountain Community, City of Burnaby – neighbourhood plan

Ten Principles

An improved understanding of the relationship between stormwater management and land use is important to make the case for closer integration of OCP and ISMP processes, and to break down barriers between planners and engineers. Table 3-2 identifies ten principles that help define the relationship between stormwater management and land use.

Looking ahead to Chapters 6 through 8, understanding the relationship between stormwater and land use is also important in deciding when, where and how stormwater management performance targets should be applied.

Table 3-2: Ten Principles that Define the Relationship between Stormwater Management and Land Use

1. 10% impervious area is a critical threshold - Stormwater impacts increase dramatically when land use creates over 10% impervious area in a watershed or drainage catchment.
2. Residential development has the greatest overall impact - Residential development often has the greatest cumulative impact on stormwater management because it covers the greatest land area.
3. Greater population = greater impact - The higher the population accommodated in a watershed or sub-watershed, the higher the likely water quantity and water quality impacts.
4. Same population, greater density = less impact - The greater the density of residential land use in a watershed for a given population, and the more remaining vegetated green space, the lower the likely stormwater impact.
5. Rule of thumb is to maintain catchment effective impervious area (EIA) below 10% - Generally, stormwater best management practices (BMPs) to manage flows should be triggered for all developments that involve more than 10% total impervious area. The objective of the BMPs would be to reduce the effective impervious area, and to meet designated targets for rainfall capture and runoff control.
6. BMPs are needed for residential densities exceed 1 unit per hectare - Most residential developments of densities greater than 1 unit per hectare will exceed the 10% impervious area trigger.
7. Industrial/commercial = greatest impervious area - Medium density commercial and industrial developments have high impervious area that needs to be mitigated. However, these developments often represent a small portion of the watershed when compared to other land uses (e.g. residential).
8. Large structures in forestry/agricultural areas may require mitigating BMPs - Very low density land uses such as agriculture or forestry will often have impervious area less than 10%, but can still have a major impact on watershed hydrology due to the consequences of clearing and ditching. In addition, local sites such as greenhouses or temporary industrial operations may trigger the need for specific stormwater management measures. At the same time, drainage from upland urban areas may have flooding impacts on agricultural lowland uses if not mitigated.
9. The impacts of impervious area are cumulative – An existing development that is not creating a problem may contribute to a future problem as adjacent development infills. For this reason, all development with >10% EIA should implement stormwater management, except in isolated cases where there is no likelihood of the total impervious area in a drainage catchment exceeding 10% (e.g. in completely rural areas).
10. Compact communities are most compatible with stormwater objectives - The most favorable land use pattern for minimum stormwater impacts is compact, dense, pedestrian-oriented development with effective stormwater BMPs, and with the majority of the watershed in vegetation and absorbent soils.

3.6 A Guide to Part B

Often it is the small or tributary drainage catchments that are heavily impacted by land use change. Since development activities can quickly transform a large portion of these at-risk catchments, it is important that integrated stormwater management programs be put in place quickly. Priority action in at-risk catchments has several advantages:

- Demonstrates that local government is taking immediate action
- Focuses attention on the types of stormwater problems that will have to be addressed in other areas
- Serves as a demonstration project for testing the effectiveness (and affordability) of stormwater management policies and techniques

Looking ahead, Chapter 4 describes two tools that can be used by local government to bring about policy changes that will result in integrated solutions.

Chapter 5 describes an approach for setting priorities for early action. This is called the *At-Risk Methodology* (ARM). This methodology relies on a roundtable process that brings together people with knowledge about future land use changes, high-value ecological resources, and locations that have chronic drainage problems. The Regional District of Nanaimo is the case study example.

Chapters 6 through 8 then lead the reader through a step-by-step discussion on the selection and application of achievable performance targets. Each chapter is a building block in a systematic process for translating performance targets into design criteria that can be implemented at the site level to achieve watershed objectives. The City of Chilliwack and the Greater Vancouver Regional District (GVRD) are the case study examples.

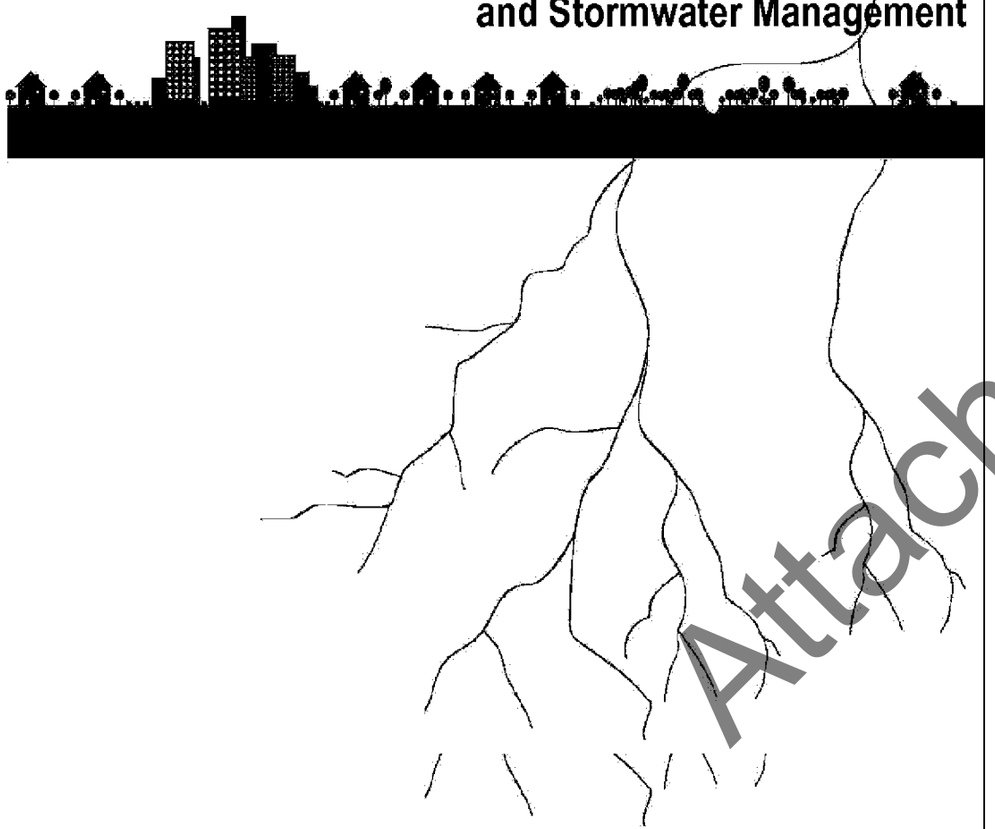
- Chapter 6 explains how science-based performance targets have been set for the City of Chilliwack, and shows how these targets have been translated into design criteria.
- Chapter 7 then demonstrates how Chilliwack has integrated performance targets with stormwater management policies.
- Finally, Chapter 8 illustrates how Chilliwack has incorporated performance targets into a set of *Design Guidelines for Stormwater Systems* that developers can understand and apply at the site level.

Case Studies

The targets, criteria, policies and guidelines are incorporated in the City of Chilliwack's *Policy and Design Criteria Manual for Surface Water Management*. This Manual has been developed as a case study application of the Guidebook content.

The GVRD case study (also presented in Chapter 8) evaluates a broad range of stormwater source control options that can be applied to achieve performance targets.

Policies for Integration of Land Use Planning and Stormwater Management



Chapter Four

4.1 Policy Tools for Implementing Integrating Stormwater Management Solutions

- Official Community Plans (OCPs)
- Liquid Waste Management Plans (LWMPs)
- Case Study Applications
- Integrating Stormwater and Land Use Strategies

4.2 Liquid Waste Management Plans

- Stormwater Management Role of Regional Districts
- Relationship Between LWMP and ISMP Processes
- ISMP Technical Products

4.3 Relationship Between OCPs and LWMPs

- An OCP Provides the Foundation for an LWMP
- Take Whatever Step Comes First
- The Link Between Land Development and Stream Protection

4.4 Stormwater Management Goals, Objectives and Policies

- Case Study Example: Customizing a Framework

4.5 Policy Transition in a Rural Regional District

- Case Study Example: A Five Year Stormwater Management Program
- The Need for Stormwater Management in Rural Regional Districts
- Focusing Rural Stormwater Planning Efforts
- An Action Plan for the Transition to Stormwater Management
- Administering the RDN Stormwater Management Program
- Partnerships for the RDN Stormwater Management Program

4.1 Policy Tools for Implementing Integrated Stormwater Management Solutions

Achieving stormwater performance targets involves change, both at the land use level, and at the site design level.

Initiating change in stormwater management through land use or site design may involve two tools of local government: the *Official Community Plan* (OCP) and the *Liquid Waste Management Plan* (LWMP), and their related bylaw tools.

Official Community Plans tend to be led by planners, with input from engineers on infrastructure sections. Liquid Waste Management Plans tend to be led by engineers, with little or no input from planners. Both processes involve approval by a Local Council or a Regional Board.

Official Community Plans (OCPs)

Official Community Plans are statements of broad objective and policy to manage land use and growth in municipalities or in designated areas of regional districts. While these plans must designate land uses, they also may address social, environmental and sustainability issues at a broad level.

Related tools are Regional Growth Strategies, Neighbourhood Plans, Zoning Bylaws, Subdivision Bylaws and Development Permits, among others. While these tools are not centered on stormwater management, the provincial *Local Government Act* has expressly permitted local governments to use these tools to manage environmental impacts, runoff and impervious area.

Liquid Waste Management Plans (LWMPs)

Creating change in stormwater practices also may be triggered by a Liquid Waste Management Plan (LWMP). A Liquid Waste Management Plan charts a local government's proposed future course of action with respect to the management, collection, treatment and disposal of the sewage, stormwater and other wastewater effluents.

LWMPs are voluntary, and are created by local governments under a public process in co-operation with the Province. There are currently about 40 LWMPs adopted or in process in BC. Although the emphasis of most LWMPs has to date been on sanitary sewage, there will be an increasing emphasis on non-point-source pollution and stormwater in new LWMPs, or as existing LWMPs are updated or amended.

Case Study Applications

This chapter presents two case study applications that have developed content for the Guidebook:

- **Suburban Municipality** – the City of Chilliwack
- **Rural Regional District** – the Regional District of Nanaimo

These case studies have provided an opportunity to test and refine core concepts contained in this Guidebook with respect to integrating stormwater management with land use planning.

Integrating Stormwater and Land Use Strategies

Official Community Plans and Liquid Waste Management Plans, although often produced in isolation, are actually highly related exercises, as shown below:

Official Community Plan (OCP)	Liquid Waste Management Plan (LWMP)
Sets land use designations	Deals with sanitary sewage and stormwater consequences of land use designations
Adopted by Council/Board bylaw	Adopted by Council/Board bylaw
Involves public process	Involves public process
Updated periodically	Updated periodically
Planner-led	Engineer-led

Rather than view these as separate processes, it is useful to recognize the complementary and iterative nature of these two tools, as illustrated in Figure 4-1. Changes in land use policy create changes in liquid waste policy, and ecological or financial limitations on liquid waste systems may limit land use change.

Each local government will have a different Official Community Plan, Liquid Waste Management Plan, and other bylaws. As almost every bylaw comes up for review periodically, changing stormwater management policies is an opportunistic process; change will be made when the opportunity exists to make change.

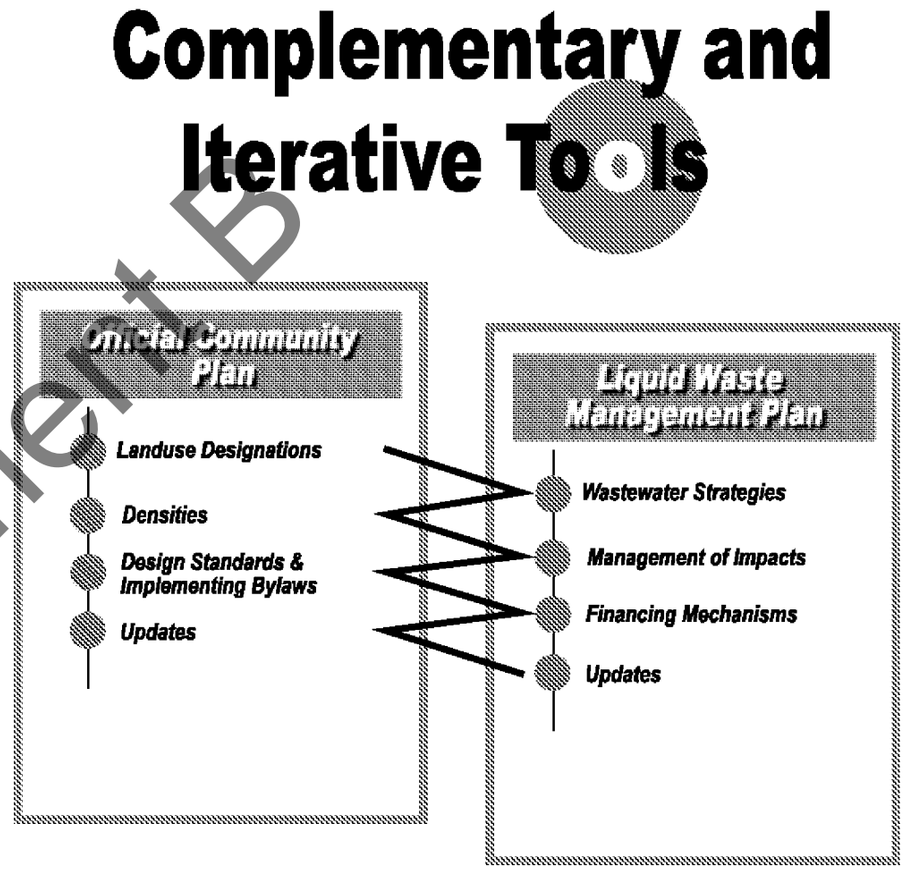


Figure 4-1

4.2 Liquid Waste Management Plans

The provincial *Waste Management Act* allows a municipality or regional district to develop an LWMP for approval by the Minister of Water, Land and Air Protection. The Minister can also order a local government to develop or revise an LWMP.

When the Guidelines for developing an LWMP were first published in 1992, urban stormwater runoff was included because the Ministry considered stormwater to be a resource to be protected. The 1992 Guidelines outlined a 3-stage process for developing an LWMP, and listed the various waste streams to be addressed, including non-point source pollution in stormwater runoff. The three stages are:

- Stage 1 - Identify Options
- Stage 2 - Evaluate Options
- Stage 3 – Prepare and Adopt Plan

Public participation is an integral component of each stage. This requirement provides an opportunity for a feedback loop that should also help broaden community support for the related but separate ISMP process for the stormwater component of an LWMP. A methodology to involve stakeholders in ISMP development is explained in Part C.

The Minister must be satisfied that there has been adequate public review and consultation with respect to the development, amendment and final content of the LWMP before providing sign-off. When approved, the LWMP authorizes disposal or re-use of municipal liquid waste. The local government then has the authority to spend the allocated public funds on the identified works and projects contained within the plan. Ideally, the LWMP should use a 20 to 40-year planning horizon.

The 1998 NPS Action Plan, introduced in Chapter 1, also identifies an LWMP as a tool to deal with pollution from stormwater runoff.

Stormwater Management Role of Regional Districts

To the date of writing, stormwater management in British Columbia has been focused on municipalities, not regional districts. The only regional districts that are highly active in stormwater management are the Greater Vancouver Regional District (GVRD) and the Capital Regional District (CRD). Within these two relatively urbanized regional districts, most of the land area falls within municipal boundaries. Therefore in the GVRD and the CRD, the regional district role is as a coordinator and economy of scale service provider, with the primary stormwater management role being provided by the member municipalities.

Outside of these two metropolitan regions and other municipalities, the great majority of the land area in British Columbia is administered as electoral areas within regional districts. Stormwater management in these relatively rural regional districts has been limited to date. In many cases, there is little active stormwater planning, other than that provided for drainage of roads administered by the provincial Ministry of Transportation and Highways.

Relationship between LWMP and ISMP Processes

There are two ways that the LWMP process potentially dovetails with stormwater management planning:

- **Regional Scale** – This is a macro view where a comprehensive approach is adopted; ISMPs are also part of the stormwater component of an overall LWMP.
- **Watershed Scale** – This is a micro view where the ISMP itself becomes the stormwater component of the LWMP; the ISMP delves into watershed-specific details

ISMP Technical Products

Looking ahead to Part C, an ISMP comprises three core technical products:

- ISMP Technical Product 1 **- Inventories** of the physical and biological systems
- ISMP Technical Product 2 **- Component plans** to protect the resources, resolve identified problems and accommodate land development and growth
- ISMP Technical Product 3 - An **implementation program** comprised of six elements:

✓ *Administration*	✓ *Community Education*
✓ *Projects, Phasing and Budgets*	✓ *Maintenance*
✓ *Financing Mechanism*	✓ *Performance Monitoring*

These three technical products generally parallel the three LWMP stages. The distribution of effort among the three products should be balanced. Often effort is concentrated on the inventory phase, and not enough effort is invested in the elements of an implementation program. The best plan, without a sound implementation strategy, can result in watershed conditions getting worse with time rather than better.

Input to Stormwater Component of Stage 1 LWMP

This is the stage where background information is gathered and the various options for resolving problems are explored. This includes identification of at-risk drainage catchments (refer to Chapter 4). The ISMP Technical Product 1 would be undertaken at this stage.

Input to Stormwater Component of Stage 2 LWMP

This is the stage at which a guiding philosophy for stormwater management is crystallized, policies are adopted and commitments are made to achieving performance targets (refer to Chapter 5) through integration with land use planning. Section 4.4 presents the elements of a policy framework to achieve integration.

This is also the stage at which options and/or approaches to stormwater management are studied in more detail in terms of cost and feasibility. This evaluation process should result in a final (one or two) best option(s) to advance to Stage 3. In short, ISMP Technical Product 2 could be a Draft Stormwater Plan within the overall LWMP.

Input to Stormwater Component of Stage 3 LWMP

This is the stage at which the stormwater component, as well as the overall LWMP itself, is finalized and adopted. The main focus is on developing an adaptive program that will enable local government to move from planning to action in an affordable manner (refer to Part C).

4.3 Relationship Between OCPs and LWMPs

There is a clear link between land use planning required of local governments in the *Local Government Act* (sections 944, 945) and waste management planning described in the *Waste Management Act* (part 1, section 16).

An OCP provides a clear statement to the public and the province about a local government's growth management objectives and provides the rationale for subsequent land use regulations.

An OCP Provides the Foundation for an LWMP

In most cases where OCPs are in place, the local government planning statement (bylaw) will form the basis of waste management plans. The purpose of an LWMP is to minimize the adverse environmental impact of the OCP and to ensure that development is consistent with Ministry of Water, Land and Air Protection objectives.

Local government land use planning is essentially a process of anticipating changes in land use and determining how to manage or influence these changes for the benefit of the community or region. In OCPs, local governments attempt to:

- Identify rural and urban development areas
- Assess the suitability of different areas for development
- Identify the expected sequence of urban and rural land development, including the proposed timing, location and phasing of sanitary and stormwater infrastructure

Where OCPs have been completed and adopted by bylaw, they should be used as a foundation for an LWMP.

LWMPs should be incorporated in total or in part as a schedule to an OCP. This will help to prevent land use decisions that eliminate or pre-empt future options for environmental management.

Take Whatever Step Comes First

In some cases, an LWMP process may be a trigger that focuses attention on stormwater management. Public concern related to flooding or habitat loss may be the trigger. Alternatively, an OCP public process may communicate public interest in raising local environmental and habitat protection standards.

Whatever the initial driver, at the end of the process a local government's Official Community Plan should include goals and objectives for stormwater management. These goals and objectives, or a variant of them, might first reside in a LWMP, and then be adapted to the OCP in the next review process. Or they may originate in the OCP process, and then be detailed through an LWMP. Either way is entirely acceptable.

The stormwater goals and objectives should be integrated into land use and growth management decisions that are embodied in the Official Community Plan, Regional Growth Management Strategy, and other local government bylaws.

The Link Between Land Development and Stream Protection

Local governments may consider directing growth away from sensitive areas, or zoning for land use that is compatible with stream protection. However, it is recognized that land use decisions are based on a broad range of considerations, among which stormwater is only one factor.

Where pre-existing land uses, or new designations, potentially impact sensitive watercourses, there will be a need to manage the development or re-development to meet a local government's goals and objectives for environmental protection and restoration.

The key to making land development compatible with stream protection is to apply appropriate stormwater source control strategies to reduce runoff volume and rate, as discussed in Chapter 7.

4.4 Stormwater Management Goals, Objectives and Policies

As discussed in Part A of the Guidebook, stormwater management and land use need to be integrated to address the source of stormwater-related problems. A critical step is to merge appropriate stormwater management goals, objectives and policies into a local government's OCP.

OCPs, and related Neighbourhood Plans, commonly set out broad goals, objectives and policies that guide implementation actions by local governments. Although OCPs do not bind a local government to a specific action, they prohibit the local government from acting contrary to the stated policies.

Establishing the right stormwater management policy framework and merging this framework with the OCP will ensure that land development decisions (at the planning and site design levels) address stormwater management objectives.

Case Study Example: Customizing a Framework

The City of Chilliwack's *Policy and Design Criteria Manual for Surface Water Management* (2002) includes stormwater management goals, objectives and policies that were developed through an inter-departmental and inter-agency process, which involved:

- City staff from both planning and engineering departments
- Representatives of senior government agencies (federal fisheries, provincial environment and agriculture ministries)

This process consisted of five working sessions where the core concepts of this Guidebook were presented to City staff and agency representatives. To provide context and relevance for participants, and to test the Guidebook concepts, local development projects were used as case study applications.

Outcome of Working Sessions

These sessions created a broad understanding of integrated stormwater management, which was the key to agreeing on:

- A stormwater management goal and a set of five related objectives
- A set of supporting policy statements to translate the goal and the objectives into action at three scales: the watershed, the neighbourhood and the site

The over-arching philosophy of the policy framework is that stormwater management and land use planning must be fully integrated to ensure complete solutions to stormwater-related problems.

This over-arching philosophy was endorsed through a series of working sessions with stakeholder focus groups, including:

- The Development Process Advisory Committee (representing the development community)
- The Agricultural Commission (representing the agricultural community)
- A Public Forum (representing the broader community)

Chilliwack's resulting stormwater management goals, objectives and policies are presented on the following pages. The detailed wording was refined through an iterative and interactive process with City staff and agency representatives.

Customizing Policies for the Local Situation

The goals, objectives and policies established through the Chilliwack process provide an example of what an appropriate policy framework could look like. However, each local government should adopt policies that reflect their individual situation, and that also reflect a long-term vision that is shared by all stakeholders (as discussed in Chapter 10).

Stormwater Management Goal
(for all watersheds in Chilliwack)

Implement integrated stormwater management that maintains or restores the Water Balance and water quality characteristics of a healthy watershed, manages flooding and geotechnical risks to protect life and property, and improves fish habitat values over time.

Stormwater Management Objectives

1. To manage development to maintain stormwater characteristics that emulate the pre-development natural watershed.

2. To predict the cumulative stormwater impacts of development and to integrate this information with other economic, land use and sustainability objectives and policies when considering land use change.

3. To regulate watershed-specific performance targets for rainfall capture, runoff control, and flood risk management during development, and to refine these targets over time through an adaptive management program.

4. To identify, by example and pilot studies, means of meeting the performance targets by application of best management practices, and to remove barriers to use of these practices.

5. To support innovation that leads to affordable, practical stormwater solutions and to increased awareness and application of these solutions.

These goals and objectives reflect the need for flexibility to account for variability in local conditions, and emphasize the importance of demonstration projects to prove the effectiveness of new approaches.

Each of these stormwater management objectives is supported by a set of policies. These are presented on the following pages.

Stormwater Management Objective #1

To manage development to maintain stormwater characteristics that emulate the pre-development natural watershed.

Supporting Discussion

Streams that are stable in their natural condition tend to become unstable after unmitigated urban development in the watershed, and become subject to instream erosion and sedimentation which impacts both flood risk and fish habitat.

These risks are often most pronounced in small catchments, which tend to be first order streams. This is because land use change may cause a high percentage change in impervious area in proportion to the size of a small catchment. This change results in a large change to flows in the stream, creating an unstable condition.

To avoid these impacts, it is necessary to mimic the characteristics of the pre-development hydrograph, including total flow volume, peak flows and hydrograph shape. Reaching this objective requires an integrated stormwater strategy that includes rainfall capture to reduce stormwater volume.

Changes in stream flow due to urbanization have greater impacts than changes in water quality, however, many of the best management practices (BMPs) that will provide rainfall capture and detention will also contribute to maintaining water quality.

Supporting Policies

1. Integrated stormwater management planning (ISMP) processes shall be undertaken to develop integrated master drainage plans (MDPs), first for the Chilliwack Creek Watershed, followed by the Hope River Watershed, and then the Sumas/Collinson Watershed.

2. Each master drainage plan shall develop a practical and affordable action plan for minimizing runoff volume, reducing both the rates and duration of peak flows, and sustaining baseflows.

3. Each action plan will integrate a practical and affordable strategy for protecting and/or improving water quality, and minimizing non-point sources of sediment and pollutant loading.

4. Within each watershed planning process, priority effort shall be focused in at-risk catchments, defined based on the risks of land use change in relation to the fisheries values and potential for flooding within the catchments.

5. For designated at-risk catchments, the City shall set stormwater performance targets and site design criteria based on site-specific rainfall and soils data.

6. Each master drainage plan shall include an adaptive management program to test and refine the stormwater performance targets and site design criteria over time, based on more detailed data collection, modeling, monitoring and analysis.

Stormwater Management Objective #2

To predict the cumulative stormwater impacts of development and to integrate this information with other economic, land use and sustainability objectives and policies when considering land use change.

Supporting Discussion

The stormwater impacts of land use change are incremental and cumulative. Land use decisions must be made with full awareness of both the incremental impacts of individual development projects and the cumulative impacts of building out existing zoning.

The guiding principles for integrated stormwater management should influence the details of land use and site planning.

Stormwater is one of many factors to be considered in land use decisions, but stormwater objectives will often be compatible with other development objectives.

Supporting Policies

1. When considering changes to its OCP or zoning bylaws, the City shall assess the cumulative impact of proposed development on stormwater flows and fish habitat and the potential for mitigation of these impacts through establishment of performance targets and application of best management practices.

2. The City will consider use of density bonus provisions to encourage more green space for developments in designated at-risk catchments.

3. For areas where the City has not yet established stormwater performance targets, applications for significant changes to OCP land use designations or zoning shall be required to include a stormwater management strategy with:

(a) a statement of cumulative impacts of stormwater on the receiving watershed and sub-catchment

(b) application of science-based performance targets for rainfall capture, runoff control and flood risk management

Stormwater Management Objective #3

To regulate catchment-specific performance targets for rainfall capture, runoff control, flood risk management, and water quality protection during development, and to refine these targets over time through an adaptive management program.

Supporting Discussion

Chapter 5 provides background information on the need for, role and basis for performance targets, and shows how to:

(a) set preliminary performance targets for rainfall capture, runoff control, flood risk management

(b) set up an adaptive management program for improving these preliminary targets over time.

Performance targets should be customized to each drainage catchment because the conditions, constraints, problems and opportunities will vary from one catchment to another (e.g. different rainfall characteristics, pattern of streams and lakes, drainage infrastructure, soil characteristics and development patterns). Appropriate strategies for meeting rainfall capture and runoff control targets will depend on local conditions, as illustrated by the following examples:

Example 1: Where there are few constraints to infiltration, and little space for community detention, both rainfall capture and runoff control may be handled by small-scale storage and infiltration systems on individual development parcels.

Example 2: Where infiltration opportunities are limited, more rainfall capture may be achieved by water re-use combined with some on-site infiltration. Runoff control would be then provided by community detention facilities, rather than on-parcel.

(Chapter 7 provides guidance for selecting stormwater source control practices are most appropriate for different land use types, soil conditions and rainfall characteristics).

Supporting Policies

1. Rainfall capture facilities that meet the rainfall capture performance targets must be provided for all new developments in designated catchments. Preference shall be given to water re-use and/or infiltration systems, backed up by small-scale storage facilities as required to support the re-use or infiltration rate of the site soils, where feasible.
2. Where site infiltration rates allow, runoff control performance targets may be met by increasing the storage capacity of rainfall capture facilities. In cases where on-site soils are not suitable, constructed wetlands (for drainage areas over 10 acres) or detention ponds (for smaller drainage areas) shall be provided to meet the runoff control performance targets.
3. In cases of new development, adequate conveyance routes for major storms shall be provided to meet the flood risk management performance targets.
4. For each designated catchment, as affordable, the hydrologic and water quality performance of representative rainfall capture and runoff control facilities shall be monitored, and the performance targets shall be adjusted for future development based on the monitoring results.
5. For each designated catchment, as affordable, early warning indicators shall be monitored to determine how well site level actions are maintaining or restoring a healthy catchment.

Stormwater Management Objective #4

To identify, through demonstration projects, means of meeting the performance targets by application of best management practices, and to remove barriers to use of these practices.

Supporting Discussion

The performance targets are intended to set minimum requirements, while allowing flexibility for applicants to be innovative and cost-effective in meeting the target.

The flexibility of this approach will be attractive for projects with sophisticated design teams.

However, during the learning curve associated with the performance standards, and for small projects, or those that do not normally involve a design team (e.g. a single family dwelling), there is a need for a set of examples that show how the performance targets can be met in a practical and affordable way.

Supporting Policies

1. The City will devise and maintain a manual of best management practices that illustrate how performance targets may be achieved.

2. Local demonstration projects will be encouraged on City land and private land to increase public and developer understanding of the best management practices, and to test their performance.

3. The City will review its existing bylaws to identify and remove clauses that would act as a barrier to the proposed best management practices. Refer to Part A for more detail.

Stormwater Management Objective #5

To support innovation that leads to affordable, practical stormwater solutions and to increased awareness and application of these solutions.

Supporting Discussion

New best management practices, and variations to existing practices, are constantly being developed. There is a need for a system that can adapt to this constant change.

There will also be a need for technical training of staff and the development community. This training will need to be updated and repeated to reflect new information and new participants.

Supporting Policies

1. Applicants shall be encouraged to propose alternative solutions to meet the performance targets, subject to the approval of City staff.
2. Educational events and training media shall be supported in co-operation with senior governments and other local governments.

4.5 Policy Transition in a Rural Regional District

Case Study Example: A Five-Year Stormwater Management Program

The Regional District of Nanaimo is entering a transition from having no role in stormwater management to playing a more active role, by creating a five-year Stormwater Action Plan.

This case study illustrates how a rural regional district is making the policy transition to such an active role.

Enhancing the Stormwater Component of an LWMP

The Regional District of Nanaimo (RDN) created a voluntary LWMP in 1997. The focus of the Plan was on wastewater treatment. The Plan was approved by the (then) Minister of Environment, Lands and Parks.

With the written encouragement of the Minister, the RDN proceeded to upgrade the stormwater management components of its Phase 3 LWMP in 2001.

To accomplish this task, the RDN partnered with the (current) Ministry of Water, Land and Air Protection and the Georgia Basin Ecosystem Initiative to develop a five-year Stormwater Action Plan.

The Need for Stormwater Management in Rural Regional Districts

To date the emphasis of stormwater planning in the RDN has been within the member municipalities of Nanaimo, Parksville and Qualicum Beach. While most of the RDN is resource land in forestry uses, there are extensive areas at lower elevations in the electoral areas that are developed. This development has created changes in stormwater flows and water quality, when compared to natural forested watersheds. Common changes resulting in altered flows and water quality are listed in Table 4-1.

Many of the land use changes identified in Table 4-1 do not create significant stormwater problems if the amount of change is small. However, the impacts are cumulative; as more land use change and densification occurs, stormwater impacts become more significant if they are not mitigated.

Table 4-1: Land Use Changes with Potential to Affect Stormwater Quantity and Quality	Agriculture and Acreage	Single and Multi Family Residential	Industrial, Commercial and Institutional
Removal of forest cover	X	X	X
Installation of open ditches or underdrainage	X	X	X
Removal of seasonal or permanent wetlands	X	X	X
Soil erosion during construction	X	X	X
Soil erosion from fields (if winter cover crops are not used)	X		
Introduction of chemical nutrients and pesticides	X	X	X
Application of manure	X		
Removal or compaction of absorbent soils in landscape areas		X	X
Paving of roads, streets, driveways, parking and yard areas and patios	X	X	X
Roof area drainage	X	X	X
Introduction of chemical pollutants, either as non-point-source runoff, or as point source pollution such as spills, accidents, and outflows	X	X	X

Stormwater Role for RDN

The RDN had a variety of reasons for deciding to take on a more active stormwater planning role, including:

1. **Stormwater impacts will increase unless mitigated.**

   As land development in the electoral areas increases, stormwater impacts and related risks of flooding, property damage and degradation of aquatic ecosystems will increase.

2. **Fish, shellfish and clean water are a part of the RDN's heritage and economic resources.**

   The RDN is bestowed with many productive salmon bearing streams and shellfish beaches. The lifestyle of its residents and the reputation of the region are enriched by these resources. Managing stormwater is a part of maintaining quality of life and attractiveness as a place for tourists and new residents.

3. **Stormwater planning in electoral areas is not being done.**

   In many cases, stormwater planning can not be done efficiently for individual developments, since both the stormwater impacts and solutions involve large areas outside an individual site. Stormwater planning by the RDN can provide economy of scale. In addition, there is no other agency that provides watershed-scale stormwater planning in electoral areas. The stormwater activities of the provincial Ministry of Transportation and Highways are limited to drainage associated with roadways.

4. **Many stormwater impacts can be avoided.**

   With proper stormwater planning and land development practices, mitigation of many stormwater impacts can be achieved. Since the RDN manages land use (other than agriculture and forestry), it has better tools than other agencies to address stormwater planning associated with land use development.

5. **Stormwater planning now can avoid future public expense.**

   Unmanaged stormwater often leads, eventually, to major public expense in infrastructure to solve flooding or erosion problems, sometimes driven by litigation. Planning ahead can find less expensive solutions, minimize public expense by solving stormwater problems at the source – the development - and provide for financial mechanisms to fund stormwater infrastructure where it is necessary.

6. **Stormwater flows across jurisdictions and land uses.**

   There are several cases in BC where successful litigation has been brought by farmers with flooded fields due to unmitigated upstream urban development. And there are cases like Walkerton, Ontario, where farm drainage has had a drastic impact on drinking water supply and human health. As municipalities in the Regional District of Nanaimo undertake stormwater management and drinking water projects, there is both an opportunity and a need for the RDN to plan co-operatively, especially where watersheds cross jurisdictional boundaries.

The promise of stormwater planning is that mitigation of many stormwater impacts can be achieved by management of the way that land is developed.

Focusing Rural Stormwater Planning Efforts

The proposed RDN Stormwater Action Plan will focus on stormwater education and co-ordination throughout the region, and stormwater planning in electoral areas. Emphasis will be on managing urban development to mitigate stormwater quantity problems, and on managing related non-point source pollution.

The need for stormwater management will vary within different areas of the RDN. For example, areas of the region that are not yet developed will not have urban stormwater concerns, and timber harvesting areas of the region are administered by the Province.

Two Levels of Effort

The RDN stormwater management program will have two levels of effort:

- **Integrated Stormwater Management for At-Risk Catchments:**

  The focus of stormwater management in the RDN will tend to be rapidly developing areas. A pilot study has identified at-risk drainage catchments (catchments where conditions combine existing and/or pending urban development with high risks of either drainage problems and/or environmental impacts). These at-risk catchments will be an opportunity for the RDN to test integrated stormwater management approaches.

  Integrated stormwater management means planning that recognizes the relationships between land use planning, stormwater quantity and quality, and environmental factors, creating a plan that balances all three for optimum results.

  It is possible that stormwater solutions in at-risk drainage catchments will require investment in public stormwater facilities.

- **Basic Stormwater Management for Other Developments and Agricultural Areas:**

  Outside of the at-risk catchments that require intensive planning, the RDN will take a proactive approach to basic stormwater management throughout its jurisdiction to avoid future public costs due to cumulative impacts of development. Basic stormwater BMPs and performance targets will be applied in all land uses and densities.

For example:

- Poorly designed developments may create unnecessary increases in runoff, resulting in flooding and downstream impacts and creating new at-risk drainage catchments over time with resulting taxpayer expense.
- Water quality issues, like lack of erosion control during the construction period, are issues throughout the RDN.
- Agricultural areas of the RDN may also have a need for basic stormwater management. Although agricultural areas are generally administered by the Province, there are potential stormwater impacts from agricultural drainage on downstream urban or fishery areas. Unmitigated urban development can also have dramatic flooding impacts on downstream agriculture.

The basic stormwater management program will create public education programs, as well as broadly applicable regulations that will influence the way that private land is developed, with the intent to minimize the need for public investment in stormwater facilities.

Management Arrangements

Management arrangements in the RDN's stormwater management program include:

- Management of potential pollutants near drinking water sources should be the subject of a separate program.
- Regulation of forestry and agricultural practices is under the jurisdiction of the Province of British Columbia. The RDN will be cognizant of resource and stormwater planning by related Provincial agencies.
- The RDN will co-operate with its member municipalities to offer economy of scale in provision of stormwater information, and will support joint planning when stormwater issues cross electoral area or municipal boundaries.
- Drainage catchments that may already be impacted as the result of existing development may be the subject of stewardship and restoration efforts, often in co-operation with non-government organizations.

An Action Plan for the Transition to Stormwater Management

The RDN has opted for a gradual entry into an active stormwater management role. It will take several years to increase public awareness of stormwater issues and solutions and to determine an appropriate role and funding mechanism for stormwater management on lands within its jurisdiction.

While being methodical about entering stormwater management, it is also important that the RDN put stormwater management tools in place as soon as possible, so that further land development without stormwater mitigation does not occur at a large scale.

A five-year Stormwater Action Plan is proposed to allow the RDN to carefully plan its role in stormwater management. Table 4-2 provides an outline of the Plan.

Each Year will have a Focus

Implementing the Action Plan will be subject to approval of general stormwater program funding. Once started, each year in the Stormwater Action Plan has a focus:

Year One Focus: Getting Started

Year Two Focus: Revise Infrastructure Standards

Year Three Focus: Develop Training and Public Awareness Programs

Year Four Focus: Implement Actions

Year Five Focus: Review and Adjust Action Plan

The Action Plan allows for effective public consultation, outreach and training for the development community, demonstration projects, incentives, and co-operation with other levels of government and the private sector.

Regulatory Change

Careful consideration will be given to regulatory change – first, to remove barriers in existing regulations to better stormwater management, and second, to consider to what extent existing regulations should be refined (e.g. zoning and subdivision bylaws).

It is also envisioned that stormwater issues and policies would be considered as each Official Community Plan undergoes a regular review.

Transfer of Approval Powers from the Ministry of Transportation and Highways

The potential transfer of subdivision approval powers from the provincial Ministry of Transportation and Highways to rural regional districts may also provide a trigger for implementing stormwater management in the RDN. In the meantime, the Ministry is open to encouraging better stormwater performance in development applications, provided that the approach does not increase the costs to the Province of BC.

Updating of Action Plan

Adopting the Action Plan does not commit the Region to ongoing funding mechanisms. These will be considered as a part of the Action Plan process, with the intent that the RDN designs a practical and affordable system to address stormwater issues.

At the end of the five-year Action Plan, the RDN will have developed a clear understanding of appropriate stormwater management approaches that are customized to the local environment and acceptable to the development community.

It is envisioned that in the fifth year of the Action Plan, a new plan will be created for the following five year period or longer, based on the needs, opportunities and priorities that are apparent at the time. The Stormwater Action Plan is intended to be updated every five years as the program moves ahead.

Table 4-2: Regional District of Nanaimo Stormwater Action Plan

Priority	Projects	Lead Role	RDN Budget	Potential Additional Funding
1	**YEAR ONE FOCUS: GETTING STARTED**			
	Adopt the Stormwater Action Plan			
	Create introductory information and public outreach materials			
	Identify priorities and budget for RDN stormwater management planning in at-risk drainage basins, in consultation with member municipalities			
	Design and adopt stormwater funding and administrative mechanisms (e.g. region-wide service area for research, coordination, planning and public awareness; specific local service areas for capital and operating projects as required)			
2	**YEAR TWO FOCUS: REVISE INFRASTRUCTURE STANDARDS**			
	Participate with others (e.g. member municipalities) to create technical information materials on low impact stormwater standards and BMPs – print / web / video			
	Review existing bylaws and remove barriers to low impact standards and BMPs for better stormwater management			
3	**YEAR THREE FOCUS: DEVELOP TRANING AND PUBLIC AWARENESS PROGRAMS**			
	In partnership with member municipalities, train staff, developers, builders, NGOs and the public on low impact stormwater standards and BMPs			
	Consider need for, and design draft stormwater clauses including performance targets and example details as potential amendments to RDN bylaws in co-operation with appropriate provincial and federal agencies			
	Consider stormwater impacts as a factor in regular Official Community Plan or zoning reviews and amendments			
4	**YEAR FOUR FOCUS: IMPLEMENT ACTIONS**			
	If applicable, amend bylaws to include new stormwater clauses			
	In co-operation with member municipalities, senior governments and the private sector, complete demonstration BMP installation projects			
	For an at-risk watershed, complete an Integrated Stormwater Management Plan as a pilot project towards the creation of a stormwater local service area			
5	**YEAR FIVE FOCUS: REVIEW & ADJUST ACTION PLAN**			
	If appropriate, proceed to implement stormwater local service area			
	Create an awards program that recognizes excellence in stormwater management			
	Review the status and success of the Action Plan			
	Prepare an updated five-year Action Plan			

Administering the RDN Stormwater Management Program

The RDN is considering the funding of stormwater management at three levels:

Level One - Stormwater Public Facility Construction and Maintenance for at-risk catchments could be funded by a local service area approach. This would fund the capital and operating costs of public facilities related to the benefiting taxpayers. A local service area is established by a bylaw that describes the service, identifies the boundaries of the service area along with the municipalities and electoral areas that include participating areas, and sets out the costs and means of cost recovery for the service. If the local service area requires borrowing, the bylaw must receive the approval of affected voters.

Level Two - Basic Stormwater Planning and Public Awareness for the entire RDN would be funded through a region-wide service area or a stormwater utility. A relatively low investment per taxpayer could provide funding for the shared aspects of basic stormwater management. Shared aspects could include dissemination of public information, monitoring of risks, stormwater research and planning and regulation.

The basic stormwater management funding program may include identification of integrated stormwater planning for at-risk drainage catchments. By having this planning funding provided by the region-wide service area, sufficient information will be available for voters to consider specific capital and maintenance works to be funded through specific local service area initiatives.

Subject to legal review, a region-wide service area for stormwater management may be established through either the LWMP process or by the assent of the electors by either vote or counter petition opportunity.

As an option, a stormwater utility could also fund stormwater planning, works and services by fees and charges established under S. 363 of the *Local Government Act*. The Board may base the fee or charge on any factor specified in the bylaw, including by establishing different rates or levels of fees in relation to different factors such as parcel imperviousness.

Level Three - Regulation of Land Development provides a third form of funding for stormwater management. It is standard practice that rezoning or subdivision applications above a certain minimum size are required to provide stormwater works and services, since mitigation of stormwater impacts is a legitimate cost of development. This source of funding works well for larger, new developments, especially in greenfield situations.

Stormwater improvements may be paid for directly by the developer, or may be funded by development cost charges which pool funds for public projects that are made necessary by the development. The requirements for this type of developer-funded stormwater planning and stormwater works should be included in regional district bylaws.

Requirements may be added to regional district bylaws and administered in tandem with the Provincial Approving Officer of the Ministry of Transportation and Highways, or could be applied directly by the regional district if the subdivision approving function were held at the regional district level. However, in cases where substantial development or development approvals already exist, and the new development is small-scale densification or infill, there will be a need for stormwater planning to be funded by the regional district.

Partnerships for the RDN Stormwater Management Program

There are several agencies that could partner with the Regional District of Nanaimo to support implementation of the basic stormwater planning program:

- Member municipalities, for economy of scale in producing public outreach and technical information materials
- The provincial Ministry of Community, Aboriginal and Women's Services, through planning grants for planning and bylaw changes
- The Canada-BC Infrastructure Program, for design and capital assistance
- The Georgia Basin Ecosystem Initiative, for ongoing support of pilot and implementation programs
- The Federation of Canadian Municipalities Green Municipal Enabling Fund and related funds

Setting Priorities for Early Action

Chapter Five

5.1 Knowledge-Based Approach

- ❑ Overview

5.2 At-Risk Methodology

- ❑ Integration of Knowledge
- ❑ Identification of Priorities
- ❑ Introduction to the Interdisciplinary Roundtable Process
- ❑ Timely Decision Making
- ❑ Focused Working Sessions

5.3 Case Study: Stormwater Priorities in the Regional District of Nanaimo

- ❑ Watersheds in the RDN
- ❑ Workshop Structure and Methodology
- ❑ Land Use Workshop
- ❑ Drainage and Aquatic Habitat Workshop
- ❑ Reporting Results and Follow-Up Questionnaire
- ❑ Strengths and Limitations of the At-Risk Methodology
- ❑ Building Support Through the Interdisciplinary Roundtable Process

5.4 The Role of Mapping

- ❑ Keeping it Simple
- ❑ Graphic Overlay versus Geographic Information System

5.1 Knowledge-Based Approach

Stormwater management may be driven by expressed goals, objectives and policies as outlined in Chapter 4, or it may be driven by evolving crises on the ground, or both. In either case, a key step for any municipality or regional district undertaking a stormwater planning process is to set priorities for action.

Setting priorities for action should be at two scales:

- **At the regional scale** – deciding which watersheds are priorities
- **At the watershed scale** – deciding which tributary drainage catchments to focus on within priority watersheds

Overview

This chapter presents a methodology for prioritizing action that focuses on low-cost results by getting the right people together in working sessions. This 'knowledge-based' approach contrasts with one that starts with extensive raw data collection and sophisticated mapping.

If the right people with the right knowledge are involved at the start, a knowledge-based approach will be both time-efficient and cost-effective. This combination should translate into cost savings that can be applied to stormwater solutions in the field.

There are many approaches to setting priorities, ranging from data-collection-intensive to knowledge-based. In regions where some watershed areas are at high risk, and others may not yet be priorities, the use of a knowledge-based approach to distinguish those catchments requiring early intervention can be an efficient way to initiate action where it is needed the most to avoid or mitigate stormwater threats.

As stormwater management actions are implemented, more rigorous long-term data collection through a monitoring program is appropriate to allow adaptive management of stormwater solutions.

5.2 At-Risk Methodology

The *At-Risk Methodology* (ARM) creates an early focus on areas that may need priority attention to avoid pending stormwater impacts.

Priority action should be focused in at-risk drainage catchments where there is both high pressure for land use change and a driver for action. The latter can be either:

- a high-value ecological resource that is threatened, or
- an unacceptable drainage problem

It is important to focus on areas of land use change because this is where problems can be turned into opportunities. Land use change is the root cause of stormwater's ecological and property impacts, and this root cause can be eliminated through land development practices that reduce the volume and rate of runoff at the source. Local governments also usually have jurisdiction over, and focus their attention on, areas experiencing land use change.

Integration of Knowledge

In order to identify at-risk drainage catchments it is important to integrate knowledge from each of the planning, ecology and engineering disciplines:

- **Planning** – to identify where the areas are with high pressure for land use change
- **Ecology** – to identify where there are significant aquatic resources.
- **Engineering** – to identify where there are chronic drainage problems

The integration of this information through discussion and brainstorming in an interdisciplinary roundtable process will enable the identification of at-risk drainage catchments – those where future land use change threatens to degrade high-value resources or exacerbate drainage problems.

Identification of Priorities

The result of the foregoing process will be identification of priority drainage catchment areas for stormwater planning and action. The top priority drainage catchment is particularly significant because of its potential to act as a demonstration project for remaining watersheds to demonstrate how:

- profitable land use can proceed while preventing stormwater-related problems
- land development practices that reduce runoff at the source can protect aquatic habitat and property from stormwater related impacts

By monitoring the performance of demonstration projects, land development and stormwater management practices can be improved over time for remaining watersheds.

Introduction to the Interdisciplinary Roundtable Process

The most effective and affordable way to identify at-risk watersheds for priority action is to tap the knowledge of people within any regional district or municipality who have the necessary planning, ecology and engineering knowledge. This can be accomplished through an interdisciplinary roundtable process that integrates planning, engineering, and ecological perspectives from the very beginning of a stormwater planning process.

The inputs and outcomes that define the interdisciplinary roundtable process are conceptualized in Figure 5-1. The knowledge-based mapping products from three focused working sessions (land use, ecology and engineering) feed into an interdisciplinary roundtable. This roundtable is where representatives from the three focused working sessions overlay key information on future land use, aquatic resources and drainage problems to identify at-risk drainage catchments and prioritize action.

The interdisciplinary roundtable is especially appropriate for a jurisdiction that has multiple watersheds. It need not be, and should not be, a lengthy process, especially if the goal is to achieve early action. The objective is to make initial decisions based on informed judgement.

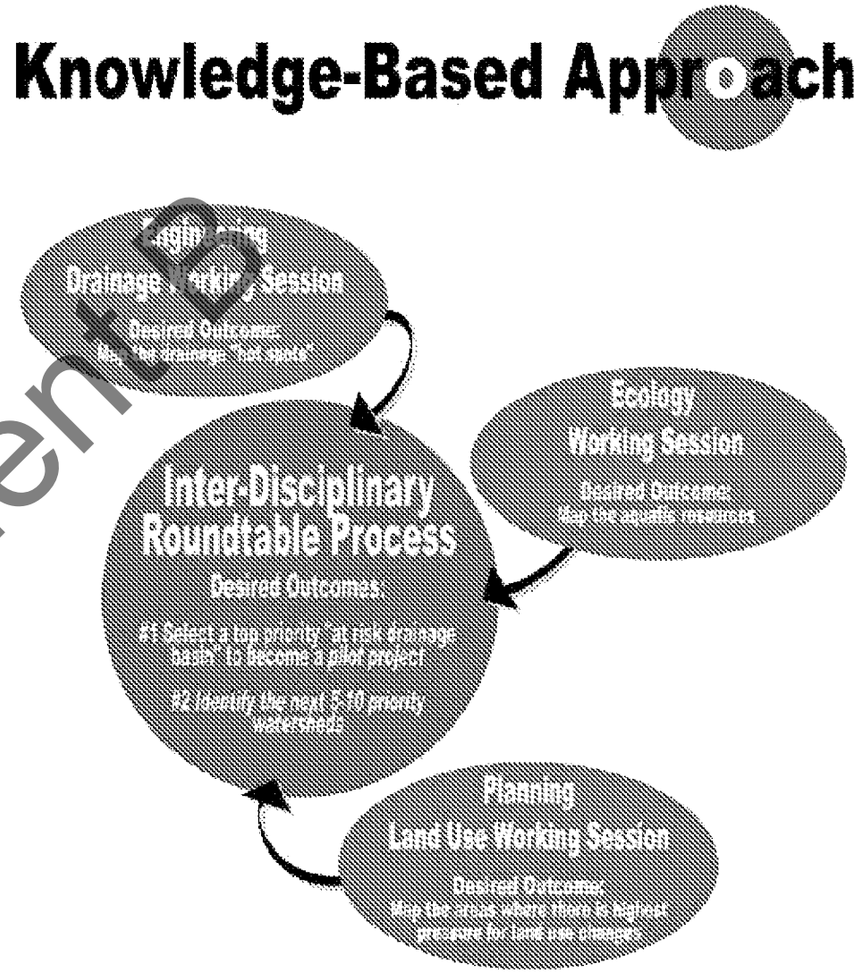


Figure 5-1

Timely Decision Making

Key decisions can be made in a relatively short period of time if:

- **The working session is focused on achieving a specific desired outcome –**

  For example, the desired outcome could be the selection of a top priority at-risk drainage catchment to focus early action. Once action is implemented, this catchment will become a demonstration project for remaining watersheds. A secondary desired outcome would be to identify the next 5 to 10 (say) priority watersheds to provide guidance for the longer-term stormwater management program.

- **The information that is key to achieving the desired outcome is presented -**

  The focused working sessions should produce overall maps of the stormwater planning region, highlighting the areas where:

  - there is the greatest pressure for land use change
  - ecological resources are concentrated or threatened
  - chronic drainage problems (i.e. 'hot spots') occur

  The overlay of this information allows an assessment of drainage catchment risk, which provides a focal point for action.

The focused working sessions should follow these same principles in order to ensure the entire process is effective and affordable.

Focused Working Sessions

The working sessions on land use, ecology and engineering are the foundation of the whole process for identifying at-risk drainage catchments and prioritizing action. For each of the focused working sessions it is important to identify the key participants, desired outcomes and technical information that could be presented at the working sessions to help achieve the desired outcomes. Table 5-1 summarizes this information.

It is recognized that many jurisdictions may not have access to all of the technical information suggested in Table 5-1. Not all of the listed technical information is necessarily required to make informed decisions. The success of the process depends mainly on the local knowledge and experience of working session participants. In the absence of hard data, it is acceptable to substitute value judgements that are knowledge-based.

Table 5-1 Structure for Focused Working Sessions

	Land Use Working Session	Drainage Working Session	Ecology Working Session
Desired Outcome	An overall map of the stormwater planning area (regional district or municipality) showing the areas where there is greatest pressure for future land use change	An overall map of the stormwater planning area (regional district or municipality) showing drainage 'hot spots'	An overall map of the stormwater planning area (regional district or municipality) showing aquatic habitat and species distribution
Key Participants	People who have knowledge about future land use change, including: ▪ planning staff representing all jurisdictions within the regional district or municipality ▪ First Nations ▪ representatives from the development community	People who have knowledge about drainage problems, including: ▪ engineering staff representing all jurisdictions within the regional district or municipality ▪ operations and maintenance staff from all jurisdictions ▪ community ratepayer associations	People who have knowledge about aquatic habitat and species, including: ▪ parks and environment staff representing all jurisdictions within the regional district or municipality ▪ representatives from senior government agencies (WLAP, Fisheries and Oceans Canada, Environment Canada), including habitat biologists and water quality specialists ▪ representatives from local stream stewardship groups and First Nations
Technical Information	Base maps or GIS layers showing key information that affects future land use change, including: ▪ OCP land use designations ▪ zoning polygons ▪ cadastral (lot) boundaries ▪ growth management strategies ▪ existing land cover characteristics, particularly impervious areas (air photos can provide this information) ▪ current development proposals ▪ limits of utility servicing or 'septic suitable' soils This information should be combined with maps showing watershed and sub-catchment boundaries. It would also be useful to assemble air photos showing existing and historic land use patterns in order to provide a perspective on past development patterns.	Base maps or GIS layers showing key factors that influence drainage problems, including: ▪ layout of existing drainage system (storm sewers and creeks) ▪ location of stream crossings, culverts and storm sewer outfalls ▪ location of known flooding incidents or other drainage-related problems ▪ floodplain mapping This information should be combined with maps showing watershed and sub-catchment boundaries. It would also be useful to provide air photos that show existing land uses.	Base maps or GIS layers showing key information that affects aquatic habitat and species, including: ▪ vegetation mapping, particularly for riparian areas ▪ watercourse classification and data, including fish presence ▪ relevant water quality data ▪ sensitive ecosystem polygons ▪ soils mapping ▪ floodplain mapping This information should be combined with maps showing watershed and sub-catchment boundaries. For certain regions, considerable biophysical mapping has already been done by senior government agencies.

5.3 Case Study: Stormwater Priorities in the Regional District of Nanaimo

The Regional District of Nanaimo (RDN) is typical of many rural/suburban regional districts in British Columbia. The majority of the regional district is in forestry uses, with growing pockets of agriculture and urban land uses at lower elevations.

Stormwater management activities to date have been concentrated in the member municipalities of Nanaimo, Parksville and Qualicum Beach. These activities have been primarily drainage-focused, and the RDN has not played a significant role in their delivery. Furthermore, there has been little planning for stormwater management in the electoral areas, other than that associated with road drainage.

Since there are development areas in the regional electoral areas that include urban densities of residential, commercial and industrial land uses, there are already stormwater impacts that likely require attention within the RDN. Stormwater issues will be exacerbated by projected urban growth increases in parts of the electoral areas.

Watersheds in the RDN

There are an estimated 50 watersheds within the developed areas of the RDN.

If a stormwater program were to commit to developing Integrated Stormwater Management Plans (ISMPs) for each of these watersheds, the program costs would be high, and political acceptance in this largely rural area would be problematic. Further, the benefits of such a comprehensive program would be limited for the RDN, because many of these watersheds are not at risk of urban stormwater impacts. In addition, the RDN does not have jurisdiction over forestry or agriculture land uses.

Clearly, rural regional districts like the RDN need to set priorities for stormwater planning that focus their efforts. The At-Risk Methodology was applied in the RDN as a means of determining these priorities.

Workshop Structure and Methodology

In general, the RDN followed the workshop structure and methodology outlined in this chapter, with one exception. Whereas the Land Use Workshop was held as a separate event, the Drainage and Aquatic Habitat Workshops were combined into a single event, for sake of time and cost efficiency and to allow for effective communication among the various disciplines involved in the process.

Land Use Workshop

Invited guests to the Land Use Workshop, in addition to members of a steering committee, included:

- Planners from the RDN
- Planners, Engineers and Approving Officers from member municipalities
- Approving Officers from the Ministry of Transportation and Highways
- Representatives of the Real Estate Board and local development associations
- Representatives of local agriculture associations

The agenda for the workshop included a review of stormwater management concepts, and the general context and objectives of the stormwater planning process.

General mapping provided at the workshop included watershed boundaries overlaying recent airphoto information, as well as cadastral and land use designations.

Identification of Land Use Change

Within this general context, participants were asked by a facilitator to identify areas in the RDN where rapid land use change was expected over the next 10 years. Specifically, participants identified areas where:

- urban development is anticipated
- zoning for 1 hectare (2.5 acre) parcels or smaller is in place but not yet built out
- utility servicing for such zoning is in place or imminent

- such land use change overlays a large portion of a drainage basin (two-thirds or more)
- time permitting, the group was also asked to identify areas of substantial expected re-development, as well as areas where lower density developments might be expected to have stormwater impacts

To record the information put forward by the group, the facilitators applied 'post-it' notes to the maps with notations. The group identified approximately twenty-one areas of rapid land use change in a half-day workshop.

Of these twenty-one areas, ten were eliminated from further consideration by the RDN since they were located entirely within the boundaries of member municipalities. The remaining eleven areas were summarized and forwarded to the Drainage and Aquatic Habitat Workshop.

There was considerable information exchange among the group, with many participants learning of pending land use changes for the first time.

Drainage and Aquatic Habitat Workshop

In the interest of time, the Drainage and Aquatic Habitat Workshops were combined into a single event.

In addition to the steering committee, invited guests for the Drainage Workshop component included:

- Engineers from the RDN
- Engineers from member municipalities
- Approving Officers and Operations Managers from the Ministry of Transportation and Highways
- Engineers from the Ministry of Water, Land and Air Protection
- Representatives of local agriculture associations
- Representatives of local consulting engineering firms

Invited guests for the Aquatic Habitat Workshop component included:

- Habitat Biologists and Water Quality Biologists from WLAP
- Habitat Biologists and Researchers from Fisheries and Oceans Canada
- Biologists from Environment Canada and the Canadian Wildlife Service
- Environmental Planners from member municipalities
- First Nations
- Representatives of local environmental consulting firms
- Representatives of local stewardship organizations, including land trusts, field naturalists and streamkeepers

The agenda for the Drainage and Aquatic Habitat Workshop included a review of stormwater management concepts for new participants, the general context and objectives of the stormwater planning process in the RDN, and the results of the Land Use Workshop.

Mapping was presented that showed the eleven candidate study areas that resulted from the Land Use Workshop in more detail. The mapping illustrated the extent of proposed land use change overlaid on watershed drainage boundaries and airphotos. In particular, mapping was used to identify land use changes that would cover a large proportion of a small drainage basin. Percentages of this expected cover were estimated. Maps also showed available information on drainage sub-catchment boundaries and watercourses.

Identification of Areas at Risk

Within this general context, participants were asked by a facilitator to review and comment on drainage or habitat risks related to the eleven candidate areas. Specifically, for each of the candidate areas, participants identified:

- areas of high risk for drainage-related problems like flooding or instream erosion and sedimentation
- risks to existing or potential fisheries and aquatic resources

After the identification of risks, participants were asked, as individuals, to rank the candidate areas by priority for integrated stormwater management (from 1 as highest to 11 as lowest). Tabulation of the results has provided the RDN with a sense of priority areas on which to focus. The next step for the RDN will be to develop an ISMP on some of these priority catchments. For a detailed discussion on developing an ISMP, refer to Chapter 10.

Reporting Results and Follow-Up Questionnaire

A third workshop was held to report the results of the process back to the participants.

This important step allowed for a presentation of the results in context along with the draft RDN five-year Stormwater Action Plan. The workshop allowed for discussion among the participants about the process and the results, and was especially important for discussion of minority opinions.

The RDN also distributed a follow-up questionnaire to confirm acceptance of the process and the results.

Strengths and Limitations of the At-Risk Methodology

The At-Risk Methodology was useful and successful for the RDN. The great majority of participants felt that it was appropriate and effective for making decisions about priorities. Strengths of the process include:

- low cost
- relative speed of decision making
- effectiveness of the process for selecting priorities and moving towards action without undue delay

Limitations of the process are:

- accuracy of the process relies on the level of knowledge of individuals participating
- subjective nature of the process can leave it open to challenge by competing interests

Building Support Through the Interdisciplinary Roundtable Process

A key byproduct of the At-Risk Methodology is the transfer of information among the participants.

It is a rare occasion that brings together into one room the key planning, engineering and environmental professionals and non-government organizations from across a region.

The RDN Interdisciplinary Roundtable provided a key opportunity for presentation of current stormwater management concepts to this interdisciplinary group. See Section 5.3 of this chapter for related information. The participants were able to understand and discuss how integrated stormwater management would involve co-operative effort.

Communication with the Interdisciplinary Roundtable should not end with the conclusion of the At-Risk Methodology. The communication and access to expertise that was established will be very important throughout the stormwater management process, including at both the neighbourhood and site planning scales when more detailed decisions become necessary.

A Look Ahead

As the RDN moves toward approval and implementation of its Stormwater Action Plan, the understanding created among professionals in the region through the At-Risk Methodology process will provide an important foundation for future success.

5.4 The Role of Mapping

Mapping the right information can provide a valuable tool to support decision making. However, mapping itself does not make the decisions; people make decisions. This is a distinction that often seems to be overlooked.

Keeping it Simple

Information presented must be directly relevant to the desired outcome of the working session. Maps should help participants achieve the desired outcome rather than divert attention away from it. This is particularly important for the Interdisciplinary Roundtable, where different types of information are integrated.

The maps of land use change, aquatic resources and drainage 'hot spots' produced as a result of the focused working sessions should only present the information needed to identify at-risk drainage basins. Ideally, there should only be three maps presented at the Interdisciplinary Roundtable, each one a distillation of the more detailed mapping presented at each of the three focused working sessions.

Graphic Overlay versus Geographic Information System (GIS)

The focused working sessions and the Interdisciplinary Roundtable rely on the overlay of maps with key information. This can be accomplished using:

- graphic overlay maps, or
- GIS ArcView layers

Both options will achieve the same basic objective, which is to illustrate the relationship between different types of information. While the data linkage and query options available with GIS provide greater opportunity for analysis, they also require greater time investment.

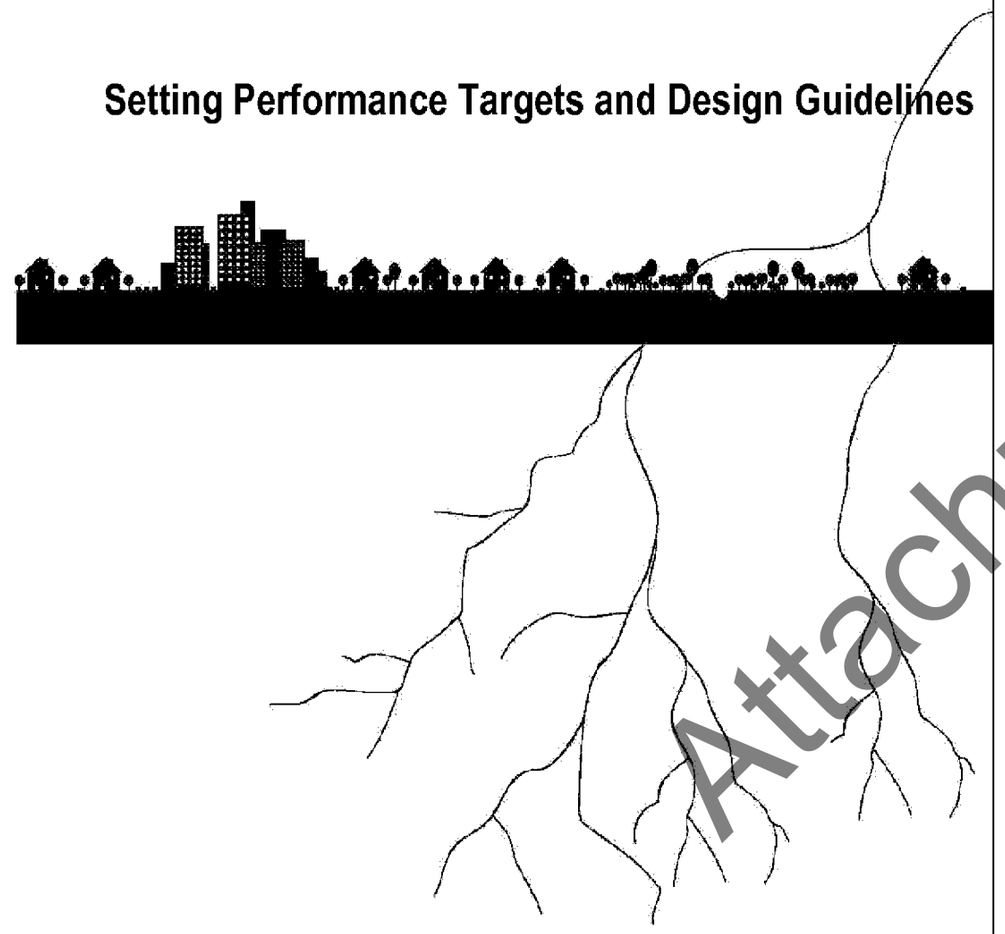
Use of Graphic Overlays

Relevant relationships may be obvious from a review of map overlays, and this may provide a more affordable analysis that is of equal effectiveness to the GIS data query. This is particularly true for the Interdisciplinary Roundtable, where the emphasis should be on simple maps that present only the relevant information. It will likely be obvious where areas with high pressure for land use change overlap areas with high habitat value or drainage 'hot spots'.

For smaller regional governments in particular, there is a likelihood that lack of GIS resources and training will lead to stormwater inertia if too much reliance is placed on technical sophistication in GIS.

Application of GIS

For jurisdictions that do have access to GIS, it provides a good tool for keeping accurate records of effective impervious area (EIA), which is a key determinant of watershed health. Using GIS, the EIA of each new development or retrofit area could be recorded at the subdivision or building permit stage. In this way an accurate record of EIA can be established over time. Airphoto or map interpretation methods cannot record EIA because they cannot differentiate impervious area that is hydraulically disconnected.



Setting Performance Targets and Design Guidelines

Chapter Six

6.1 The Role of Performance Targets

- Constant Improvement through Adaptive Management

6.2 Defining the Target Condition

- Defining a Runoff Volume Target
- Defining a Runoff Rate Target
- Additional Performance Indicators
- Achieving the Target Condition at the Site Level
- Other Objectives for Managing Stream Health
- A Widely Applicable Target Condition

6.3 Moving from Science to Site Design

- The Need for Flexibility in Setting Performance Targets

6.4 Managing the Complete Rainfall Spectrum

- Understanding the Rainfall Spectrum
- The Importance of Rainfall Tiers
- Components of an Integrated Strategy for Managing the Complete Spectrum of Rainfall
- The Role of Continuous Simulation Modeling
- Understanding Why Rainfall Capture is the Key

6.5 Methodology for Setting Performance Targets and Site Design Guidelines

- Step #1: Assemble a Rainfall Database
- Step #2: Define Rainfall Distribution
- Step #3: Define Performance Targets for Managing the Complete Spectrum of Rainfall Events
- Step #4: Translate Performance Targets into Design Guidelines that can be Applied at the Site Level
- Step #5: Evaluate Source Control Options Through Continuous Water Balance Modeling
- Step #6: Optimize Stormwater System Design Through Adaptive Management

6.1 The Role of Performance Targets

Performance targets provide the foundation for implementing common sense solutions that eliminate the source of stormwater related problems. This chapter presents a cost-effective framework for local governments to:

- establish performance targets that reflect science-based understanding to guide early action in at-risk catchments (see Chapter 5)
- translate these performance targets into design criteria and guidelines that can be applied at the site level to design stormwater systems that mitigate the impacts of land development

Performance targets provide a starting point to guide the actions of local government in the right direction. Site design criteria provide local government staff and developers with practical guidance for moving from planning to action.

For a performance target to be implemented and effective, it must be quantifiable. It must also have a feedback loop so that adjustments and course corrections can be made over time. To be understood and accepted, a performance target needs to synthesize complexity into a single number that is simple to understand and achieve, yet is comprehensive in its scope. A runoff volume-based performance target fulfils these criteria. This chapter presents a methodology for setting volume-based performance targets.

Volume-based thinking is an integral element of a paradigm-shift that views watersheds as a fully integrated system where creek headwaters originate at rooftops and roads. Looking ahead to the GVRD case study results presented in Chapter 7, the implications are far-reaching because a volume-based approach to stormwater management touches on virtually every aspect of land use planning and site design. Volume-based thinking leads directly into landscape architecture, green roofs, urban reforestation, interflow and groundwater recharge, and water re-use.

Constant Improvement through Adaptive Management

Performance targets and design criteria provide a basis for:

- integrating appropriate stormwater management policies with land use and community planning (see Chapter 4)
- selecting appropriate site design practices to reduce runoff and improve water quality at the source (see Chapter 7)

The policies and site design practices implemented in at-risk catchments become demonstration projects. Monitoring the performance of these demonstration projects provides the foundation for adaptive management, as illustrated in Figure 6-1.

The goal of adaptive management is to learn from experience and constantly improve land development and stormwater management practices over time. This requires ongoing monitoring of demonstration projects to assess progress towards performance targets and the shared watershed vision. The details of adaptive management are discussed further in Section 6.5.

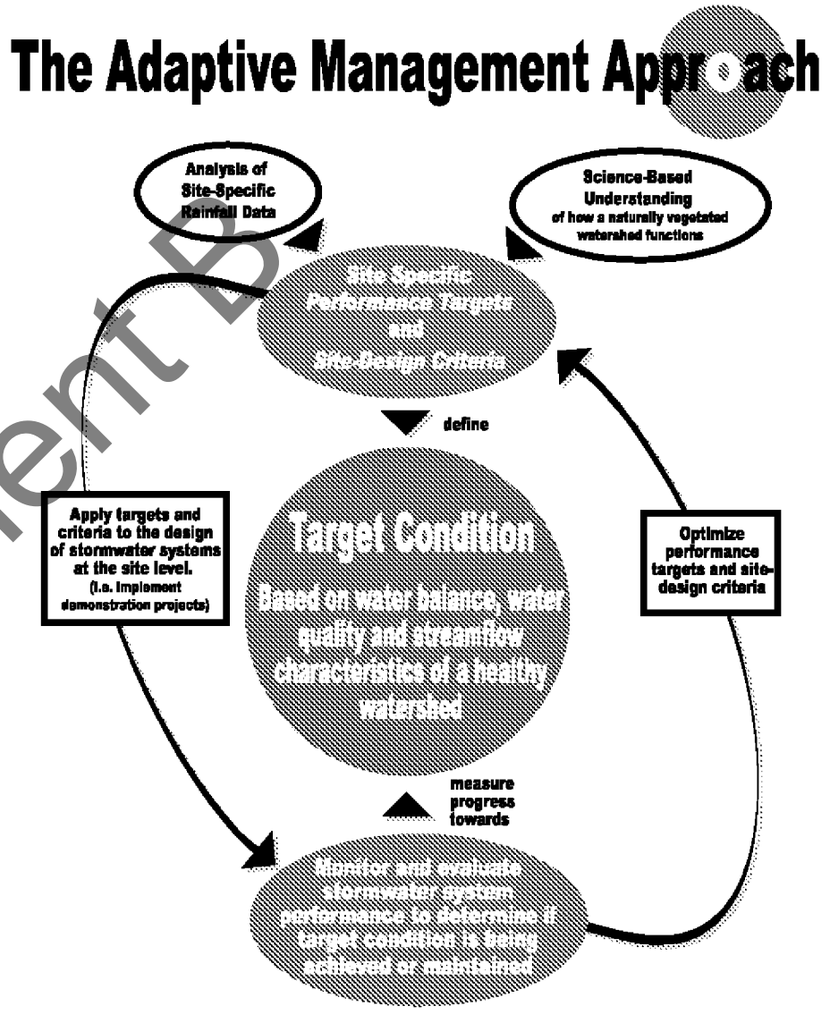


Figure 6-1

6.2 Defining a Target Condition

A biophysically-based target condition can be established based on an understanding of the characteristics of a healthy watershed.

In order to be achievable, a biophysically-based target condition must be translated into performance targets that can be applied to stormwater management practice.

Since changes in Water Balance and hydrology are the primary source of stormwater related impacts on watershed health (see Chapter 2), it is especially important to establish performance targets for managing:

- **Runoff Volume**, and
- **Runoff Rate**

Defining a Runoff Volume Target

Recent research from Washington State shows that stormwater related impacts on stream health start to occur once the impervious percentage of a watershed exceeds about 10% (see Chapter 2). Therefore, to ensure the health of aquatic systems, developments should be planned and built to function like watersheds with less than 10% total impervious area.

Stormwater-related impacts are a direct result of runoff from impervious surfaces that are directly connected to a storm drainage system or to downstream watercourses (often defined as effective impervious area (EIA)).

The Washington State research is based on data from watersheds with traditional ditch and pipe systems designed to remove runoff from impervious surfaces as quickly as possible, and deliver it to receiving waters.

When the impervious area of watersheds with traditional ditch and pipe systems reaches the 10% threshold, about 10% of the total rainfall volume becomes runoff that enters receiving waters; this runoff volume is the root cause of aquatic habitat degradation. Note that there is virtually no surface runoff from the naturally vegetated portion of a watershed, but nearly all rain that falls on directly connected impervious surfaces becomes runoff.

An appropriate performance target for managing runoff volume is to limit total runoff volume to 10% (or less) of total rainfall volume. This means that 90% of rainfall volume must be returned to natural hydrologic pathways, through infiltration, evapotranspiration or re-use on the development site. Managing 90% of the rainfall volume throughout a watershed should achieve the biophysical target condition for the watershed. Managing 90% of rainfall volume therefore becomes the volume-based performance target.

Defining a Runoff Rate Target

As discussed in Chapter 2, the Mean Annual Flood (MAF) is defined as the channel-forming event; as the MAF increases with development, stream channels erode to expand their cross-section, thereby degrading aquatic habitat. Therefore, an appropriate runoff rate target is to ensure that streamflow rates that correspond to the natural MAF occur no more than once per year, on average.

In order to achieve this target, stormwater systems should be designed to limit the frequency that the natural MAF is exceeded.

The MAF correlates roughly with the runoff from a Mean Annual Rainfall (MAR), which is defined as the rainfall event that occurs once per year, on average. The significance of the MAR is discussed further in Section 6.4.

Natural streamflow patterns can be approximated for the majority of rainfall conditions (all rainfall in an average year) by providing enough storage capacity to capture the runoff from a MAR, and releasing the stored runoff at a rate that mimics the rate of interflow in a naturally vegetated watershed.

Additional Performance Indicators

As discussed in Chapter 2, there are additional science-based indicators that could be used as performance targets for protecting watershed health, including:

- Maintain stream baseflow at a minimum of 10% of the Mean Annual Discharge (MAD).
- Maintain natural total suspended solids (TSS) loading rates.
- Maintain key indicators of aquatic ecosystem health (e.g. maintain Benthic Index of Biological Integrity (B-IBI) score above 30).
- Preserve a 30-metre wide intact riparian corridor along all streamside areas.
- Retain 65% forest cover across the watershed.

These indicators of watershed health can play an important role in comprehensive performance monitoring and adaptive management programs (as discussed in Section 6.5).

These indicators may also be used to help define a biophysically-based target condition for a healthy watershed. The GVRD's *Integrated Stormwater Management Planning Terms of Reference Template* (2002) provides an example of how some these indicators have been applied to define a target condition.

This Guidebook presents a methodology for setting performance to achieve the runoff volume target (i.e. limiting runoff volume to 10% of total rainfall) and runoff rate target (i.e. maintaining natural MAF). The runoff volume and rate targets have been selected as the primary basis for defining a biophysically-based target condition to guide stormwater planning and design because:

- They are based on scientifically defensible research that correlates watershed imperviousness and changes in hydrology with stream health.
- They provides an easily understood starting point for the design of stormwater systems at the site level (as described in this chapter). These targets can be directly managed at the site level.
- Achieving the 10% volume target should also achieve management objectives for stream baseflows, water quality and aquatic ecosystem health. This is a reasonable assumption because:
  - Infiltrating rainfall at the source is the most effective way to maintain stream baseflows.
  - Infiltration and other stormwater source control strategies provide effective treatment for the first flush of pollutants that wash off from developed areas.
  - Restoring the natural Water Balance eliminates the source of stream degradation and improves aquatic ecosystem health.

Monitoring the performance of demonstration projects will provide the opportunity to test how well alternative performance targets relating to baseflows, water quality and aquatic ecosystem health can be managed by achieving the runoff volume and rate targets (see Section 6.5).

Achieving the Target Condition at the Site Level

Degradation of watershed health is the result of the cumulative impact of individual land development projects on runoff volume and rate (i.e. incremental changes in Water Balance and hydrology). Each development project contributes to increased runoff volume and rate in downstream watercourses.

In order to achieve the target condition for a healthy watershed as a whole, cumulative impacts must be managed at the site level. This means that stormwater systems at the site level must be designed to achieve to achieve the runoff volume and rate targets.

The Role of Source Control

To achieve runoff volume and rate targets, development sites and their stormwater systems must be designed to replicate the functions of a naturally vegetated watershed (the most effective stormwater system). This requires stormwater source control strategies that capture rainfall at the source (on building lots or within road right-of-ways) and return it to natural hydrologic pathways - infiltration and evapotranspiration - or re-use it at the source. This creates hydraulic disconnects between impervious surfaces and watercourses (or storm drains), thus reducing the volume and rate of surface runoff.

Looking ahead, Chapter 7 presents a variety of source control solutions for maintaining or restoring natural runoff volume and rates, including:

- Preserving natural vegetation cover, natural stormwater management features (e.g. wetlands), and limiting the extent of impervious areas through low impact development practices
- Preserving or restoring natural infiltration capacity by infiltrating runoff from impervious surfaces and applying absorbent landscaping
- Preserving or restoring natural evapotranspiration capacity to the extent possible through conservation, landscaping and the application of green roofs
- Re-using rainwater for irrigation and for indoor uses

Chapter 7 provides guidance for selecting appropriate source control strategies for different land use types, soil conditions and rainfall characteristics.

Other Objectives for Managing Stream Health

To maintain or restore stream health, this Guidebook recommends focusing limited resources on managing runoff volume and rate. Scientific research on the subject recommends a broad range of strategies including:

- Preserve or restore natural vegetation along riparian corridors.
- Preserve or restore natural features, such as wetlands, that play a key role in maintaining the hydrologic and water quality characteristics of healthy streams.
- Preserve or restore instream features that are key to the health of aquatic ecosystems, such as channel complexity and adequate spawning gravel.
- Control sources of water pollution (point and non-point sources).

Integrated Stormwater Management Plans (ISMPs) should address these objectives, in addition to the runoff volume and rate targets.

Desired Outcomes for ISMPs

Integrated stormwater management plans (ISMPs) for individual watersheds should therefore:

- establish objectives for maintaining and/or restoring stream health
- develop comprehensive strategies to achieve these objectives, which not only deal with runoff volume and rate, but also address issues relating to water quality and preservation/restoration of key natural features (e.g. riparian forests, wetlands, in-stream features)

The elements of ISMPs are discussed further in Chapter 10.

A Widely Applicable Target Condition

The fact that performance targets are based on the characteristics of a healthy watershed is key. This means that the performance targets for any given watershed apply to:

- **new development *Or* retrofit scenarios -** Appropriate land development practices can prevent the degradation of a healthy watershed or restore an unhealthy watershed. The target condition remains the same.
- **protection of environment *Or* property -** Maintaining or restoring the ecological health of a watershed will also eliminate the source of flooding risk to property and public safety. Protecting aquatic resources and protecting property are complementary objectives. Even if property impacts are the driver for action, biophysically-based performance targets are still appropriate.

The Range of Case Study Experience

The methodology presented in this chapter for setting performance targets and design criteria evolved through recent integrated stormwater management experiences in British Columbia. Preliminary performance targets and site design criteria were developed using this methodology in three different catchments, all with different initial conditions, development types and drivers for action. The three case studies included the following development scenarios:

- **Urban** - High-density urban development at the top of a mountain, where protection of downstream aquatic habitat was the primary driver for action.
- **Suburban** - Fully developed suburban watershed, where the need for immediate flood relief was the driver for action.
- **Suburban/Rural** - A municipality comprising rural and suburban land uses, where future development areas (currently forested) drains to agricultural lowlands. Aquatic habitat protection was also a driver.

The methodology has been tested and accepted by the local governments in all three cases. The suburban/rural example (City of Chilliwack) is used as a case study for the remainder of this chapter to illustrate the methodology.

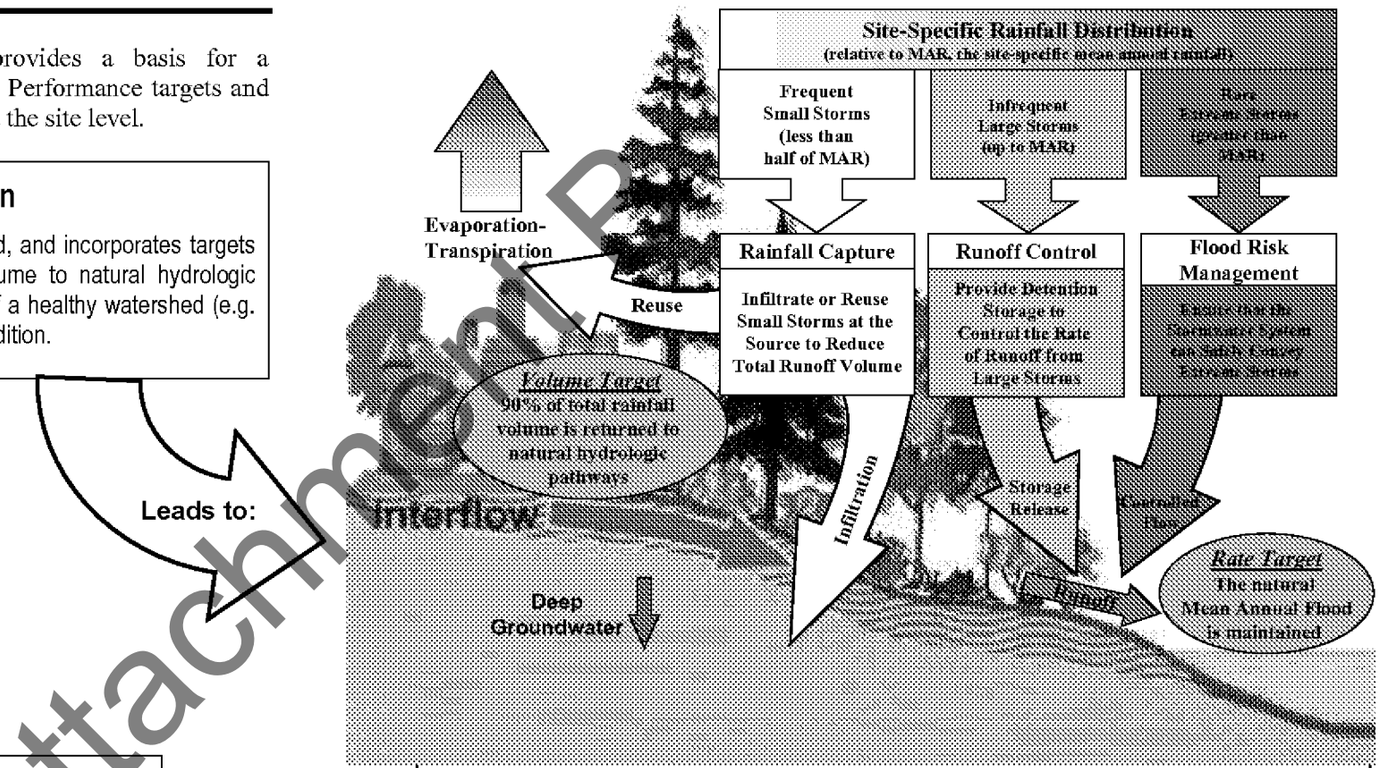
6.3 Moving from Science to Site Design

As shown below, the biophysically-based target condition provides a basis for a comprehensive stormwater management strategy (see Figure 6-3). Performance targets and site design criteria are needed to translate this strategy into action at the site level.

Biophysically-Based Target Condition

The target condition is based on the characteristics of a healthy watershed, and incorporates targets for maintaining the natural Water Balance (restore 90% of rainfall volume to natural hydrologic pathways) and hydrology (maintain natural MAF). Other characteristics of a healthy watershed (e.g. water quality, baseflow, riparian integrity) may also help define a target condition.

Leads to:



Science Based Strategy for Managing the Complete Spectrum of Rainfall Events

Stormwater impacts occur when land use change alters the water balance, thus increasing the volume and rate of surface runoff from *every rainfall event*. In order to maintain or move towards the target condition, the complete spectrum of rainfall events must be managed in a manner that approximates a naturally vegetated watershed.

Implementing this strategy requires:

Science-Based Performance Targets and Site Design Criteria

Translating the above strategy into an action plan requires performance targets and design criteria to guide stormwater management and development practices at the site level.

Performance targets and design criteria can be evaluated and optimized to reduce costs over time by monitoring the performance of demonstration projects.

Figure 6-2

The Need for Flexibility in Setting Performance Targets

Establishing performance targets provides a quantifiable way of measuring success in protecting or restoring a watershed, and for identifying what needs to be done to achieve a certain level of protection for a given watershed.

The runoff volume and rate targets presented in presented in Section 6.2 provide a reference point that is based on the Water Balance and hydrology of a healthy watershed. To determine whether these targets are realistic or achievable for a given watershed, an ISMP must answer the following questions:

- What is the existing level of annual runoff volume? What percentage of total annual rainfall volume does it represent? What is the existing Mean Annual Flood (MAF)?
- What are acceptable levels of runoff volume and rate in terms of flood risk and environmental risk? What are the consequences of increased or decreased flows related to land development? Are these consequences acceptable?
- What actions are needed to avoid flooding or environmental consequences?
- How can necessary actions be staged over time?
- Are the targets to maintain 10% runoff volume and maintain the natural MAF necessary or achievable over time? If not, what levels are?

Performance targets that are based on the characteristics of a healthy watershed, including targets for runoff volume, runoff rate, and any other indicators that may be used to define a target condition, should be used as a starting point. Performance targets should be customized for individual watersheds and catchments, based on what is effective and affordable in the context of watershed-specific conditions.

For example, the 10% runoff volume target may not be appropriate for a watershed with limited fisheries value. In this case it may be more appropriate to establish targets for reducing the volume and rate of runoff based on judgements regarding acceptable levels of flooding.

Continuous Water Balance modeling can be applied to determine what is effective and affordable. Further discussion of Water Balance modeling is found in Chapter 7.

6.4 Managing the Complete Rainfall Spectrum

A guiding principle of integrated stormwater management is to design for the complete spectrum of rainfall events (as shown in Figure 6-2). Designing for the complete spectrum of rainfall events provides the foundation for protecting both property and stream health.

Understanding the Rainfall Spectrum

A key parameter for describing the rainfall spectrum is the size of the Mean Annual Rainfall (MAR), the rainfall event that occurs once per year, on average. The distribution of rainfall events relative to the MAR is fairly constant throughout British Columbia.

The following rainfall tiers are the building blocks of an integrated strategy for managing the complete spectrum of rainfall events:

- **Tier A Events*** – The small rainfall events that are less than half the size of a MAR. About 90% of all rainfall events are Tier A events.
- **Tier B Events*** – The large rainfall events that are greater than half the size of a MAR, but smaller than a MAR. About 10% of all rainfall events are Tier B events.
- **Tier C Events*** – The extreme rainfall events exceeding a MAR. An extreme event may or may not occur in any given year.

* For the purpose of setting performance targets, a rainfall event is defined as total daily rainfall (i.e. mm of rainfall accumulated over 24 hours). This assumption results in conservative site design criteria, which can be optimized over time through continuous simulation modeling, and by monitoring the performance of demonstration projects (as discussed in Section 6.5).

These three rainfall tiers correspond to three components of an integrated strategy for managing the complete spectrum of rainfall events (see Figure 6-2): rainfall capture (source control), runoff control (detention), and flood risk management (contain and convey). These three components are discussed further in this section.

The Importance of Rainfall Tiers

Defining tiers is the key to the rainfall analysis. It enables a systematic approach to data processing and identification of rainfall patterns, distributions and frequencies. Establishing the MAR as a reference point provides a convenient way to divide the rainfall database into three groupings.

Table 6-1 below shows how the rainfall tiers vary across the regions of BC where the most development is occurring. In the Georgia Basin the MAR ranges from about 40 mm on the East Coast of Vancouver Island, to about 60 mm in the Fraser Valley (also representative of much of the Lower Mainland), to about 80 mm on the North Shore of Vancouver. For the Okanagan Region, the MAR is closer to 20 mm.

Table 6-1 – Rainfall Spectrum for Various Locations in BC

Location	Tier A Events (less than 50% of MAR)	Tier B Events (between 50% of MAR and MAR)	Tier C Events (Greater than MAR)
Vancouver (North Shore)	< 40 mm	40 to 80 mm	> 80 mm
Chilliwack	< 30 mm	30 to 60 mm	> 60 mm
Nanaimo	< 20 mm	20 to 40 mm	> 40 mm
Kelowna	< 10 mm	10 to 20 mm	> 20 mm

* approximate values based on statistical analyses using of 30+ years of rainfall data

One of these examples (Chilliwack) is used throughout this chapter to illustrate how to:

- use rainfall data to define MAR and the rainfall tiers
- apply the rainfall tiers to establish performance targets and site design guidelines

Managing Rainfall Volume at the Source

Tier A events make up the bulk of total annual rainfall events and rainfall volume (see Figures 6-3 and 6-4). Capturing these small events at the source is the key to reducing runoff volume and managing the Water Balance (i.e. rainfall capture).

Figures 6-3 and 6-4 illustrate both coastal and interior conditions. Regardless of location, the majority of rainfall events are small (less than 50% of MAR). This is a key observation with respect to the feasibility of approximating the natural Water Balance through infiltration and/or rainfall re-use.

Consistency with Current Stormwater Practice

Referencing the rainfall tiers to the Mean Annual Rainfall (MAR) provides consistency with criteria that became accepted practice in the 1990s.

In British Columbia, the *Land Development Guidelines for the Protection of Aquatic Habitat* (1992) focus on managing runoff from storms with a 2-year return period, which is approximately equal to the MAR.

Also, 50% of the MAR corresponds to what is called a '6-month storm' in Washington State. The concept of the '6-month storm' was introduced in Washington to provide context for managing the six to ten runoff events per year that have the most potential to cause watercourse erosion (i.e. Tier B events). At the time, this approach represented a major departure from traditional drainage practice.

Prior to the late 1990s, the focus of drainage planning was on the extreme events that rarely occurred (Tier C events).

The tiered approach marks a further shift in drainage practice, from managing 25% of the rainfall volume (Tier B and C) to managing 100% of the rainfall (i.e. the complete spectrum).

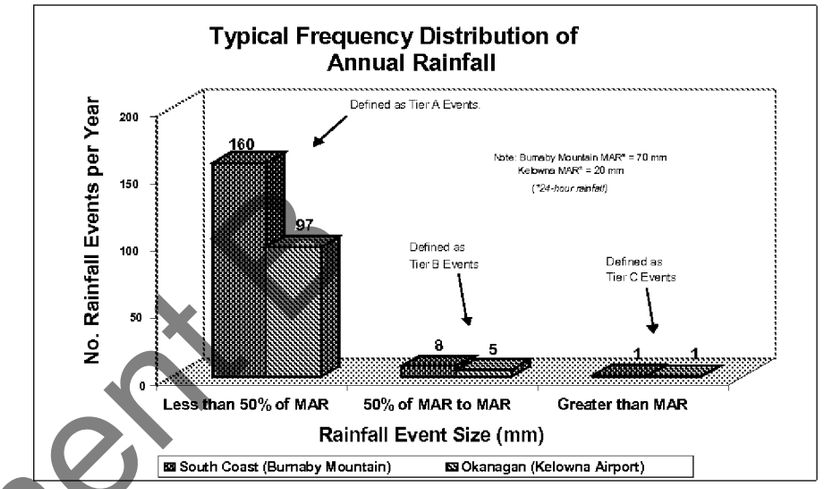


Figure 6-3

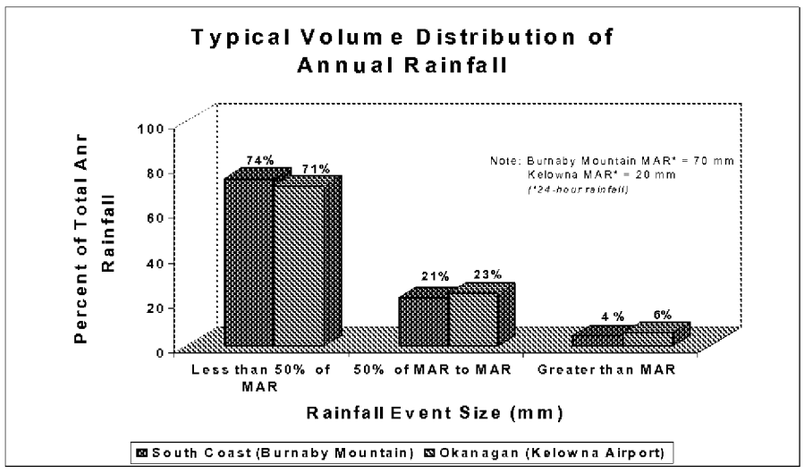


Figure 6-4

Components of an Integrated Strategy for Managing the Complete Spectrum of Rainfall

Each of the three rainfall tiers corresponds to a component of an integrated strategy:

1. *Rainfall Capture* (Source Control) to Manage the Small Tier A Rainfall Events

The key to runoff volume reduction and water quality improvement is capturing the small storm runoff (Tier A rainfall events) from rooftops and paved surfaces. This captured rainfall should be infiltrated, evapotranspired, and/or re-used at the source. Rainfall capture can be provided at the source with:

- **On-lot stormwater source control facilities** to capture runoff from rooftops, driveways, parking and other impervious areas for infiltration, evapo-transpiration and/or reuse.
- **On-street source control facilities** to capture and infiltrate runoff from paved roadways. These facilities must also be designed to convey extreme storms, similar to conventional storm sewers.

Chapter 7 describes specific source control options available for development parcels and roads, including specific examples.

2. *Runoff Control* (Detention) to Manage the Large Tier B Rainfall Events

The runoff resulting from the large Tier B events causes the most significant peak flows in downstream watercourses. Therefore, the key to runoff rate control is storing the runoff from impervious surfaces resulting from the large Tier B rainfall events and releasing it at a controlled rate. This controlled release will eliminate the 'spikes' that characterize the rapid response of runoff from impervious surfaces. Storage capacity for large Tier B storms can be provided:

- By increasing the storage capacity of on-parcel and on-street source control facilities (above the capacity required to achieve rainfall capture targets).
- In community detention facilities that serve sub-catchments of a watershed (can provide runoff control but not rainfall capture).

3. *Flood Risk Management* (Contain and Convey) for the Extreme Tier C Rainfall Events

Development sites must have adequate escape routes for runoff from extreme storms (combination of overland flow and flow collection and conveyance systems). Stream channels and stream crossing (e.g. culverts and bridges) must have sufficient capacity to contain and convey flood flows resulting from very large storms (e.g. the 100-year storm), without resulting in threats to public safety or property damage. A framework for flood risk management is presented in Section 6.5.

The Role of Continuous Simulation Modeling

Performance targets (i.e. a starting point) can be established based on simple rainfall analysis (see Section 6.5). The level of effort required to apply continuous simulation modeling is not appropriate for setting performance targets, but is appropriate for optimizing design solutions to achieve the performance targets.

As explained in Chapter 7, continuous simulation modeling is also appropriate for evaluating stormwater source control options and optimizing the design of stormwater system components.

Understanding Why Rainfall Capture is the Key

Runoff control without rainfall capture is the conventional detention-based approach to stormwater management. It is only a partial solution. It is now recognized that this approach does not protect downstream fish habitat because it does not maintain natural levels of erosion or support baseflows in watercourses.

The water released from conventional detention storage typically goes directly to downstream watercourses. This slows down the water and reduces peak runoff rates, but does not reduce the total runoff volume. Therefore, the total runoff volume is spread out over a longer period of time, which can result in erosive streamflows for longer periods of time.

Rainfall capture requires storage at the source, where runoff from impervious surfaces can be infiltrated into the ground, evapotranspired, or re-used rather than released directly to surface drainage systems. Infiltration not only reduces runoff volume, but also supports stream baseflow by partially restoring the natural Water Balance.

Detention facilities that serve sub-catchments of a watershed do not provide the opportunity for infiltration, evapotranspiration or re-use at the source. However, there may be opportunities to implement community source control facilities through neighbourhood planning (e.g. infiltration facilities that serve multiple dwelling units).

The objective of emphasizing rainfall capture is to place the stormwater management focus clearly on volume. Traditional drainage practice concentrated on peak flow rates and overlooked the importance of volume management.

The Importance of Rainfall Capture for Water Quality

Rainfall capture is important for improving water quality as well as for reducing runoff volume. The objective of rainfall capture is to infiltrate small storms and the first portion of large storms at the source. This means that the 'first flush' of pollutants that get washed off impervious surfaces at the beginning of rainfall events will be filtered and receive some treatment as they infiltrate into the ground.

Rainfall that is captured at the source for re-use may require a certain amount of treatment, depending on its intended use. Indoor uses, such as toilet flush water, would likely require some form of treatment to satisfy regulatory requirements for public health protection.

6.5 Methodology for Setting Performance Targets and Site Design Guidelines

Case Study Example: City of Chilliwack

The City of Chilliwack is used as a case study in this section to demonstrate how to set performance targets and translate these targets into site design criteria. Chilliwack has applied a 6-step process for setting performance targets and developing site design criteria (see Figure 6-5). These steps are described in this section.

Chapter 4 showed how Chilliwack has integrated performance targets with stormwater management policies. This is a first step towards integrating targets with the Official Community Plan.

Chapter 7 elaborates on how Chilliwack has translated performance targets into a series of *Design Guidelines for Stormwater Systems* that developers can apply at the site level.

Chilliwack started applying the Guidebook methodology in the spring of 2001. Over the year that followed, the Chilliwack case study provided an opportunity to test, validate and refine the Guidebook methodology. This process was undertaken in an inter-departmental and inter-agency environment, and used actual land development projects in the City to apply the methodology. The interaction with the development community was essential to making the methodology practical.

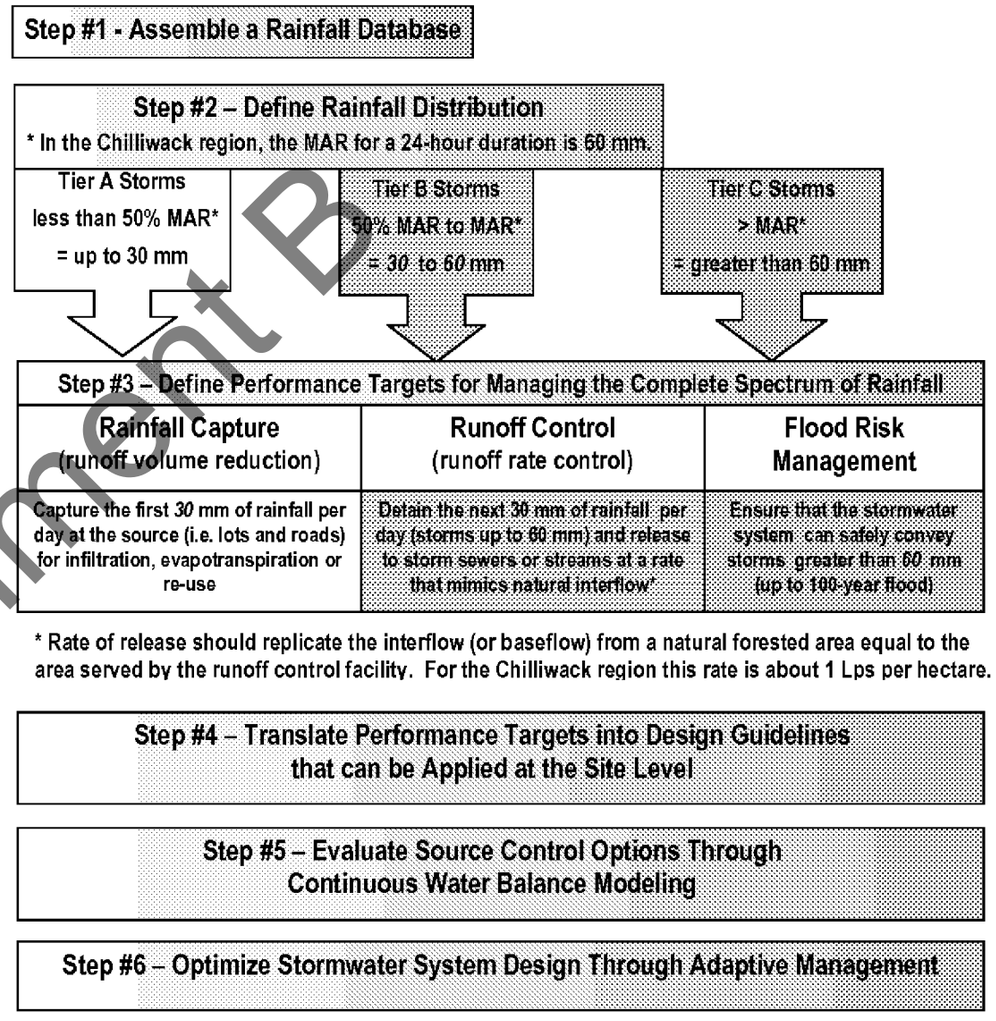


Figure 6-5

Step #1 - Assemble a Rainfall Database

Rainfall data is readily available in most jurisdictions. Environment Canada operates an extensive network of rainfall gauging stations across the province. Many regional districts and municipalities are beginning to operate their own stations, and in some cases local government-operated networks are in place.

Rainfall data should be obtained from a gauging stations as close as possible to the watershed where performance targets are being set.

Obtaining rainfall data from several stations in a region can provide a good idea of rainfall variability and enable the establishment of regional performance targets (as shown in the Chilliwack example).

For establishing performance targets, a rainfall data set should have a period of record that is long enough to enable statistical analysis (longer is better). The rainfall data must be put into a spreadsheet format to enable the necessary analysis (described on the following page).

A key principle is to assemble the best rainfall data available (i.e. longest period of record, closest to watersheds of interest) and to use this data to establish performance targets.

Even in the absence of rainfall data, the example rainfall tiers shown in Table 6-1 (from the relevant region) can be used to develop performance targets that provide a reasonable starting point for action. The values in Table 6-1 can also provide a check on analyses performed using data from rain gauges with short periods of record.

Daily versus Hourly Rainfall Data

Daily rainfall data is adequate for the basic analysis needed to set preliminary performance targets and site design criteria. However, hourly rainfall data provides a better description of local rainfall characteristics. Certain rainfall characteristics, such as rainfall intensity, can not be established based on daily data. Hourly data also enables more detailed monitoring and modeling (see Step #5 and #6).

Climate Change Concerns

Climate change projections show that total winter rainfall is likely to increase over time (thus increasing total runoff volume), and that the frequency of short intense storms, or cloudbursts, is also likely to increase. Chapter 7 shows how the implementation of stormwater source control strategies can mitigate the impacts of climate change.

Performance targets provide a starting point for evaluating source control options. It does not matter that these targets are based on historic rainfall data.

Case Study Example: Assembling Rainfall Data

Long-term rainfall data is available from three Environment Canada rainfall gauging stations in the greater Chilliwack area:

- **Agassiz** (on the north side of the Fraser River) – 109 years of record
- **Sardis** (near Vedder crossing) – 46 years of record
- **Chilliwack** (between Chilliwack City Center and Highway 1) – 90 years of record

Rainfall data from these three stations were used to establish general performance targets for the Chilliwack region. These targets can be customized for individual sub-catchments within the region by monitoring the performance of demonstration projects (see Step #6).

Since April 1999, the City has been operating two continuous rain gauges on a hillside area above the agricultural lowlands that is designated for future land development. These gauges are important for monitoring the change in rainfall-runoff response as land development progresses on the hillsides, and thus evaluating how well particular site design practices are mitigating the impacts of land development.

Step #2 – Define Rainfall Distribution

The rainfall event categories (Tier A, Tier B, and Tier C) form the basis for setting performance targets and developing site design criteria to manage the complete spectrum of rainfall events. In order to define the thresholds for these categories, the Mean Annual Rainfall (MAR) must be determined.

Methodology for Defining Mean Annual Rainfall (MAR)

The MAR for any watershed can be defined through the following process:

1. Calculate the peak daily rainfall (24-hr rainfall depth) for each year of record from the rainfall gauge. This can be done with a simple spreadsheet function.
2. Rank the rainfall maxima from highest to lowest and calculate a return period (T) for each using a standard plotting position formula (e.g. Weibull formula, T = [total # of rainfall maxima + 1]/rank).
3. Create a logarithmic plot of rainfall maxima vs. return period.
4. From this plot determine the rainfall maxima with a 2-year return period (R_2). This is approximately equal to the MAR (the statistical definition of MAR is the rainfall with a 2.33 year return period).

Since the preceding methodology is a statistical analysis, a long period of record (30 years or more) will ensure confidence in the results.

Defining Rainfall Tiers

Once the site-specific MAR is determined, rainfall event categories can be defined:

- Tier A = less than 50% of MAR
- Tier B = 50% MAR to MAR
- Tier C = greater than MAR

Illustrating the Rainfall Distribution

The site-specific rainfall frequency distribution (see Figure 6-3) can be determined by applying a spreadsheet query to the rainfall database (count the total # of Tier A, Tier B, and Tier C events). This will validate that the majority of rainfall events are small.

The site-specific rainfall volume distribution (see Figure 6-4) can also be determined using spreadsheet functions (add up the total depth of Tier A, Tier B, and Tier C events). This will validate that the small Tier A events account for the majority of total annual rainfall volume.

Case Study Example: Defining Rainfall Distribution

The MAR (24-hour duration) for Chilliwack was determined using data from the three long-term rainfall gauging stations. The points plotted on Figure 6-6 represent the peak annual rainfall event (24-hr rainfall depth) for each of the 90 years of record from the Chilliwack rainfall gauge. The same analysis was performed using the Sardis rainfall gauge and the Agassiz rainfall gauge.

Based on this analysis, the MAR at each of the three stations was determined to be:

- Chilliwack = 63 mm
- Agassiz = 60 mm
- Sardis = 55 mm

Therefore, the regional MAR for the Chilliwack area can be defined as 60 mm (over 24 hrs). This regional approximation provides the basis for specifying the following rainfall tiers:

- **Tier A** = less than 50% of MAR = less than 30 mm
- **Tier B** = 50% MAR to MAR = 30 mm to 60 mm
- **Tier C** = greater than MAR = greater than 60 mm

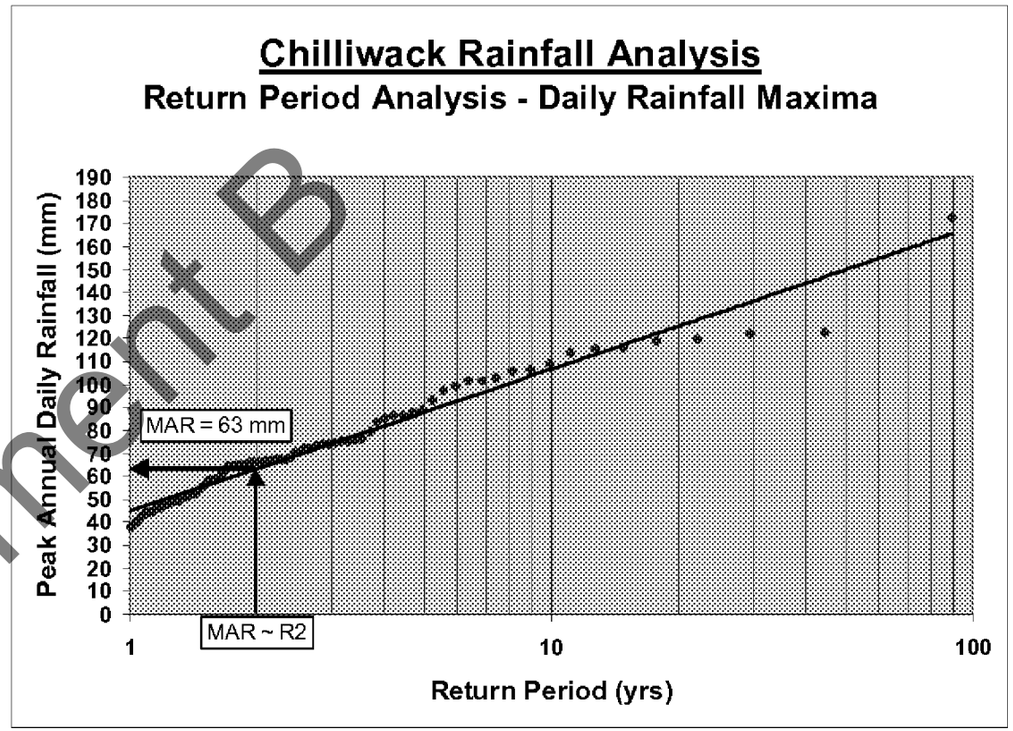


Figure 6-6

Step #3 – Define Performance Targets for Managing the Complete Spectrum of Rainfall Events

The rainfall tiers, established in Step #2, must be translated into performance targets for rainfall capture, runoff control and flood risk management.

Case Study Example: Translating Tiers into Targets

The City of Chilliwack's performance targets are presented below to illustrate how rainfall tiers translate into performance targets.

Rainfall Capture Performance Targets (for Tier A Events)

Capture the first 30 mm of rainfall per day (24 h) at the source (i.e. lots and roads) and restore to natural hydrologic pathways (infiltration and evapotranspiration) and/or re-use.

This relates to the following specific rainfall capture targets:

- **For impervious areas –** Provide stormwater source control facilities* on development lots, roads or neighbourhood sites that are designed to capture 30 mm of rainfall per day, and either infiltrate, evapotranspire, or re-use the captured rainfall.
- **For pervious areas –** Preserve as much undisturbed natural area as possible. For landscaped areas, provide an absorbent surface soil layer that has the capacity to store at least 60 mm of rainfall and infiltrate at the natural rate of local soils. This will ensure that pervious areas produce virtually no surface runoff (much like a naturally vegetated watershed).

* the selection and design of source controls must be based on site-specific conditions (see Steps #4 and #5)

Runoff Control Performance Targets (for Tier B Events)

Detain the next 30 mm per day (all rainfall events up to 60 mm over 24 h) and release to storm sewers or stream channels at a rate that approximates a natural forested watershed.

This relates to the following specific runoff control target:

- **For impervious areas –** Provide enough storage volume to detain the runoff resulting from rainfall events up to 60 mm per day, either in rainfall capture facilities and/or community detention facilities. Release the stored rainfall at a rate that replicates the interflow from a natural forested area* (equivalent to the area served by the runoff control facility).
- **For pervious areas –** Meeting the rainfall capture target also provides adequate runoff control (i.e. enough storage for 60 mm of rainfall).

* natural interflow can be defined based on streamflow monitoring in undeveloped catchments (see Step #4)

Flood Risk Management Performance Target (for Tier C Events)

Ensure the stormwater system is capable of safely conveying an extreme flood event that results from rainfall events greater than 60 mm (e.g. the 100-Year Flood, Q_{100}).

The runoff from extreme storms must be conveyed, through a combination of overland flow paths and flow collection and conveyance systems, without causing property damage, posing a threat to public safety, or causing unacceptable levels of flooding in agricultural areas.

Validating Performance Targets

As discussed in Section 6.2, achieving the biophysically-based target condition (a healthy watershed) means that 90% of total rainfall volume must be captured at the source to reduce total runoff volume to 10% or less of total rainfall volume.

Figure 6-7 relates the performance targets for rainfall capture, runoff control and flood risk management to rainfall volume distribution (at the Sardis gauge).

The same analysis was performed using data from the other two long-term rainfall stations (Chilliwack and Agassiz). The volume distribution for all three stations is summarized below.

Rainfall Station	Rainfall Capture Volume	Runoff Control Volume	Flood Control Volume
Chilliwack	89%	7%	4%
Agassiz	91%	6%	3%
Sardis	93%	5%	2%

Capturing the first 30 mm of rainfall per day (i.e. meeting Chilliwack's rainfall capture target) would result in capture of about 90% of the total volume of runoff from impervious areas. Also, implementing absorbent landscaping practices can virtually eliminate runoff from pervious areas (i.e. achieve close to 100% capture), as discussed in Chapter 7.

The key point is that meeting rainfall capture targets should achieve the biophysically-based target condition.

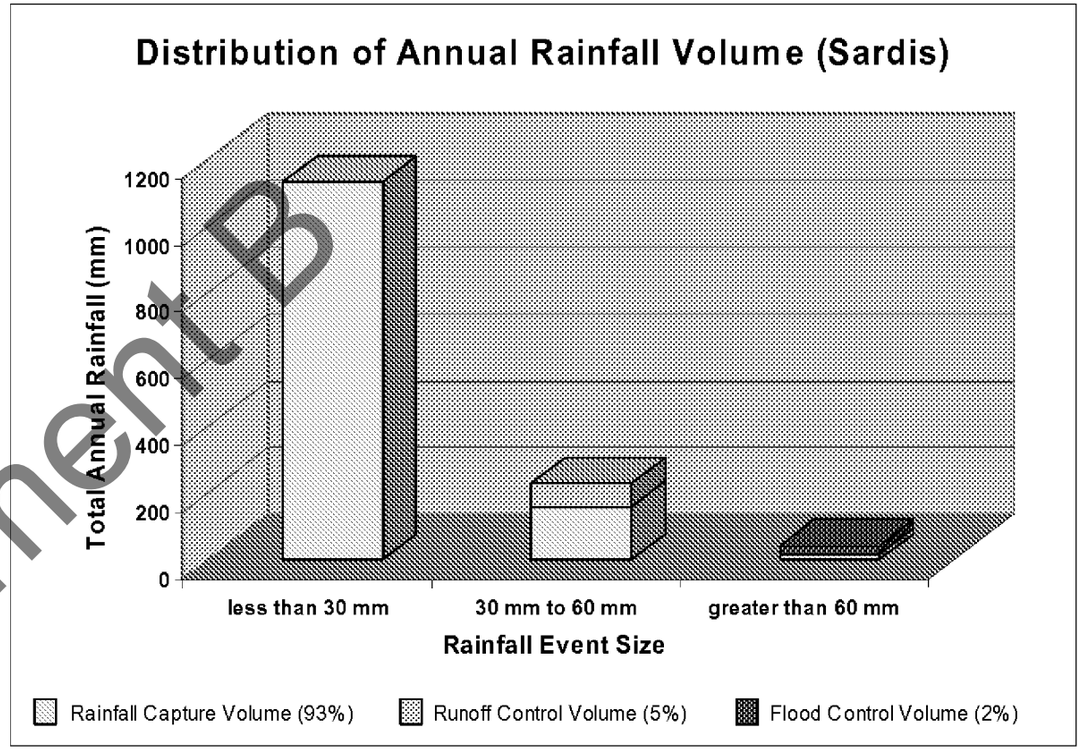


Figure 6-7

Step #4 – Translate Performance Targets into Design Guidelines that can be Applied at the Site Level

In order to achieve performance targets for rainfall capture, runoff control and flood risk management, the targets must be translated into achievable design guidelines that developers and local government staff can understand and apply at the site level.

Design Guidelines for Rainfall Capture (Managing Tier A Events)

Reducing runoff volume is the key to achieving performance targets for rainfall capture. The following volume reduction strategies should be applied:

- **Minimize the disturbance of natural soils and vegetation.** At the land use planning and site design levels, it is important to identify and preserve the natural areas that are most important to maintaining the natural Water Balance, such as wetlands, natural infiltration areas and riparian forests. Low impact site design practices that limit the creation of impervious area, the compaction of natural soils and the clearing of natural vegetation should also be applied.

- **Apply absorbent landscaping.** For landscaped areas, an absorbent surface soil layer should be provided. This absorbent soil layer should:
  - be deep enough to store the mean annual rainfall (24-h duration). Since most absorbent soils store about 20% of their volume in soil water, five times the MAR is an appropriate soil depth (e.g. for Chilliwack this would be 60 mm x 5 = 300 mm).
  - meet the BC Landscape Standard for medium or better landscape, which will ensure the type of hydrologic characteristics required for rainfall capture.

- **Implement stormwater source control practices to capture runoff from impervious surfaces.** Source control options include:
  - **Infiltration Facilities** – Infiltration is likely the only way achieve the target condition of restoring 90% of total rainfall volume to natural hydrologic pathways, and is the most appropriate source control for single family land uses, which is the dominant land use in most developed watersheds in the province. The level of reduction in the volume and rate of runoff that is achievable using infiltration depends on soil conditions, and therefore, soils information is key to the planning and design of infiltration facilities.
  - **Green Roofs –** The volume and rate of rooftop runoff can be reduced by installing absorbent landscaping on rooftops of buildings or parkades. Green roofs will store and evapotranspire rainfall from small events, and will slow the rate of release of medium-sized events. Green roofs are most effective for land uses with high levels of rooftop coverage, such as multiple family and commercial land uses (especially with underground or structured parkades).
  - **Rainwater Re-use –** Capturing and re-using rooftop runoff for greywater uses (e.g. toilets, laundry) or for irrigation can reduce runoff volume. The opportunities for volume reduction through re-use are most significant for high density residential and commercial land uses with high water use.

Chapter 7 provides quantitative information on the effectiveness of these stormwater source control options under various conditions (e.g. rainfall, land use, soil type), and also provides further guidance on low impact site design practices and absorbent landscaping.

Determining What is Achievable

Establishing a rainfall capture target, as shown in Step #3, provides a starting point that is based on the characteristics of a healthy watershed. The next step is to determine what is achievable and affordable based on assessments of constraints and opportunities in individual catchments.

Based on these assessments, catchment-specific performance targets and design guidelines for achieving these targets can be established. These catchment-specific targets and guidelines will then provide direction for all land development projects within each catchment.

The following information is key to assessing opportunities and constraints in any given catchment:

- **Soils Information -** Soil conditions govern the feasibility and affordability of using infiltration facilities to meet rainfall capture targets. At the watershed planning level, coarse level soils mapping can provide local government staff with the information needed to determine where infiltration makes sense, and to evaluate the level of runoff volume reduction that could be achieved through infiltration in various catchments. This will enable the establishment of catchment-specific performance targets.

  It is also important to evaluate soil conditions at the site level, in order to determine how much infiltration area is required to meet catchment-specific targets, and to identify the most suitable infiltration areas within a development site (see the case study example on the following page).

- **Land Use Information –** Land use information will provide local government staff with guidance regarding where source control options other than infiltration should be considered. In multiple family and commercial land uses, or where opportunities for infiltration are limited, there may be opportunities to achieve significant levels of runoff volume reduction by implementing green roofs or rainwater re-use.

Case Study Example: Design Guidelines for Infiltration Facilities

Since the majority of new development in the City of Chilliwack are likely to be single family residential, the City's guidelines for rainfall capture focus on infiltration.

The key design parameter for infiltration facilities is footprint area. Increasing the area of infiltration facilities improves their effectiveness at reducing runoff volume, but also increases their cost.

Determining What is Achievable Through Infiltration

Soil conditions govern the feasibility and affordability of using infiltration facilities to meet rainfall capture targets. Figure 6-8 shows that the amount of infiltration area required to meet Chilliwack's rainfall capture target becomes very large where the hydraulic conductivity of soils is low.

The City's rainfall capture target is not likely achievable through infiltration in areas where the hydraulic conductivity of local soils is less than about 5 mm/hr (typical of soils with high clay content). Also, infiltration is not likely feasible in areas where the regional water table is at or very near the ground surface. Where appropriate, alternative source control strategies (green roofs or rainwater re-use) should be considered in areas where the opportunities for infiltration are limited.

Chilliwack's approach allows for flexibility in setting catchment-specific performance targets that reflect what is achievable and affordable.

Catchment-Specific Performance Targets

Chilliwack has adopted three levels of stormwater planning: watershed, sub-watershed and catchment. Catchment-specific performance targets will be established through the master planning process (at the sub-watershed level) based on a planning-level assessment of soil and groundwater conditions in individual catchments. Having catchment-specific targets will then provide direction for all land development projects within that catchment.

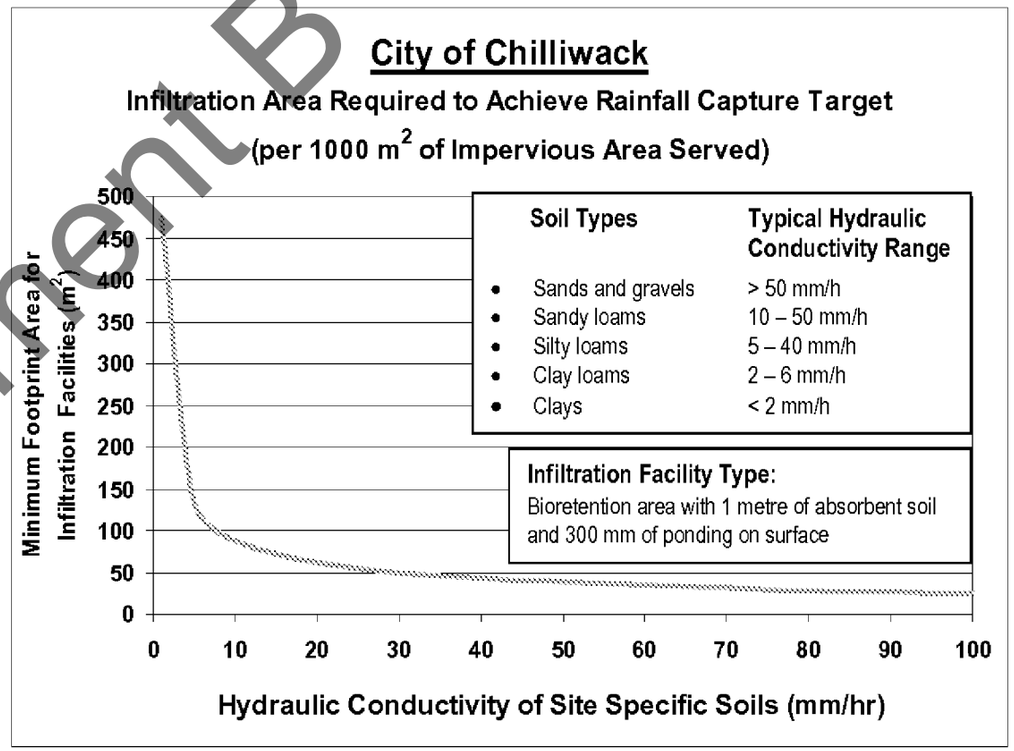


Figure 6-8

Communicating Performance Targets to Developers

Chilliwack's *Design Guidelines for Stormwater Systems* (see Chapter 7) include a step-by-step procedure for land developers to follow in order to design infiltration facilities that meet the City's rainfall capture performance targets. These Guidelines apply to all land development projects in catchments where the rainfall capture target is considered achievable.

Figure 6-8 shows an example design curve for sizing a particular type of facility based on the hydraulic conductivity of site specific soils.

Soils Information

Chilliwack has been building a database of the soils data submitted with development applications throughout the City. Using this information, coarse level soils mapping has been prepared to provide City staff and developers with guidance regarding where infiltration makes sense. This soils information will be used to develop catchment-specific performance targets.

At the site level, developers are required to perform soil investigations and percolation testing to identify the best infiltration areas and to design infiltration facilities.

Infiltration facilities should be sized based on site-specific estimates of saturated hydraulic conductivity. To obtain these estimates, on-site specific percolation tests should be performed at the location and depth of proposed infiltration facilities, and carried out under saturated soil conditions.

Developers may consider using areas with the best soil conditions to locate neighbourhood infiltration facilities serving multiple dwelling units.

Estimating Hydraulic Conductivity of Soils

The hydraulic conductivity of soils can initially be estimated through on-site percolation testing. These estimates can be improved over time by monitoring infiltration facility water levels and overflows (see Step #6).

It is also possible to estimate hydraulic conductivity based on soil texture and composition. A good reference is Washington State University's on-line *Soil Texture Triangle* (http://www.bsyse.wsu.edu/saxton/soilwater/), which estimates hydraulic conductivity based on approximate sand and clay content. The typical conductivity ranges shown on Figure 6-8 were obtained from this source.

The Importance of Protecting Infiltration Areas

Where infiltration facilities are to be located, it is critical to maintain soils in their natural, undisturbed state and to prevent sedimentation during construction. This requires:

- **sediment and erosion control** during construction to prevent clogging of rainfall capture facilities and their underlying soils
- **management of constructions sites** to prevent disturbance and compaction of infiltration areas; infiltration areas should be identified by fencing or other means

Failure to adequately protect infiltration areas during construction will likely result in failure to achieve rainfall capture targets.

Design Guidelines for Runoff Control (Managing Tier B Events)

In order to meet runoff control targets, the combination of source control facilities and community detention facilities should have the capacity to detain the MAR. Increasing the level of runoff reduction achieved through source control (i.e. rainfall capture) decreases the storage volume needed in community detention facilities.

For detention facilities, the operational objective is to replicate the hydrograph of an undeveloped drainage catchment as closely as possible. Therefore, the rate of release from detention facilities should approximate the natural streamflow rates that results from Tier B rainfall events (i.e. the target events for runoff control). Ideally, this release rate should be estimated based on streamflow monitoring from undeveloped catchments, as shown in the following case study example.

Case Study Example: Design Criteria for Runoff Control Facilities

Chilliwack has established preliminary detention storage and release criteria to achieve the City's runoff control target (i.e. detain rainfall events up to 60 mm per day and release at the natural interflow rate).

Storage Volumes

For development sites that achieve the City's rainfall capture target (i.e. capture the first 30 mm per day), an additional 300 m^3 of detention storage (i.e. 30 mm x 10 m^3 per mm) should be provided in community detention facilities.

Developers can reduce the size of detention facilities by increasing the size of infiltration facilities. The City's *Design Guidelines for Stormwater Systems* (see Chapter 7) provide a step-by-step procedure for designing integrated infiltration and detention systems and allow developers to make trade-offs between storage at the source and community storage.

Similarly, in catchments where the City's rainfall capture target cannot been achieved due to physical constraints (high water table, poor soils), more detention storage is required.

Release rate is not subtracted from storage volume criteria, which builds in a safety factor to account for back-to-back rainfall events. Performance monitoring may demonstrate that the safety factor is not needed in future development phases (see Step #6).

Release Rates

In 1999, the City of Chilliwack was proactive in setting up a network of streamflow monitoring stations, including two in natural forested catchments. This has enabled the City to establish the following detention release rate that approximates the natural forested condition.

Preliminary Release Rate for Detention Facilities in the City of Chilliwack
= 1 L/s per hectare (total area tributary to the detention facility)

Continued operation of the streamflow monitoring stations in the forested catchments (prior to development occurring in these catchments) will enable validation and refinement of this release rate. Post-development streamflow monitoring will enable the operation of detention facilities to be optimized (see Step #6).

Design Guidelines for Flood Risk Management (Managing Tier C Events)

Conveyance of peak flows from extreme storms and minimizing flood risk was the focus of traditional drainage engineering. While the focus has shifted to managing the complete spectrum of rainfall events (i.e. incorporating rainfall capture and runoff control), the flood risk management function is still an essential component of the overall strategy.

Providing Escape Routes for Extreme Storms

Flood risk management at the site level requires a common sense approach to site drainage. The objective is to ensure that the runoff from extreme rainfall events, such as a 100-year storm event, can escape to downstream watercourses without posing a threat to property or public safety. To achieve this objective, three design conditions must be addressed:

- All rainfall capture and runoff control facilities must include overflow escape routes to allow extreme storms to be routed to downstream watercourses, either as overland flow or via a storm drainage system (swales, ditches or pipes).
- Sites must be graded to ensure that any overland flow resulting from extreme storms is dispersed away from areas where flooding problems could otherwise result (e.g. residential properties in low-lying areas).
- The downstream storm drainage system must meet assessment criteria for both hydraulic and physical adequacy to handle the runoff from upstream development areas (refer to adjacent discussion).

Note that managing volume at the site through rainfall capture and runoff control will also reduce peak rates of stormwater runoff resulting from extreme storms.

Ensuring that Drainage Installations in Watercourses are Adequately Designed

Drainage system requirements for adequate containment and conveyance of stormwater runoff via watercourses are highly site-specific. However, the risk and acceptability of any drainage facility should be assessed in the context of two basic criteria:

- **Hydraulic Adequacy** – A comparison of rated capacity versus design flow
- **Physical Adequacy** – A qualitative judgement regarding physical constraints (e.g. culvert blockage) that could adversely impact hydraulic adequacy

Based on long-term experience, the governing criterion is almost always physical adequacy, with hydraulic adequacy generally being a secondary concern. Assessment of physical adequacy is a key input for any flood risk analysis.

Drainage problems often occur in small tributaries where stream crossings, such as culvert installations, are vulnerable to blockage (i.e. physically inadequate). Flooding may be a common occurrence at tributary stream crossings even though conventional analysis indicates that the conveyance capacity (i.e. hydraulic adequacy) is adequate.

Guiding Design Principle for Stream Crossings: Maintain Waterway Opening

A guiding principle for the design of stream crossings is to preserve or improve the cross-sectional area and gradient of the natural waterway. Clear span bridges are typically better than culverts.

A smooth flow condition should be maintained through culvert installations to minimize the degree of interference with creek processes. If this principle is followed, then the need for peak flow estimates to design culverts is diminished because it is of incidental interest. Physical acceptability governs.

Physical Acceptability of Culvert Installations in Watercourses

The high-risk locations for stormwater system failure are most often at culvert installations that are vulnerable to blockage (often on the smaller watercourses). Assessment of physical adequacy for culvert installations involves a 3-step process:

- **Conformance with Design Guidelines (Step #1):** Assess the overall conformance with the nine guidelines for effective culvert design presented below.

Nine Guidelines for Effective Culvert Design

1	Maintain line and grade of creek channel
2	Maintain the waterway opening by 'bridging' the creek channel
3	Construct inlet structure to provide direct entry and accelerated velocity
4	Ensure that culvert can pass trash, small debris and bedload material
5	Install debris interceptor upstream to provide protection from large debris
6	Provide scour protection to prevent undermining of the outlet structure
7	Incorporate provision for an overflow route in the event of a worst-case scenario
8	Provide equipment access for ease of maintenance (debris removal)
9	Consider environmental issues, such as fish passage

- **Vulnerability to Blockage (Step #2):** Assess culvert vulnerability and probability of culvert failure due to blockage. The potential for blockage reflects the bedload and debris characteristics of a creek.

- **Consequences of Failure (Step #3):** Assess the consequences of culvert failure due to blockage (e.g. road failure, damage to downstream properties)

The nine guidelines can be used to qualitatively assess the adequacy of existing facilities as either poor, fair, good or excellent. The outcome of Step #1 is an overall rating.

The results of Step #2 and Step #3 then determine the acceptability of the overall rating and whether or not to replace an existing facility.

The level of risk associated with the status quo then determines the need for and timing of replacement.

The Importance of Erosion Control for Flood Management

The culvert blockages that are often the cause of flooding problems on tributary streams can usually be traced back to two sources:

- erosion and deposition of bedload material
- transport of floatable debris such as branches and brush

Deposition of bedload material also results in the progressive reduction of drainage channel capacity, which increases flooding risk and can create an ongoing channel maintenance problem.

As discussed in Chapter 2, these physical processes are the result of increases in volume and rate of surface runoff. Therefore, providing rainfall capture and runoff control to reduce the volume and rate of runoff is an important part of flood risk management.

Flood Management Guidelines for Agricultural Areas

A primary flood management objective for agricultural areas is to provide adequate drainage to ensure that the frequency and duration of flooding in agricultural areas does not inhibit productivity. Meeting the following drainage criteria from the *Agri-Food Regional Development Subsidiary Agreement* (ARDSA) will ensure that flood management is adequate for agriculture:

- Flooding should be limited to a maximum of five days for the 10-year, 5-day winter storm (November to February).
- Flooding should be limited to a maximum of two days for the 10-year, 2-day growing season storm (March to October).
- Between storm events, the baseflow in ditches should be maintained at 1.2 m below the average ground level to provide free outlet for drains.

Note that these criteria are based on winter storms with a 10-year return period, which are significantly larger than a MAR (corresponds roughly to a 2-year return period).

The stormwater management practices required to achieve flood management criteria for agricultural areas will be highly watershed-specific, and should be evaluated as part of Integrated Stormwater Management Plans (ISMPs).

It is important to consider agricultural drainage objectives in the context of other objectives. For example, there may be a need to achieve a balance between the third ARDSA criterion defined above, and a fisheries objective of maintaining adequate low flows in channels to allow for fish passage, since agricultural drainage channels are often used as fish migration corridors.

Impacts from Upstream Areas

A key stormwater planning consideration is the potential impact that development could have on downstream agricultural areas (and vice versa). A common stormwater-related problem is the increase in frequency of flooding of agricultural areas as a result of increased runoff from upstream development areas. Implementing site design practices that meet rainfall capture and runoff control targets will mitigate this problem to a large extent.

Impacts on Downstream Areas

Agricultural areas can also have an impact on downstream urban and suburban land uses. This is often related to water quality impacts associated with agricultural land uses. Specific practices for managing water quality in agricultural areas (e.g. proper storage of manure) are beyond the scope of this Guidebook.

Step #5 – Evaluate Source Control Options Through Continuous Simulation Water Balance Modeling

The Importance of Continuous Simulation for Site Design

The most appropriate site design solutions for achieving rainfall capture targets on any given development site will depend on site-specific conditions such as soil type, land use type, rainfall and groundwater characteristics.

Continuous simulation modeling provides a tool to evaluate site design options under a full range of operating conditions (i.e. the complete rainfall spectrum).

While single event modeling provides an expedient way of establishing capacities and sizes for the design of conveyance facilities, it does not account for seasonal variation in hydrologic parameters such as antecedent soil moisture and evapotranspiration capacity. Nor does it account for the frequently occurring small rainfall events (the focus of rainfall capture). Chapter 7 provides a more detailed discussion on continuous simulation modeling for stormwater source controls.

Chapter 10 provides a more detailed discussion on the applications of single event and continuous simulation modeling in the context of integrated stormwater management plans (ISMPs).

Water Balance Modeling

Water Balance modeling using spreadsheets is a cost-effective method to ensure that the design of rainfall capture and runoff control facilities:

- meets performance targets for reducing runoff volume and rate
- is practical and achievable in the context of local conditions

Water Balance modeling for rainfall capture and runoff control facilities serves several purposes:

- **Validates preliminary design criteria** – Model outputs will provide confidence that preliminary design criteria meet (or exceed) performance targets for rainfall capture and runoff control.
- **Provides a benchmark for future evaluation** – Model outputs will guide the periodic evaluation of stormwater system performance and facilitate the process of optimizing design criteria (see Step #6).
- **Provides further design guidance for source control facilities** - The performance of source control options will depend on site-specific conditions such as soil conditions, land use and rainfall characteristics. Water Balance modeling helps with the selection of appropriate design options.

Case Study Example: Applying Water Balance Modeling to Evaluate the Effectiveness of Stormwater Source Control Options

The Water Balance Model (WBM) is a continuous simulation model that has been developed to simulate the hydrologic performance of stormwater source control options (i.e. how well they reduce the volume and rate of runoff). This model has evolved through case study applications of the Water Balance design approach presented in this Guidebook, including:

- developing design criteria for infiltration facilities in the City of Chilliwack (discussed in Step #4)
- evaluating the potential effectiveness of a broader range of stormwater source control options in the Greater Vancouver Regional District (GVRD), including:
  - absorbent landscaping
  - infiltration facilities (on lots and along roads)
  - green roofs
  - rainwater re-use

Key findings from the GVRD source control evaluation are presented in Chapter 7.

Step #6 - Optimize Stormwater System Design Through Adaptive Management

The performance targets and site design criteria presented in Steps #1 through #5 provide a starting point for the design of stormwater systems.

Stormwater system design criteria should be reviewed periodically (e.g. every 3 years), and optimized based on a detailed performance evaluation. The primary objective of this evaluation is to reduce stormwater-related costs while still achieving the defined goals and objectives for protecting downstream property, aquatic habitat and receiving water quality.

Performance Evaluation at the Site Level

Monitoring and evaluating the performance of demonstration projects at the site level is the primary basis for optimizing the design of stormwater systems. Figure 6-9 shows the indicators that should be monitored to enable a thorough evaluation of stormwater system performance.

Monitoring water level and flow in rainfall capture and runoff control facilities provides the basis for performance evaluation. A continuous record of water level and flow in rainfall capture and runoff control facilities (including road drainage flows) over an extended time period, combined with continuous rainfall data over the same time period, provides an accurate picture of how water moves through a stormwater system.

This continuous record will provide answers to key questions related to stormwater system performance, such as those shown in the adjacent table.

Framework for Performance Evaluation

For Rainfall Capture Facilities:	For Runoff Control Facilities:	For Road Infiltration/Drainage:
▪ What is the frequency and volume of overflow? ▪ Are targets for runoff volume reduction being achieved? ▪ How often does water accumulate? ▪ How fast does water level drop (i.e. infiltrate) under saturated soil conditions? ▪ What would be the effect of increasing/ or decreasing infiltration area? ▪ What would be the effect of decreasing storage volume?	▪ What is the frequency and volume of overflow? ▪ Are targets for runoff rate control being achieved? ▪ Do detention facilities empty prior to large rainfall events? ▪ What would be the effect of decreasing storage volume? ▪ Does the outflow hydrograph from detention facilities resemble the hydrographs observed at the streamflow monitoring stations in adjacent undeveloped catchments?	▪ Where does road runoff go? ▪ How much runoff discharges to detention ponds? storm sewers? directly to watercourses? ▪ How much infiltrates? ▪ How fast does road runoff and overflow from rainfall capture facilities enter the road drainage system? ▪ are the targets for runoff volume reduction and rate control being achieved?*

* These targets will depend on the road design objectives. Roads may be designed to provide rainfall capture or to be 'self-mitigating' (i.e. provide rainfall capture *and* runoff control).

Case Study Example: Communicating Performance Monitoring Requirements to Developers

The City of Chilliwack's *Design Guidelines for Stormwater Systems* (refer to Chapter 7) include requirements for performance monitoring, which correspond to Figure 6-9.

Performance Monitoring Requirements

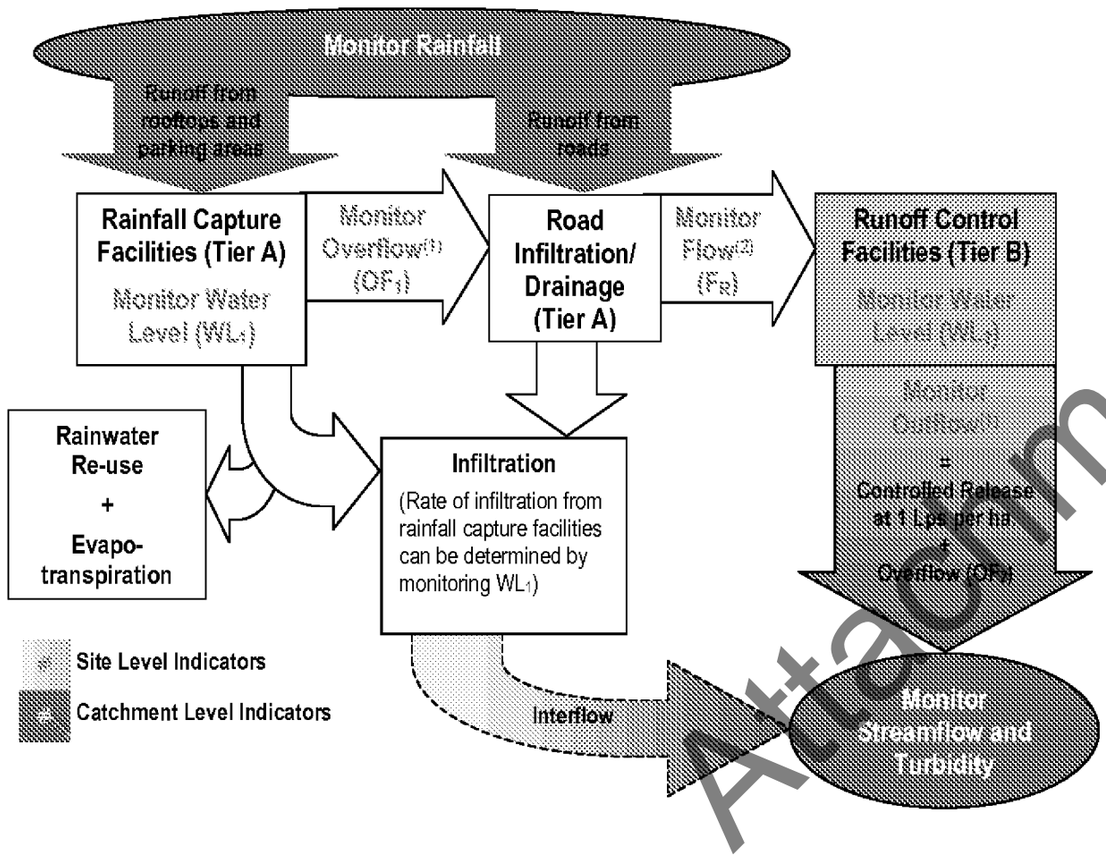


Figure 6-9

Indicator	OF_1	OF_2	Road Drainage	Streamflow
Performance Targets	➢ **Total overflow volume** should be about 10% of total runoff volume. ➢ **The frequency of overflows** should be about 6 to 8 times per year, on average.	➢ **Total overflow volume** should be about 3% of the total runoff volume. ➢ **The frequency of overflows** should be about once per year, on average.	➢ **total flow in the road drainage system** should meet the volume and frequency targets(3) for OF_1 or OF_2	➢ **The pre-development hydrograph** should be maintained in downstream watercourses.

Note: These overflow targets relate to the typical volume and frequency distribution of Tier A and Tier B rainfall events.

(1) Compound weir outlet structures will enable overflow from rainfall capture facilities and outflow from runoff control facilities to be correlated with water levels (WL_1 and WL_2, respectively). Overflow from runoff control facilities (OF_2) can be determined by subtracting controlled release (a known parameter) from total outflow.

(2) The amount of road runoff that infiltrates can be determined by subtracting F_R from total road runoff (and accounting for OF_1).

(3) If the design objective for roads is to provide rainfall capture, then the targets for OF_1 would apply. If the design objective is to make roads 'self-mitigating' (i.e. provide rainfall capture *and* runoff control), then the targets for OF_2 would apply. Note that storage does not need to be provided in runoff control facilities for self-mitigating roads.

Deciding Which Facilities to Monitor

To properly evaluate the performance of a demonstration stormwater management system, a comprehensive monitoring program should define the Water Balance of the development site served by that system. This means that the monitoring information must answer the following question:

- Where does the rain that falls on the site end up?

Not every rainfall and runoff control facility needs to be monitored, however, it is important to monitor a representative sample from each component of the stormwater system. For example, a comprehensive monitoring program for a residential subdivision may include:

- **On-lot rainfall capture monitoring (Tier A)** – Monitor water level and overflow from at least one on-lot rainfall capture facility.
- **Road infiltration/drainage monitoring (Tier A)** – Monitor the drainage from at least one section of road, which may include more than one drainage path (e.g. french drains and catch basins).
- **Community detention pond monitoring (Tier B)** – Monitor water level and outflow from a detention pond serving the entire subdivision.

The monitoring information from a stormwater system should enable the performance of each stormwater system component and the performance of the overall system to be evaluated separately based on the appropriate performance targets and design objectives.

Testing Conservative Assumptions

To deal with uncertainty, the preliminary stormwater system design criteria presented in Steps #1 through #5 are based on conservative assumptions:

- Detention storage volumes are conservative because they are based on long-duration rainfall events (24 hr) and do not account for release rate.
- Infiltration facility design criteria are based on conservative modeling assumptions.

Performance monitoring would be expected to confirm that initial assumptions are conservative and provide the certainty needed to reduce the size of facilities installed in subsequent developments. This should translate into cost savings over time.

Customizing Infiltration Criteria for Different Zones

The rate of infiltration from on-lot or on-road infiltration facilities, and from unlined detention ponds, depends on soil conditions.

Monitoring the water level in rainfall capture or runoff control facilities will demonstrate how much water actually infiltrates and how the infiltration rate varies throughout the year.

This site-specific information can be used to develop customized design criteria for zones that have similar soil types.

Performance Evaluation at the Catchment Level

Performance evaluation at the site level is the primary basis for optimizing the design of stormwater systems. Performance evaluation at the catchment level is also important to ensure that overall objectives for protecting aquatic habitat and receiving water quality are being achieved over time, and to improve stormwater management practices. Performance evaluation at the catchment level may require monitoring of:

- **Hydrologic Indicators** (e.g. change in rainfall-runoff response). Monitoring rainfall and runoff patterns provides an understanding of the effectiveness of source control strategies at maintaining or restoring the catchment's natural Water Balance and hydrology.
- **Water Quality Indicators** (e.g. change in total suspended solids (TSS)). Monitoring changes in TSS provides an indicator of improvements or declines in water quality. TSS acts as a 'carrier' for other pollutants such as heavy metals, and provides a direct measure of stream erosion and sedimentation rates.
- **Ecological Indicators** (e.g. abundance of benthic invertebrate community). Monitoring the characteristics of benthic invertebrate communities can provide a direct measure of changes in stream health over time.

Hydrologic Performance Evaluation

A key performance objective is to maintain, as closely as possible, the characteristics of the natural hydrograph (i.e. hydrograph of the catchment in its undeveloped state), including:

- total flow volume
- peak flow rates
- baseflow rates (i.e. interflow)
- hydrograph shape

Note that when natural forest cover is removed a certain amount of natural evapotranspiration capacity is lost. Therefore, an increase in total flow volume is almost always expected from developed catchments (unless rainwater re-use is implemented). This underscores the importance of land development practices that preserve and/or restore as much natural forest cover as possible. The use of green roofs can also limit, though not replace, the loss of natural evapotranspiration capacity.

Continued streamflow monitoring at the catchment level will answer the following key performance evaluation question:

- How well are stormwater management practices at the site level maintaining the characteristics of a natural hydrograph as development proceeds within a catchment?

Water Quality Performance Evaluation

Another performance objective is to maintain pre-development water quality. Turbidity and total suspended solids (TSS) are key water quality indicators that can be monitored at the catchment level. Because turbidity can be correlated with TSS, turbidity monitoring could be effectively integrated with streamflow monitoring.

A water quality baseline should be established by measuring turbidity and TSS prior to development proceeding in a catchment. This will enable future water quality monitoring to answer the following performance evaluation question:

- How well are stormwater management practices at the site level maintaining the pre-development water quality?

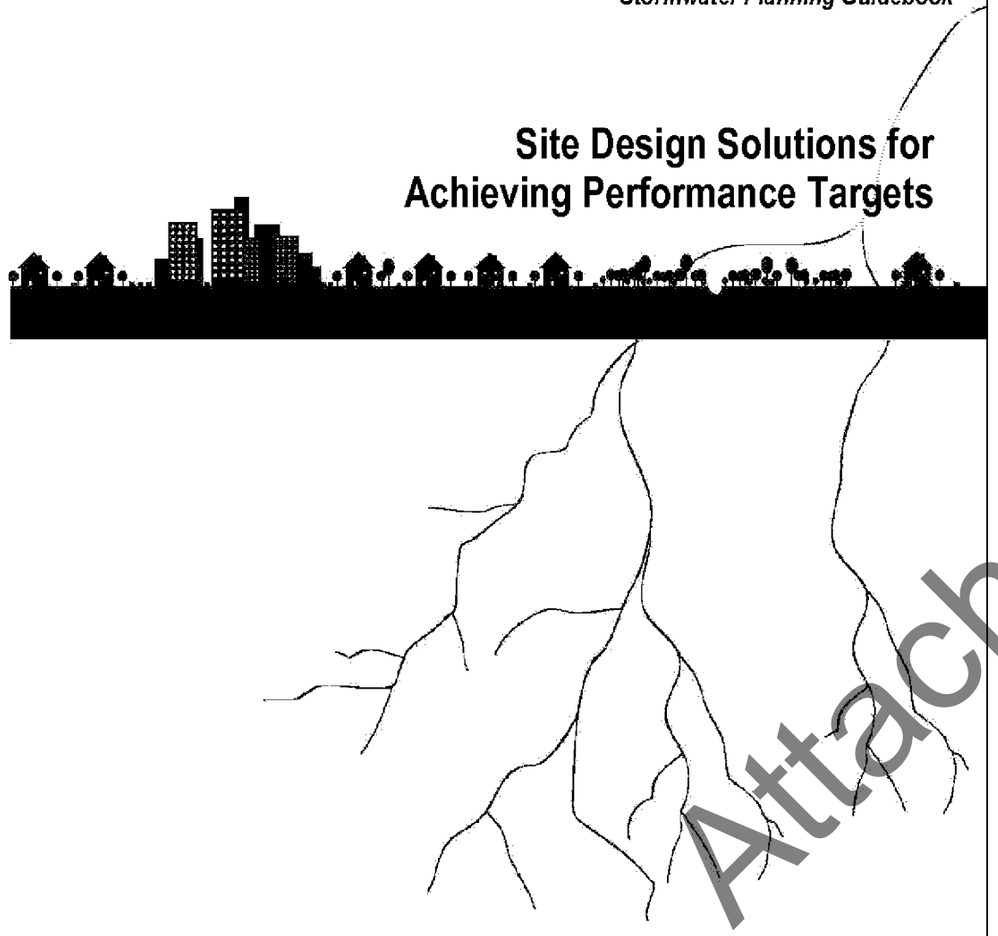
Benthic Monitoring as an Early Warning Indicator

The Benthic Index of Biological Integrity (B-IBI) is a direct indicator of stream health. For streams that are seen as highly valuable (by citizens or environmental agencies), establishing a B-IBI baseline and implementing an ongoing monitoring program would provide an 'early warning' of stream degradation, and signal the need for action.

A Look Ahead

Chapter 10 elaborates on environmental monitoring techniques that can be used to measure success at the catchment scale. This includes a discussion of the suite of tools that comprise a comprehensive approach, and an overview of the appropriate scale on which to use them.

The key message is that this suite of indicators accurately represents the environmental state of both the surface drainage function and the ecological function of receiving waters and can therefore be used to evaluate and optimize stormwater management strategies over time.



Site Design Solutions for Achieving Performance Targets

Chapter Seven

7.1 Overview of Site Design Strategies for Achieving Performance Targets

7.2 Low Impact Development Practices

- Reducing Impervious Area
- Stormwater Source Control – A Key Element of Site Design
- Consistency with Other Low Impact Development Objectives
- Preserving Significant Natural Features

7.3 Stormwater Source Control Practices

- The Role of Source Control
- Guidance for Selecting Appropriate Source Controls
- Modeling the Effectiveness of Source Controls
- Integrating Source Controls into ISMPs
- Evaluating the Cost of Source Controls
- Ensuring the Long-Term Performance of Source Controls
- Operation and Maintenance Implications
- Water Quality Benefits of Source Control

7.4 Type 1 Source Control - Absorbent Landscaping

- The Importance of Surface Soil and Vegetation
- Absorbent Soil and Vegetation Characteristics
- Absorbent Soil Depth
- The Importance of Forests
- The Benefits of Absorbent Landscaping for Different Rainfall Conditions
- Benefits of Absorbent Landscaping for Different Land Use Types
- Cost Implications of Absorbent Landscaping
- Maintenance Tips for Absorbent Landscaping
- Rehabilitation of Disturbed Soil

7.5 Type 2 Source Control - Infiltration Facilities

- The Importance of Disconnecting Impervious Surfaces
- Different Types of Infiltration Facilities
- Factors that Affect the Performance of Infiltration Facilities
- The Effectiveness of Infiltration under Different Rainfall Conditions
- Selecting Infiltration Facility Depth
- The Importance of Infiltration Area and Soil Type
- Determining What is Feasible and Affordable
- Infiltration Facilities for Land Uses with High Impervious Coverage
- Performance of Infiltration Facilities for a Range of Land Use Types
- Performance of Infiltration Facilities on Roads
- Achievable Level of Runoff Volume Reduction for Different Land Use Types
- Creating Hard Surfaces that Infiltrate
- Applying Combination of Infiltration Strategies
- Cost Implications of Infiltration Facilities
- Design and Construction Tips for Infiltration Facilities
- Operation and Maintenance Tips for Infiltration Facilities

7.6 Type 3 Source Control - Green Roofs

- The Effectiveness of Green Roofs under Different Rainfall Conditions
- The Importance of Green Roof Soil Depth
- Benefits of Green Roofs for Different Land Uses
- Cost Implications of Green Roofs
- Design and Construction Tips for Green Roofs
- Operation and Maintenance Tips for Green Roofs

7.7 Type 4 Source Control - Rainwater Re-use

- Benefits of Rainwater Re-use for Different Land Uses
- The Effectiveness of Rainwater Re-use under Different Rainfall Conditions
- Selecting an Appropriate Storage Volume
- Cost Implications of Rainwater Re-use
- Design and Construction Tips for Rainwater Re-use
- Operation and Maintenance Tips for Rainwater Re-use

7.8 Applying Source Controls to Mitigate Extreme Cloudbursts

7.9 Communicating Performance Targets to Developers

- Case Study Example: Design Guidelines for Developers

7.1 Overview of Site Design Strategies for Achieving Performance Targets

Chapter 6 showed how to establish performance targets. This chapter presents site design strategies for achieving performance targets, including:

- **Low Impact Development Practices** that:
  - minimize the creation of impervious cover (i.e. reduce total impervious area (TIA)) and other land cover changes that are detrimental to downstream watercourses, such as clearing of natural vegetation and compaction of soils.
  - preserve natural features that are key to maintaining healthy aquatic ecosystems, such as riparian forests and wetlands.

- **Stormwater Source Control Practices** that capture rainfall at the source (on building lots, road right-of-ways, or in neighbourhood facilities) and return it to natural hydrologic pathways - infiltration and evapotranspiration - or re-use it at the source. Source controls create hydraulic disconnects that reduce effective impervious area (EIA).

Catchment-specific performance targets for rainfall capture and runoff control may be achieved at the site level through some combination of these strategies.

Section 7.2 discusses low impact site design practices, and Sections 7.3 through 7.8 provide guidance for selecting appropriate stormwater source control options.

Section 7.9 shows how to communicate performance targets and related design guidelines to developers so that they can be applied at the site level.

7.2 Low Impact Development Practices

Reducing Total Impervious Area

Runoff from impervious surfaces is the primary cause of drainage-related problems such as stream degradation and flooding risk. Limiting impervious coverage can reduce runoff volume and partially mitigate these problems.

At the Land Use Planning Level

Impervious coverage can be controlled at the land use planning level by controlling where certain land use types are permitted. Limiting the amount of development, or controlling the type of development, in catchments where local and downstream ecosystem values could be negatively impacted, can be a science-based strategy to support stormwater management goals.

However, stormwater is just one of many factors that need to be considered when making land use decisions.

At the Site Design Level

There are a number of site design practices that can reduce impervious coverage for a wide range of land uses, including:

- **Reducing Road Widths** – Paved roadways are often larger than they need to be. Reducing road width not only reduces impervious area, but also reduces motor vehicle speeds, improves pedestrians and bicycle safety, reduces infrastructure costs and allows more of the paved surface to be shaded by overarching tree canopy.
- **Reducing Building Footprints** – Building footprints can be reduced (thus reducing rooftop area) without compromising floor area by relaxing building height limitations. Taller, more slender building forms provide greater flexibility to develop building layouts that preserve naturally vegetated areas and provide space for infiltration facilities. This also has important implications for integrating source control into site design, as discussed in Section 7.5.
- **Reducing Parking Standards** - Reducing parking standards reduces the amount of space devoted to parking (driveways, parking lots and parkades). In compact and/or high density communities where dwelling units are within walking distance to transit and services, parking standards may be reduced to 1.3 or even as low as 1 space per dwelling unit. There are other factors that could reduce the need for parking, including a high proportion of low income housing units, the implementation of transportation demand management strategies, and high parking costs. Reducing parking standards not only reduces impervious area, but also reduces parking-related development cost, and facilitates the provision of affordable housing.
- **Limiting the Amount of Surface Parking** – The more parking provided within the building envelope (e.g. underneath other land uses), the less additional lot area will be needed for parking. For parking outside the building envelope, surface parking typically creates far more impervious coverage than parkades. There is also greater opportunity to mitigate the runoff from parkades using green roofs or rainwater re-use (see Sections 7.6 and 7.7). Generally, underground parking only occurs where land economics favour residential or commercial development over surface parking.
- **Building Compact Communities** – Building compact communities enables more natural area to be preserved, thus reducing impervious coverage at the watershed scale. In a compact community pattern, there can be up to 75% less roadway pavement per dwelling unit. The need for parking is also reduced in compact communities, as discussed previously.

Site design practices that reduce total impervious areas also reduce clearing of natural vegetation and the compaction of natural soils (total site disturbance is reduced).

Reducing Impervious Area Improves Source Control Effectiveness

Reducing impervious coverage on lots and roads can improve the effectiveness of stormwater source controls, particularly infiltration facilities. Less impervious coverage on roads and building lots means that:

- less runoff becomes concentrated into infiltration facilities
- more space is available to locate infiltration facilities

This can significantly improve the effectiveness of infiltration facilities, as discussed in Section 7.5.

Stormwater Source Control – A Key Element of Site Design

Implementing low impact site design practices that reduce impervious coverage is not enough to protect downstream watercourses and prevent drainage-related problems. Even low levels of impervious coverage can cause significant stormwater-related impacts. For example, the volume of runoff from low-density single family land uses far exceeds the target condition for Water Balance management (i.e. the 10% runoff volume target).

Source controls are needed to further reduce runoff from impervious surfaces on development parcels (rooftops, driveways, parking lots) and roads (paved roadway and sidewalks).

Consistency with Other Low Impact Development Objectives

Site design practices that achieve stormwater objectives (reducing impervious area, forest clearing and soil compaction) are highly compatible with other low impact development objectives, including:

- Compact communities and cluster development that encourage walking, cycling and transit use
- Smaller streets that are more pedestrian and cyclist-oriented
- Continuous riparian corridors and open space systems (greenways)
- Preservation of environmentally significant areas
- Tree retention
- Community parks and recreation areas
- Construction practices that minimize soil and vegetation disturbance
- Lower expenditures on infrastructure

Preserving Significant Natural Features

Preserving natural vegetation and soils in their undisturbed state is key to minimizing changes in the natural Water Balance (i.e. loss of evapotranspiration and infiltration capacity). There are certain natural features that are especially important for maintaining the health of aquatic ecosystems, including riparian forests, wetlands, natural infiltration areas and floodplains. These features can also have significant benefits in terms of reducing flood risk.

A key component of an integrated strategy to manage stream health and flood risk is to identify significant key natural features at a watershed scale, and protect these features through growth management, land use planning, and development policies and regulations.

Significant natural features should also be identified at the site design level, and preserved through creative site design practices that integrate significant natural features with community open spaces.

Riparian Forests

As discussed in Chapter 2, riparian forests are key to maintaining the health of aquatic ecosystems. Preserving riparian forests enables overland flow to infiltrate and directly feed stream baseflow, thus helping to maintain the natural Water Balance.

Wetlands

Wetlands play a key role in maintaining natural Water Balance and hydrology. They retain large volumes of water, and promote recharge of the interflow zone and evapotranspiration from wetland vegetation. The vegetation in wetlands also improves water quality by removing sediments, nutrients and other contaminants such as heavy metals. Wetlands are typically very productive ecosystems that provide high quality habitat for waterfowl, fish and other wildlife. Constructed wetlands can be used to manage runoff from developed areas.

Natural Infiltration Areas

Natural areas where large volumes of rainfall infiltrate (e.g. natural depressions with highly permeable soils) are key to maintaining the natural Water Balance and should be preserved. Natural infiltration areas that directly feed stream baseflow (e.g. riparian corridors) are particularly important. These areas may also be used to infiltrate runoff from impervious surfaces.

Floodplains

Natural floodplains provide the space for streams and rivers to expand during periods of high rainfall and/or snowmelt. Floodplains provide natural flood control by dissipating the energy of high peak flows. Confining watercourses using flood protection structures such as dykes prevents this natural energy dissipation, and increases the risk of downstream flooding.

The periodic flooding of floodplain areas is also key to maintaining important ecosystems, including riparian forests and wetlands.

The hydrologic functions of natural floodplains can be preserved by limiting development, or by promoting 'flood-friendly' land uses (e.g. types of agriculture that can support periodic flooding, buildings that are flood-proofed) in floodplain areas.

7.3 Stormwater Source Control Practices

The Role of Source Control

Stormwater source control practices can play a key role in achieving performance targets for rainfall capture, runoff control and flood risk management.

The primary objective of source control is to reduce runoff volume (i.e. provide rainfall capture) by managing the Water Balance at the site level. Source control can also have significant benefits in terms of reducing runoff rates (i.e. provide runoff control and flood risk management).

Source controls can be very effective at reducing runoff volumes and at reducing peak runoff rates from relatively large storms (e.g. 5-year storms) or from very intense short duration storms (e.g. 100-year cloudburst). However, the ability of source controls to reduce peak runoff rates from very large, long duration storms (e.g. a 100-year winter storm) is limited. Even with source controls, stormwater systems must be designed to safely convey these extreme events.

The Need for Information on Source Control Effectiveness

In order to select appropriate source control options to achieve catchment-specific performance targets, there is a need for information on how well different types of source controls perform under different conditions (e.g. land use types, soil and rainfall conditions).

There is a lack of scientifically defensible data on the long-term effectiveness and benefits of different types of stormwater source controls. To bridge this information gap, in the Greater Vancouver Regional District (GVRD) commissioned a report titled *Effectiveness of Stormwater Source Controls* (2002) to assess the potential effectiveness of various source control options (as measured by their ability to reduce runoff volume and peak rate).

The GVRD report provides a quantitative reference on the effectiveness of the following categories of stormwater source controls:

- **Type 1 - Absorbent Landscaping** - refer to Section 7.4
- **Type 2 - Infiltration Facilities (on lots and along roads) -** refer to Section 7.5
- **Type 3 - Green Roofs -** refer to Section 7.6
- **Type 4 - Rainwater Re-use -** refer to Section 7.7

Guidance for Selecting Appropriate Source Controls

Sections 7.4 to 7.7 present key information from the GVRD report to show how the hydrologic performance of each source control category (i.e. their ability to reduce the volume and rate of runoff) varies depending on land use type, soil conditions, rainfall characteristics and source control design.

For each source control category, these sections also provide design guidance, discuss cost implications and review operation and maintenance requirements.

The information provided in Sections 7.4 to 7.7 is intended to help local governments:

- identify opportunities to manage stream health and/or stormwater infrastructure by applying various types of stormwater source controls
- determine what can realistically be achieved through the application of source controls
- determine which source control options are worth pursuing, and
- estimate the likely return on investment

This provides a starting point for integrating stormwater source control strategies into:

- long-range land use and infrastructure planning decisions
- the design of stormwater systems at the site level

The most appropriate source control options and source control design features for any given development or re-development site will depend on site-specific conditions.

The selection of source controls to meet catchment-specific performance targets should be flexible to allow for innovation. Local government staff, consulting professionals, or developers that select source control options should consider the need for these options, site constraints to their use, expected performance and benefits, maintenance considerations and costs implications (both positive and negative).

This chapter helps evaluate these factors. For more detailed information on the effectiveness of stormwater source controls refer to the GVRD report.

Modeling the Effectiveness of Source Controls

The commonly used hydrologic modeling applications were developed when flow-based thinking dominated stormwater management and surface water modeling. Therefore, none of these models are well suited for modeling Water Balance volumes at the site level.

The Water Balance Model (WBM), introduced in Chapter 6, was used to simulate the performance of source controls under a range of conditions.

Overview of the Water Balance Model

The WBM provides a continuous simulation of the runoff from a development (or re-development) area, or from a watershed (or sub-catchment) with multiple land uses, given the following inputs:

- **Continuous rainfall data** (time increment of one hour or less) and **evapo-transpiration data** (daily) over a long period of record (at least a year). Historic rainfall data can be modified to create climate change scenarios.
- **Site design parameters** for each land use type being modeled (e.g. road width, rooftop coverage, surface parking coverage, population density).
- **Source control information** for each land use type, including:
  - extent of source control application (e.g. % of road and % of building lots with a certain types of source controls)
  - source control design parameters (e.g. area and depth of infiltration facilities, soil depth for green roofs or absorbent landscaping, volume of rainwater re-use cisterns)
- **Soils information**, including:
  - surface soil parameters (e.g. maximum water content, vegetation rooting depth)
  - sub-surface soil parameters (e.g. saturated hydraulic conductivity)

Scenario Modeling

The WBM was used to generate a series of scenarios that demonstrate how a range of factors (e.g. rainfall, land use type, soil conditions) affect the hydrologic performance of the various source control categories.

The source control modeling was based on the best available knowledge of source control performance, but has not been calibrated with measured hydrologic performance data. Performance monitoring from source control demonstration projects will improve understanding of how well source controls can reduce runoff under a variety of conditions, and provide the data needed to calibrate the source control models.

The source control scenarios presented in this chapter are examples, and do not reflect the complete range of available source control options. The examples are intended to provide a starting point for evaluating the potential for source control application, and should not limit innovation in applying combinations and types of source controls.

Chapter 8 presents the results of scenario modeling for case study watersheds to demonstrate what is achievable at the watershed scale through the application of source controls.

Integrating Source Controls into ISMPs

Source controls are applied at the site level, but must be implemented in the context of an Integrated Stormwater Management Plan (ISMP). At the planning level it is important to:

- **Identify stormwater related issues**
  - significant resources to be protected and/or restored
  - drainage problems, such as high flooding risk
- **Characterize development pressures that could affect aquatic ecosystem values or drainage system performance**
  - are there plans for new development in existing natural areas?
  - are there older development areas where re-development is imminent?
- **Evaluate the opportunities for implementing stormwater source controls to:**
  - avoid further stream degradation
  - avoid worsening of drainage problems
  - improve water quality
  - restore watershed health over time

Performance targets, such as the 10% runoff volume target, provide a reference point based on the characteristics of a healthy watershed. The ISMP process will determine what is achievable and affordable in the context of each individual watershed.

Chapter 8 presents case study examples that show how watershed restoration could be achieved over a 50-year timeline through the application of source controls.

Evaluating the Cost of Source Controls

This chapter discusses cost implications of each source control category and provides order-of-magnitude cost estimates. Detailed cost estimates can only be obtained based on the characteristics of each individual development site.

Site-specific costs should be evaluated relative to the potential benefits gained, in terms of protecting or improving watershed health and/or in terms of flood risk management. The information in this chapter helps evaluate the benefits of using source control options.

Cost estimates can be misleading if they are not considered in the context of the overall development process. For example, there may be excavation costs associated with the construction of an infiltration facility on a particular lot, but much of this cost may be incurred through the site grading process (even without infiltration).

It is also important to consider the potential cost savings of source controls. For example, applying infiltration facilities may reduce the cost of storm sewer pipes needed for a new development project, avoid the need for ongoing maintenance of eroded channels, or avoid the need for drainage infrastructure upgrades.

Ensuring the Long-Term Performance of Source Controls

Source control facilities typically require ongoing maintenance to ensure that they continue to function effectively over the long term. While this report discusses operation and maintenance requirements and costs for each source control category, there is a need for further research to better define the:

- operation and maintenance practices required to maintain source control performance over the long term
- cost of these operation and maintenance practices

To address these research needs and provide further guidance on how maintain the long-term performance of source controls, it is important to continue monitoring the performance of source control demonstration projects over long periods of time and to keep accurate records of ongoing operation and maintenance practices.

Operation and Maintenance Implications

New source control practices raise concerns about associated operations, maintenance and liability issues. It is important during any adoption of new design standards to involve operations and maintenance personnel, and to use their creative and practical talents to anticipate and solve these issues.

Demonstration projects are an excellent way to solve real operations and maintenance problems, and to allay false fears.

Certain types of source control facilities may be operated and maintained by local government staff (e.g. infiltration facilities within road right-of-ways). However, many source control facilities are likely to be on private property (e.g. on-lot infiltration facilities, re-use facilities or green roofs). Responsibility for maintaining these facilities shifts to individual landowners or strata corporations, which places a greater reliance on the conscientiousness of individuals.

An on-lot stormwater system is similar to an on-lot septic sewage system, in that owners must be given basic information about operation and maintenance requirements.

There are potential liability issues related to operation and maintenance responsibility (e.g. who is responsible in the event of a failure?). Local governments should resolve these issues in collaboration with landowners and the development community. There are parallel issues relating to water supply and sanitary sewer systems (e.g. sewer cross connections) that local governments have been dealing with for years and could use as precedents.

Education of local government staff, developers and the general public regarding the need for source controls, as well as their long-term operation and maintenance requirements, is essential to the successful implementation of stormwater source controls.

Section 8 provides further discussion and guidance on how to facilitate the changes in standard practice that are needed to promote the widespread implementation of source controls.

Water Quality Benefits of Source Control

Stormwater source controls capture the first flush of pollutants that wash off from impervious surfaces. This is particularly important for roads and parking areas because pollutants from motor vehicles and road maintenance can accumulate on these surfaces.

Infiltration facilities are particularly beneficial in terms of improving water quality at the source. Absorption of stormwater runoff in the shallow soil zone filters out sediments and many pollutants, thus improving downstream water quality.

This chapter focuses on the effectiveness of source controls at reducing runoff volume and rate, because this information enables source control to be evaluated relative to performance targets for rainfall capture and runoff control. Further research is needed to provide similar quantitative modeling of the effectiveness of source controls for improving groundwater and surface water quality.

This research should start with a good understanding of the source of water quality problems (e.g. runoff from roadways, lawns and agriculture areas). This understanding will enable the selection of appropriate water quality indicators and the development of an appropriate water quality model.

As a parallel example, the evaluation of hydrologic effectiveness presented in this report started with a good understanding of the source of water quantity problems (i.e. an increase in the volume and rate of runoff). This understanding led to selection of appropriate hydrologic performance indicators and development of the Water Balance Model.

7.4 Type 1 Source Control - Absorbent Landscaping

The Importance of Surface Soil and Vegetation

Surface soil structure plays a fundamental role in stormwater management. Minimizing surface soil disturbance and using absorbent landscaping can significantly reduce the volume and rate of runoff from developed areas.

In a natural condition, surface soil layers are highly permeable. Surface plants provide a layer of organic matter which populations of earthworms and microbes stir and mix into the soil. This soil ecosystem provides high infiltration rates and a basis for interflow that supports the baseflow needs of aquatic ecosystems.

In an urbanized condition, it is common practice to remove the surface soil layers, to regrade and heavily compact the site, and then to replace only a thin layer (often 50mm or less) of imported topsoil. This practice creates a surface condition that results in significant amount of runoff from lawn and landscape areas.

Absorbent Soil and Vegetation Characteristics

Vegetation and organic matter improve soil structure and contribute to macropore development. This is essential for promoting and maintaining infiltration and evapo-transpiration capacity. To optimize infiltration, the surface absorbent soil layer should have high organic content (about 10 to 25%). Surface vegetation should be either herbaceous with a thickly matted rooting zone (shrubs or grass), deciduous trees (high leaf density is best), or evergreens.

A range of soil and vegetation characteristics is acceptable depending on whether the area is to be covered by lawn, shrubs or trees. The soils required by the BC Landscape Standard for medium or better landscape will provide the required hydrologic characteristics. Often this standard can be achieved by adding organic matter to existing top soils on a residential site.

Figure 7-1 shows the mixing of soil and organic matter to create a good landscape soil.

A range of acceptable absorbent soil compositions are shown in Section 7.9.

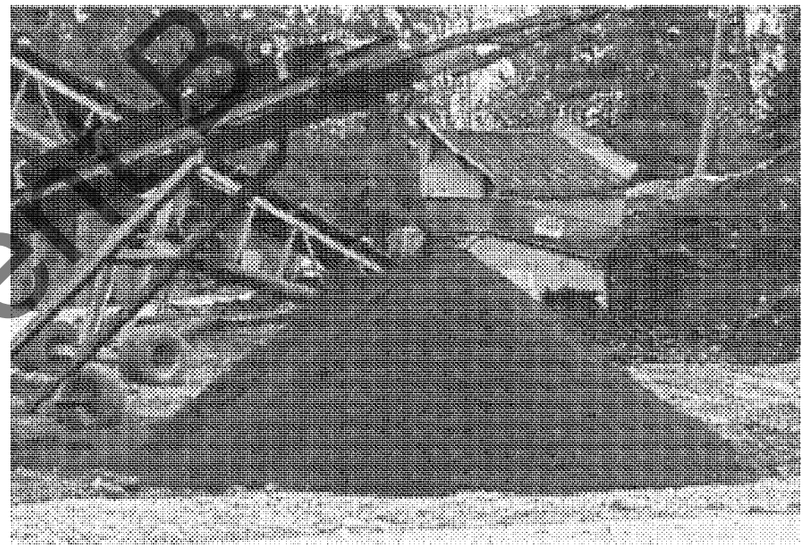


Figure 7-1 Creation of Landscape Soil

Absorbent Soil Depth

Figure 7-2 shows that runoff from landscaped areas can be virtually eliminated by providing a 300 mm layer of landscaped absorbent soil, even under very wet conditions where the hydraulic conductivity of the underlying soil is low.

The Figure assumes that the rooting zone of the surface vegetation extends to the depth of the absorbent soil layer, and that absorbent landscaping covers all undeveloped areas.

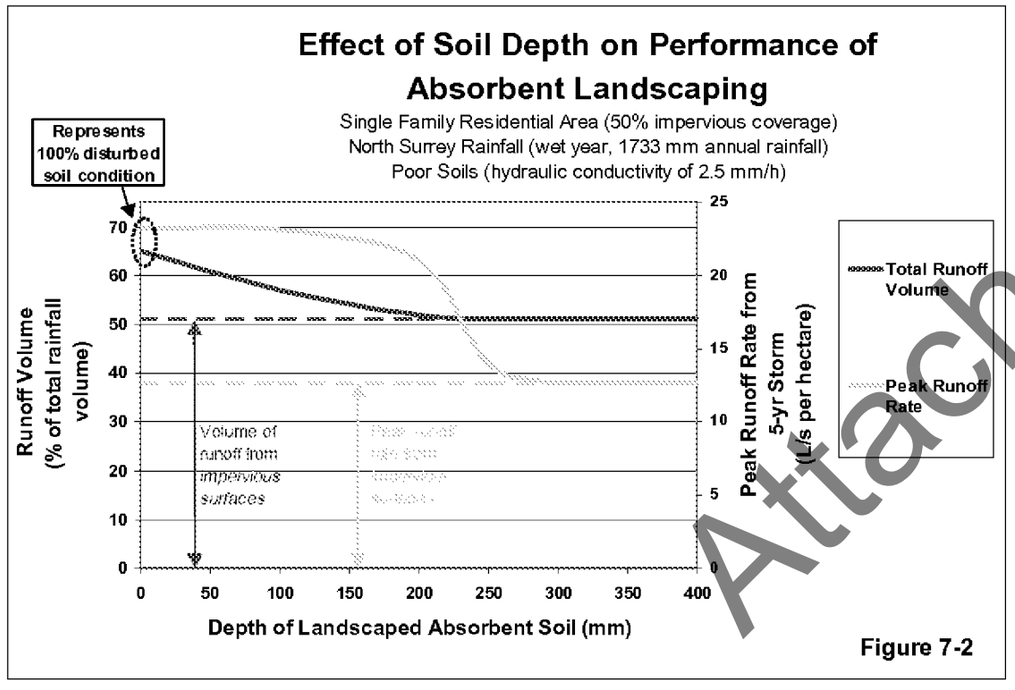


Figure 7-2

The Importance of Forests

Forests are the most effective form of absorbent landscaping. Since trees typically have very deep rooting zones (often in the range of 2 metres), there is virtually no surface runoff from forested areas. Tree canopies that shade impervious surfaces (e.g. roadways) can reduce the runoff from these surfaces by intercepting rainfall.

Preserving and/or restoring as much forested area as possible through implementation of an urban forestry strategy is an effective way to reduce runoff volumes and rates.

The thick layers of absorbent soil in forested areas typically have the capacity to retain and infiltrate large volumes of runoff (in addition to direct rainfall). Dispersing runoff from rooftops or paved surfaces over forested areas can be an effective infiltration strategy, as discussed in Section 7.5.

The Benefits of Absorbent Landscaping for Different Rainfall Conditions

Figure 7-3 shows that absorbent landscaping is most beneficial for high rainfall locations. This is because increased rainfall typically leads to greater volumes of runoff from disturbed soil, but not from absorbent landscaping.

Absorbent landscaping (300 mm soil depth or more) can virtually eliminate surface runoff from undeveloped areas, even in the wettest conditions. This has significant benefits in terms of reducing peak runoff rates from extreme rainfall events, as shown on the following page.

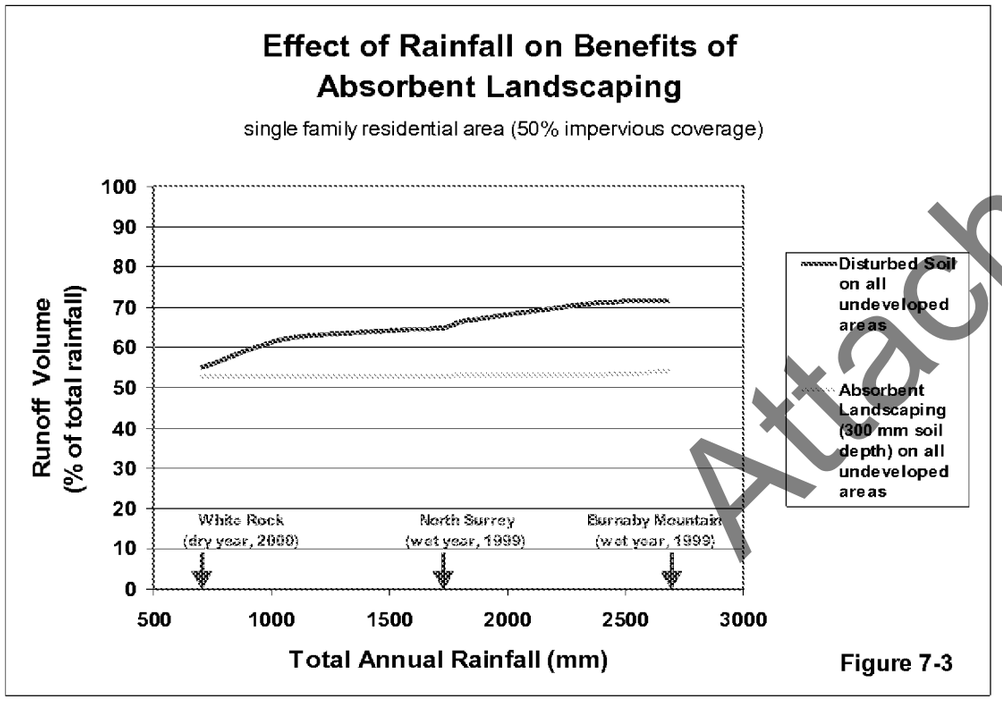


Figure 7-3

Benefits of Absorbent Landscaping for Different Land Use Types

The benefits of absorbent landscaping are more significant for land uses with lower levels of impervious site coverage and higher proportions of undeveloped area (e.g. single family residential), as shown in Figures 7-4 and 7-5.

These figures show the simulated runoff volumes and peak runoff rates during a very wet year (1999) in North Surrey. A total of 1733 mm of rainfall fell during this year, and the most extreme rainfall event was a long duration, wet weather storm with a 5-year return period.

Figure 7-4 shows that absorbent landscaping is particularly beneficial in terms of reducing peak runoff rates. During large rainfall events (e.g. a 5-year storm), disturbed soil can generate nearly as much runoff as impervious surfaces, whereas an absorbent soil layer (300 mm depth) can continue to absorb rainfall. Therefore, absorbent soil can significantly reduce peak runoff rates from large storms, especially for land uses with large amounts of undeveloped space.

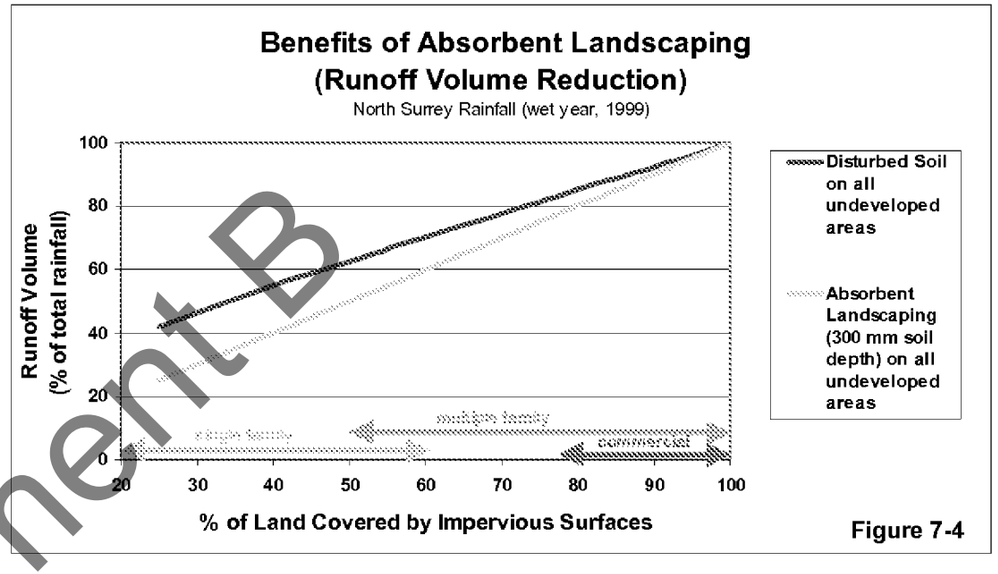


Figure 7-4

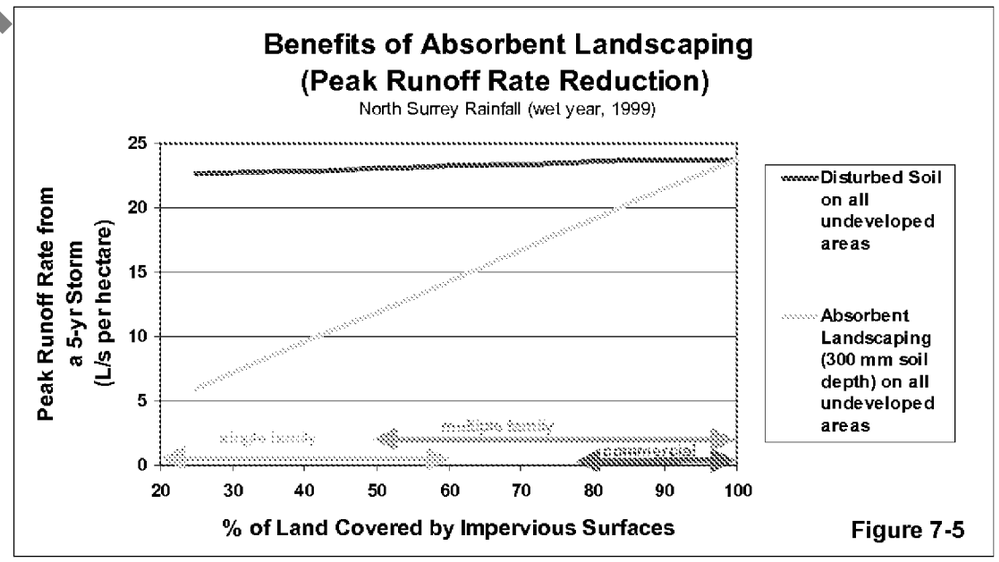


Figure 7-5

Cost Implications of Absorbent Landscaping

The costs of absorbent landscaping are highly variable and depend on site-specific conditions such as vegetation type. This reflects the customized nature of individual site landscaping plans.

Typical costs for absorbent landscaping range from about $25 - $70 per m^2. In the lower cost ranges, the absorbent soil depth would be about 150 mm, with turf cover and some trees. In the upper ranges, soil depth would be about 450mm, with shrubs or groundcover and trees.

Maintenance Tips for Absorbent Landscaping

- Maintaining the absorbency of soils is an advantage both to turf and plant health and to stormwater management. Normal landscape maintenance of absorbent soils will generally produce an absorbent landscape surface.
- In shrub beds, regular application of bark mulch, natural leaf drop or other organic inputs will keep burrowing insect populations high and maintain soil permeability.
- In lawn areas, use of proper sandy topsoil will avoid compaction problems. Aerating techniques can assist air and water exchange in locally compacted areas.
- Bare soils should not be left uncovered (e.g. during construction) because rainfall impact can create a relatively impermeable surface crust, even in sandy soils.
- Dry season watering of plants is essential, especially when plants are first becoming established.
- Maintenance requirements (and costs) are typically highest in the first year when plants may require more watering, weeding and some replacement.

Rehabilitation of Disturbed Soil

There are a number of ways to convert a disturbed surface soil layer into absorbent soil that has good hydrologic properties, including:

- Mixing in organic content (e.g. compost); this is the most effective soil rehabilitation technique
- Mechanical tilling or scarifying of the surface soil
- Soil aeration, which requires specialized equipment

Immediate replanting of the surface soil layer is an essential part of any soil rehabilitation project.

7.5 Type 2 Source Control - Infiltration Facilities

The Importance of Disconnecting Impervious Surfaces

Direct runoff from impervious surfaces is the primary cause of drainage-related problems (e.g. stream degradation, flooding risk). This direct runoff can be eliminated to a large extent by infiltrating runoff from impervious surfaces on development parcels (rooftops, driveways, parking lots) and roads (paved roadways and sidewalks).

Figure 7-6a and 7-6b show the runoff volume and rate reduction benefits that can be achieved in one of the wettest parts of the province (North Vancouver) during a very wet year (2355 mm of annual rainfall) by disconnecting impervious surfaces. These figures show that the benefits vary significantly depending on the type of surface and the amount of space available to infiltrate runoff (discussed further on the following pages).

Simple Disconnections

There is very little benefit gained by impervious surface disconnection if the runoff is simply dispersed over an area with disturbed surface soil.

Dispersing runoff over an area with absorbent landscaping can result in significant runoff volume reduction, even if the underlying soils have poor hydraulic conductivity. However, this is not likely to reduce peak runoff rates resulting from large, long duration rainfall events (e.g. a 5-year winter storm). Concentrating runoff from an impervious surface area onto a smaller area of absorbent landscape causes the surface soil to become saturated during prolonged rainfall. There must be an adequate collection and conveyance system (e.g. lawn basins) to ensure that runoff from saturated soils does not cause water damage, nuisance problems, or inconvenience to the public.

The most significant reduction in runoff volume and peak rates can be achieved by dispersing runoff over a forested area. The rooting depth of trees provides significant storage capacity to retain runoff for extended periods of time and allow it to seep into the ground.

Infiltration Facilities

The hydrologic function of a forested infiltration area can be approximated using infiltration facilities (e.g. bioretention areas) that are designed to retain runoff and provide time for it to infiltrate. Different types of infiltration facilities are discussed on the following page.

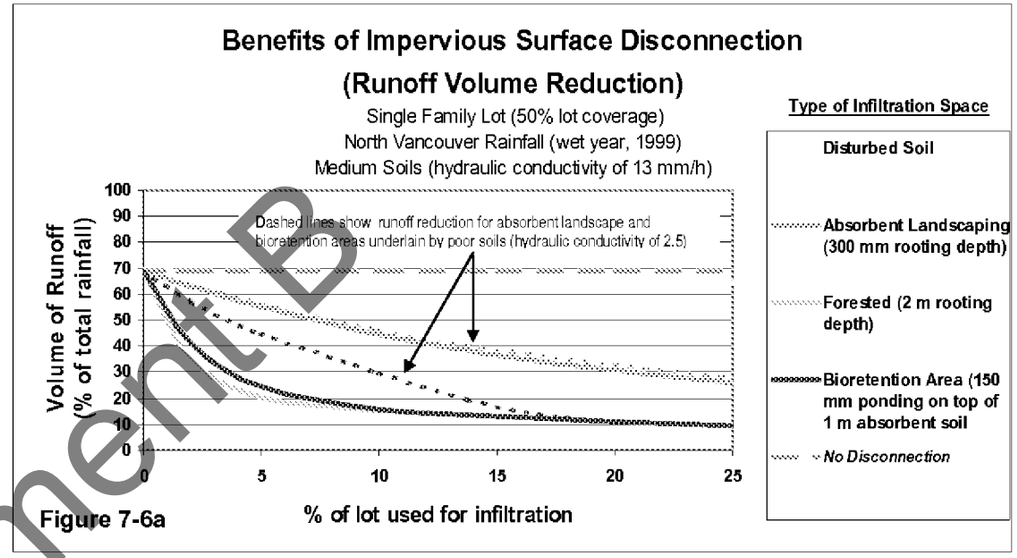


Figure 7-6a

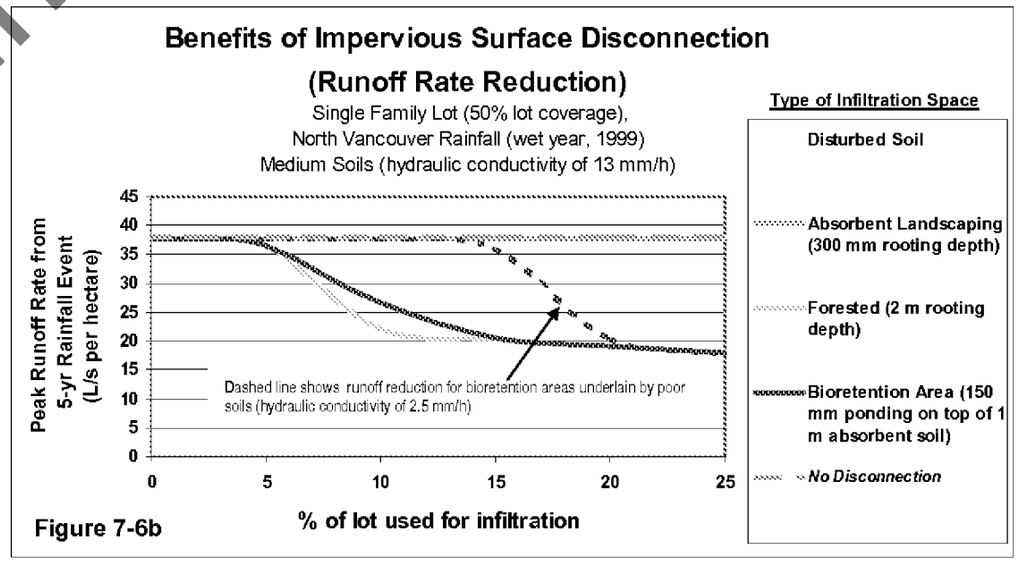


Figure 7-6b

Different Types of Infiltration Facilities

The storage capacity needed to retain impervious surface runoff and allow it to infiltrate can be provided:

- in the void space of absorbent soil, sand or gravel layers
- on the ground surface (i.e. ponding)
- in infiltration chambers (see Figures 7-7a and 7-7b)
- in storage structures, such as cisterns; runoff stored in structures must eventually be released to an infiltration area

Note that the amount of area provided for infiltration is a more important design parameter than storage volume.

There are two general categories of infiltration facilities:

- **Surface Facilities** – Runoff is stored in a layer of absorbent soil, sand or gravel, and/or on the ground surface in a ponding area. Surface facilities can be aesthetically landscaped and integrated into the design of open spaces (often called bioretention facilities or rain gardens). Figure 7-8a shows an example of a bioretention facility in the form of a terraced landscape feature on a hillside. Figure 7-8b shows an example of parking lot runoff draining to linear bioretention areas (landscaped islands in the parking lot). Bioretention can also be applied at the neighbourhood scale (e.g. constructed wetlands serving multiple dwelling units).

  Surfaces facilities can also be infiltration trenches, which store runoff in a layer of clean gravel or stone (see Figure 7-9).

- **Sub-surface Facilities** – Runoff is stored in sub-surface layers of gravel, sand or drain rock and/or in infiltration chambers (e.g. inverted plastic half pipes). Absorbent landscaping can be installed over the surface, and with proper engineering, pavement and light vehicle traffic may be allowed on the surface (e.g. a soakaway pit under a driveway).

Note that infiltration facilities can also be a combination of the two types described above. For example, infiltration swales along roads (see Figure 7-10) may consist of an absorbent soil layer (surface swale) on top of a sub-surface infiltration trench (gravel filled soakaway).

Design, construction, and operation and maintenance tips for different types of infiltration facilities are provided later in this section.

The Need for Escape Routes

All infiltration facilities must have overflow pipes or channels to ensure that runoff from extreme storms can escape to downstream watercourses without posing a threat to property or public safety. Infiltration facilities along roads (e.g. swales and infiltration trenches) must also be designed to convey extreme storms from the development areas they serve (as conventional storm sewers do).

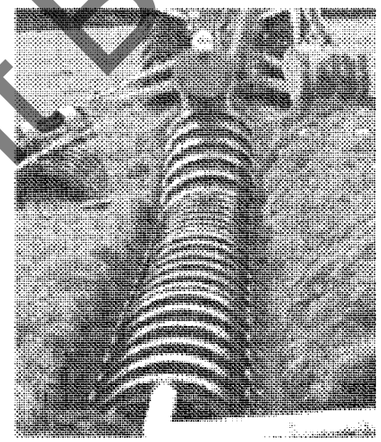


Figure 7-7a
Infiltration Chamber

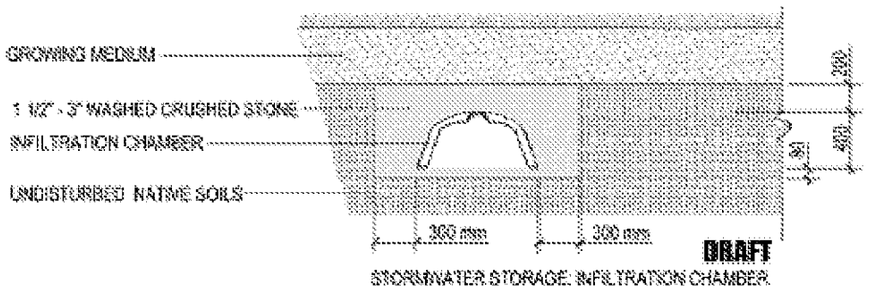


Figure 7-7b

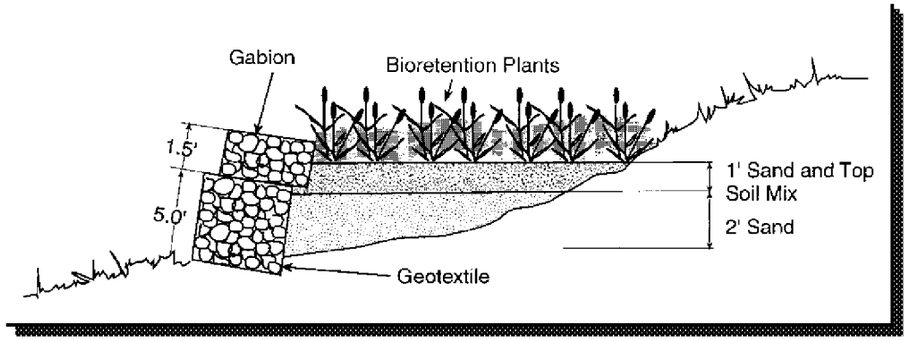


Figure 7-8a Bioretention Landscaping Feature

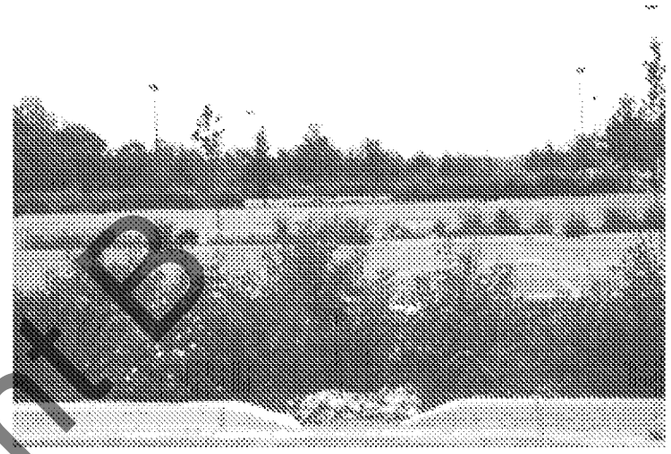


Figure 7-8b Bioretention for a Parking Lot

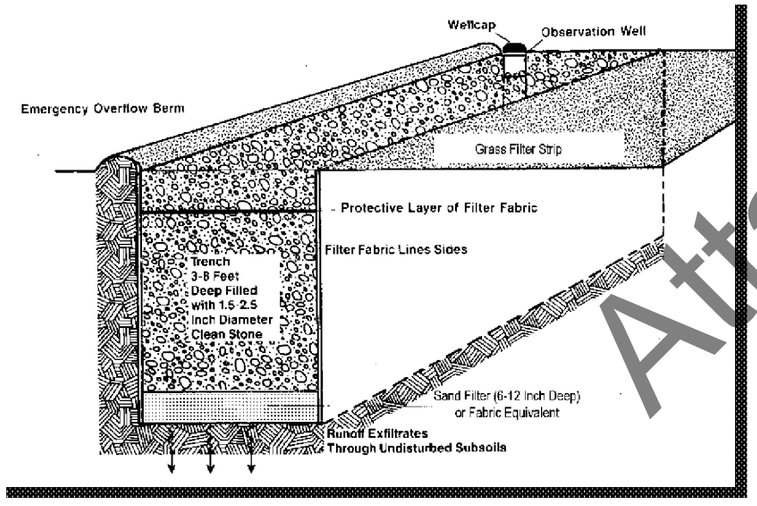


Figure 7-9 Infiltration Trench

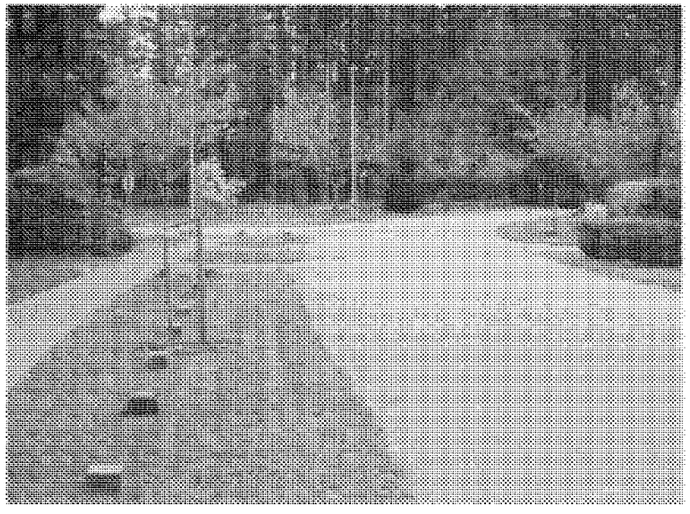


Figure 7-10 Infiltration Swale Along Roadway

Factors that Affect the Performance of Infiltration Facilities

The hydrologic effectiveness of infiltration facilities (i.e. amount of reduction in runoff volume and rate) varies depending on the following factors:

- **Land Use Type –** Infiltration is more challenging for land uses with higher levels of impervious surface coverage (e.g. commercial or high-density residential uses). On high coverage land uses there is more surface runoff (thus concentrating more water into infiltration facilities), and less space available to locate infiltration facilities.
- **Soil Type** – The maximum rate at which water can exfiltrate from infiltration facilities is controlled by the hydraulic conductivity of soils.
- **Amount of Area Provided for Infiltration –** Footprint area is the most important design parameter for infiltration facilities. Increasing infiltration area reduces runoff volume and rate by:
  - dispersing runoff over a larger area, and thus reducing the concentration of runoff (governed by the ratio of impervious surface to infiltration area)
  - increasing the rate at which this runoff can exfiltrate
- **Rainfall Characteristics –** The effectiveness of infiltration facilities typically decreases as rainfall increases. This is because more rainfall results in more runoff to be concentrated into infiltration facilities, which leads to more overflow (i.e. greater volumes and rates of runoff).
- **Depth and Type of Infiltration Facility –** Increasing the depth and/or void space for storage in an infiltration facility increases the retention storage capacity, thus decreasing the amount of overflow (i.e. runoff). In general, infiltration area is a more important parameter than depth.
- **Depth to Groundwater –** In order for infiltration facilities to be effective, the bottom of the facility must be a reasonable depth (at least 0.5 m) above the groundwater table. Infiltration facilities are not appropriate in areas where the water table is at or near the ground surface

The graphs presented on the following pages illustrate how these factors affect the performance of infiltration facilities.

The Effectiveness of Infiltration under Different Rainfall Conditions

Figure 7-11 illustrates how the performance of infiltration facilities (in terms of runoff volume reduction) decreases as total annual rainfall increases.

More infiltration area is required to achieve the same level of runoff volume reduction in a wetter location (or year) than in a drier location (or year). For example, in order to reduce the total runoff volume from a typical single family lot (on poor soils) to 10% or less of total rainfall volume (i.e. the target condition):

- in a location where the annual rainfall is around 700 mm, about 3% of the lot would have to be provided for infiltration
- in a location where the annual rainfall is around 1800 mm, about 15% of the lot would have to be provided for infiltration

Variability in soil type and land use also has a big effect on the amount of area required to meet a given volume reduction target (e.g. the 10% target), as discussed on the following pages.

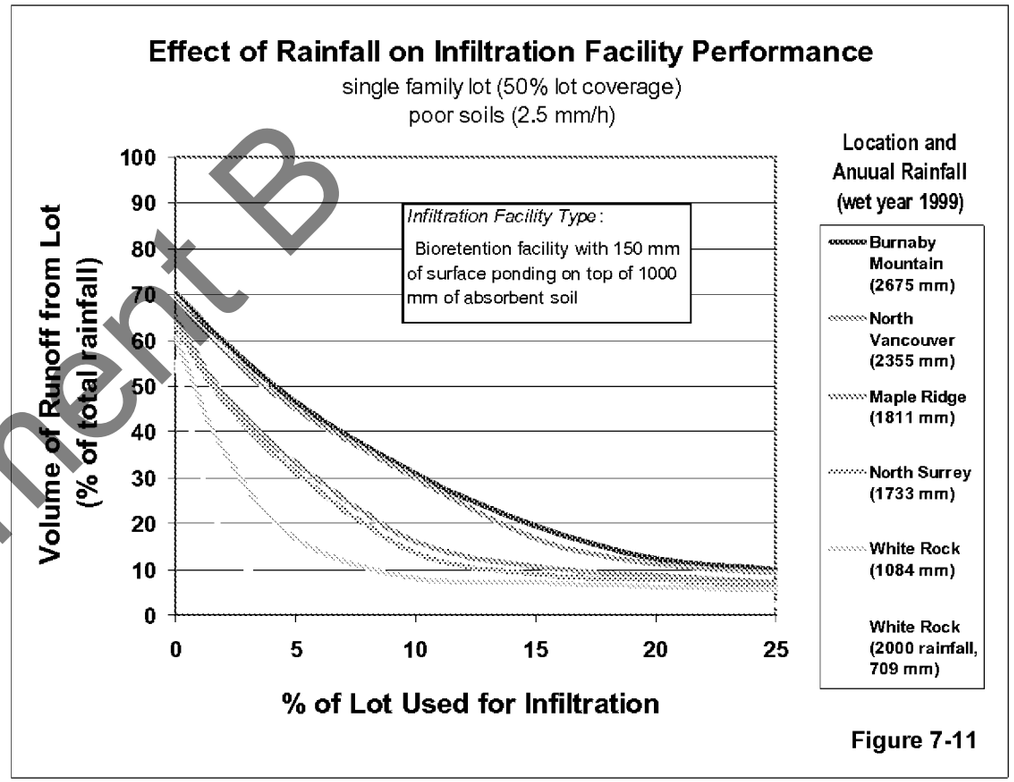


Figure 7-11

Selecting Infiltration Facility Depth

Figure 7-12 illustrates how the depth of an infiltration facility (i.e. distance from the bottom of the facility to the overflow level) increases the level of runoff volume reduction that can be achieved for different types of facilities.

The benefits of increasing facility depth diminish beyond a certain threshold (around 500 mm). Beyond this threshold, the area of an infiltration facility has a much greater impact on performance than its depth (as discussed on the following pages).

It is important to note that shallow infiltration facilities typically provide the best opportunity for recharging the soil interflow zone. In addition, the hydraulic conductivity of soils tends to be higher closer to the surface.

Constraints on Facility Depth

Appropriate depths for infiltration facilities must be selected based on site-specific characteristics and constraints.

As noted previously, the bottom of an infiltration facility should be at least 0.5 m above the local groundwater table. The depth to bedrock or to relatively impermeable soil layers may also govern the feasible depth of infiltration facilities.

Appropriate ponding depths for surface infiltration facilities may also be governed by safety or aesthetic considerations.

Comparing Different Types of Infiltration Facilities

Figure 7-12 shows that a soakaway pit would be slightly more effective than a bioretention facility of the same depth (with no surface ponding), because gravel stores more runoff per unit volume than absorbent soil (i.e. it has higher void space storage).

Placing an infiltration chamber in a soakaway trench (as shown in Figure 7-7b) increases its storage volume, and slightly improves its effectiveness. Similarly, surface ponding increases the storage capacity and improves the effectiveness of bioretention facilities, particularly for facilities with fairly low absorbent soil depth (e.g. less than about 500 mm).

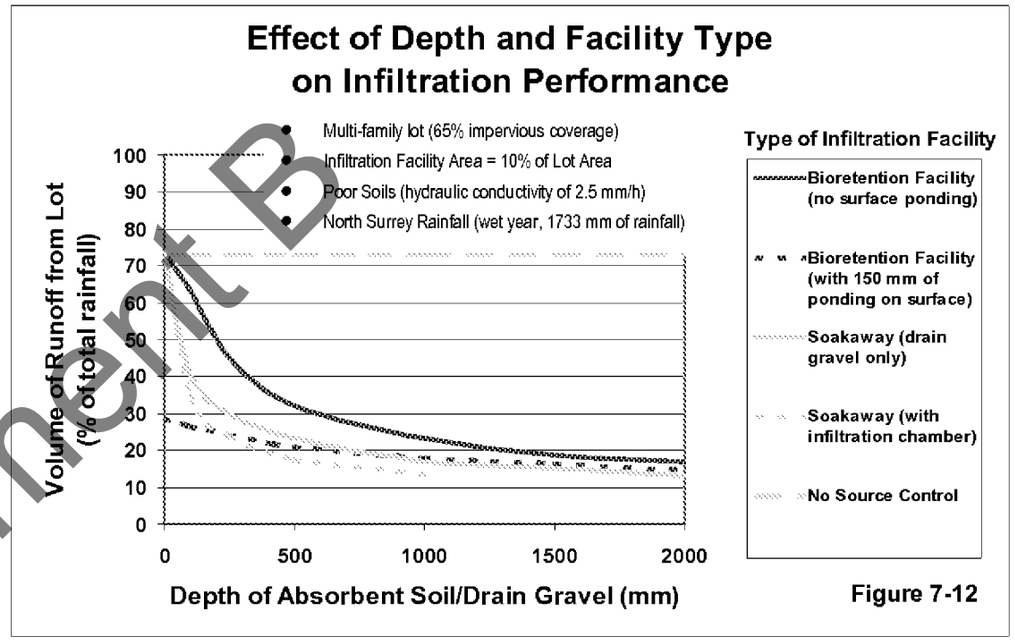


Figure 7-12

The Importance of Infiltration Area and Soil Type

Figures 7-13a and 7-13b show how the level of reduction in runoff volume and rate that can be achieved using infiltration facilities is highly dependent on the hydraulic conductivity of local soils and on the amount of area provided for infiltration.

For example, providing 10% of a single family lot area for infiltration could:

- reduce total runoff to about 10% of total rainfall and reduce the peak runoff rate from a 5-year storm by about 45%, where soils have good hydraulic conductivity (greater than about 13 mm/h)
- reduce total runoff to about 35% of total rainfall but achieve virtually no reduction in the peak runoff rate from a 5-year storm, where soils have very poor hydraulic conductivity (about 1 mm/h)

Note that these graphs are based on Water Balance Model simulations for a very wet year in North Surrey (1999). In locations and/or years with less rainfall, infiltration facilities can be expected to perform better than the graphs indicate (and vice versa).

These graphs assume that all undeveloped areas have disturbed surface soil (i.e. no absorbent landscaping), and that runoff from disturbed soils on building lots is not captured by bioretention facilities.

Determining What is Feasible and Affordable

The size of infiltration facility that can be provided in any given situation will depend on:

- the physical constraints associated with the available undeveloped space (feasibility thresholds), and/or
- willingness to pay (affordability thresholds)

Affordability thresholds will likely govern infiltration facility sizes for lower coverage land uses (e.g. single family residential) and feasibility threshold will likely govern for higher coverage land uses (e.g. commercial land uses).

The affordability thresholds shown on the adjacent infiltration performance curves are for illustration purposes only, and reflect judgement as to what seems appropriate. Further discussion on how to establish affordability and feasibility thresholds is provided on the following page.

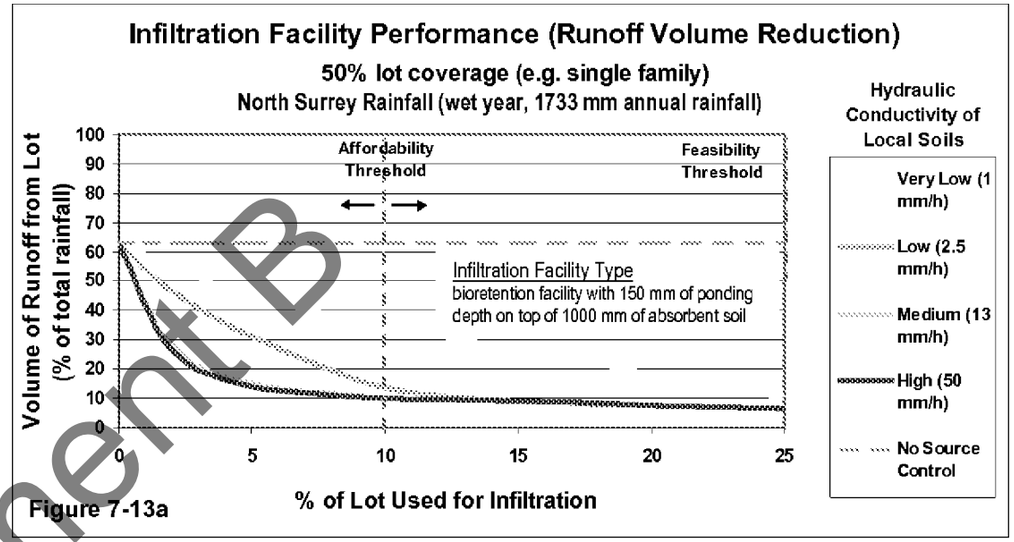


Figure 7-13a

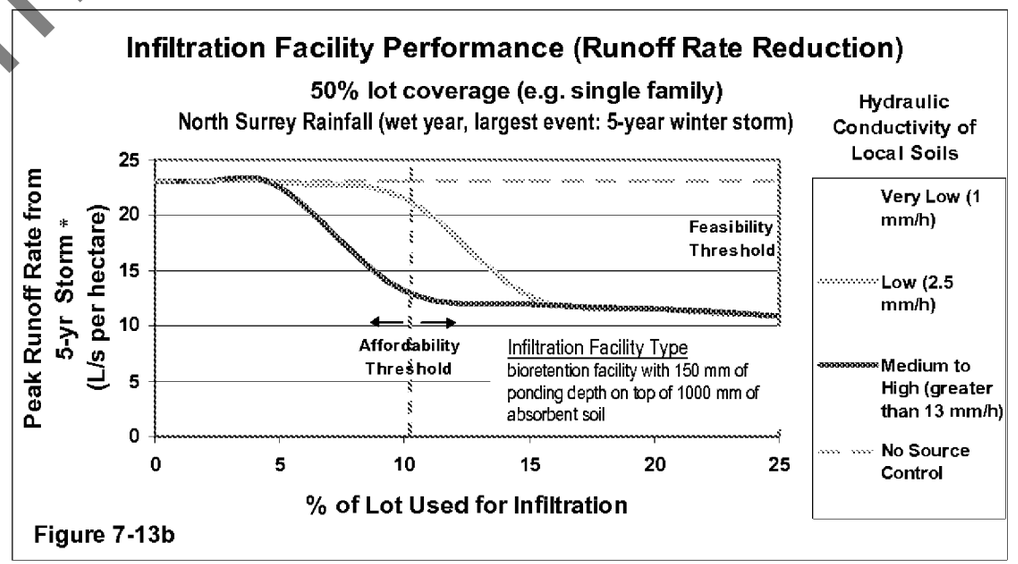


Figure 7-13b

* refers to the rate of runoff from an entire development area (i.e. building lots *and* the roads serving these lots).

Feasibility Thresholds

As lot coverage increases there is less space available to locate infiltration facilities. The feasibility threshold refers to the maximum amount of physical space that could be used for infiltration.

These thresholds will be highly site-specific because they depend on the layout of impervious and pervious spaces within a lot (or road), as well as on soil type.

It is typically not possible to use all undeveloped lot space for infiltration facilities. Feasibility thresholds can be estimated at about 50% of undeveloped lot space to provide a starting point for planning purposes.

Since constant wetting can cause localized expansion of clay soils, a certain amount of clearance between infiltration facilities and building foundations (and property boundaries) is needed to prevent potential damage. A clearance distance of 3 m or more should be used in any soils with significant clay content. For heavy clay soils, the clearance distance should be about 5 m.

With proper engineering, it may be feasible to use nearly all of the undeveloped space within road right-of-ways for infiltration.

Affordability Thresholds

Increasing the size of infiltration facilities improves their effectiveness (as shown in Figures 7-13a and 7-13b), but also increases their cost. Local governments must establish affordability thresholds based on the community's willingness to pay, and on the potential benefits of the infiltration facilities.

Note that reductions in runoff volume and rate are indicators of hydrologic benefits, which translate into benefits for a community in the form of stream protection and restoration, avoided flooding, or other avoided drainage costs.

Establishing Affordability Thresholds

Figure 7-14 shows an example of how order-of-magnitude cost estimates can provide a starting point for answering the questions:

- what can realistically be achieved through infiltration?
- are infiltration source controls worth pursuing?
- what is the likely return on investment?

The costs of infiltration facilities can be highly variable depending on site-specific conditions, such as amount and type of material that needs to excavated. The benefits of infiltration facilities are also highly dependent on site-specific conditions, and therefore, site-specific cost-benefit analyses are essential. The costs and benefits of infiltration facilities must be considered in the context of an Integrated Stormwater Management Plan (ISMP).

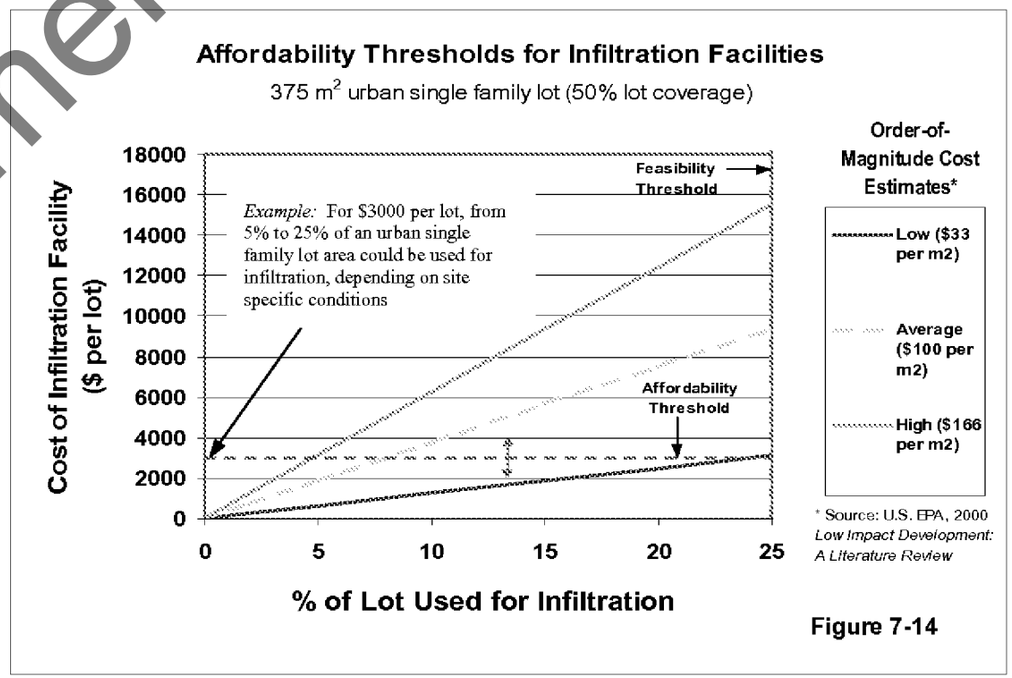


Figure 7-14

Infiltration Facilities for Land Uses with High Impervious Coverage

Figures 7-15a and 7-15b show the level of runoff volume and rate reduction that could be achieved for land uses with relatively high impervious coverage, such as high-density multiple family or commercial land uses.

In this case, the feasibility threshold rather than the affordability threshold governs the amount of infiltration area that can be provided.

By providing the feasible amount of infiltration area (about 7.5% of the lot area), the volume of runoff volume from a high coverage lot could be reduced to:

- about 10% of total rainfall, where soils have good hydraulic conductivity (greater than about 13 mm/h)
- about 60% of total rainfall, where soils have very poor hydraulic conductivity (about 1 mm/h)

The peak runoff rate from a 5-year, long duration winter storm could not be reduced using infiltration facilities on high coverage land uses, even where soils have good hydraulic conductivity. This conclusion does not necessarily apply to lower rainfall locations.

The effectiveness of infiltration facilities on land uses with high impervious coverage can be improved by providing additional storage structures such as cisterns, and releasing stored runoff to infiltration areas at a controlled rate.

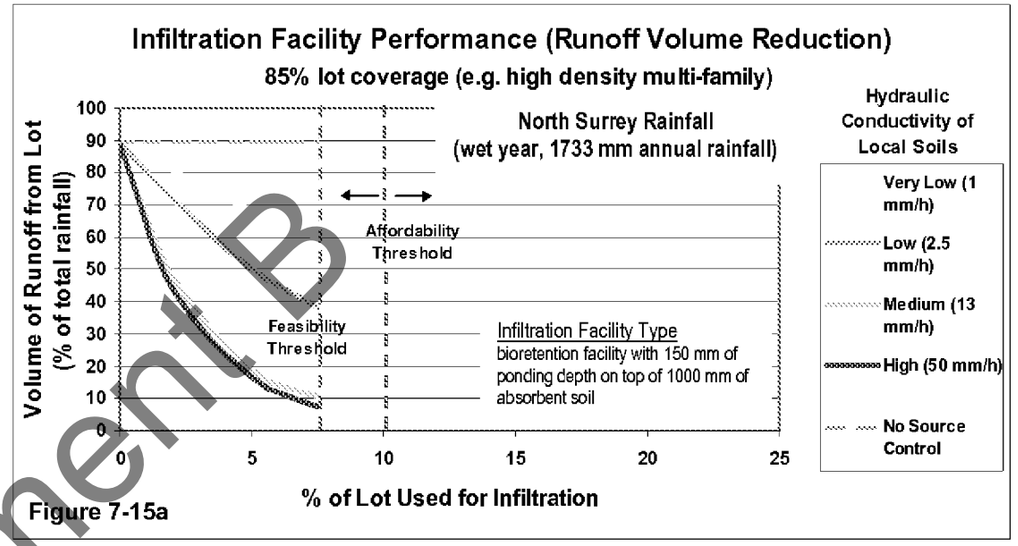


Figure 7-15a

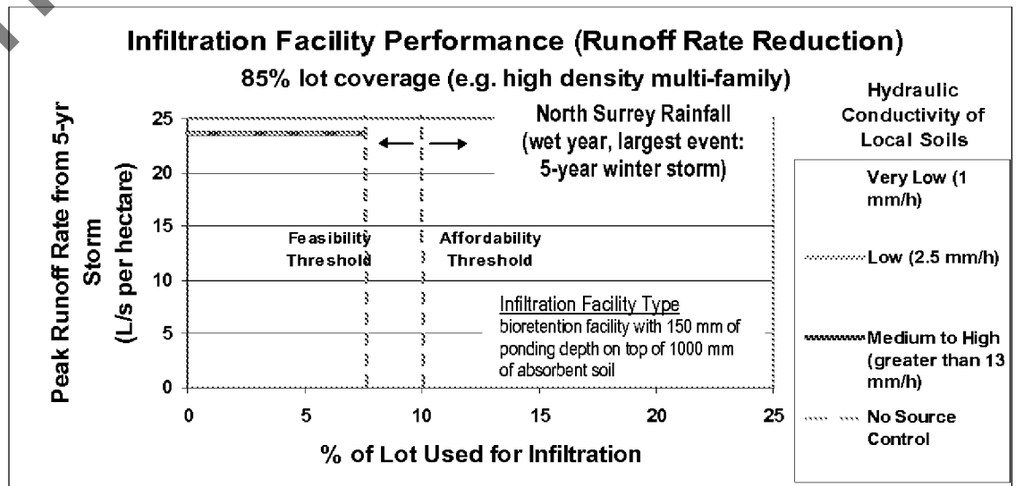


Figure 7-15b

Performance of Infiltration Facilities for a Range of Land Use Types

The GVRD report on the *Effectiveness of Stormwater Source Control* includes infiltration performance curves (similar to Figures 7-13 a-b and 7-15 a-b) for eight different land use types, with total lot coverage ranging from 30% (e.g. low-density single family) to 98% (e.g. town centre commercial).

The GVRD report also provides infiltration performance curves for four road types, with paved roadway widths ranging from 8.5 m (e.g. local roads) to 16 m (e.g. divided arterials). Sample infiltration performance curves for roads are shown on the following page.

For a given land use or road type and soil condition, these curves can be used to estimate the hydrologic benefits (i.e. runoff volume and rate reduction) of providing a certain amount of infiltration area.

Performance of Infiltration Facilities on Roads

Figures 7-16a and 7-16b show the reduction in runoff volume and rate that could be achieved using infiltration facilities on roads. These graphs show the simulated performance of two-layer swale and infiltration trench systems, assuming:

- top layer (surface swale) = 300 mm of absorbent soil
- bottom layer (infiltration trench) = gravel-filled trench with perforated overflow pipe 300 mm above the trench bottom

The performance curves show that the runoff from a typical local road could be virtually eliminated (even during a very wet year) by dispersing roadway runoff to:

- a 2 m wide swale/trench (or two 1 m swales) along the road, where soils have very good hydraulic conductivity (around 50 mm/h)
- a 4 m wide swale/trench (or two 2 m swales) along the road, where soils have good hydraulic conductivity (around 13 mm/h)

Even where soils have very poor hydraulic conductivity (around 1 mm/h), a 4 m swale/trench could reduce the volume of runoff from a typical local road to about 25% of total rainfall.

In general, infiltration facilities along roads are more effective than on-lot infiltration facilities because there is typically less concentration of runoff (i.e. the ratio of impervious area to infiltration area tends to be lower).

Note that the affordability thresholds shown on Figure 7-16a and 7-16b are provided for illustration purposes only. Local governments should establish their own thresholds by evaluating costs, benefits and willingness to pay.

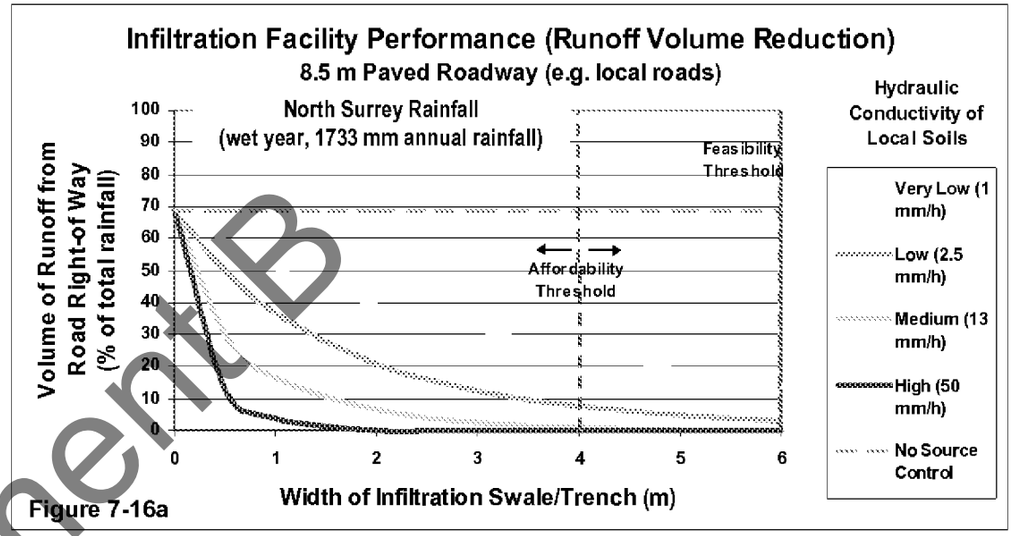


Figure 7-16a

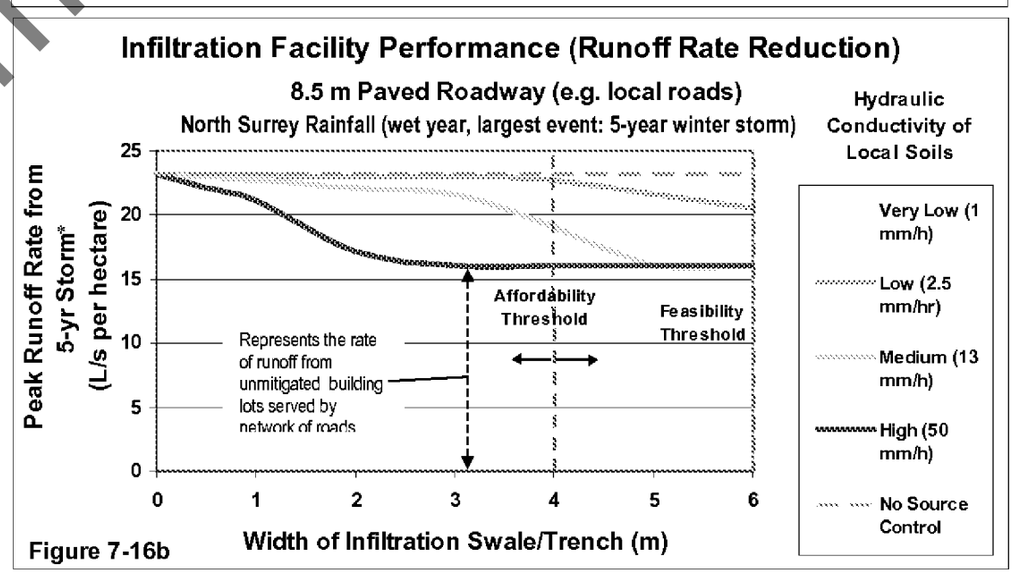


Figure 7-16b

* refers to the rate of runoff from an entire development area (i.e. building lots *and* the roads serving these lots).

Achievable Level of Runoff Volume Reduction for Different Land Use Types

Figure 7-17 provides an estimate of the level of runoff volume reduction that could be achieved using infiltration facilities (during a wet year in the South Coast climate) for a range of land use types, under different soil conditions. This figure assumes that infiltration facility size is based on the governing threshold for each land use type (i.e. either feasibility or affordability).

Where soils have medium or better hydraulic conductivity (greater than about 13 mm/h), runoff volume could be reduced to about 10% of total rainfall (i.e. the target condition for a healthy watershed) for all but the highest coverage land uses (high density multiple family or commercial).

To achieve the 10% target for lower coverage single family land uses, absorbent landscaping would be required in addition to infiltration facilities. This is because lots with lower impervious coverage typically have more runoff volume from disturbed soil (Figure 7-13 assumes that undeveloped areas are covered by disturbed soil).

Significant levels of runoff volume reduction can also be achieved in soils with poor conductivity (around 2.5 mm/h), for all but the highest coverage land uses. Even where the hydraulic conductivity of soils is very poor (around 1 mm/h), runoff volume can be reduced by about 40 to 50% on single family and low to medium-density multiple family land uses.

Note that greater levels of runoff volume reduction would likely be achievable in locations and/or years with less rainfall (and vice versa).

Typical hydraulic conductivity ranges for different soil types are provided below for reference purposes.

Soil Type	Typical Hydraulic Conductivity Range*
• Sands and gravels	> 50 mm/h
• Sandy loams	10 – 50 mm/h
• Silty loams	5 – 40 mm/h
• Clay loams	2 – 6 mm/h
• Clays	< 2 mm/h

* Source: Soil Texture Triangle: Hydraulic Properties Calculator, Washington State University (http://www.bsyse.wsu.edu/saxton/soilwater/)

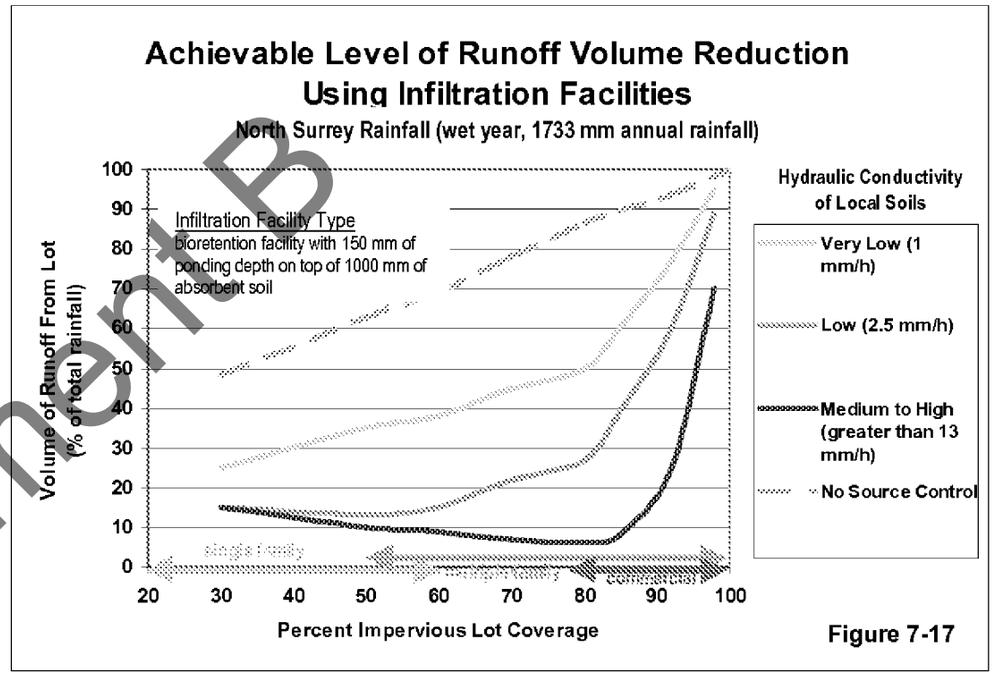


Figure 7-17

Creating Hard Surfaces that Infiltrate

Pervious Paving

Runoff from paved surfaces can be virtually eliminated by replacing impervious pavement with pervious pavers that allow rainwater infiltrate through cracks between the pavers. Figure 7-18 shows an example of pervious paving.

Pervious pavers are placed over a reservoir base course of fractured drain rock (similar to railway ballast), which can be sized to store a given design storm. For example, to store a 60mm storm, the reservoir part of the base course would have to be about 180 mm deep (33% void space).

Pervious paving can be applied on areas with light (or no) vehicle traffic (e.g. driveways, shoulders of roadways, sidewalks, overflow parking areas).

Figure 7-19 provides an example of how pervious paving options for roadways can reduce runoff volume.

Since pervious paving effectively reduces the impervious coverage on lots or road right-of-ways, applying pervious paving can also improve the effectiveness of infiltration facilities (by reducing the concentration of runoff discharged into these facilities).

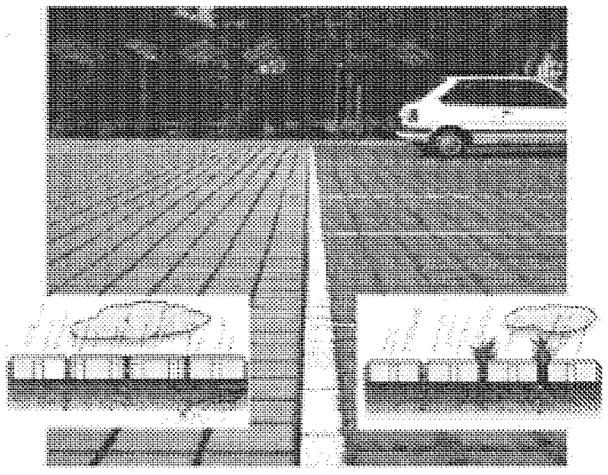


Figure 7-18 Pervious Pavers

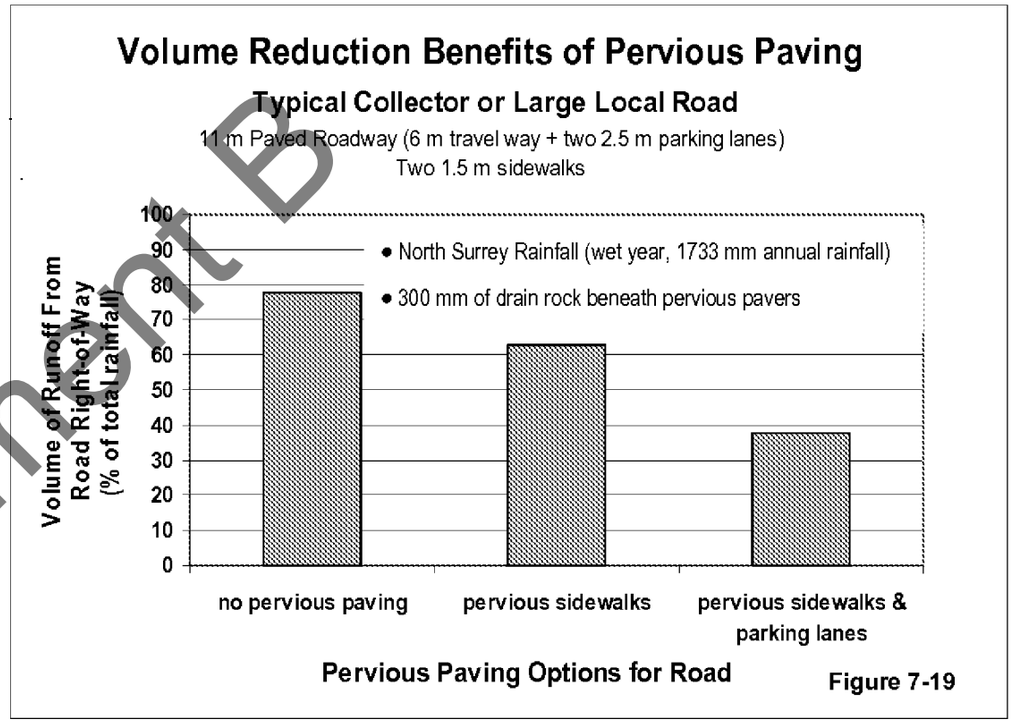


Figure 7-19

Pervious Decks

Runoff from decks or patios can be virtually eliminated by using wood decks with space between the boards (see Figure 7-20) rather than impervious surfaces such as concrete.

Rainfall hitting a spaced wood deck flows to the ground below, and provided there is a reasonable depth of absorbent soil beneath the deck, runoff from the deck is eliminated.

This is an example of a simple, well-known, site design strategy that can effectively reduce impervious coverage and promote infiltration.

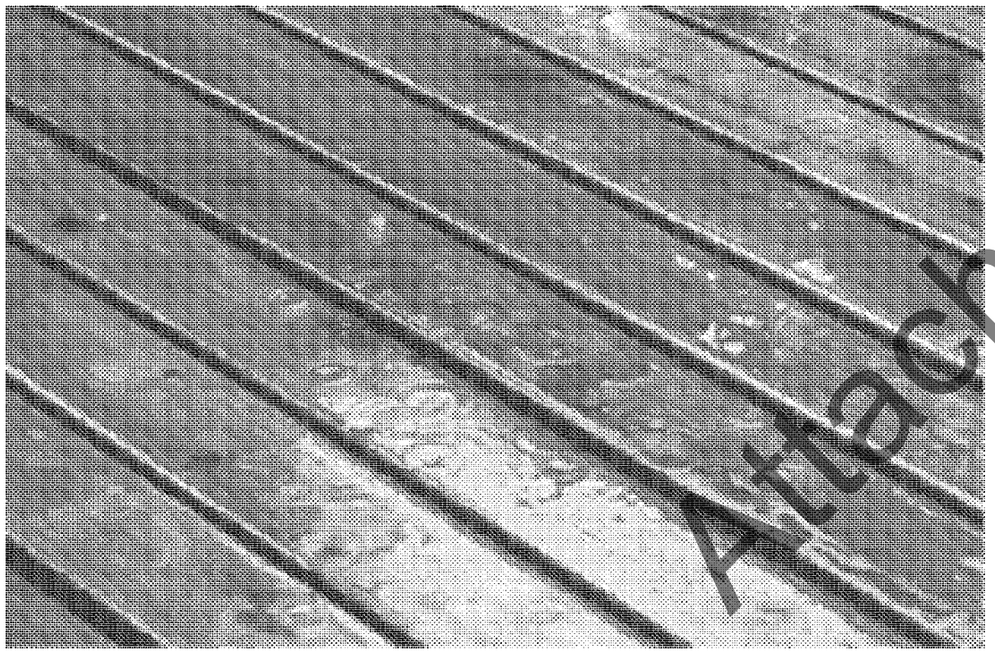


Figure 7-20 Pervious Decks

Applying Combinations of Infiltration Strategies

Figure 7-21 illustrates an example of the installation of selected infiltration techniques on a typical single-family lot, where the performance target is to capture and infiltrate 60 mm of rainfall per day in order to provide both rainfall capture and runoff control in an on-parcel system.

- Roof drain leaders outfall through a debris catcher to an array of infiltration chambers (see Figures 7-7a and 7-7b) in the front lawn. In order to infiltrate the runoff from the 280 m^2 roof, a 7.6 m x 6 m infiltration areas is provided. This could be entirely in the front yard, or could be split over various locations in the yard based on soil characteristics and landscaping objectives.
- The infiltrator chambers have an overflow pipe connected to the street storm drain system that allows rainfall events that exceed the storage capacity to overflow.
- The plan also shows an interceptor perforated drain along the downstream property boundary. This is shown as an illustration only. It could be installed as required on lots with steep slopes or seepage problems to remove surface water and shallow interflow and deliver it to the storm drain system. Ideally, there should be at least 9 m between the infiltration chamber and the perforated drain. This would provide an approximately 30-day delay between the time that water is absorbed as interflow and the time it is removed by the perforated drain. The 30-day delay is based on a moderate 12.5 mm/h infiltration and interflow rate. Delays between infiltration chamber and footing drains would follow a similar pattern, where each foot of interflow distance represents a day or more of delay.
- The bulk of the site is maintained with absorbent soils. Special care is taken to ensure that the top 300 mm of soil are highly absorbent, by avoiding compaction and ensuring high organic matter content.
- Driveway and surface paving is shown as permeable pavers, with a reservoir base course. This ensures that rainfall landing on the driveway is stored underground and allowed to soak into the underlying soils.
- The rear outdoor living area is a spaced wood deck over absorbent ground. This allows rainfall to bypass the deck and infiltrate into the ground below. See Figure 7-20 for details.
- Reducing the building roof area on the site would reduce the amount of infiltration chamber area required.

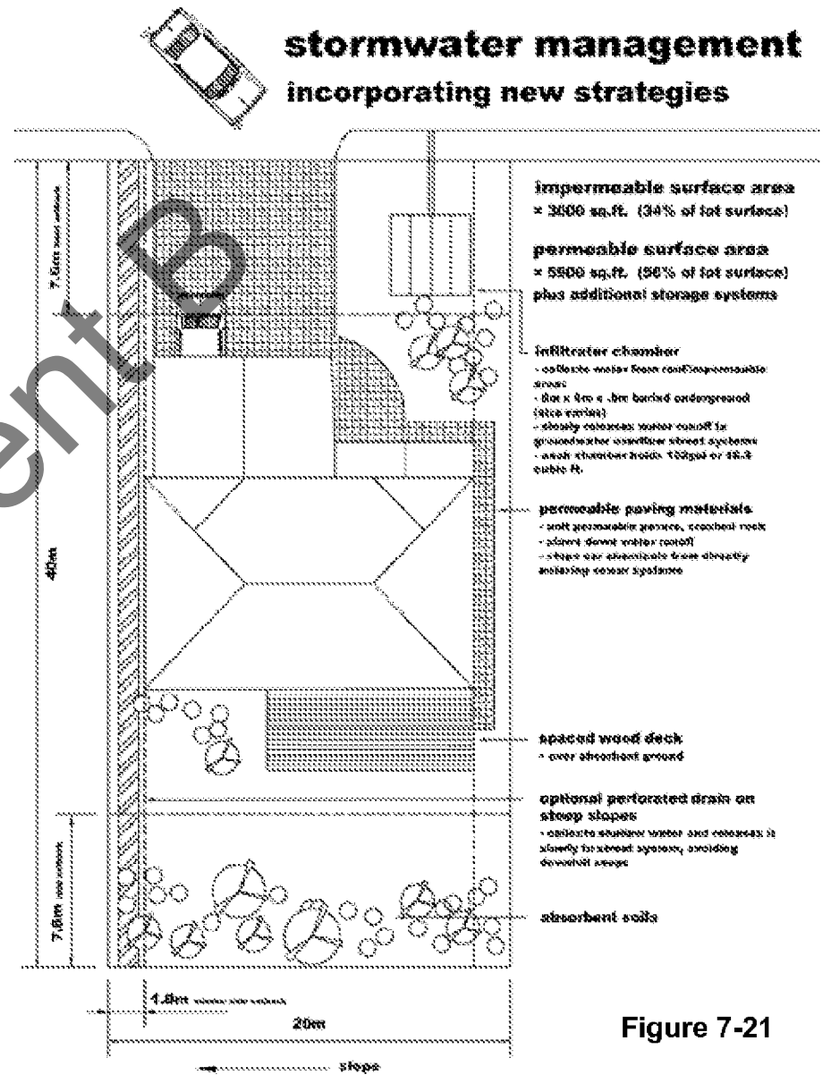


Figure 7-21

Infiltration Strategies for Land Uses with High Levels of Surface Parking

Figure 7-22 shows an example of infiltration strategies for a typical commercial land use with extensive surface parking areas. This Figure shows how a combination of swales with infiltration trenches and bioretention areas could be integrated into parking lot design to infiltrate runoff from rooftops and paved surfaces.

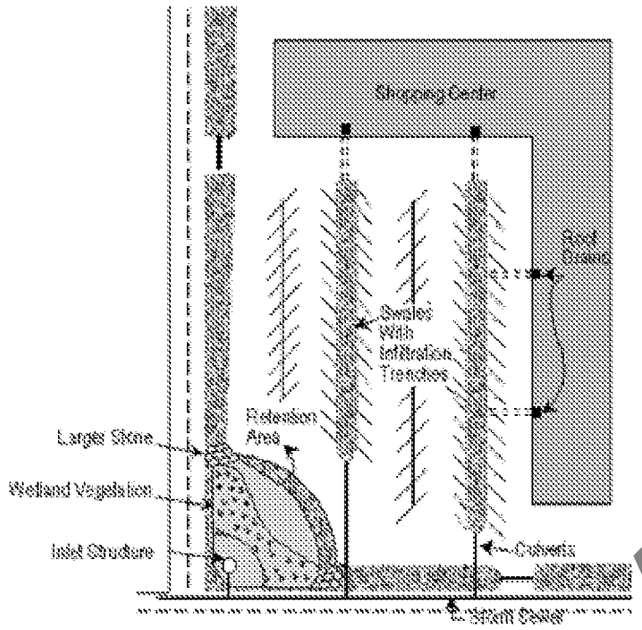


Figure 7-22 Designing Parking Lots that Infiltrate

Cost Implications of Infiltration Facilities

The costs of infiltration facilities are highly variable and depend on site-specific conditions such as soil type, topography, the scale of installation, and infiltration facility design. Typical installation costs for infiltration facilities range from about \$30 - \$170 per m^2.

The operation and maintenance requirements for surface facilities are mainly aesthetic (e.g. landscape maintenance). Annual operation and maintenance costs for surface infiltration facilities are typically in the range of 5-10% of capital costs.

Operation and maintenance requirements for sub-surface facilities are less frequent but can be more costly (e.g. periodic cleaning of soakaway trenches). Annual operation and maintenance costs for sub-surface infiltration facilities are typically in the range of 5-20% of capital costs.

Pervious Paving Costs

The cost of installing of pervious paving is typically in the range of \$20 - \$30 per m^2, depending on the design and site conditions. This is significantly more expensive than conventional paving (approximately \$5 - \$10 per m^2). Also, the operation and maintenance costs associated with vacuum sweeping may be substantial if a community does not already have the necessary equipment.

Design and Construction Tips for Infiltration Facilities

- Site-specific percolation tests should be carried out (ideally under saturated soil conditions) to determine the hydraulic conductivity of soils on a development site, and to identify suitable infiltration areas. Percolation tests should be performed at the depth of proposed infiltration facilities.
- Infiltration facility sites should be protected during construction from compaction and sedimentation, by pre-identifying and fencing, or other means. Inadvertent compaction should be removed by ripping or scarifying the site prior to installation of infiltration facilities.
- Infiltration facilities should be placed over undisturbed or lightly compacted ground (about 80% modified proctor density) to maximize exfiltration of rainfall into the underlying subsoil.
- Adequate sediment and erosion control during construction is essential to prevent clogging of infiltration facilities and underlying soils.
- Pipes leading to infiltration facilities should be fitted with debris catchers and cleanouts to minimize the movement of sediment and debris into the facilities. This is particularly important for sub-surface infiltration facilities.
- Infiltration facilities should be designed with pathways to allow overflow to escape to downstream watercourses via a storm drain system or overland flow.

Tips for Bioretention Facilities

- Low points of bioretention facilities should be planted with flood-tolerant plants.
- Higher areas should be planted with streamside or upland species. Examples of appropriate bioretention plants are shown below:

Frequency of Flooding	Botanical Name	Common Name
Winter standing water	Juncus spp.	Rush
Occasional standing water	Carex spp.	Sedge
Rare flooding	Spiraea douglasii	Hardhack
No flooding	Rosa spp.	Shrub rose

These plants would work best in coastal climates, but may also be used in other parts of the province. Appropriate plant species will vary across the province depending on biogeoclimatic zone.

- Soils in bioretention areas should have the characteristics of absorbent soils, discussed in Section 7-3.
- Bioretention facilities should be constructed in the dry season whenever possible, or they should be totally isolated from flows during construction, to protect other parts of the drainage catchment form sedimentation.
- In areas where soils are relatively impermeable, bioretention facilities can be designed with a sub-drain to slowly remove water that infiltrates through the absorbent soil layer. This filters out sediments and many pollutants.

Tips for Pervious Pavers

- Pervious paving systems are at risk of being plugged by silt or organic debris that washes onto the surface layer. To avoid this risk, careful attention should be paid to protecting the pervious paving from sedimentation during construction. In addition, most pervious pavement systems are designed with a high factor of safety for permeability e.g. often the permeability at time of construction is 10 times that required for the successful performance of the pavement (i.e. a Factor Of Safety of 10).

- The pervious paving system includes a special base course under the paving designed to hold the stormwater until it has time to soak into the ground below. This 'reservoir' base course is often made of fractured drain rock (railway ballast) that has about 33% void. The depth of the base course is designed with the storage capacity for stormwater as one consideration, with the surface live load and bearing capacity of the underlying soils as other factors. Generally, the deeper the base course, the more stormwater holding capacity and the greater the structural strength. Slope on the pervious pavers should be between 1% and 6%. Calculation of the reservoir capacity should consider any drainage areas flowing to the pavement.

- Pervious paving should not be used on any stormwater quality 'hot spot' where surface contaminants may be concentrated and enter the groundwater (e.g. gas stations, wrecking yard, fleet storage yards, or other sites that store hazardous materials).

- A vertical pipe inlet should be installed so that the reservoir base course overflows to a storm drain when full.

Operation and Maintenance Tips for Infiltration Facilities

- Sediment and debris must be regularly removed from debris catchers and cleanouts.

- Periodic cleaning of infiltration facilities will likely be required to remove accumulated sediment and maintain hydraulic performance.

Tips for Bioretention Facilities

- Provisions for dry season watering of plants in bioretention facilities is essential, especially in the plant establishment period.

- Normal landscape maintenance, with an emphasis on minimum inputs of fertilizer and integrated pest management is appropriate.

Tips for Pervious Pavers

- Where pervious paving is used, regular street sweeping with vacuum and brush machinery is needed to remove surface sediment and organics that may enter the cracks and reduce permeability.

- Low traffic areas (e.g. roadway medians) may experience some weed growth in the cracks (which is a problem for any paved surface). Steam-based weeding systems are available to efficiently manage weed growth without use of herbicides.

- Snow clearing of properly installed pervious pavements can be achieved with standard equipment. Following the manufacturer's design specifications should eliminate any significant freeze-thaw issues.

7.6 Type 3 Source Control - Green Roofs

Replacing impervious rooftops with green roofs can significantly reduce the volume and rate of runoff from building lots. A layer of absorbent soil and vegetation on top of building and parkade rooftops can retain rainfall and allow it to evaporate or transpire. The runoff from a green roof passes through the absorbent soil layer to an underdrain layer (there is no surface runoff), and thereby attenuates peak runoff rates.

Green roofs are classed into two categories: *extensive* green roofs which typically have a shallow soil profile of 20 to 100 mm and support mosses, grasses and sedums; and *intensive* green roofs with soil depths greater than 100 mm able to support substantial vegetation (shrubs, trees, etc.). Intensive green roofs are typically landscaped features that require more maintenance than extensive green roofs.

Green roofs are common in many parts of Europe and are becoming more common in North America. They are often applied for reasons other than stormwater management; engineered green roofs may also provide heating or cooling savings by insulating buildings, as well as aesthetic benefits, air quality benefits, and reductions in the 'urban heat island' effect.

Figure 7-23 shows a lightweight extensive green roof on an airport building. Figure 7-24 shows an example cross-section of an intensive green roof over a parking garage.

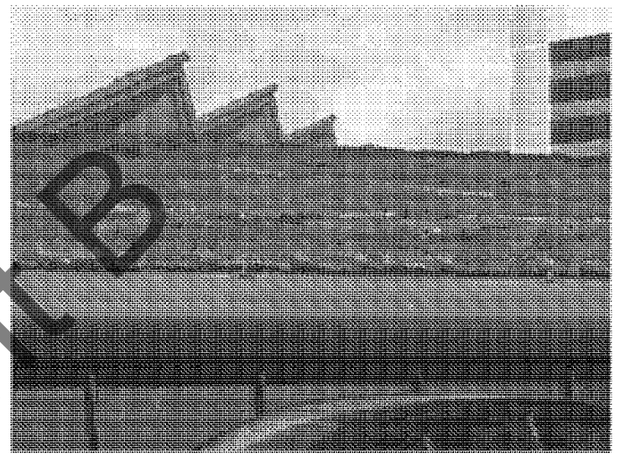
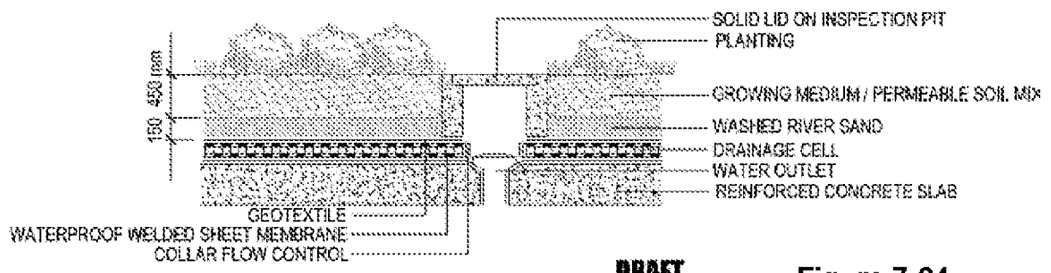


Figure 7-23 Lightweight Extensive Green Roof



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ABSORBANT SOILS AND FLOW CONTROL OVER PARKING GARAGE

Figure 7-24

The Effectiveness of Green Roofs under Different Rainfall Conditions

Figure 7-25 shows that green roofs provide more significant reduction in runoff volume where (and when) total annual rainfall is lower. As total rainfall decreases, a greater percentage of total rainfall becomes evapotranspiration.

Green roofs would be most effective at reducing runoff volumes in drier parts of the province, and would be more effective in drier years as opposed to wet years.

In terms of reducing runoff volume, extensive green roofs can be almost as effective as intensive green roofs.

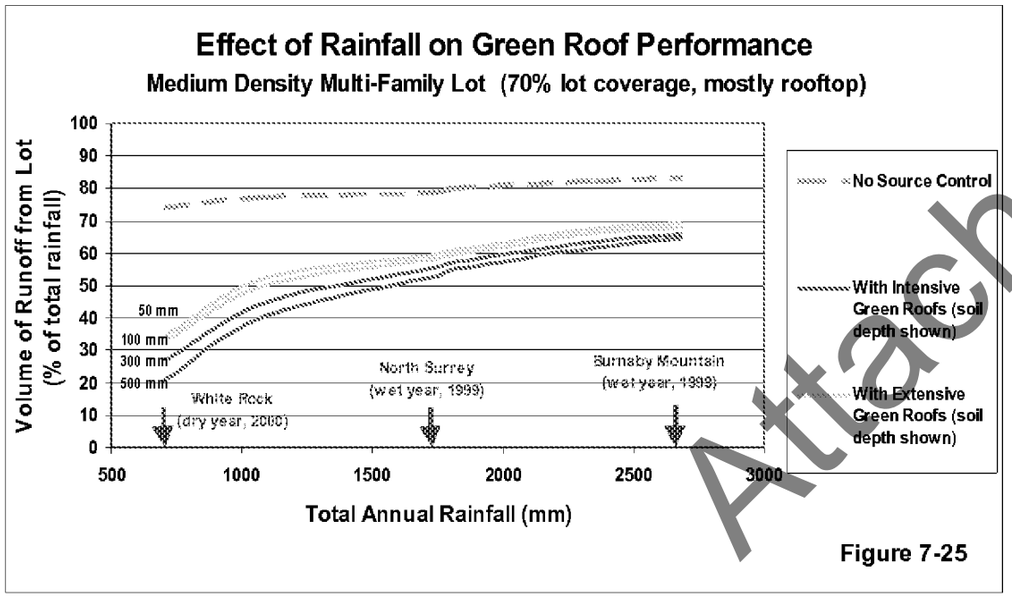


Figure 7-25

The Importance of Green Roof Soil Depth

Increasing the depth of absorbent soil increases the retention capacity of green roofs. This decreases the volume and rate of green roof runoff, as shown in Figures 7-26a and 7-26b.

The volume reduction benefits of increasing green roof soil depth diminish beyond about 70 mm.

In order to maximize the reduction in runoff rates from large, prolonged storms that occur during wet weather periods, intensive green roofs with about 300 mm of soil depth are needed (see Figure 7-26a). Where building structural limitations do not permit this soil depth, green roofs with shallower soil profiles may still be able to achieve significant reductions in runoff rates from long duration wet weather storms that are less extreme and/or in locations with less rainfall.

Significant reduction in runoff rates from short intense storms (i.e. cloudbursts) that occur during dry weather periods can be achieved using extensive green roofs with 100 m of soil depth (see Figure 7-26b).

Figure 7-26b shows the runoff rate from an extremely intense cloudburst (100-year return period) that occurred in White Rock on June 8th, 1999. This event is discussed in more detail in Section 7.8.

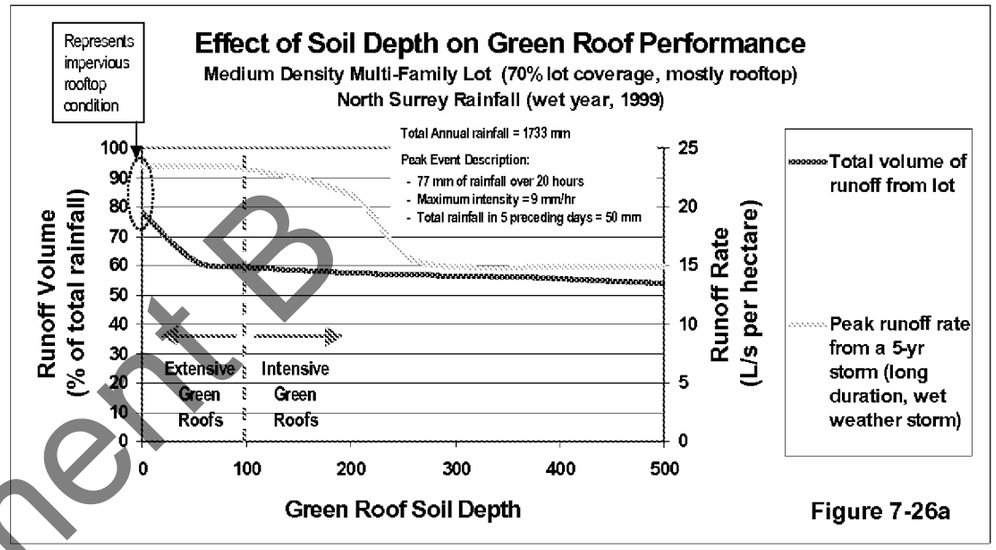


Figure 7-26a

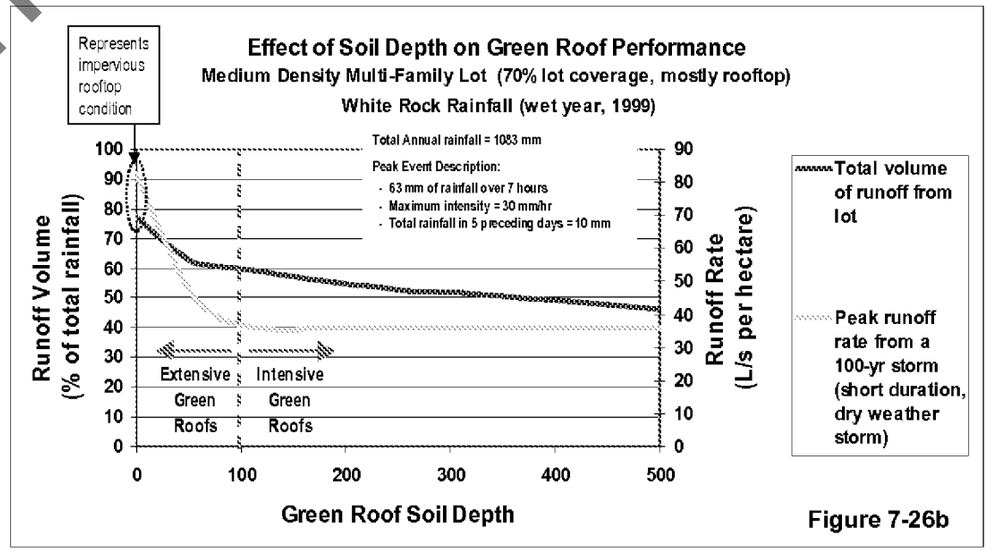


Figure 7-26b

Benefits of Green Roofs for Different Land Uses

Figures 7-27a and 7-27b show that the benefits of green roofs, in terms of reducing runoff volume and rate, is most significant for land uses with high percentages of rooftop coverage, such as high density multi-family or commercial uses (without substantial surface parking). Green roofs have less benefit for single family land uses, and it is likely less feasible to implement green roofs on single family buildings.

The Importance of Parking Type

Note that the type of parking provided for multi-family and commercial land uses has a big impact on the potential benefits of green roofs (green roofs can be applied to parkades but not to surface parking). Figures 7-27a and b show modeling results for multi-family and commercial land uses with limited surface parking (i.e. rooftop coverage is approximately equal to impervious coverage).

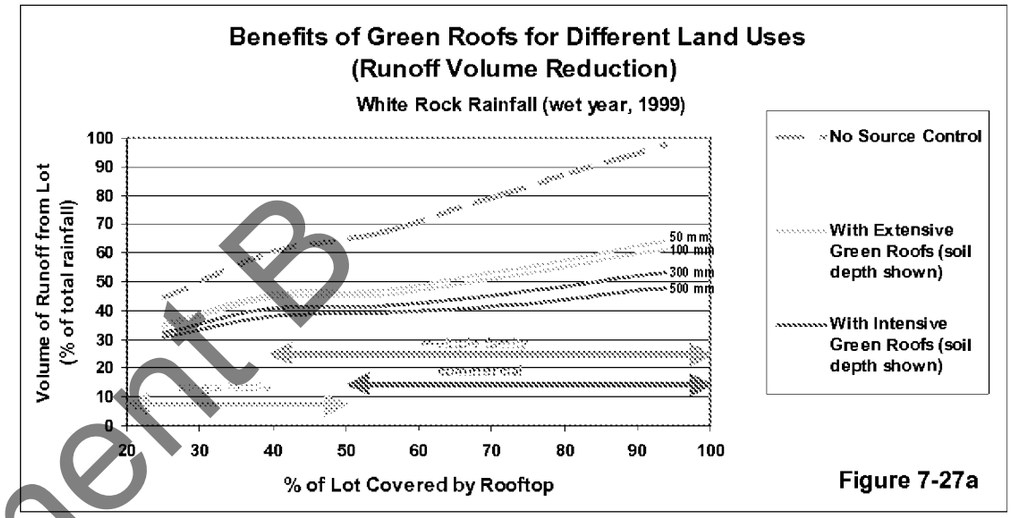


Figure 7-27a

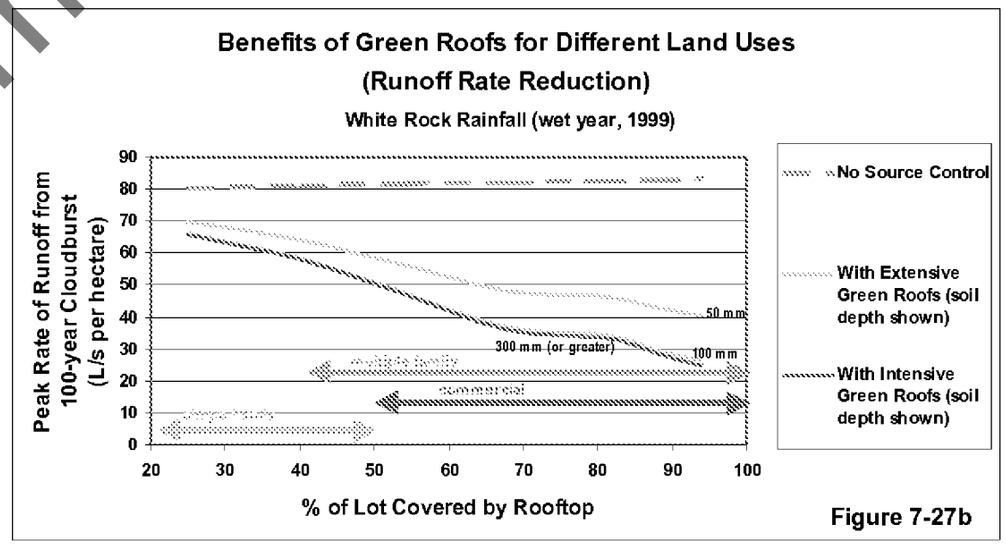


Figure 7-27b

Cost Implications for Green Roofs

The costs of green roofs are highly variable and depend on site-specific conditions, such as the scale of installation, vegetation type and green roof design. Typical installation costs for green roofs infiltration facilities range from about $60 to $150 per m^2 (intensive green roofs with 300 mm or more of soil depth are likely to be near the high end of this range). There may also be increased structural costs (although this is not likely a factor for concrete buildings).

Note that the scale of the installation alone can influence the installation cost of green roofs by a factor of 3 or more. This is a direct consequence of the fact that the present market for green roofs in North America is too small to be economically efficient. The cost of installing green roofs in Germany (where a mature green roof industry exists) is typically half the cost of a similar installation in North America.

Annual operation and maintenance costs for green roofs are typically in the range of $1 to $2.50 per m^2. Operation and maintenance costs are typically highest in the first year when plants may require establishment watering, weeding, and some replacement.

Design and Construction Tips for Green Roofs

- To reduce structural costs, the design of the absorbent soils over the parking garage lid or roof may use a light weight growing medium. The depth of the soil related to its absorbency may also be fine-tuned for structural load efficiency.
- If light-weight soils are used, they can be subject to wind erosion when they dry out. Appropriate scheduling of soil placement, and temporary protection of the soils until planted or watered should be arranged.
- Roof water should be kept separate from runoff from paved surfaces, which can be polluted with hydrocarbons and heavy metals. Whereas paved surface runoff may require treatment, most green roof runoff will be clean enough to be released directly to storage and receiving waters.
- Proper waterproofing and flashing are essential for green roofs.
- Most green roof systems include a root growth inhibitor to keep roots from invading the waterproof membrane area.
- The most successful green roof systems use drought tolerant plants, and avoid grasses.
- Establishment watering may be required, using either surface standard watering devices, or an automatic irrigation system. Watering requirements will vary based on the green roof system chosen.

Operation and Maintenance Tips for Green Roofs

- Intensive roofs are typically landscaped features that require a higher level of maintenance than extensive green roofs. Through proper plant selection, it may be possible to design extensive green roofs that are essentially self-sustaining and require very little maintenance.
- Irrigation, fertilization and pesticide/herbicide application should be kept to a minimum. Occasional weeding of wind-blown seeded plants may be required.
- Storage in a plastic drainage layer, or equivalent storage volume in drain rock, under the green roof soil can increase the effective rainfall capture and storage volume.
- The drainage outflow from the parking garage lid should be connected to infiltration facilities, in suitable areas of the site off the parking garage, with an overflow to the storm drain system.
- Drain inlets from green roofs will require regular inspection (as is normal practice).
- Normal landscape maintenance techniques should suffice for the absorbent soils on green roofs. Landscaping contractors must be made aware of the need to avoid damaging roof membranes during maintenance activities.

7.7 Type 4 Source Control - Rainwater Re-use

Just as the trees in a forest use a significant portion of rainfall, capturing rainfall for human re-use can play a key role in managing the Water Balance at the site level. The benefits of rainwater re-use go beyond stormwater management (i.e. reducing the volume and rate of runoff from developed areas). Re-use can also reduce the amount of water drawn from reservoirs and reduce the costs of water supply infrastructure.

In general, the most significant reductions in runoff volume can be achieved by capturing and re-using rainwater for indoor greywater type uses, particularly for land uses with high rates of water use. Re-using rainwater for irrigation typically provides less benefit in terms runoff reduction because the demand for irrigation water occurs during the dry weather periods, and most runoff occurs during wet weather periods.

For rainwater re-use on single family residential land uses, rooftop runoff is typically stored in rain barrels (see Figure 7-28a). For re-use on multiple family, commercial or institutional land uses, rooftop runoff is typically stored in cisterns or detention vaults (e.g. see Figure 7-28b).

Rainwater re-use systems can be combined with infiltration facilities as shown schematically in Figure 7-28b. In catchments where maintaining stream base flows is a key objective, first priority may be given to groundwater recharge, with only surplus water applied to in-building re-use.

Figure 7-28a Rainwater Re-use using Rain Barrels

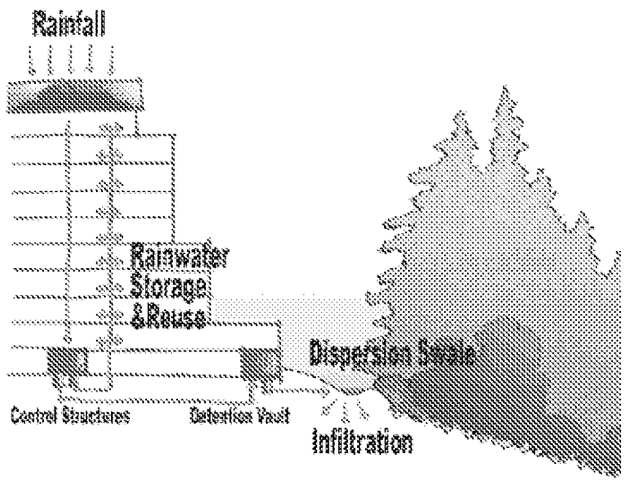


Figure 7-28b Rainwater Re-use using Cisterns

Benefits of Rainwater Re-use for Different Land Uses

Significant reductions in runoff volume can be achieved on high-density residential land uses by capturing and re-using rooftop runoff for toilets and washing machines, as shown in Figure 7-29a. As population density increases, residential water use rates increase, and therefore, the level of reduction in runoff volume that can be achieved through rainwater re-use increases.

The level of volume reduction that can be achieved by re-using rainwater for greywater uses (toilets and washing machines) on commercial land uses varies significantly depending on the type of commercial land use, as shown in Figure 7-29b. Commercial land use types with high water use rates, such as restaurants and bars, can achieve significant runoff reduction, even where density is low (e.g. local commercial).

Note that rainwater re-use for greywater uses is most beneficial on high-coverage land uses where opportunities for infiltration are most limited.

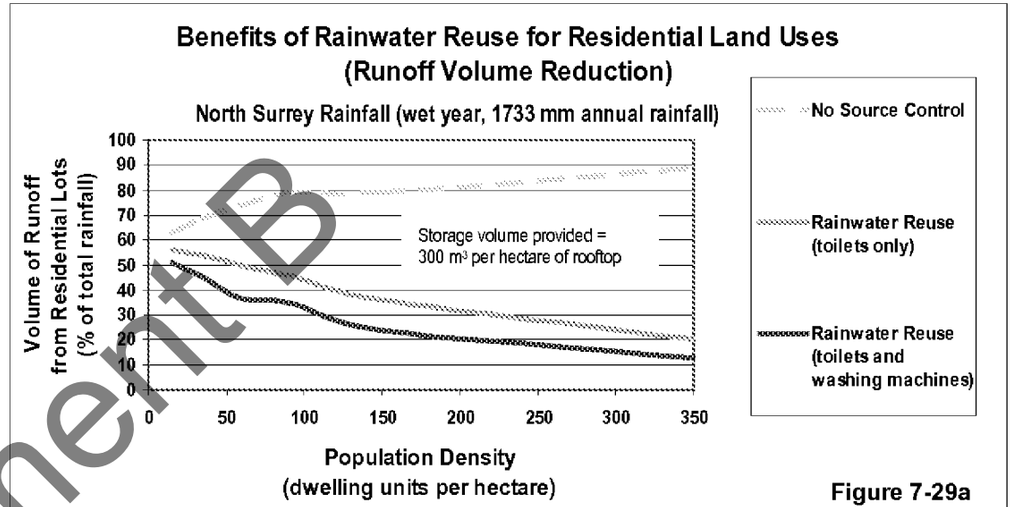


Figure 7-29a

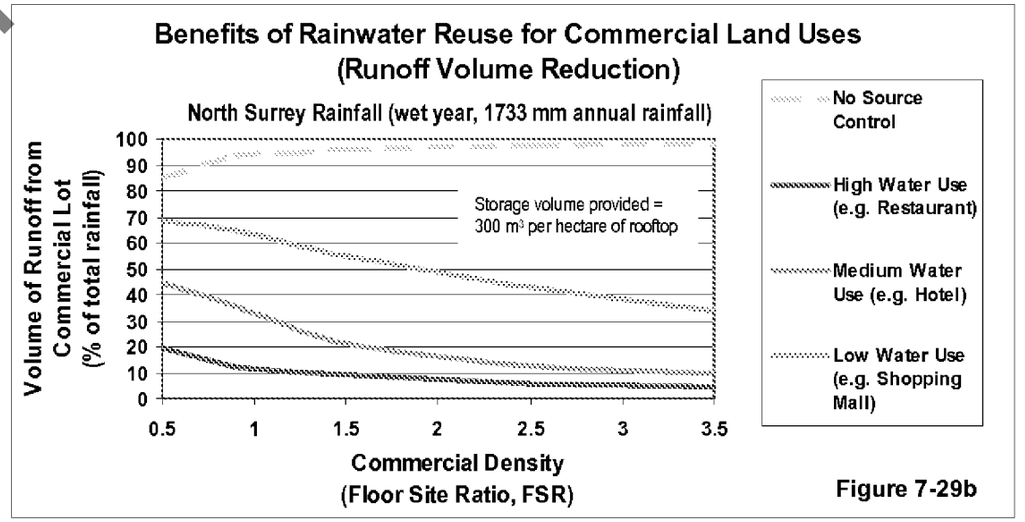


Figure 7-29b

The Impact of Surface Parking

The potential benefits of rainwater re-use are significantly less for land uses that have significant amounts of surface parking, as shown in Figures 7-30. This reflects the assumption that runoff from paved surfaces is less suitable for indoor re-use, primarily due to water quality concerns (although it may be possible with appropriate treatment).

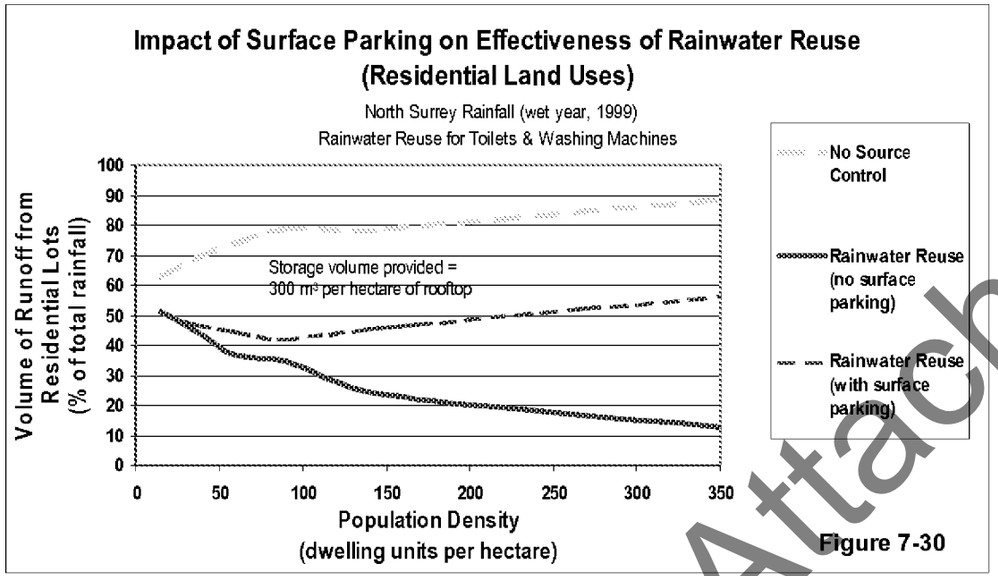


Figure 7-30

The Effectiveness of Rainwater Re-use under Different Rainfall Conditions

Greater reductions in runoff volume can be achieved through rainwater re-use where (and when) total annual rainfall is lower, as shown in Figure 7-31. As total rainfall decreases, water use rates (a function of land use type) become a greater percentage of total rainfall.

In certain situations it may be possible to re-use virtually all rooftop runoff. However, it is important that rainwater re-use systems be designed to ensure that adequate baseflow is maintained in downstream watercourses.

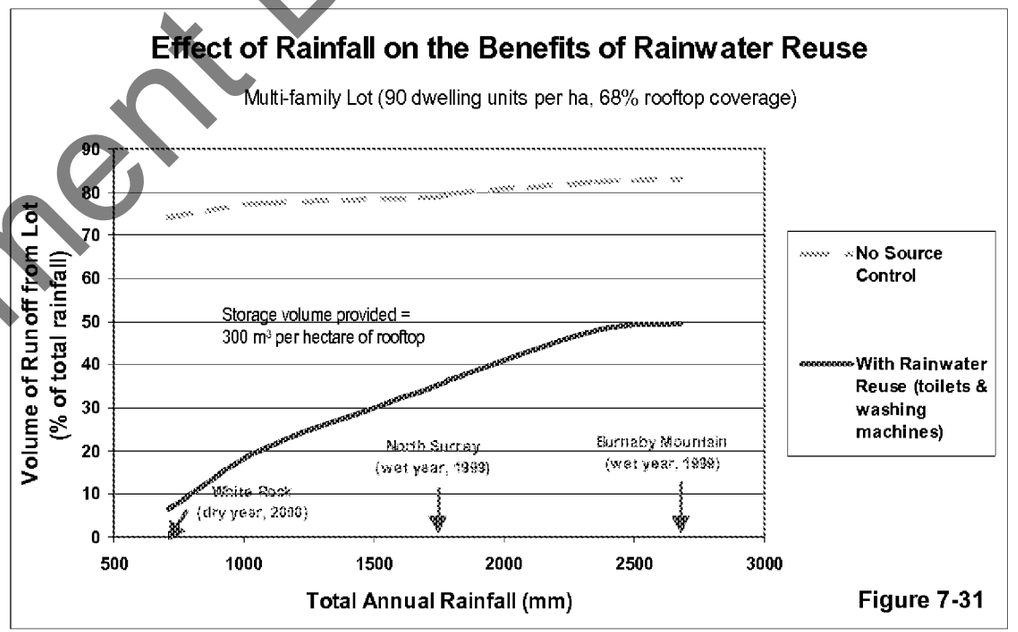


Figure 7-31

Selecting an Appropriate Storage Volume

Increasing storage volume (i.e. size of rain barrels or cisterns) can improve the hydrologic benefits of rainwater re-use, as shown in Figure 7-32. The volume reduction benefits of providing additional storage capacity diminish beyond a relatively low threshold (about 100 m^3 per hectare of rooftop). Beyond this threshold, runoff volume reduction is primarily a function of land use characteristics (e.g. population density, commercial density, land use type and type of parking).

Figure 7-32 also shows that very large storage volumes are needed to achieve any significant reduction in peak runoff rates from extreme rainfall events (e.g. a 5-year winter storm).

Note that this figure is based on Water Balance Model simulations for a very wet year in the GVRD (1733 mm annual rainfall). In locations and/or years with less rainfall, it is likely that the same benefits could be achieved using with less storage volume (and vice versa).

Effect of Storage Volume on Benefits of Rainwater Reuse

Multi-family lot (150 dwelling units per ha, 67% rooftop coverage)
Rainwater reuse for toilets and washing machines
North Surrey rainfall (wet year, 1999)

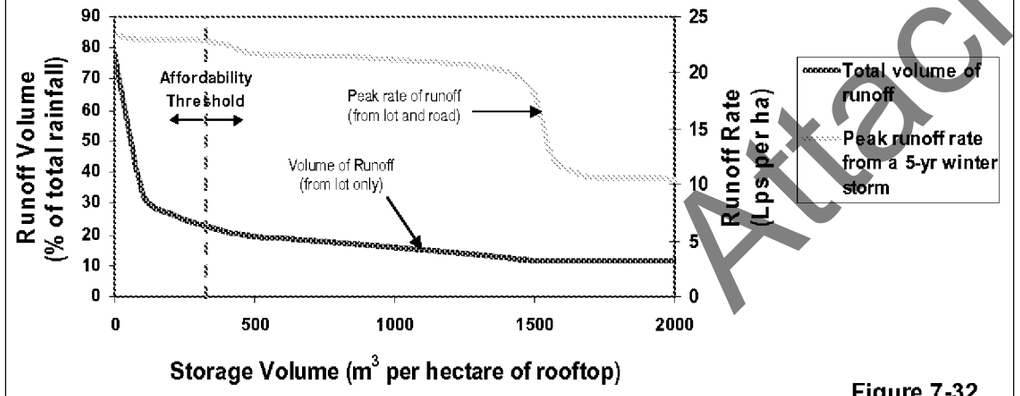


Figure 7-32

Cost Implications of Rainwater Re-use

The design and costs of rainwater re-use systems must be considered in the context of site-specific characteristics, including:

- nature of the development (e.g. water use characteristics, design of individual buildings)
- site-specific rainfall patterns
- characteristics of both stormwater and water supply infrastructure (existing or planned)

Costs implications must be considered at the scale of individual building (e.g. cisterns, additional pipe), as well as at the larger site (or regional) scale (e.g. water use savings, reduction in size of water supply and/or stormwater infrastructure). It is not possible to provide generalized costs estimates for rainwater re-use.

Design and Construction Tips for Rainwater Re-use

- Rainwater re-use systems may be designed to slowly release small amounts of water in order to maintain stream baseflows.
- Rainwater re-use systems in major buildings would require mechanical engineering design.
- There are traditional and evolving new systems for use in single family or small buildings. Some store rainwater right at the eaves, and more traditional systems include rain barrels or plastic vaults with either gravity or pump feed.
- Refer to publications on the subject for details of cistern pre-treatment and dewatering systems. Access for vacuum hose cleaning from a truck is advisable.
- Storage cistern designs are subject to waterproofing and structural engineering.

Operation and Maintenance Tips for Rainwater Re-use

- To reduce contamination of water stored in cisterns, the source of water should generally only be roofs, or other clean sources.
- Occasional cleaning of cisterns may be necessary. This is usually performed by vacuum hose.
- Regular inspection of cisterns is required to ensure that control structures continue to function properly.

7.8 Applying Source Controls to Mitigate Extreme Cloudbursts

One of the anticipated effects of climate change is an increase in the frequency of cloudbursts – high intensity short duration storms - which could cause significant drainage problems.

An extremely intense cloudburst (100 year short duration storm) occurred in White Rock on June 8th, 1999 and caused extensive flood damage. The simulated runoff hydrographs (from a typical multi-family neighbourhood) shown in Figure 7-33 demonstrate how effective the following source control scenarios would be at reducing the runoff from this event:

- **Scenario 1: No Source Control -** All impervious area is directly connected to a storm sewer system and pervious areas are covered by disturbed soil.
- **Scenario 2: Absorbent Landscaping** - Disturbed soil is replaced with 300 mm of absorbent landscaping; peak runoff rate would be reduced by about 27%.
- **Scenario 3: Absorbent Landscaping plus On-Lot Infiltration Facilities** – Same as Scenario 2 except that all lots have bioretention facilities (150 mm of surface ponding on top of 1 m of absorbent soil) covering 10% of lot area; peak runoff rate would be reduced by about 70%.
- **Scenario 4: Absorbent Landscaping plus Intensive Green Roofs -** Same as Scenario 2 except that all residential buildings and parkades have green roofs with 300 mm of soil depth; peak runoff rate would be reduced by about 80%. Note that the same level of runoff rate reduction could be achieved using green roofs with extensive green roofs that have 100 mm of soil depth (see Section 7.6).
- **Scenario 5: Absorbent Landscaping plus Intensive Green Roofs plus On-Street Infiltration Facilities** – Same as Scenario 4 except that all roads have one 3 m wide infiltration swale/trench system (as described in Section 7.5) within road right-of-ways; peak runoff rate would be reduced by about 92%.

This case study shows that source controls can be very effective at reducing runoff rate from cloudbursts, and thus partially mitigating some of the anticipated effects of climate change.

Another anticipated effect of climate change is an increase in the amount of fall/winter rainfall, which will increase total runoff volume. The watershed case studies presented in Chapter 8 show that source controls can also be effective at mitigating this effect of climate change.

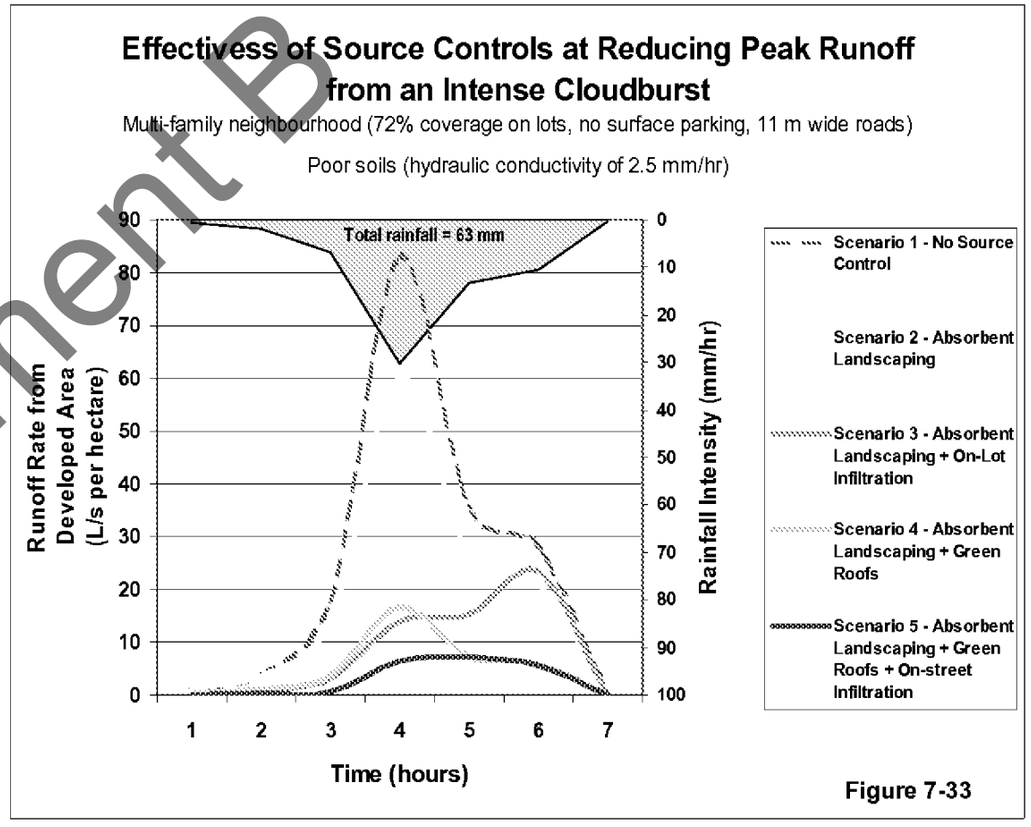


Figure 7-33

7.9 Communicating Performance Targets to Developers

To achieve performance targets, appropriate stormwater management practices must be integrated with site design. For this to happen, performance targets must be clearly communicated to developers in a format that they can apply to the design of stormwater systems at the site level.

Case Study Example: Design Guidelines for Developers

Infiltration has been identified as the most applicable source control option in the City of Chilliwack.

Chilliwack's *Design Guidelines for Stormwater Systems* provide step-by-step procedures for land developers to follow in order to design infiltration and detention systems that meet the City's design criteria for rainfall capture and runoff control. This example shows how to communicate performance targets and design criteria to developers. These Guidelines also specify performance monitoring requirements.

The Design Guidelines consist of the following forms:

- **Form 1 - Development Site Summary Characteristics**
- **Form 2 – Criteria for Absorbent Landscaping**
- **Form 3 – Design of Infiltration Facilities**
- **Form 4 – Design of Detention Facilities**
- **Form 5 – Performance Monitoring Requirements**

These forms are reproduced on the following pages.

City of Chilliwack – Design Guidelines for Stormwater Systems

Procedure for Sizing Infiltration and Detention Facilities

Form 1 – Development Site Summary Characteristics

Total development site area:

- A_{total} = _____ ha

Minimum hydraulic conductivity of on-site soils (from on-site percolation testing):

- **H** = _____ mm/hr

Total impervious area on development parcels (excluding green roofs):

- $IA_{on\text{-}lot}$ = _____ ha

Total impervious area on roads (excluding pervious paving):

- IA_{road} = _____ ha

Total impervious area on development site

- $IA_{total} = IA_{on\text{-}lot} + IA_{road}$ = _____ha

Total pervious area on development site

- $PA_{total} = A_{total} - IA_{total}$ = _____ha

Site and Key Plan

Form 2 - Criteria for Absorbent Landscaping

The design guidelines presented in Forms 3 and 4 are based on *impervious areas only*.

On-site pervious areas must be 'self-mitigating' (i.e. meet rainfall capture and runoff control targets). In order to achieve this:

❑ **Minimum depth of absorbent soil* for on-site pervious area = 300 mm**

* must meet *BC Landscape Standard* for medium or better landscape. The range of acceptable soil textures is shown below:

Lightest Soil:	**Heaviest Soil:**	**Typical Design Soil:**
Sand 90% Silt/Clay 5% Organic Matter 5%	Sand 55% Silt/Clay 25% Organic Matter 20%	Sand 75% Silt/Clay 15% Organic Matter 10%

Form 3 – Design of Infiltration Facilities

Rainfall capture criteria: capture and infiltrate 300 m³ of rainfall per day per impervious hectare

Infiltration facilities are to be provided as follows:

- On individual development parcels to capture runoff from rooftops and parking areas (e.g. by means of on-lot soakaways)
- Within road right-of ways to capture runoff from paved roadway (e.g. by means of roadside infiltration trenches)

Sizing Infiltration Facilities (applies for both development parcels(1) and roads)

Step 1) Select Design Depth, **D**

D = _____ m

D = distance from bottom of infiltration facility to the maximum water level (the point where overflow occurs)

Step 2) Select Facility Type and Determine Effective Depth, $\mathbf{D_{eff}}$

$\mathbf{D_{eff} = [D \times VS]}$ = _____m

VS = void space storage, the ratio of the volume of water retained per unit volume of the infiltration facility. Typical values for different types of infiltration facilities are shown in Table B on the following page.

Step 3) Determine Minimum Footprint Area, **A** *(i.e. bottom area) needed to meet rainfall capture target*

$\mathbf{A_{min}}$ = [(____ m², *from Table A*) *x* (_____ m² of IA served)] / 1000

A = the total area (in plan view) covered by the infiltration facility

(1) A typical facility size may be developed for multiple lots that have similar soil characteristics and similar amounts of IA.

Conveyance of Overflow from Infiltration Facilities

Overflow from infiltration facilities (on-lot and on-road) should be conveyed into runoff control facilities (refer to Form 3) via a stormwater drainage system, most likely within the road ROW. Road drainage may consist of:

a) a perforated pipe at the top of an infiltration trench
b) a catch basin connected to storm sewer pipe
c) a surface swale

Providing Runoff Control Storage in Infiltration Facilities (Optional)

Increasing the dimensions of infiltration facilities (whether they are on on-lot or on-road above the minimum requirement (i.e. A > A_{min}) reduces the storage volume that must be provided in off-lot runoff control facilities (refer to Form 4).

The amount of runoff control volume provided by on-lot and on-road facilities can be calculated as follows:

- $\mathbf{V_{on\text{-}site}}$ **= [**Facility depth **(D)** x Footprint Area **(A_{actual})] – [D x A_{min}] =** _____ m³

The total runoff control volume provided by all on-lot and on-road facilities **($\Sigma V_{on\text{-}site}$)** can then be subtracted from community detention requirements (refer to Form 4).

Table A - Required Footprint Area (in m²) for Infiltration Facilities (per 1000 m² of impervious area served by the facility)

Effective Depth of Infiltration Facility[1]	Hydraulic Conductivity of On-Site Soils[2] (mm per hour)				
	5	10	25	50	> 100
0.25 m	175	125	75	50	30
0.5 m	140	90	55	40	25
1.0 m	120	70	40	30	20
1.5 m	110	65	35	25	15
2.0 m	100	60	30	20	15

[1] Depths for rainfall capture facilities must be selected based on site-specific characteristics and constraints. The feasible depth may be governed by physical constraints (e.g. depth to the water table or to bedrock). The effective depth is equal to total depth multiplied by void space, and will depend on facility type (see Table A).

[2] Based on percolation tests from the development site (ideally carried out under saturated conditions, following periods of extended rainfall). Sizing of rainfall capture facilities should normally be based on the *minimum* percolation test results from a development site. Tests should be performed at the locations and depths of proposed infiltration facilities.

Table B - Typical Void Space Storage Values (VS)

Infiltration Facility Type[3]	Storage Medium	Typical Void Space (VS)
Retention ponds	Open	1.0
Bioretention facilities	Absorbent soil	0.2
Soakaways (infiltration trenches/pits)	Gravel or drain rock	0.33
Infiltration Chambers	Sub-surface chambers & surrounding gravel	0.55

[3] Infiltration facilities may be a combination of types. In this case, effective depth of the facility is the sum of total depth multiplied by VS, for each layer. For example, a bioretention facility with 0.3 m of ponding depth on top of a 1.5 m absorbent soil layer would have effective depth, D_{eff} = [1.5 m x 0.2] + [0.3 m x 1] = 0.6 m.

Form 4 – Design of Detention Facilities

Runoff Control Criteria: Detain an additional 300 m^3 of rainfall per impervious hectare and release at 1 Lps per hectare (total site area)

Designing Community Detention Facilities

The storage volume that must be provided in community detention storage facilities (e.g. wet or dry detention ponds) is:

- ❑ $V_{off\text{-}site} = [IA_{total} \times 300\ m^3/ha] - [\Sigma\ V_{on\text{-}site}] =$ _____ m^3

The rate of release from detention storage is:

- ❑ $R = A_{total} \times 1$ L/s per ha = _____ L/s

Form 5 – Performance Monitoring Requirements

Target: to provide an accurate picture of how rainfall moves through the stormwater system to enable future evaluation of system performance and optimization of design criteria

) Monitoring within Development Sites

The City will select certain development sites as demonstration projects and develop a comprehensive monitoring plan for these sites. The costs of installation and continued operation of monitoring equipment will be funded through Development Cost Charges.

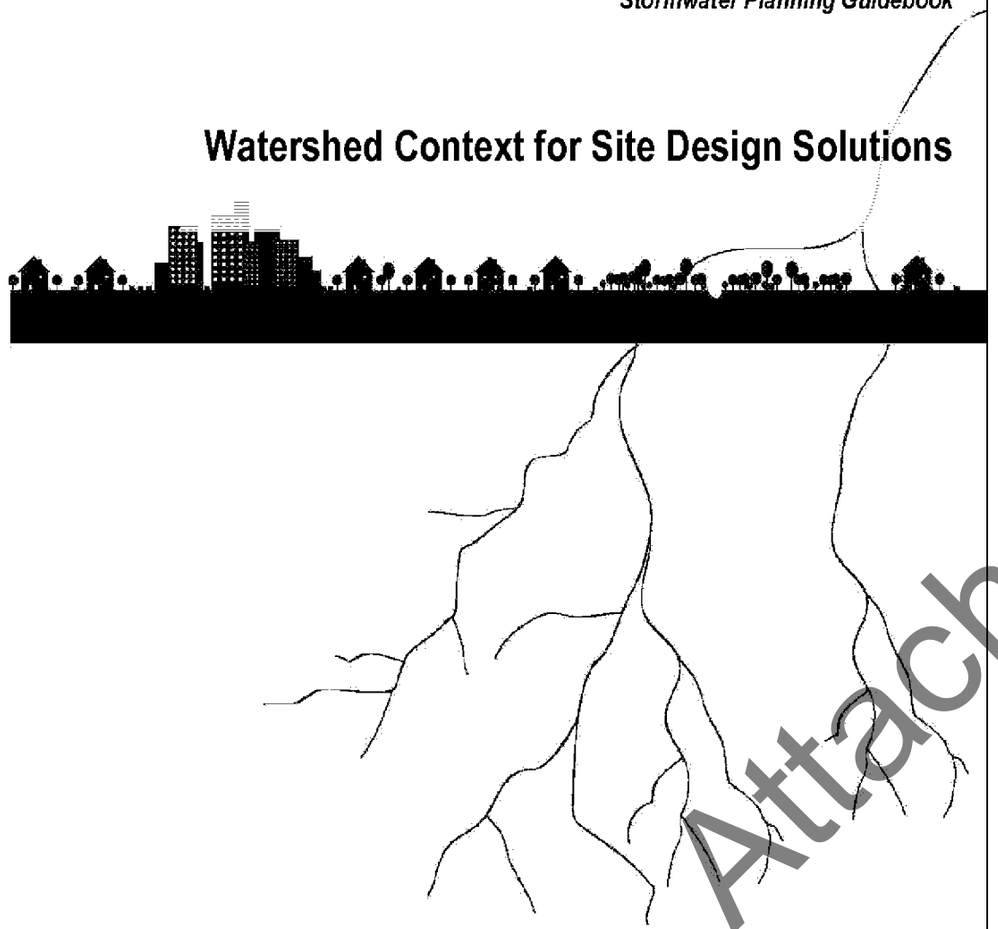
The purpose of monitoring within development sites is to evaluate and refine the City's design criteria and customize criteria for different zones within Chilliwack. In order to properly evaluate the performance of a stormwater system, the Water Balance of the development site served by that system must be defined. Therefore, it is important to monitor a representative sample from each component of the stormwater system, including:

- **On-Lot Rainfall Capture Facility monitoring** – Monitor water levels and overflow from at least one on-lot rainfall capture facility.
  - for surface facilities - install a compound weir, water level sensor and data logger at the overflow point
  - for sub-surface facilities – install a piezometer (to measure water level) and data logger
- **Road Infiltration/Drainage monitoring** – Monitor the road drainage flow from at least one section of road. This may include more than one drainage path (e.g. perforated pipe plus catch basins connected to a storm sewer).
  - install a compound weir, water level sensor, and data logger in a manhole at the downstream end of the road
- **Runoff Control Facility monitoring** – Monitor water levels and outflow from detention facilities (e.g. community detention ponds)
  - install a compound weir, water level sensor and data logger in the outlet control manhole

B) Monitoring at the Catchment Level

The City will install streamflow and TSS monitoring stations downstream of catchments where land development is occurring to verify that development practices are adequately protecting downstream hydrology and water quality. The costs of installation and continued operation of monitoring equipment will be funded through Development Cost Charges.

Refer to Figure 5-8, in Chapter 5 for illustration of a comprehensive monitoring program.



Watershed Context for Site Design Solutions

Chapter Eight

8.1 Determining What is Achievable at the Watershed Scale

- ❑ The Value of Watershed Retrofit Scenarios
- ❑ The Need for an ISMP Context

8.2 Watershed Retrofit Case Studies

- ❑ Indicators of Watershed Restoration
- ❑ Source Control Scenarios
- ❑ Case Study #1: McKinney Creek Watershed, Maple Ridge
- ❑ Case Study #2: Quibble Creek Watershed, Surrey

8.3 Achieving Watershed Protection or Restoration

- ❑ Changing Development Standards
- ❑ Facilitating Stormwater Source Control Applications

8.1 Determining What is Achievable at the Watershed Scale

The purpose of applying site design solutions is to ultimately achieve benefits (in terms of watershed health and/or flood risk management) at the watershed scale.

Determining what is achievable at the watershed scale is key to developing a shared long-term vision for a watershed. This long-term vision then provides a context for all planning, data collection, capital expenditures and regulatory changes.

Section 8.2 presents case studies that show what can be achieved at the watershed scale through the application of stormwater source controls.

Section 8.3 illustrates what is needed to achieve the widespread application of source controls that are required to achieve significant benefits at the watershed scale.

The Value of Watershed Retrofit Scenarios

Watershed retrofit scenarios were modeled using the Water Balance Model (see Chapter 7) for three developed watersheds in the Greater Vancouver Regional District (GVRD). The purpose of the watershed modeling was to answer the questions:

- How can implementation of stormwater source controls on all new developments and re-developments over a long time period, on a watershed-wide basis, benefit flood management and urban stream health?
- Are there specific stormwater source controls that work better in theory than others?

The modeling results from two of the GVRD case study watersheds are presented in Section 8.2. These results demonstrate that it is achievable to significantly improve and potentially restore watershed health over a 50-year timeline by applying stormwater source controls to re-development projects.

In general, restoring a degraded watershed is more challenging than preserving a healthy watershed. The GVRD case studies demonstrate that watershed restoration is achievable through source control (in one of the wettest parts of the province). This also demonstrates that watershed protection is achievable through stormwater source control.

Drivers for the Watershed Retrofit Evaluation

The Greater Vancouver Region is projected to experience significant population growth over the next 50 years (possible doubling). This will lead to densification of existing land uses and some development of existing natural areas, which will increase the volume and rate of stormwater runoff discharged into watercourses in the GVRD. The increased runoff is likely to result in:

- the need for upgrades and/or repairs to drainage infrastructure in many parts of the GVRD
- further degradation of aquatic ecosystems in urban watersheds
- further water quality deterioration (also a result of population increase)
- increased flooding risk to life and property

The effects of climate change are likely to exacerbate these impacts. The amount of fall and winter rainfall in the GVRD is anticipated to increase over the next 50 years due to climate change, which will further increase runoff. Climate change is also expected to increase the frequency of high-intensity rainfall events (cloudbursts), thus increasing the potential for flash flooding.

A key objective of the GVRD's *Effectiveness of Stormwater Source Control* report (2002) was to determine how:

- the impacts of increased runoff and more frequent cloudbursts could be avoided by applying stormwater source controls on future development and re-development projects within the GVRD
- the application of source controls on re-development projects could support restoration of aquatic ecosystems and decrease flooding risk over time, thus turning a potential problem (the combination of densification and climate change) into an opportunity (watershed restoration).

The Need for an ISMP Context

This chapter provides a broad overview of the potential benefits of source control (at a watershed scale), but does not evaluate source control options in the context of an Integrated Stormwater Management Plan (ISMP) – that is the next step (see Chapter 10). The ISMP process will determine what is achievable and affordable in the context of each individual watershed.

A key objective of any ISMP is to develop a source control strategy that is watershed-specific.

The ISMP process should identify where there is significant aquatic habitat to be protected or restored, and whether there are drainage problems, such as erosion of ravines or chronic flooding. A more detailed assessment of source control opportunities should focus on areas where land use change could cause or exacerbate stormwater-related problems. An ISMP should evaluate opportunities to mitigate potential negative impacts or to improve conditions through the application of source control.

An analysis of the land use in these catchments will provide an estimate of the expected time frame for new development or re-development over the next 50 years.

The costs and benefits of implementing source control options in these catchments must be evaluated based on more detailed information on soil conditions, hydrogeology, rainfall, streamflow, drainage infrastructure, land use and site design.

8.2 Watershed Retrofit Case Studies

This section summarizes the results of watershed retrofit modeling for two developed watersheds in the GVRD (see Figure 8-1), including:

- a watershed that is predominantly single family land use (McKinney Creek, Maple Ridge), and
- a watershed where re-development to higher density commercial and multiple family land uses is expected (Quibble Creek, Surrey)

The reference publication for these case study examples is the report *Effectiveness of Stormwater Source Control* (CH2M Hill Canada, 2002).

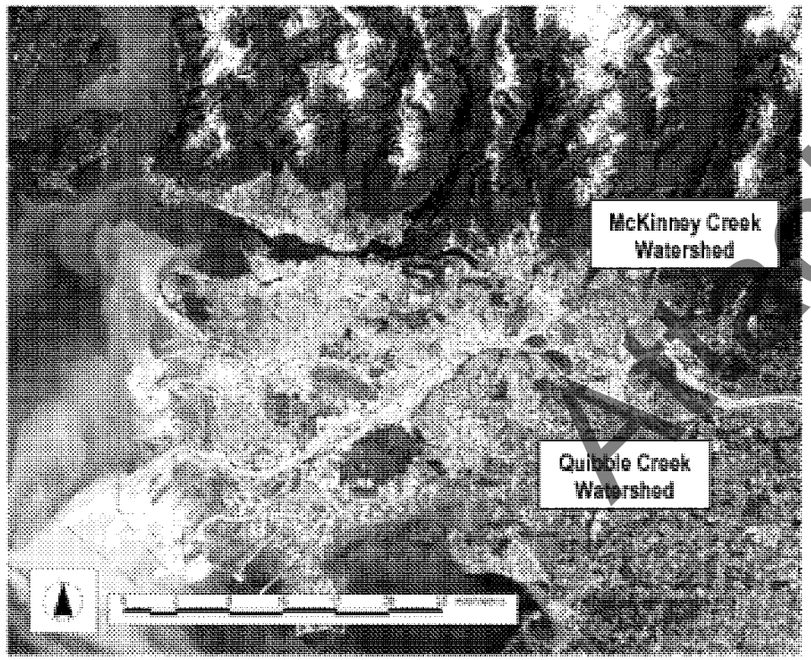


Figure 8-1 GVRD Case Study Watersheds

Indicators of Watershed Restoration

The watershed retrofit scenarios were evaluated based the following indicators of success:

- **Total runoff volume** - The primary watershed restoration target is to limit total runoff volume to 10% (or less) of total rainfall volume. This runoff volume target is based on the Water Balance of a healthy watershed (see Chapter 6).
- **Number of times the natural Mean Annual Flood (MAF) is exceeded** – The peak runoff rates from developed areas should only exceed the MAF that occurred under natural conditions about once per year, on average (more often during wet years). This runoff rate target is based on the hydrology of a healthy watershed (see Chapter 6).
- **Peak runoff rate from extreme rainfall events** – Reduction of peak runoff rates from extreme storms (e.g. from a 5-year storm) reduces watercourse erosion and flooding risk. Specific targets for flood risk management are highly watershed-specific.

The first two indicators show how well stream health is being restored, while the third provides an indication of how well flood risk is being managed over time.

Note that these are simply indicators of potential benefits. A more detailed evaluation of source control benefits for a particular watershed must consider the value of aquatic resources and the condition of drainage infrastructure throughout the watershed.

Without stormwater source control, land use densification, new development, and climate change will increase all of these indicators, resulting in watershed degradation.

Source Control Scenarios

The following source control scenarios were modeled using the Water Balance Model for each case study watershed, and evaluated relative to the three indicators of watershed restoration:

- **Scenario 1: Unmitigated** – Re-development is assumed to occur according to the standard practice of land development and stormwater management (i.e. no source controls applied).
- **Scenario 2: Unmitigated with Climate Change** – Same as Scenario 1, except that the anticipated effect of climate change on rainfall patterns is factored into the future scenarios.
- **Scenario 3: Absorbent Landscaping plus Infiltration Facilities** – For all future re-development projects, it is assumed that undeveloped areas are covered by absorbent landscaping (300 mm soil depth) and infiltration facilities are provided for all impervious surfaces (infiltration swales on all roads and bioretention facilities on all building lots). The size of infiltration facilities used for each land use type and road type were adjusted until the 10% runoff volume target was achieved or until the feasibility threshold was exceeded.
- **Scenario 4: Intensive Green Roofs plus Absorbent Landscaping plus Infiltration Facilities** – Same as Scenario 3, except that all re-developed multiple family and commercial buildings are designed with intensive green roofs (300 mm of soil depth). The runoff from green roofs is directed to infiltration facilities (sized as described in Scenario 3). All re-developed single family homes have impervious roofs connected to infiltration facilities. Intensive green roofs are not considered feasible for single family land uses.
- **Scenario 5: Rainwater Re-use plus Absorbent Landscaping plus Infiltration Facilities** – Same as Scenario 3, except that all re-developed buildings (including single family) incorporate rainwater re-use cisterns (300 m^3 of storage per hectare of rooftop, water re-used for toilets and washing machines). Overflow from the re-use cisterns is directed to infiltration facilities (sized as described in Scenario 3).

The cumulative hydrologic benefits (or impacts) associated with implementing these source control scenarios were modeled over a 50-year timeline.

Information and Assumptions Applied to Scenarios

The source control scenarios were modeled based on information and assumptions regarding:

- **Land use within the watersheds -** Local government staff (from the District of Maple Ridge and the City of Surrey) provided statistical data on the distribution of land use types within their respective watersheds. Surrey provided information on both existing zoning and future Official Community Plan zoning, which provided a basis for quantifying future land use change (densification). The site design characteristics for each land use type were estimated based on information on zoning bylaws and development standards (also provided by local government staff).
- **Expected timeframe for re-development –** For the McKinney Creek watershed, the age of existing development within the watershed was estimated based on discussion with the local government staff and field investigation. For the Quibble Creek watershed, the City of Surrey provided data showing the date of servicing for individual development parcels (a good approximation of building age). A 50-year re-development cycle was assumed for all watersheds.
- **Soil conditions –** There was limited soils information available for the case study watersheds. Conservative assumptions were made regarding the hydraulic conductivity of soils, which resulted in conservative findings regarding what is achievable using infiltration facilities.
- **Rainfall -** Rainfall data from the GVRD gauges closest to each case study watershed were used to simulate the performance of the source control scenarios. A year of continuous rainfall data from a very wet year (1999) was used to simulate the scenarios for each watershed.
- **Climate change -** Climate change scenarios were generated by applying climate change factors (developed by the Canadian Centre for Climate Modeling and Analysis) to the rainfall data for each watershed for a very wet year (1999).

Case Study #1: McKinney Creek Watershed, Maple Ridge

Land Use

The majority of land use in the 517 hectare McKinney Creek watershed (about 72%) is single family residential. With the exception of a small amount of housing in the northern portion of the watershed, most of this single family housing is relatively old (pre-1980s) with relatively low levels of lot coverage (around 30%). The remaining watershed area comprises some multi-family housing (about 8% of the watershed), some commercial land use along the highways (about 6%), and some other land uses (about 14%), including agriculture, schools and community parks.

Rainfall

Hourly rainfall data from GVRD rainfall gauge DM44 in Maple Ridge was used to simulate the performance of the source control scenarios. Rainfall data from a wet year was used (total annual rainfall = 1811 mm).

Soils Information

The available soils information included Geologic Survey of Canada mapping, and some soils mapping that was done in conjunction with a sub-surface drainage assessment (at a fairly coarse level). Based on this information, a conservative assumption was made that soils in the watershed have poor to medium hydraulic conductivity (around 6 mm/hr). There was little basis for estimating the variability of soil conditions throughout the watershed.

The District of Maple Ridge has reports that indicate the potential for fairly high water table conditions in a localized region of the watershed. The depth of all infiltration facilities was reduced to reflect this information.

Results

The primary form of re-development that is likely to occur over the 50-year time horizon in the McKinney Creek watershed is re-development of older (relatively low coverage) single family lots to higher coverage single family lots. This will likely be the result of larger homes and driveways being placed on existing lots and/or existing large lots being subdivided into smaller lots.

Figure 8-2 shows the difference in impervious coverage between a typical older single family development (on the left) and a typical newer single family development (on the right).

Without source control (Scenarios 1 and 2), this re-development is expected to increase total runoff volume, peak runoff rates, and the number of times the natural MAF is exceeded (see Figures 8-3a, 8-3b and 8-3c). The effects of climate change are likely to exacerbate the increase in runoff volume and rate.

Based on the stated assumptions, the 10% runoff volume target could be achieved with infiltration facilities and absorbent landscaping (source control Scenario 3) for all residential land uses, though not for commercial land uses. However, since commercial land uses represent a relatively small portion of the total watershed area, the application of infiltration facilities and absorbent landscaping could come very close to achieving the 10% runoff volume target at a watershed scale over the 50-year re-development cycle.

At the watershed scale, there would be little additional benefit gained by adding rainwater re-use or green roofs. The addition of green roofs could significantly improve the reduction in peak runoff rates from multiple family and commercial land uses. However, since most of the watershed is single family, this translates into a relatively small benefit at the watershed scale. Similarly, rainwater re-use would improve the reduction in runoff volume from commercial land uses, but this translates into a small benefit at the watershed scale.

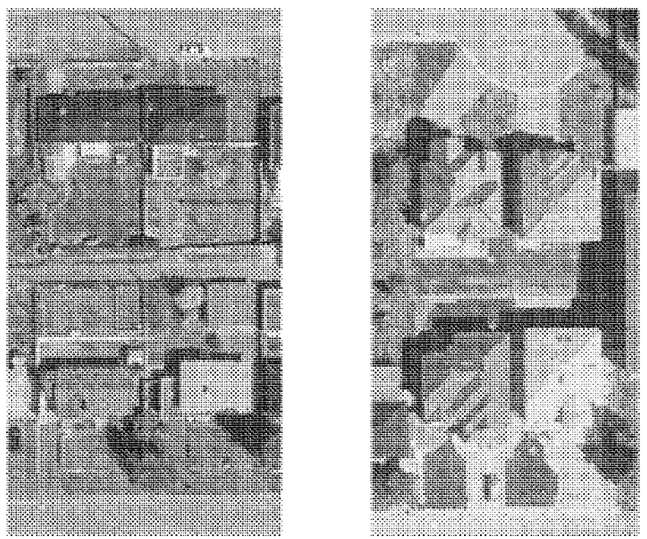


Figure 8-2:

Re-development impacts in the McKinney Creek watershed

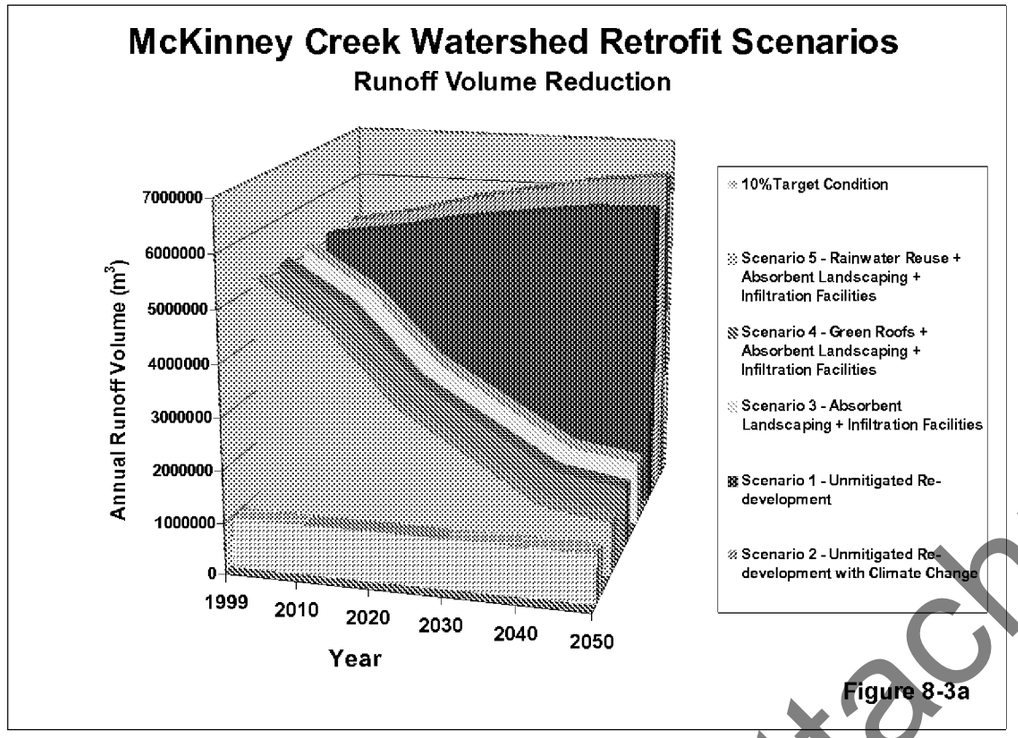


Figure 8-3a

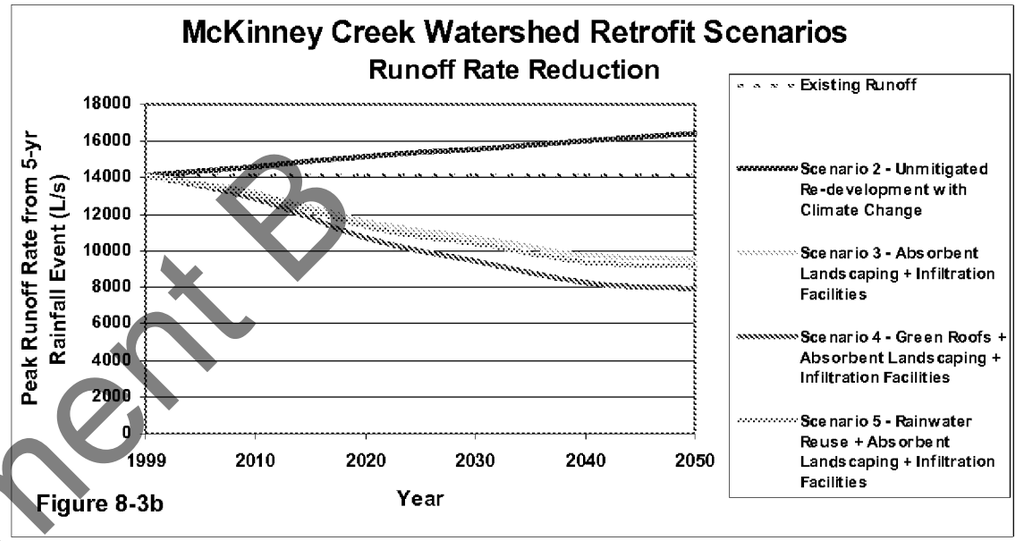


Figure 8-3b

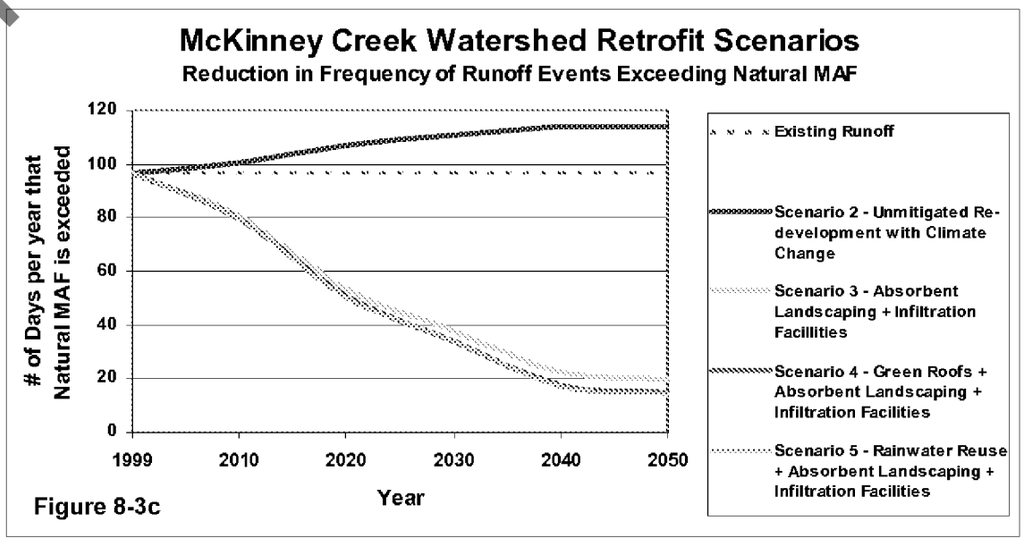


Figure 8-3c

Case Study #2: Quibble Creek Watershed, Surrey

Land Use

A substantial portion of land use in the 622 hectare Quibble Creek watershed (about 54%) is currently single family. A significant portion of the single family homes are relatively new (post-1980). The remaining watershed area comprises commercial land uses (about 20% of the watershed area), some multi-family housing (about 8%), and conservation areas (about 18%) that are not likely to develop in the future.

The City of Surrey's Official Community Plan calls for significant densification in the Quibble Creek watershed. About two-thirds of the existing single family housing in the watershed is expected to re-develop into multiple family land uses (a range of densities). The amount of commercial land is not likely to increase substantially, but existing local and community commercial land uses are expected to re-develop as higher-density town centre commercial.

Rainfall

Hourly rainfall data from GVRD rainfall gauge SU56 in North Surrey was used to simulate the performance of the source control scenarios. Rainfall data from a wet year was used (total rainfall = 1733 mm).

Soils Information

The only soils information available for the watershed was the Geologic Survey of Canada soils mapping (1:50,000 scale). This mapping shows about half of the watershed to be high conductivity soils and the other half to be low conductivity soils. Based on this information, a conservative assumption was made that soils have poor hydraulic conductivity (around 2.5 mm/hr). Aside from the coarse level GSC mapping, there was no basis for estimating the variability of soil conditions throughout the watershed.

Results

The primary impact of densification in the Quibble Creek watershed is likely to result from the re-development of single family land uses to multi-family land uses with higher impervious coverage (see Figure 8-4). Commercial densification also increases impervious coverage but to a lesser extent (even local commercial land uses have relatively high levels of impervious coverage).

Without source control (Scenarios 1 and 2), densification and the effects of climate change are expected to increase total runoff volume, peak runoff rates, and the number of times the natural MAF is exceeded (as shown in Figures 8-5a, 8-5b and 8-5c on the following page).

The 10% runoff volume target could be achieved with infiltration facilities and absorbent landscaping for all land uses except those with greater than about 80% impervious coverage (includes the highest density multi-family land uses and nearly all commercial land uses). At the watershed scale, the application of absorbent landscaping and infiltration facilities (i.e. Scenario 3) could reduce runoff volume to about 20% of total rainfall. In order to achieve the 10% target, it would be necessary to apply rainwater re-use to the high coverage land uses (i.e. Scenario 5).

Green roofs and rainwater re-use would have more significant runoff reduction benefits for the Quibble Creek watershed than for the McKinney Creek watershed (Case Study #1) because high coverage land uses (high density multi-family and commercial) represent a larger portion of the total watershed area. The benefits of rainwater re-use are most significant in terms of reducing runoff volume. The benefit of green roofs are most significant in terms of reducing peak runoff rates from extreme rainfall events.

Since much of the development in the Quibble Creek watershed is relatively new, the opportunity to apply source control to re-development projects is likely limited in the short term (over the next 10 years).

Figure 8-4:

Projected densification in Quibble Creek watershed

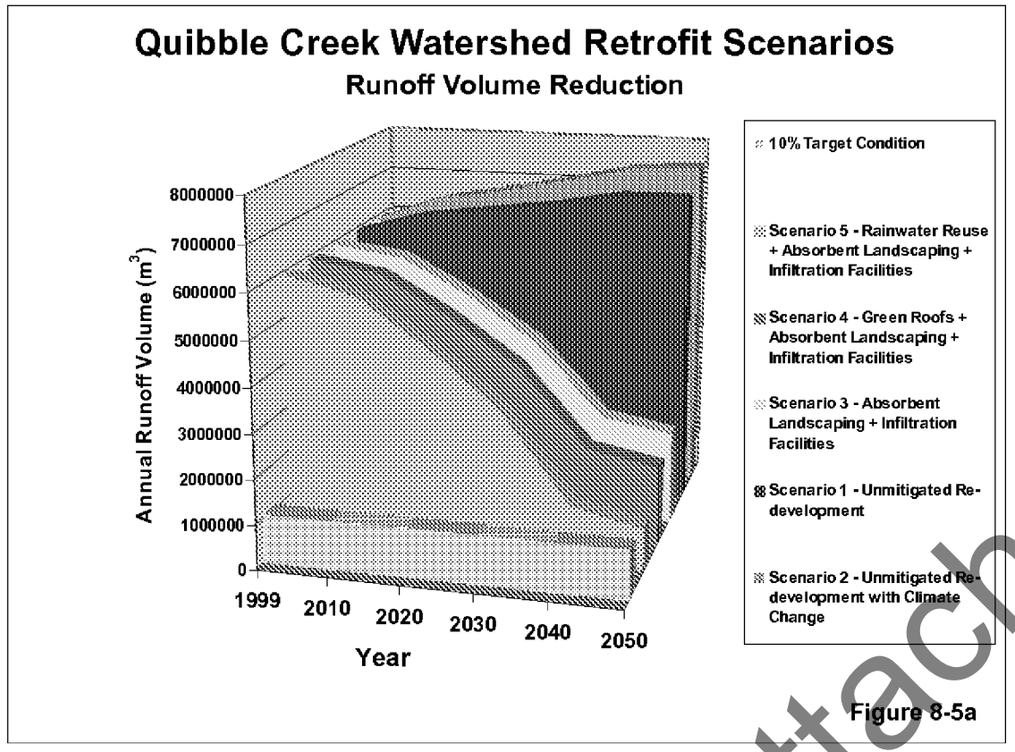


Figure 8-5a

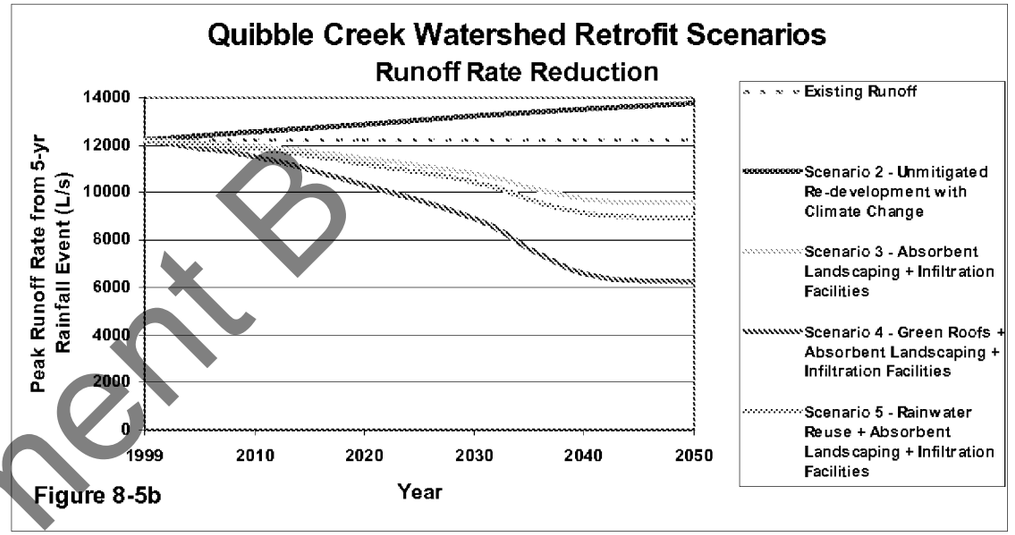


Figure 8-5b

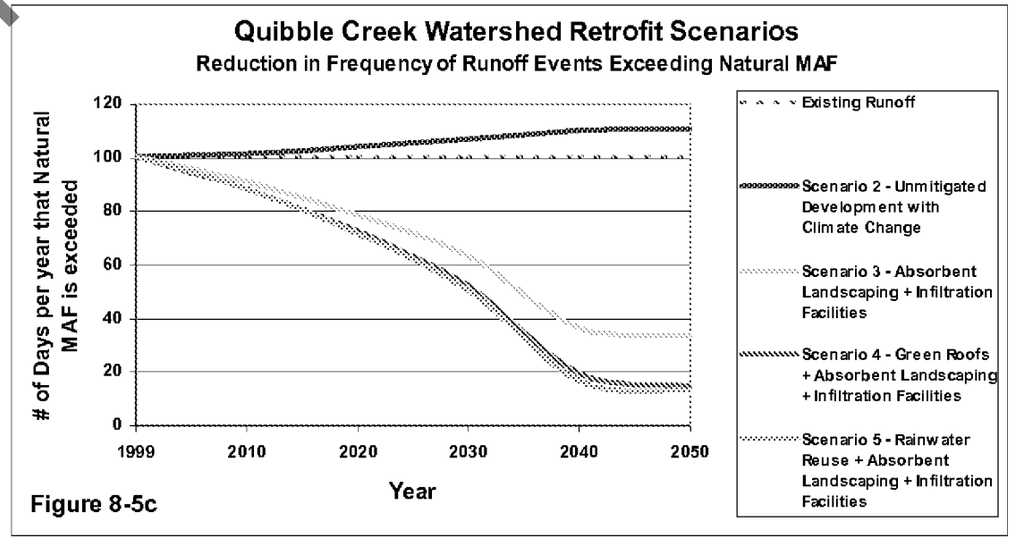


Figure 8-5c

8.3 Achieving Watershed Protection or Restoration

Widespread application of stormwater source control is needed to protect or restore watershed health. This will require changes to the standard practice of land development and stormwater management.

The details of these changes will vary from one watershed to the next. Watershed-specific source control strategies should be developed through the ISMP process (see Chapter 10) based on an assessment of watershed-specific opportunities and constraints.

The core objective is to identify options to change the way that land is developed and re-developed, so that people, property and natural systems can be better protected; and over time, stormwater infrastructure can be managed more efficiently and watersheds can be protected or restored.

Changing Development Standards

An ISMP may identify the need for changes to development standards and regulations in order to implement a watershed-specific source control strategy. The level of support from the public and from all levels of government, as well as the ability of the development community to adapt to new standards, will set the pace of change and influence the pace of ISMP implementation.

This support can only happen if there is a broad understanding among all players, the development community in particular and public in general, about the changes in standard practices - why they are needed, what they are, and how they can be practically accomplished.

Facilitating Stormwater Source Control Applications

The first large-scale applications of stormwater source controls and supporting policies may be implemented as demonstration projects. Local governments (independently or collectively) will need to take the lead in implementing and monitoring these initial demonstration projects (e.g. public works projects, neighbourhood concept plans, progressive ISMPs).

Local government leadership is important for demonstrating to developers, the community and senior government regulators that proposed actions at the site level are both effective and affordable. This will build support for the regulatory, professional and industry changes that will enable the realization of long-term stormwater infrastructure planning and management.

Monitoring demonstration projects provides the foundation for adaptive management. The goal is to learn from experience and constantly improve land development and stormwater management practices. Hydrologic monitoring is fundamental to adaptive management, since it is the hydrologic indicators that provide the information needed to improve the way we develop land and manage stormwater at the site level.

In order to build and maintain trust between local governments, landowners, developers and senior government agencies, the rules of adaptive management must be established at the ISMP stage. These rules must define requirements and consequences of monitoring. In many instances, either prior to or concurrent with the first demonstration projects, there will be a need to change current standards and administrative processes to accommodate these new standards. The following steps will facilitate this process of change:

- **Step 1 - Establish an enabling regulatory framework** – Make regulatory changes that will facilitate the approval process for development and re-development projects that capture rainfall at the source for infiltration, evapotranspiration and/or re-use.
- **Step 2 - Ensure that new design standards reflect local conditions** - Through the implementation and monitoring of demonstration projects, establish the design options for source control that will be most effective in the context of site-specific conditions (i.e. soils, precipitation, planned land use, etc).
- **Step 3 - Adopt a collaborative approach to change** – Consult with citizens and the development industry to determine:
  - preferred design options for stormwater source control
  - appropriate implementation strategies for regulatory change
  - appropriate financing strategies for rainfall capture and runoff control

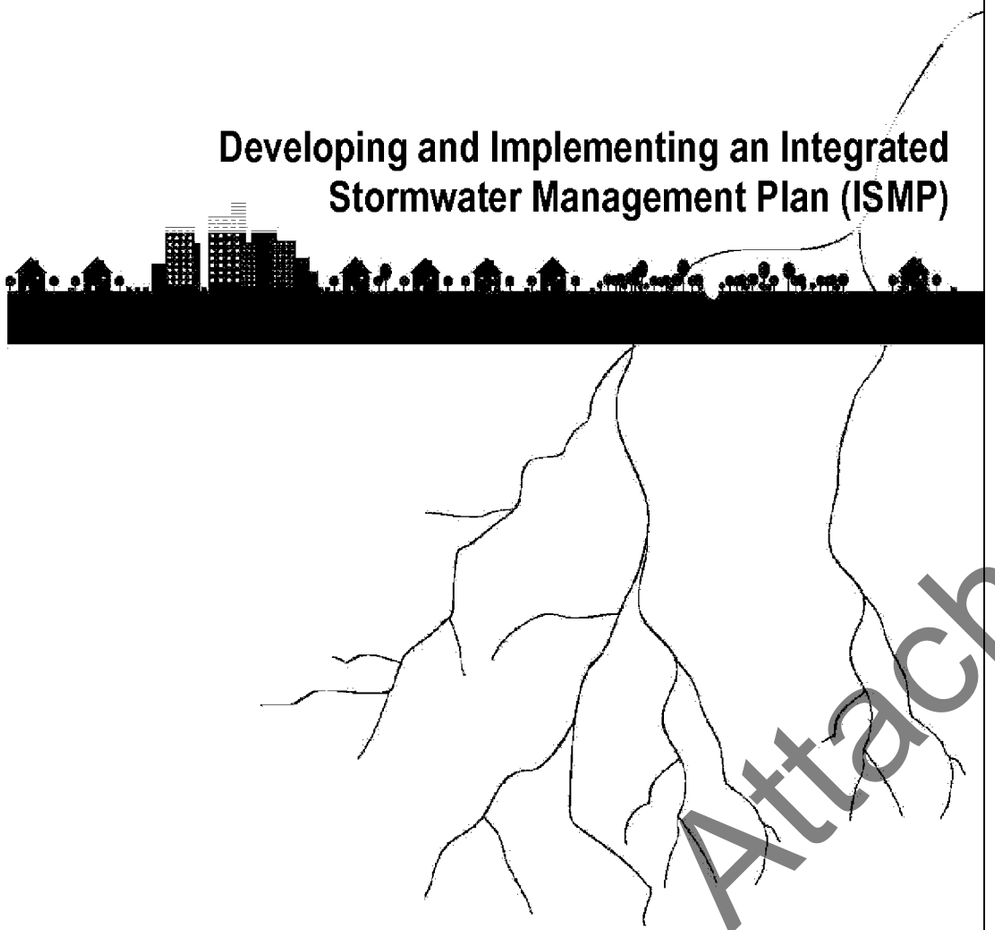
- **Step 4 - Incorporate the most effective and acceptable design options into engineering standards -** Revisions to engineering standards should reflect local conditions as well as the preferences of the community and the development industry. Although new engineering standards for source controls can be incorporated into the relevant development regulations (Subdivision Bylaws, Building Bylaws, Zoning Bylaws, Development Permit Guidelines), it is also possible that standards could be performance-based, leaving the determination of appropriate source control strategies to the proponent as part of their development application.

- **Step 5 - Make the details of new design standards readily available -** Create a technical manual of options for on-lot stormwater source control, including details and specifications of design standards, and make it available on-line.

- **Step 6 - Facilitate procurement of materials needed to implement new design standards -** Implement a bulk purchase/re-sale program that makes it easy and affordable for developers to obtain the specialty products needed to implement stormwater source control. Also, provide a cheap source of material for absorbent soils through a local government composting program.

- **Step 7 - Build support through education -** Implement education programs to inform city staff, the development community and the general public about the need for changes in development practices and how to implement them.

In summary, these seven initiatives form the basis for a developing an action plan (see Chapter 9) which provides a framework for removing barriers and reaching the target condition for a watershed over a period of years.



Developing and Implementing an Integrated Stormwater Management Plan (ISMP)

Chapter Nine

9.5 Step #3: Develop Objectives and Alternative Scenarios

- ❑ Developing a Shared Vision
- ❑ Identify Alternatives and Make Choices
- ❑ Case Study Example: Scenarios for Stoney Creek ISMP
- ❑ Case Study Example: Evaluate Scenarios and Make Choices
- ❑ Using Performance Targets to Quantify Watershed Objectives
- ❑ Modeling Alternative Scenarios

9.6 Step #4: Collect Meaningful Data and Refine Scenarios

- ❑ Be Strategic When Investing In Data Collection
- ❑ Data on Soils and Groundwater
- ❑ Data on Drainage Facilities
- ❑ Data on Fish and their Habitats
- ❑ Water Quality Data
- ❑ Sources of Data

9.7 Step #5: Evaluate Alternatives and Develop Component Plans

- ❑ Habitat Enhancement Plan
- ❑ Flood Risk Mitigation Plan
- ❑ Land Development Action Plan
- ❑ Adding the Dimension of Time

9.8 Step #6: Develop An Implementation Program

- ❑ Financial Plan and Implementation Program

9.9 Step #7: Refine Through Adaptive Management

- ❑ Defining the Rules of Adaptive Management
- ❑ Adaptive Management Roles and Responsibilities
- ❑ Types of Monitoring
- ❑ The Role of Effectiveness Monitoring
- ❑ Managing Drainage from an Ecological Perspective

9.10 Synopsis of the Seven-Step Process for ISMP Development and Implementation

- ❑ Build the Vision, Create a Legacy

9.1 Overview of ISMPs

The focus of Part B was on developing integrated solutions at the site level, where the source of stream degradation and flooding problems can be eliminated. The purpose of this chapter is to:

- Show how these site level solutions fit in to a larger watershed context, and are complemented by a range of other watershed protection and flood risk management tools.
- Provide a framework for developing an ISMP. This framework is adapted from a range of BC case study experiences.

In general, an ISMP process must address the following fundamental question:

- How can the ecological values of stream corridors and receiving waters be protected and/or enhanced, and drainage-related problems prevented, while at the same time facilitating land development and/or redevelopment?

Objectives of an ISMP

The objectives of an ISMP will be watershed-specific, but will generally encompass the following:

- **Drainage Objectives** - Alleviate existing and/or potential drainage, erosion, and flooding concerns.
- **Stream Protection Objectives** - Protect and/or restore stream health, including riparian and aquatic habitat.
- **Water Quality Objectives** - Remediate existing and/or potential water quality problems.

The ISMP focus is on the integration of stormwater management and land use planning. An ISMP is an integral component of a local government's land development and growth management strategy because upstream activities (land use change) have downstream consequences (flood risk and environmental risk).

Elements of the ISMP Process

This chapter presents a process for developing an ISMP for a watershed and its constituent drainage catchments. Through this process, watershed stakeholders collectively answer the questions listed below and illustrated as Figure 9-1:

- ***"What do we have?"*** - understanding the watershed issues
- ***"What do we want?"*** - setting achievable performance targets
- ***"How do we get there?"*** - developing an ISMP implementation program

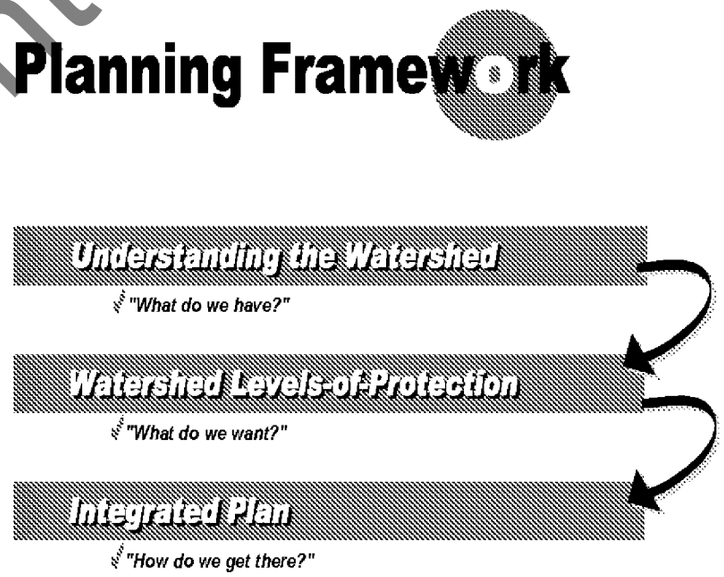


Figure 9-1

Layered Approach to Developing an ISMP

Figure 9-2 conceptualizes the building blocks that are the essence of an integrated approach to stormwater management. It was originally developed to guide an ISMP process for the City of Kelowna.

Figure 9-2 also illustrates how the bridge is built between environmental goals (as defined by community expectations and legislative initiatives) and a stormwater management and stream stewardship strategy (as defined by an ISMP). This involves a layered approach:

- **First Layer** – Identify the stormwater-related objectives for a watershed (e.g. protection of aquatic resources, protection of life and property, protection of water quality). These objectives define what the ISMP is striving to achieve.
- **Second Layer** – Develop strategies to achieve the watershed objectives. This includes setting performance targets to guide selection of site design solutions.
- **Third Layer** – Implement appropriate site design solutions (e.g. source controls) for achieving performance targets that suit local objectives and conditions.

To select appropriate stormwater management strategies and site design solutions, it is first necessary to identify the resources to be protected, the threats to those resources, and the alternative management strategies for resource protection. The foundation for this approach is found in the At-Risk Methodology presented in Chapter 5.

ISMP Technical Products

An ISMP includes three core deliverables or 'technical products' – an inventory, component plans, and an implementation program - as shown in the table part of Figure 9-2. These technical products were introduced in Chapter 4.

The distribution of effort among the three products should be balanced. Often effort is concentrated on the inventory phase, and not enough effort is invested in the elements of an implementation program. The best plan, without a sound implementation program, can result in watershed conditions getting worse with time rather than better.

The remainder of this chapter presents the process for developing and implementing an ISMP for either a watershed or its component drainage catchments.

Political Commitment to the ISMP Process

If site level solutions are to successfully fit into a larger watershed context, political will and commitment are essential inputs at two critical points in the ISMP development process:

- **Launching the ISMP Process** – Unless there is a political buy-in to do things differently, the process will not be effective.
- **Implementing the ISMP Action Plan** - Political will is crucial if there is to be a move from planning to action.

Integrated solutions transcend technical analyses. This chapter discusses how to secure political support and commitment to first develop and then implement an ISMP. Looking ahead, Chapter 11 elaborates on the ingredients for building consensus and creating change.

Community Expectations and Legislative Initiatives

Community expectations and legislative initiatives provide the driving force for political action to launch the ISMP process. Community expectations are reflected in both an Official Community Plan and a Liquid Waste Management Plan. This is the first building block as shown in Figure 9-2.

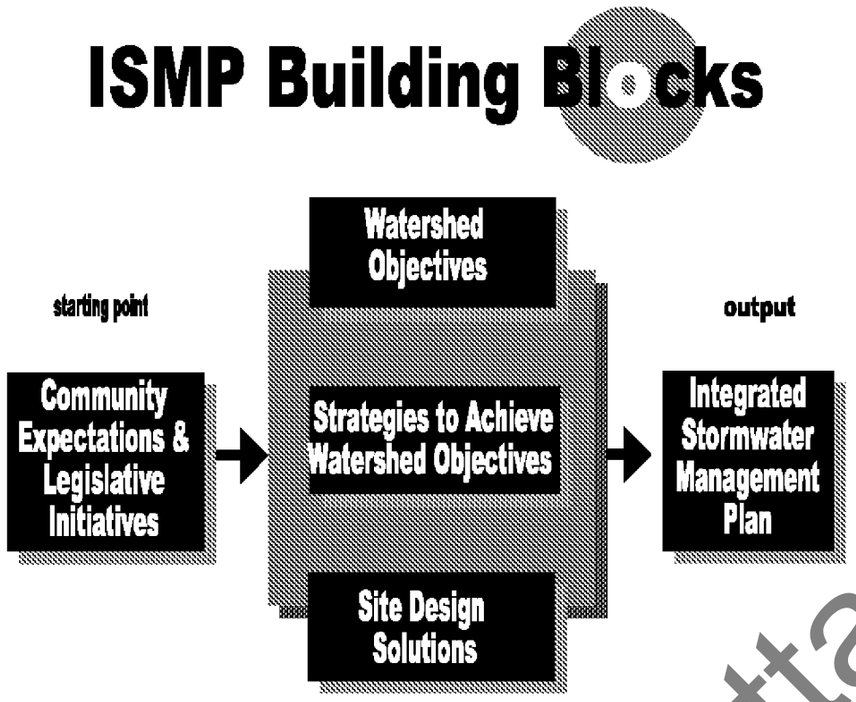


Figure 9-2

ISMP DELIVERABLE	SCOPE OF DELIVERABLE
An inventory of the physical and biological systems	• streams, rivers, and drainage systems • wetlands, ponds and lakes • infiltration areas and aquifers • land use information • flooding and erosion problem areas • water quality problems
Component plans to protect key resources, resolve identified problems, and accommodate development	• plan for integrating appropriate source controls with land development, including a description of any required regulatory changes • plan for improvements to drainage systems and stream reaches • plan for ongoing data collection and monitoring • cost estimates for all planned actions
An implementation program	• administration • projects, phasing and budgets • financing mechanisms • community education • maintenance activities, standards and schedules • performance monitoring

Case Study Example: GVRD Template for ISMPs

The Greater Vancouver Regional District (GVRD) has developed a *Terms of Reference Template for Integrated Stormwater Management Planning* (2002) to provide a standardized process that includes all of the key stormwater components. These are listed in Table 9-1, and are categorized in terms of three disciplines – engineering, planning and environmental. The work effort is organized as four phases:

- Information Gathering (15 tasks)
- Analysis (9 tasks)
- Alternatives (6 tasks)
- ISMP (5 tasks)

A municipality can decide which components are applicable, and establish the level of effort required based on risk and local conditions. Not all of the components may be relevant for a given watershed or drainage catchment.

Table 9-1: ISMP Components (from GVRD Template)

		ISMP Component	Code*
Information Gathering	1	Establish Framework	I
	2	Mapping/Information Gathering	I
	△	Stakeholder/Public Notification & Consultation	S
	3	Hydrometric Data Collection	E1
	4	Drainage System Inventory	E1
	5	Hydrogeology/Geotechnical Assessment	E1
	6	Land Use Information	P
	7	Agricultural Lands	P
	8	Recreation Opportunities & Public Access	P
	9	Biophysical Inventory	E2
	10	Riparian Corridor Assessment	E2
	11	Wildlife Assessment	E2
	12	Benthic Community Sampling	E2
	13	Water Quality Analysis	E2
	14	Baseplan Mapping	I
	15	Existing Stormwater Program	I
Analysis	16	Hydrological Analysis (Tool 1)	E1
	17	Hydraulic Analysis (Tool 2)	E1
	18	Channel Erosion	E1
	19	Agricultural-Upland/Lowland Analysis	E1
	20	Natural Hazard Assessment	E1
	21	Land Use Sensitivity Analysis	P
	22	Recreation & Public Access Analysis	P
	23	Environmental Parameters	E2
	24	Ecological Health Analysis (Tool 3)	E2
Alternatives	25	Flood/Erosion Management Alternatives	E1
	26	Land Use Alternatives	P
	27	Stormwater Management Alternatives	E2
	28	Water Quality Alternatives	E2
	29	Evaluate Alternatives	I
	30	Stormwater Program	I
	△	Stakeholder/Public Consultation	S
ISMP	31	ISMP	I
	32	Implementation Strategy	I
	33	Integrate with Other Municipal Master Plans	I
	34	Develop Adaptive Management Program	I
	35	Draft/Final Report	I
	△	Stakeholder/Public Consultation	S

***Legend of Codes for ISMP Components**

E1	=	Engineering item
P	=	Planning item
E2	=	Environmental item
S	=	Stakeholder/Public Process
I	=	Integration of all disciplines

9.2 Process for Developing and Implementing an ISMP

Figure 9-3 illustrates a seven-step process for developing and implementing an ISMP. The objective is to reach the target condition over time. This process is based on a proven approach to decision making for complex issues. This process underpinned the four ISMP case studies introduced in Table 1-1.

The first six steps ultimately lead to implementation of integrated solutions for a watershed. These steps are described in Sections 9.3 to 9.8. Overcoming barriers in order to get from Step #5 to Step #6 is described in the context of moving from planning to action.

In Step #7, the ISMP process is revisited in a greater level of detail to validate and refine the integrated solutions. Step #7 will involve successive cycles of adaptive management over time. This step is discussed in Section 9.9.

Case Study Example: Brunette Basin Plan and the Stoney Creek ISMP

The Stoney Creek ISMP established a British Columbia precedent for application of all steps in the seven-step process to move from planning at the watershed scale to action at the site level. This was a pilot project that was completed in 1999 as part of the GVRD's Brunette Basin Plan (reference: Table 1-1). Success at each level has been accomplished through a working session process that resulted in a shared vision of what is achievable, both in the short-term and over the long-term.

Develop a Shared Watershed Vision

The Brunette River is an inter-municipal waterway that is managed by the Greater Vancouver Region District. It receives runoff from five cities: Vancouver, Burnaby, New Westminster, Coquitlam, and Port Moody.

The Brunette River Basin Plan was developed through an inter-municipal pilot process for consensus-based watershed planning in the Greater Vancouver Region. All five municipalities agreed to the vision, goals and objectives for catchments within the Basin. To determine how to achieve the shared watershed vision, the Stoney Creek catchment was selected as a pilot program for ISMP development.

Selecting an At-Risk Drainage Catchment

Stoney Creek was selected for three reasons: it has the highest value aquatic resources; these resources are at risk due to pending residential development in the Burnaby Mountain headwaters; plus it has an active and proactive streamkeeper group. The Stoney Creek pilot program was also directed by an inter-municipal and inter-agency Steering Committee.

The purpose of the pilot program was to test the principles of a watershed-based approach to integrating stormwater and riparian corridor management. The Stoney Creek process resulted in a philosophy and hydrologic criteria for watershed protection and restoration over a 50-year timeline. By consulting the streamkeeper group and applying their expert knowledge, an aquatic habitat rating was established for each creek reach. The critical reaches drove selection of the plan elements for stormwater management.

Protect the Natural Water Balance at the Site Level

A high-density urban community for 10,000 people is being built at the top of Burnaby Mountain, the headwaters of Stoney Creek, over a 20-year period. Hence, this is where early action has been focused to blend policy, science and site design. The resulting *Burnaby Mountain Watercourse and Stormwater Management Plan* (2002) is a pilot project for stormwater volume reduction at the source. The Plan has been developed under the umbrella of an inter-agency advisory committee. The Plan:

- translates the Stoney Creek vision and hydrologic criteria into performance targets and design criteria that are being applied at the neighbourhood level
- translates the performance targets and criteria into specific stormwater management and site design practices

The performance of the Burnaby Mountain stormwater management system will be monitored as development proceeds. In this way, stormwater management and site design practices can be improved for future development within the Brunette Basin, and elsewhere.

Step	Description and Scope
1	**Secure Political Interest and Support** ❑ Inter-departmental & inter-agency steering committee ❑ Political and public support ❑ Stakeholder focus groups
2	**Frame the Watershed Problems and Opportunities** ❑ Assemble existing information ❑ Identify and prioritize problems (knowledge-based approach)
3	**Develop Objectives and Alternative Scenarios** ❑ Establish desired levels of environmental protection and other objectives ❑ Set appropriate performance targets ❑ Model alternative scenarios for achieving targets
4	**Collect Meaningful Data and Refine Scenarios** ❑ Collect data needed to: ▪ refine scenario models ▪ evaluate effectiveness and affordability ▪ e.g. hydrometric data, soils data
5	**Evaluate Alternatives & Develop ISMP Component Plans** ❑ Land Development Action Plan ❑ Habitat Enhancement Plan ❑ Flood Risk Mitigation Plan
6	**Develop an Implementation Program** ❑ Finance and implement ISMP actions
7	**Refine Through Adaptive Management** ❑ Define adaptive management rules, roles and responsibilities ❑ Constantly improve integrated solutions

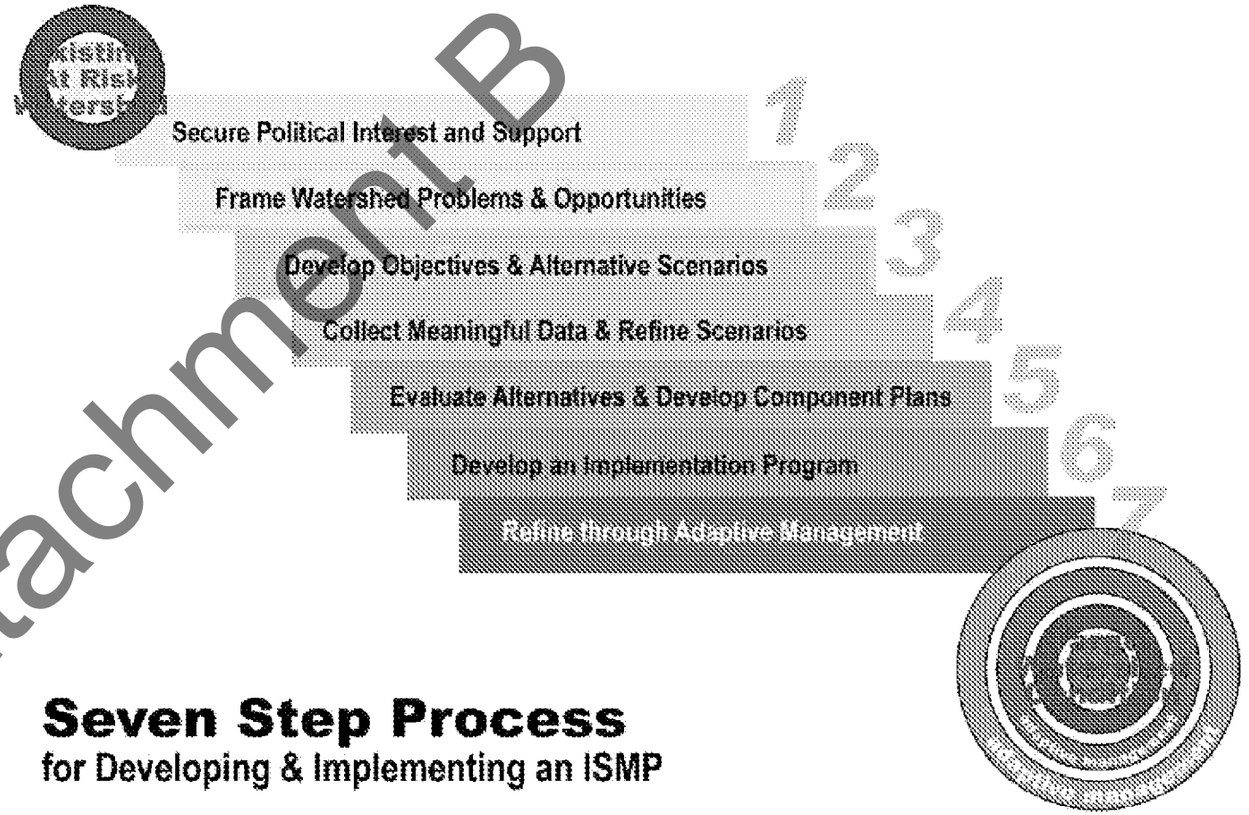


Figure 9-3

9.3 Step #1: Secure Political Interest and Support

An ISMP process starts with a high-level political commitment to protecting property, water quality and aquatic habitat. This policy commitment is made through an over-arching OCP and/or LWMP. Step #1 in the actual ISMP process is to convert high-level policy statements into concrete action so that there will be a flow of funding for the ISMP process.

To accomplish this objective requires a different level of political support, especially when there are multiple watersheds and the financial commitment is multi-year. Without political support for funding, there will be no ISMP process. Once funding is assured, however, a key to a successful outcome is that there be a commitment by all stakeholders to make the ISMP process work.

Framework for ISMP Process

Before elected officials can be expected to commit to a long-term investment in an ISMP process for multiple watersheds, local government managers must be able to provide a clear and convincing case that answers four questions:

- Why do it?
- What will it cost?
- What are the benefits?
- Why should this take priority over other community needs?

These questions are best addressed through front-end development of an over-arching or framework document that:

- Defines a drainage planning philosophy
- Formulates a set of supporting policy statements
- Establishes design criteria to achieve the policies

This approach provides elected officials with an informed basis for making the decision to fund and proceed with the first ISMP (Step #2). The purpose of the over-arching document is to demonstrate to elected officials that there has been stakeholder input, that stakeholders have endorsed the process, and that stakeholder input is reflected in the policy content.

Case Study Example: City of Chilliwack Surface Water Management Manual

The City of Chilliwack has developed a *Policy and Design Criteria Manual for Surface Water Management* (2002) that serves two purposes:

- **At the Watershed Scale** - Provides a comprehensive framework that will guide the development of individual ISMPs over a multi-year period.
- **At the Neighbourhood and Site Scales** - Provides land developers with specific direction in undertaking the stormwater component of sustainable urban design.

The Manual was developed and vetted through an inter-departmental and inter-agency process that also included community participation. It took nine months to complete, and culminated with an interactive session with Chilliwack City Council.

The Manual presents key information that elected officials, City staff, and land developers need in order to understand and implement the City's approach to stormwater management. The Manual includes a five-year Action Plan for removing barriers and undertaking ISMPs.

Case Study Example: Regional District of Nanaimo Action Plan

Chapters 4 and 5 described how the stormwater component of the Regional District of Nanaimo's (RDN) Liquid Waste Management Plan was developed through a roundtable process. This resulted in a five-year Action Plan for gradual phase-in of stormwater management.

At the end of the five-year period, the RDN will have developed a clear understanding of appropriate stormwater management approaches that are customized to the local environment and are acceptable the development community.

The objective of the RDN is to take small steps that build community and political support for undertaking ISMPs. It is proposed that a pilot ISMP be completed in year four.

Time-Frame for Launching an ISMP Process

The RDN timeframe is consistent with the experience of Chilliwack and other communities. It typically takes 3 to 5 years of sustained effort for local government to generate the momentum needed to launch a new program. In part, this reflects the budget cycle. When a need is first identified, it may take a year or two to obtain initial funding. There are often delays in funding subsequent steps in the process.

Communicating Relevant Information to Elected Officials

Securing political approval and commitment to proceed to Step#2 requires that the need for action be communicated in clear and concise terms. Presented below is an example of a single page synopsis of the supporting rationale for a Resolution by Council to adopt an Action Plan that will guide City of Chilliwack staff for the next five-year period.

Case Study Example: City of Chilliwack Staff Report

- **Manage the Complete Spectrum of Rainfall Events** – The City's approach to stormwater management is evolving, from a reactive approach that only dealt with the consequences of extreme events, to one that is proactive in managing all 170 rainfall events that occur in a year. The objective is to control runoff volume so that watersheds behave as though they have less than 10% impervious area.

  Reducing runoff volume at the source – where the rain falls - is the key to protecting property, habitat and water quality.

- **Five-Year Action Plan for Integration of Stormwater Management and Land Use Planning** – In 2000, Council accepted a Process Flowchart and Timeline for moving forward with master drainage planning. The Manual is a milestone in that process. It identifies and organizes the actions required over the next five years to achieve the City's stormwater management objectives.

  Implementation of regulatory change should proceed on a phased-in basis, with ISMPs providing a mechanism to study, test and adapt proposed regulations to suit the range of needs and conditions in Chilliwack.

- **Submission Requirements for Land Development Projects** – To provide clarity and conciseness regarding the City's expectations and requirements for subdivision design, the Manual defines the technical information that land developers must submit to the City in order to obtain development approvals. The Manual also includes Design Guidelines that illustrate how to comply with performance targets for stormwater source control, detention and conveyance.

  Having a comprehensive checklist will help proponents think through the drainage details of project implementation, and will ensure consistency in the way information is presented for review and evaluation by the City.

Leadership and Inter-Departmental Commitment

Leadership is established through the formation of a Steering Committee that has inter-departmental representation. Also, there must be a champion within local government (refer to Chapter 11) to provide the energy and organizational drive needed to move the ISMP process through the various steps.

The integration of disciplines and departmental objectives must be the beginning and foundation of any ISMP. Only then should each discipline focus on its specific analytical skills and tools.

The objective is to benefit from the synergies that result from brainstorming and the sharing of interdisciplinary perspectives. Thus, it is important to create an atmosphere that is conducive to free thinking and open discussion.

Too often the reverse is used where disciplines work independently, and at best integration becomes merely a lateral process or something added at the end to appease stakeholders.

Stakeholder Involvement

Because of the implications for land use planning and aquatic habitat, senior government agencies and other affected stakeholders need to be represented in the ISMP development process. Chapter 11 elaborates on how to involve stakeholders in a Focus Group so that they can contribute to development of integrated solutions.

Looking ahead to Chapter 11, the stakeholder involvement process is described as the second track in a 'Two-Track Approach' because technical analysis feeds into working sessions with the Steering Committee and Focus Group.

9.4 Step #2: Frame the Watershed Problems and Opportunities

Step #2 is critical. This involves application of an interdisciplinary roundtable process (refer back to Chapter 5) to identify and rank the problems and opportunities in a watershed. Sufficient time must be invested at this stage to ensure that there is a clear understanding of the problems to be solved. This understanding will then guide the rest of the ISMP process.

All too often, technical people go directly to Step #4 (Collect Data) without first asking what they are trying to accomplish, and why. As a result, they solve the wrong problem, and then wonder why elected officials and/or the public takes issue with the proposed solution.

Applying a Knowledge-Based Approach

It is important to identify where problems are in relation to areas where future land use change is likely (new development or re-development), because land use change can:

- create or exacerbate stormwater-related problems (e.g. degrade aquatic resources or increase flooding risk)
- present opportunities to restore stream health, improve water quality, or reduce drainage-related problems through the application of source controls

The knowledge-based approach described in Chapter 5 should be applied to determine what the existing and/or potential problems and issues are in a watershed, and the level of concern related to these problems and issues.

Existing knowledge and information about a watershed should be adequate to determine where in the watershed there are general indicators of existing or potential problems, such as:

- flood hazards
- stream channel erosion
- aquatic habitat degradation
- water quality deterioration

The roundtable approach relies on the knowledge of local residents and key experts (from the planning, ecology and engineering disciplines), combined with a local government's existing information on land use, aquatic resources and drainage systems.

Making Use of Available Information

Available information can and should be used to provide a better understanding of the watershed. The following information is useful in helping to define the watershed issues and frame the problems:

- **Watershed Base Map** - the first building block
- **Watershed Issues Summary** - where and what are the identified problems
- **Sensitive Ecosystem Inventory** - what is to be protected
- **Land Use Map** - what are the existing and future generators of runoff
- **Drainage System Inventory** - how the conveyance system functions
- **Concurrent Rainfall and Streamflow Data** - how the watershed responds to rainfall
- **Soils and Groundwater Maps** – where might infiltration be feasible

The foregoing are the core deliverables resulting from Step #2. This set of graphics provides a picture of the watershed. Visual presentation helps develop a common understanding among ISMP participants. Section 9.5 explains why this is so.

All available information should be assembled at this stage to help frame the problems, but further investment in data collection should not be made at this stage. Once watershed objectives and catchment-specific performance targets are established (see Step #3), the investment in data collection can be directed where it will be most useful and effective. Data collection is discussed in depth in Step #4.

Broad-Brush Ranking of Issues

In Step #2, the approach is broad-brush. The objective is to create understanding and an intuitive feel for conditions in the watershed. This will then guide follow-up investigations that achieve greater levels of detail where it is required.

An outcome of Step #2 should be a preliminary ranking of watershed issues. This ranking would reflect a generalized assessment of questions such as: Is flooding the dominant concern? Or is it aquatic habitat degradation? Is water quality a real or perceived problem? Where can existing and/or potential problems be turned into opportunities?

Case Study Examples: Creating a Picture of Stream Habitat Conditions

The evolving science of stormwater management has broadened the traditional engineering approach to one that integrates flooding and aquatic habitat concerns. Whereas flooding and erosion problems are normally obvious to all, habitat concerns can be subtle in nature. Hence, assessing aquatic habitat at an overview level is a key part of framing the problems in a watershed. This helps to focus subsequent effort.

The Bear Creek and Stoney Creek case studies introduced in Table 1-1 resulted in development of a five-task process for creating a reach-by-reach picture of aquatic habitat conditions. This process applies the knowledge-based approach described in Chapter 5, and goes to another layer of detail in assessing conditions reach-by-reach. The desired outcome is a mapping tool that serves two purposes - planning and communication.

- **Task #1 - Develop an Ecosystem Overview:** Review all existing biophysical information for stream corridors.
- **Task #2 – Identify and Fill Critical Data Gaps:** Fill any critical information gaps with a reconnaissance inspection of specific locations or reaches.
- **Task #3 – Create a Planning Tool:** Prepare an overview map of the stream that identifies spawning and rearing habitat and highlights aquatic habitat concerns related to readily apparent sedimentation and erosion, barriers to fish movement and point sources of pollution.
- **Task #4 - Prioritize Ecosystem Values:** Convene a workshop for individuals with practical, hands-on experience in the watershed to refine the stream map and build consensus on stream corridor and/or aquatic habitat values and threats.
- **Task #5 - Integrate Ecosystem Values:** Analyze and integrate the habitat and fisheries constraints with the engineering requirements and a land use map that breaks the stream into reaches for stormwater planning.

Task #4 is pivotal as it provides the foundation for the habitat component of an ISMP. To build local government commitment and secure financial support for habitat protection and/or enhancement initiatives, it is first necessary to demonstrate what is to be protected, and why.

9.5 Step #3: Develop Objectives and Alternative Scenarios

Step #3 involves further application of the interdisciplinary roundtable process to:

- determine which problems and/or opportunities are priorities for action
- establish objectives for dealing with these priority problems/opportunities
- develop alternative scenarios for achieving the objectives

Developing a common understanding among participants in the ISMP process is key to developing a shared vision of what is desirable, practical and achievable.

Developing a Shared Vision

People typically learn best in one of three ways: either by seeing, by hearing or by doing. Hence, it is important to use a variety of communication techniques to ensure clarity of understanding. Looking ahead, Chapter 11 elaborates on this topic. In general, a common understanding is achieved in a workshop setting by:

- illustrating concepts through the use of graphics
- guiding individuals to blend concepts with their own experience

The graphic presented on Figure 9-4 translates scientific findings on the impacts of land use change into a decision making tool for stormwater goals and objectives. It illustrates the consequences for stream corridor ecology of various attitudes towards stormwater management.

Figure 9-4 was at the heart of the stakeholder visioning process for all four ISMP case studies introduced in Table 1-1. Participants were provided with clear visual choices regarding a desired ISMP outcome.

To reach consensus on a shared vision of what is desirable and achievable for watershed protection, ISMP participants need a picture of what a stream corridor could and/or should look like. Figure 9-4 fulfils this need. The visioning process boils down to whether or not a stream corridor will have a functioning aquatic ecosystem.

ALTERNATIVE VISIONS FOR THE LONG-TERM ENVIRONMENTAL HEALTH OF STREAM CORRIDORS

Conceptual Framwork for Selection of ISMP Level

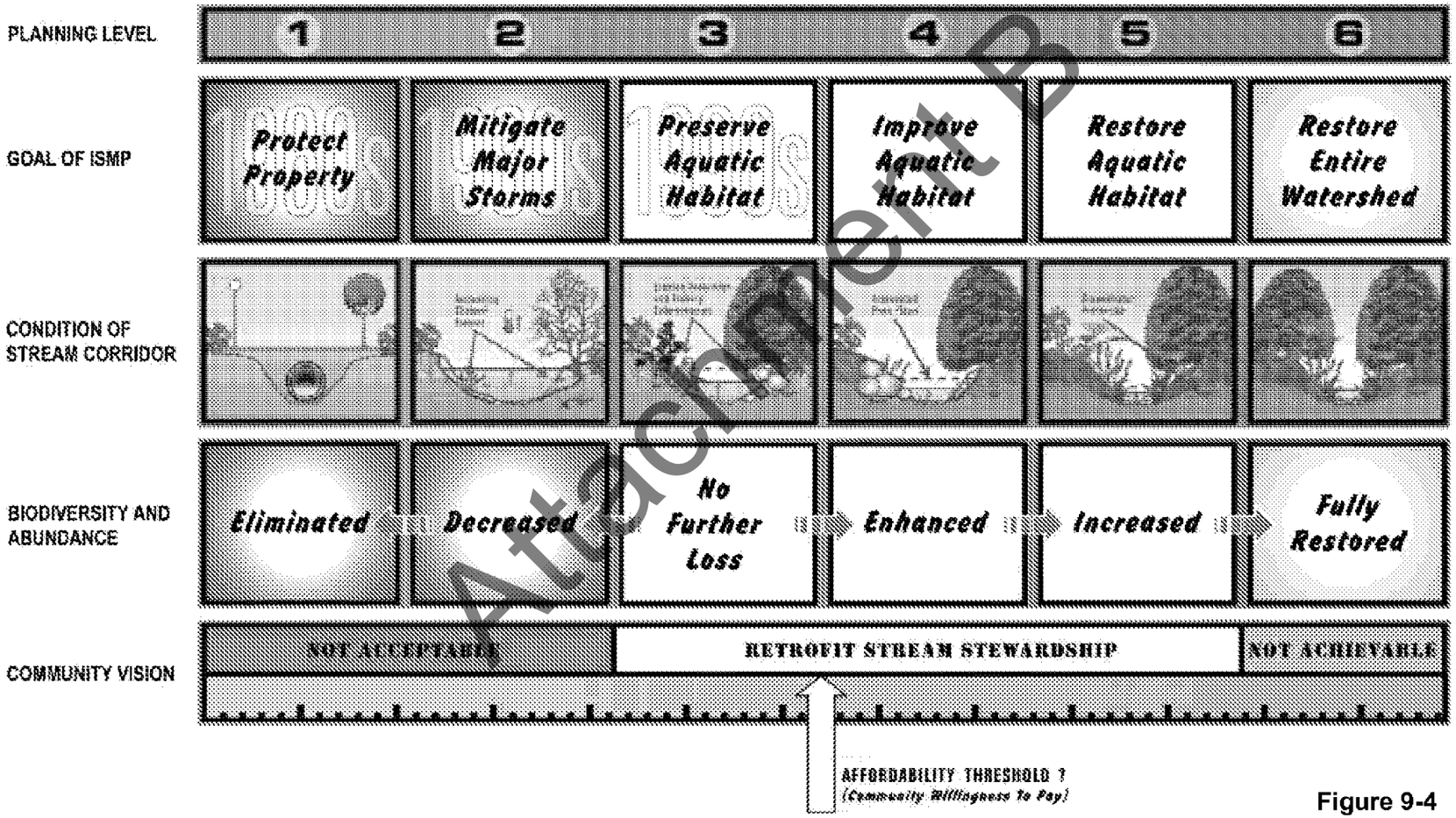


Figure 9-4

Identify Alternatives and Make Choices

Figure 9-4 captures the evolution of drainage planning philosophy over the decades for watersheds that include some prior development. It provides a framework for defining strategic objectives and identifying management practices for achieving those objectives.

Figure 9-4 provides a starting point for an interdisciplinary roundtable to make choices and agree on a guiding philosophy for integrated stormwater management for specific watersheds. It can also be employed to assess whether technical solutions are environmentally and politically acceptable. The choices can be considered to lie on a spectrum of:

(Allow to) Worsen ←----------"Hold the Line" ----------→ Improve

The process of determining an appropriate shared vision balances what is desired (or ideal) with what is technically feasible, affordable and politically palatable.

Integration of Aquatic Habitat Condition Assessment

The results of the five-task aquatic habitat condition assessment in Step #2 provide both a frame of reference and a starting point for scenario development in Step #3. The reach-by-reach picture enables ISMP participants to ask two questions:

- Where are we now?
- Where do we wish to be in future?

In general, priority effort should generally be directed where the best habitat is threatened by pending or potential land use change.

Starting Point for an Action Plan

For developed watersheds, Level 3 (from Figure 9-4) would be the likely starting point for an action plan, with the objective of moving from left to right over time (i.e. to improve conditions).

For an undeveloped watershed, the starting point would likely be Level 5, with the objective of 'holding the line' to preserve and protect existing habitat values in the short term, with restoration of aquatic habitat over the long term.

Case Study Example: Scenarios for Stoney Creek ISMP

Based on Figure 9-4, the alternative watershed visions listed below were defined for Stoney Creek:

- **SCENARIO A - Status Quo Strategy for Stream Management (Level 2)**

  Maintain the status quo for local government decision making around development practices. Existing regulations and procedures would continue, and habitat values would continue their present downward trend.

- **SCENARIO B - Hold the Line and Accommodate Growth Strategy for Stream Management (Level 3)**

  Sustain existing environmental conditions as development and re-development proceeds, with associated additional program requirements and financial costs.

- **SCENARIO C - Enhance Aquatic Conditions and Accommodate Growth Strategy for Stream Management (Level 4)**

  Enhance existing aquatic environmental conditions, but at substantial additional cost for regional facilities and increased requirements for on-site facilities to manage stormwater from new development and redevelopment.

The application of these scenarios to make decisions is discussed next. These scenarios provided the basis for Resolutions by all three City Councils that embraced Scenario B as the 20-year vision, and Scenario C as the 50-year vision.

Case Study Example: Evaluate Scenarios and Make Choices

Table 9-2 is the Stoney Creek example of how to apply a decision making matrix for evaluating alternative scenarios. The decision criteria are the management objectives. To decide which level of environmental protection is preferred, the decision maker must determine how well each scenario achieves each objective and balance the trade-offs and conflicts.

With the matrix, each criterion can be considered for each scenario and the results can be visualized, compared and recorded. In a workshop setting, roundtable participants can evaluate and discuss each alternative and select a preferred approach.

Because data are often limited, and in view of the complexities of dealing with natural systems, each decision maker has to rely in part on his/her own informed, professional judgement to evaluate the alternatives.

Adding the Dimension of Time

Change takes time. What is not achievable in the next five years may be quite achievable over fifty years. Integration of stormwater management with land use planning involves a timeline. General time-related objectives can be defined as follows:

- **20-Year Vision (Preservation)** – Develop policies and implement demonstration projects that show how to succeed in achieving stream preservation (i.e. 'hold the line'), thereby building support for the 50-year vision to improve watershed and stream conditions.
- **50-Year Vision (Improvement)** – Continue to implement changes in land use and regulation that mitigate changes in hydrology at the source (i.e. improve conditions), thereby enabling watershed protection/restoration and lasting stream improvement.

Ongoing monitoring and assessment of progress towards a long-term vision will improve the understanding of how to blend policy, science and site design to achieve the shared vision for property, water quality and habitat protection. Building on initial successes, local governments may well decide to advance the schedule and strive for improvement within the 20-year horizon.

Table 9-2 Decision Criteria to Select Strategies for Stream Management

OBJECTIVES OR DECISION CRITERIA		IMPORTANCE?❶	HOW WELL DOES EACH SCENARIO ACHIEVE EACH OBJECTIVE?❷		
			SCENARIO A (LEVEL 2)	SCENARIO B (LEVEL 3)	SCENARIO C (LEVEL 4)
As Established by the Brunette Basin Task Group			STATUS QUO, CONTINUED DECLINES IN FISH	HOLD THE LINE, SUSTAIN TROUT AND HATCHERY SALMON	ENHANCE HABITAT, SUSTAIN WILD SALMON
1.	**Protect or enhance biodiversity**	very important	low	medium	high
2.	**Protect or enhance aquatic habitat***	very important	low	medium	high
3.	**Protect or enhance terrestrial habitat**	moderate importance	low	medium	high
4.	**Enhance recreation opportunities**	moderate importance	low	medium	high
5.	**Minimize health and safety impacts**	very important	high	high	high
6.	**Minimize total costs**	very important	high (no change in existing costs)	medium (increased costs)	low (high cost)
7.	**Minimize property damage**	very important	medium	high	high
8.	**Increase scientific and management understanding**	least important	medium	high	high
9.	**Increase opportunity for public learning**	least important	medium	high	high

❶ Three judgmental choices are provided for rating each objective: very important, moderate importance, and least important.
❷ Three judgmental choices are provided for rating each scenario: low, medium and high.

Using Performance Targets to Quantify Watershed Objectives

Performance targets provide a quantifiable way of measuring success in protecting (or restoring) a watershed, and for identifying what needs to be done to achieve a given environmental protection objective.

- Desired protection objectives for significant stream reaches should be translated into performance targets for the catchments draining into those reaches. For example, to maintain or restore the health of a stream reach, an appropriate performance target would be to limit the volume of runoff from land uses in the drainage catchment to 10% or less of total rainfall volume.
- For catchments upstream of drainage 'hot spots' (e.g. chronic flooding locations), a more appropriate performance target may be to reduce peak runoff rates from large rainfall events (e.g. 5-year storms).
- Other performance targets relating to the preservation/restoration of significant natural features (e.g. riparian forests, wetlands), measurement of stream health (e.g. B-IBI), protection/improvement of water quality, or instream enhancements (e.g. for habitat or fish passage) should also be established.

A key principle is to establish performance targets that relate directly to the watershed objectives. Refer back to Chapter 6 for further guidance on setting performance targets.

The selected targets should also be monitored over time to ensure that the ISMP is achieving the desired results. Refer to Section 9.9 for more detail on this topic.

Setting Performance Targets

To establish realistic performance targets for a given watershed, an ISMP must answer questions such as those introduced in Chapter 6 and reiterated below:

- What is the existing level of annual runoff volume? What percentage of total annual rainfall volume does it represent? What is the existing Mean Annual Flood (MAF)?
- What are acceptable levels of runoff volume and rate in terms of flood risk and environmental risk? What are the consequences of increased or decreased flows related to land development? Are these consequences acceptable?
- What actions are needed to avoid flooding or environmental consequences?
- How can the necessary actions be staged over time?
- Are the targets to maintain 10% runoff volume and maintain the natural MAF necessary or achievable over time? If not, what levels are?

Modeling Alternative Scenarios

Scenario modeling can be used to assess a range of performance targets, and evaluate options for achieving these targets.

Scenario modeling involves consideration of the complete spectrum of rainfall events that typically occur in a year. (Refer back to Chapter 6 for further details regarding the three tiers.) An integrated approach to managing these events comprises three components:

- retain the small events (Tier A) at the source,
- detain the large events (Tier B) in detention facilities
- safely convey the extreme events (Tier C)

Relationship of Rainfall Spectrum to Watershed Objectives

The balance between the above three components depends on the watershed objectives.

- Stream protection/restoration objectives would likely govern scenarios that emphasize source control (e.g. infiltration, rainwater re-use), along with other possible options, such as riparian corridor protection.
- Flood management objectives would likely govern scenarios that place more emphasis on detention and conveyance.

The key is to determine which scenario or blend of scenarios has the best 'fit' to address a range of watershed objectives.

A key aspect of scenario development will be to consider what can be done at the site level to retain the small events, given constraints such as soil conditions, hydrogeology, topography and land use. Further data collection may be required to assess the feasibility of achieving performance targets (see Step #4).

Modeling Hierarchy

A computer model is a decision support tool. A model can help evaluate alternative scenarios, but it does not make decisions. Sometimes there is a tendency to over-emphasize the value of modeling. The reliability of model output depends on the quality of the input data, and especially on the judgement of the modeler in making critical assumptions.

A fundamental principle is that the level and/or detail of modeling should reflect the information needed by decision makers to make an informed decision. The modeler must always take a step back and ask three key questions:

1. Why is the model being built?
2. How will the model be applied?
3. What problems will the model help us solve?

Figure 9-5 illustrates the four main levels (or applications) of drainage modeling. Moving down the pyramid reflects an increasing level of detail, and hence investment of resources.

At this stage of the ISMP process, modeling should be at a strategic (i.e. conceptual or overview) level to provide basic information to support the decision making process.

Modeling tools take on added importance once the focus shifts to the functional planning and design of proposed stormwater management facilities. More data is required at this level of modeling.

Data Requirements for Strategic Level Scenario Modeling

Continuous rainfall data (in time increments of one hour or less) is the key data requirement for scenario modeling. Ideally, site-specific rainfall data should be used, but even data from a location with similar rainfall characteristics can be used at this stage.

At this strategic level of modeling, the other model inputs (e.g. regarding land use and soil conditions) should be estimated based on the best available information (assembled in Step #2). Where there is high degree of uncertainty regarding certain parameters, a range of assumptions may be tested, and data collection efforts can then be targeted to refine these assumptions (see Step #4).

The appropriate type of modeling will depend on the characteristics of the scenarios being modeled, as discussed on the following page.

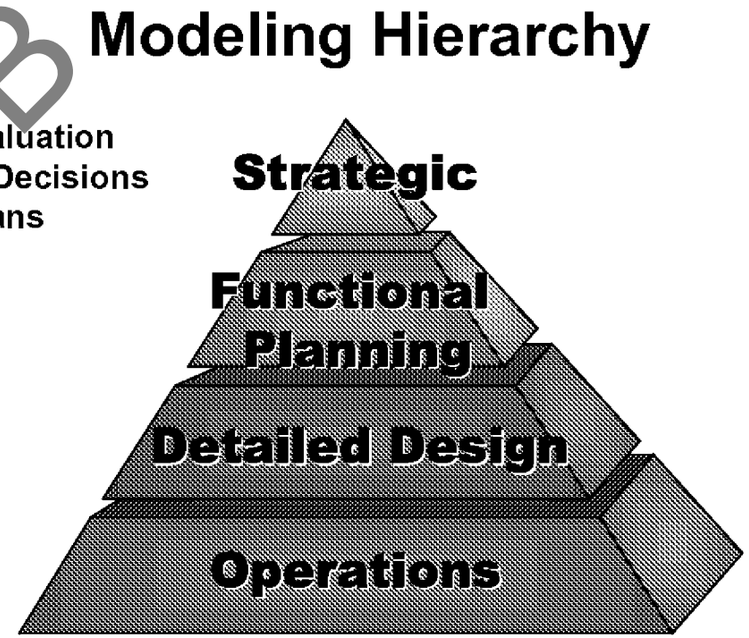


Figure 9-5

Types of Modeling: Single Event versus Continuous Simulation

There are two types of modeling: 'single event' and 'continuous simulation'. Single event typically means a storm duration up to 24 hours. Continuous simulation typically covers a year or a multi-year period, with time-steps up to 1 hour. Their respective applications are summarized as follows:

- **Single Event Modeling –** acceptable for most applications of Tier C flood risk management
- **Continuous Simulation Modeling –** required for Tier A rainfall capture, Tier B runoff control, and some applications of Tier C flood risk management

For both types of modeling, measured rainfall data (rather than artificial 'design storms') should be used as input data. Refer back to Chapter 6 for further discussion on the three rainfall tiers.

Continuous Simulation for Source Control (Tier A) and Detention (Tier B)

The distinction between Tier A and Tier B modeling is that Tier A requires volume-based thinking, whereas Tier B involves flow-based thinking. Conventional modeling packages are flow-based, and thus most appropriate for modeling detention (Tier B) and conveyance (Tier C) scenarios.

Models may be hydrologic (i.e. simulate runoff response), hydraulic (i.e. perform flow routing functions), or both. A selection of flow-based models is provided below for reference purposes. The appropriate model type depends on the scenario being modeled.

Model Name	Does it have Continuous Simulation Capabilities?	Is it a Hydrologic and/or Hydraulic Model?
HEC-1	No	Hydrologic
HEC-RAS	No	Hydraulic
HYDSYS	No	Both
OTTHYMO	No	Hydrologic
QUALHYMO	Yes	Hydrologic
HSPF	Yes	Hydrologic
SWMM	Yes	Both
MOUSE	Yes	Both

Note that the level of effort and amount data required to apply these models is highly variable. Some of these models require a high level effort, which may not be suitable for scenario modeling applications at the strategic level. The GVRD ISMP Template provides further details on these models.

Because Tier A simulation is volume-based, it is described as Water Balance modeling (refer back to Chapter 7 for further details). Since the focus of stormwater source control is on runoff volume reduction, Water Balance Modeling is most appropriate for source control scenarios. The Water Balance Model (WBM) is an example application (refer back to Chapter 7 for details).

Source Control Scenario Modeling

Whereas the use of conveyance and detention are relatively well understood stormwater management strategies, the use of source control is less well-known. Discussion among ISMP participants is likely to focus on whether source controls are effective or practical in the context of watershed-specific conditions.

Generating source control scenarios through Water Balance modeling can be a critical tool in informing this discussion (refer back to both Chapters 7 and 8).

Model scenarios can provide guidance for selecting source control options to achieve catchment-specific performance targets. Further data collection should focus on collecting the information needed to determine whether these options are achievable (see Step #4). For example, if infiltration is identified as an option for achieving performance targets in a particular drainage catchment, a key information need would be to determine soil conditions in that catchment.

Flood Management Scenario Modeling

The primary purpose of modeling for flood management purposes (i.e. Tier C) is to assess the conveyance capacity of drainage facilities installed at stream crossings. The level of preciseness in quantifying design flows is not critical because rated capacity is not the governing consideration.

Physical adequacy normally governs the acceptability of a drainage installation (refer back to Chapter 6). Hence, the real purpose in comparing design flows to rated capacities is to provide a relative measure of the degree of risk. This comparison helps elected officials make decisions to invest in drainage facility upgrades and/or replacement.

For certain flood management scenarios, continuous simulation modeling would be more appropriate. For example, continuous simulation would be needed to provide an idea of the extent and duration of flooding over an extended period of time under different detention and/or flow conveyance scenarios.

9.6 Step #4: Collect Meaningful Data and Refine Scenarios

Step #4 is to collect the additional data that may be needed to evaluate the effectiveness, feasibility and affordability of implementing the scenarios identified in Step #3 for meeting watershed objectives.

This step may involve collecting site-specific data to refine the assumptions of the scenario models generated in Step #3 (e.g. site-specific data on soils or drainage system components).

Be Strategic When Investing in Data Collection

The level and/or detail of data collection should reflect the information needed by the decision maker to make an informed decision. This principle is framed by these three questions:

- Why do we need the data?
- How will the data be applied?
- What problems will the data help us solve?

The impacts of changes in land use are generally understood. At this point, the investment in data collection needs to be strategic. We know that restoring the natural Water Balance and hydrology is required to address the source of stormwater-related problems. Data collection should focus on improving understanding of how to do so in the context of local conditions.

Before investing in data collection, there needs to be a clear understanding of the methodology to ensure that data collection is done right. Consistency and rigour are important to allow the data to be used as a baseline for comparison with future data.

Concurrent Rainfall and Streamflow Data

Having reliable rainfall and streamflow data is the key to a performance-based approach to ISMP development, implementation and effectiveness monitoring.

The minimum requirements are a streamflow station at the drainage outlet of watersheds or catchments of concern, and a strategically located rainfall station.

Concurrent and continuous records of rainfall and streamflow data provide a picture of the characteristic rainfall-runoff response of a neighbourhood, a drainage catchment or a watershed. Having a picture creates understanding. Understanding is required for two conditions in particular:

- 'rainfall-runoff response' during wet weather periods
- 'runoff decline' during dry weather periods

The latter is key to baseflow analysis. Baseflow availability is likely to be the limiting factor for fish survival in small streams during dry weather periods.

Rainfall and streamflow data play a key role in an adaptive management program (see Step #7 and also refer back to Chapter 6). Monitoring the change in rainfall-runoff response as land development progresses in a catchment will indicate the effectiveness of site design solutions.

Concurrent rainfall and streamflow data is also needed to calibrate and verify computer models. This is key to refining the scenarios developed in Step #3.

Streamflow Data from Undeveloped Catchments

Monitoring streamflow in undeveloped catchments (i.e. under natural conditions) provides valuable information because it defines the target hydrograph. The key objective for the design and operation of stormwater systems is to replicate this target hydrograph as closely as possible in catchments where development is occurring.

Streamflow data from undeveloped catchments also provide the best basis for establishing release rates for detention facilities (refer back to Chapter 6). Monitoring also provides a baseline for evaluating any future changes in hydrology due to development in these catchments.

Data on Soils and Groundwater

Soil and groundwater conditions govern the feasibility and affordability of using infiltration facilities to meet catchment-specific performance targets for runoff volume or rate reduction.

If not already available, soils information should be collected in catchments where infiltration is identified as an option for achieving stream protection and/or flood management objectives. This will enable a more detailed assessment of what is actually achievable in these catchments.

It is also important to collect basic groundwater information to identify areas where the groundwater table is very high, since infiltration is not likely feasible in these areas.

Refer back to Chapters 6 for details regarding the importance of soils information in setting catchment-specific performance targets. Refer back to Chapter 7 for details on the relationship between soils and infiltration performance.

Data on Drainage Facilities

Scenario modeling may identify flood management concerns relating to certain drainage system components. Data collection should then focus on characterizing these critical drainage system components and evaluating the effectiveness of improvement options.

For example, if the conveyance capacity of a particular culvert installation is identified as a high risk flooding location, data collection may focus on determining the effectiveness of options for improving physical and/or hydraulic acceptability of that culvert.

Data on Fish and their Habitats

Where watershed objectives focus on the protection and/or restoration of fish and their habitats, there may be a need to collect additional data to define the value of these resources and evaluate options for their protection or restoration.

For example, if restoration of a critical stream reach is established as an objective, detailed surveys of this reach would likely be required to evaluate restoration options.

Water Quality Data

If surface water or groundwater pollution is identified as a key issue in a catchment, there may be a need to collect water quality data in order to provide a better understanding of the types and sources of pollution. This would become important for evaluating options to manage the sources of water quality problems.

For example, high nutrient loading in watercourses may indicate the need to manage runoff quality from upstream agricultural areas.

Monitoring turbidity (and correlating with TSS) can provide a good indicator of changes in water quality and watercourse erosion rates over time. This can play an important role in evaluating the effectiveness of integrated solutions that are implemented in a watershed (refer back to Chapter 6).

Also, performance targets can be established based on total suspended solids (TSS) loading, using natural loading rates as a baseline. Note that TSS targets are closely related to runoff volume targets (increase in runoff volume is the primary cause of watercourse erosion).

Sources of Data

Data can typically be obtained by contacting the federal and provincial agencies listed below:

- Rainfall – from the Atmospheric Environment Service (Environment Canada)
- Streamflow – either from the Water Survey of Canada (Environment Canada) or the provincial Ministry of Water, Land and Air Protection (MWLAP)
- Species and Habitats of Concern – either from Fisheries and Oceans Canada or the Environmental Stewardship Division of MWALP
- Water Quality - from the Environmental Protection Division of MWALP

9.7 Step #5: Evaluate Alternatives and Develop Component Plans

Once watershed objectives have been established, alternative scenarios for achieving those objectives have been generated, and the data needed to evaluate the effectiveness of these scenarios has been collected, the next step is to evaluate the alternatives and make decisions.

These decisions will provide the basis for developing plans for habitat enhancement, flood risk mitigation and relevant land development actions. These are all related components of an ISMP, as shown in Figure 9-6. These component plans are described in this section.

The fourth component is a financial and implementation program (see Step #6), which is essential for moving from planning to action.

Habitat Enhancement Plan

The Habitat Enhancement Plan should identify:

- key wetlands or sensitive ecosystem areas needing protection
- riparian setback objectives
- schematic alignment for creek relocations, with corresponding riparian restoration and land requirements
- streamside and instream complexing features to be incorporated
- location and description of barriers to fish passage, and prescriptions to remove barriers where advisable

A companion report would provide cost estimates, land acquisition costs, logical phasing and logistics of the planned habitat improvements. It should outline a monitoring and maintenance program that addresses jurisdiction and ownership of stream corridors, and requirements for agency approvals.

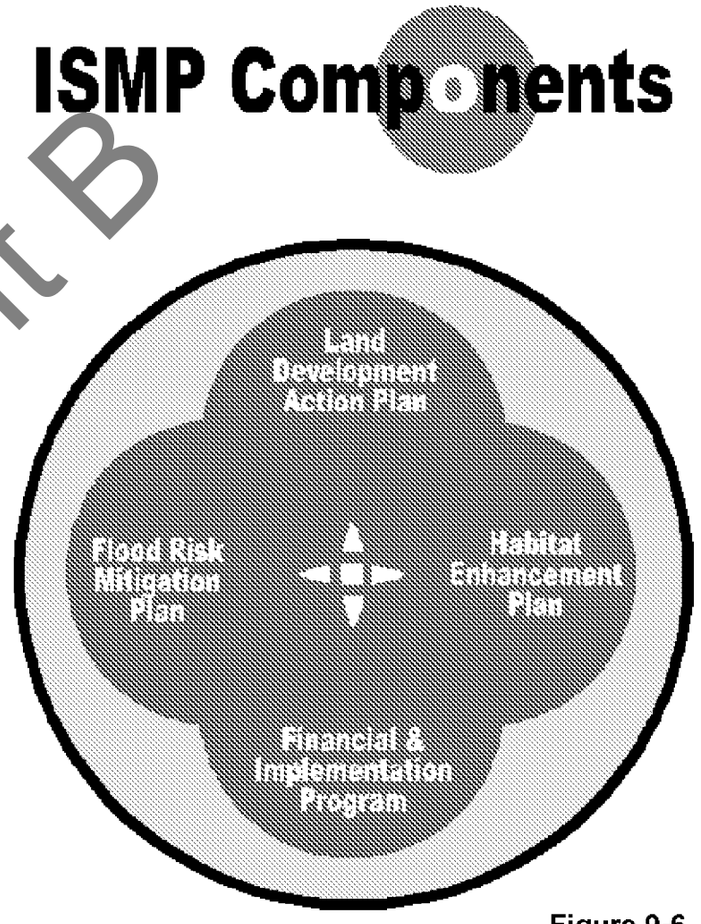


Figure 9-6

Flood Risk Mitigation Plan

The Flood Risk Mitigation Plan should identify:

- required stormwater storage facilities
- proposed split between storage budgets in community detention facilities and private developments
- type and distribution of stormwater infiltration and storage facilities
- flow paths for major events
- piped sections, or high-flow pipe diversion works
- conceptual cross-sections of major stream diversions

A companion report would provide a description of the elements and cost estimates for land acquisition and capital works, suitable for use in development cost charge (DCC) bylaws and capital works plans.

Land Development Action Plan

A Land Development Action Plan should illustrate the relationship between the proposed habitat enhancement and flood mitigation works and existing and proposed land use in the watershed. Recommended changes to land use designations should be highlighted for consideration in Neighbourhood Plans and the Official Community Plan.

Location and routing of flood control works, stream relocations and riparian leave strips should be developed within a strategy for land acquisition or regulatory protection. The Land Development Action Plan should show the location of required lands and outline a strategy to achieve their protection over the long-term.

The Land Development Action Plan should also identify the distribution of stormwater source control use in the watershed. Some source controls may be targeted to only part of the watershed (e.g. infiltration only in certain soil conditions). Other source controls may vary in application by zoning (e.g. green roofs only on commercial or multiple family buildings).

Adding the Dimension of Time

Changes take time. What is not achievable over the next five years may be quite achievable over a twenty-year or fifty-year timeline. Action plans to integrate stormwater management with land use planning should be framed in terms of long-term visions and time-related objectives (e.g. what do we want to achieve over the next 5, 20 and 50 years). Refer back to Section 9.5 for further discussion of planning horizons.

9.8 Step #6: Develop an Implementation Program

Step #6 is essential for moving from planning to action, yet many planning processes never get to this step. Without an implementation program and financial plan, watershed objectives will not be achieved.

Financial Plan and Implementation Program

The purpose of an ISMP is to identify the risks, what needs to be done to manage the risks, who should be responsible, and lay out a general timeline for implementation.

The Financial Plan and Implementation Program should therefore outline how the land acquisition and capital financing of the elements can be achieved. Tools might include negotiations during zoning changes, land exchange, density bonuses, adjustment of existing DCCs or other means. Strategies will be specific to the properties in question.

In addition to capital financing, the regulatory framework is another component of implementation to be used in balance with public awareness and capital works programs.

There many questions related to regulatory change that must be resolved, including:

- What is the role of various regulatory tools (e.g. zoning negotiations, development permits for protection of the natural environmental, ecosystems and biodiversity, tree protection bylaws, watercourse protection bylaws, engineering standards and specifications)?
- How can regulatory tools work together, without overlap or excessive red tape?

Chapter 11 provides guidance regarding the types of regulatory changes that may be needed to achieve stormwater management objectives.

Recommended Bylaw Approach

A key objective of the ISMP process is to create a recommended bylaw approach. This would define the bylaw that each stormwater source control or policy is to be implemented through, and the relationship between bylaws. The product would be a point form outline of each proposed bylaw change. The outline should be relatively specific, and should address:

- Enabling legislation
- Principles behind the bylaw change
- Key bylaw requirements
- Key definitions needed
- Key illustrations or engineering details needed
- Key filter and exemption clauses
- Key application information requirements
- Enforcement options

This product should provide clear direction for subsequent work by separate assignment to write and provide legal review of the actual bylaw changes. Land use regulation should reflect a pragmatic approach that is based on these guiding principles:

- **Principle #1 -** Recognize the body of existing local bylaws, and identify how they can be adapted to suit new objectives.
- **Principle #2 -** Create the simplest possible regulatory system. Watch out for overlap or conflicting bylaws. Try to reduce the number of permits required.
- **Principle #3 -** Understand that bylaws will only succeed if the solid majority of the public supports them.

The last principle underscores the importance of public awareness programs that provide the public and the development community with the information they need in order to decide whether to support new regulations.

9.9 Step #7: Refine Through Adaptive Management

Step #7 is key to resolving stakeholder uncertainty associated with changes in standard practice. This objective is achieved through an adaptive management framework as illustrated by Figure 9-7. This will be ongoing through time.

Monitoring and evaluating the performance of demonstration projects will provide confidence in new approaches. It will also provide the basis for optimizing stormwater system design to reduce costs while still achieving defined goals for protecting downstream property, aquatic habitat and receiving water quality (refer back to Chapter 6).

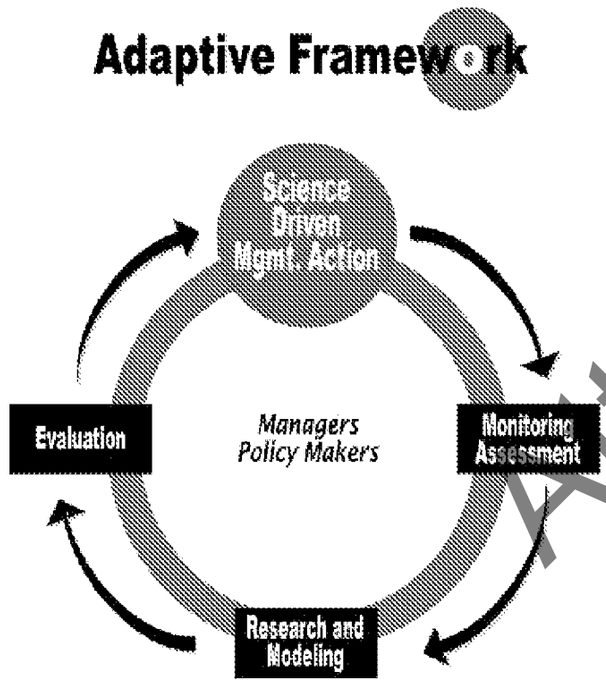


Figure 9-7

Defining the Rules of Adaptive Management

An ISMP implementation plan must define:

- **Early Actions** - the integrated stormwater management solutions to be implemented in priority (at-risk) catchments
- **Rules of Adaptive Management** – a clear set of rules that define monitoring requirements and consequences to allow for improving integrated solutions over time

Build and Maintain Trust

In order to build and maintain trust between local governments, landowners, developers and senior government agencies, the following questions must be answered at the plan development stage:

- What needs to be monitored?
- How will monitoring results:
  a) define better stormwater management and development practices?
  b) lead to changes in development standards and regulations?

The adaptive management framework presented in Chapter 6 provides a starting point for establishing a set of rules that answer the above questions. This must be a collaborative process, so that the rules are understood and supported by all stakeholders.

Desired Outcomes

A clearly understood and widely supported set of adaptive management rules will:

- Enable landowners and developers to make long-term land use and investment decisions with more confidence.
- Provide senior government agencies with regulatory certainty as new approaches are tested and refined.
- Ensure that the investments of local governments (both staff and financial resources) will lead to constant improvement.

Adaptive Management Roles and Responsibilities

An implementation plan must clearly define who is responsible for monitoring what, and establish regular intervals (e.g. every year) for working sessions to review monitoring results. These working sessions are critical to the ongoing process of change, because this is where decisions will be made regarding what to change and how these changes will be made.

Local governments may need to take the lead in implementing and monitoring the initial demonstration projects (e.g. on public works projects). Local government leadership is important for demonstrating to developers, landowners and senior government regulators that proposed actions at the site level are both effective and affordable. This will build support for regulatory changes that enable or require these site level actions.

Stewardship groups also have a role to play in monitoring the catchment and watershed scale effectiveness of new land development practices.

Types of Monitoring

The following types of monitoring should all be included in a comprehensive adaptive management program.

- **Effectiveness Monitoring** – Determines the extent to which the completed actions have achieved the management objectives (for example, monitor the volume and frequency of overflow from an on-site facility and compare with the performance targets).
- **Compliance Monitoring** – Identifies whether or not the implementing parties have completed the actions they agreed to complete in the planning phase (for example, confirm that developers are incorporating properly sized on-site storage and infiltration facilities).
- **Validation Monitoring** – Measures the extent to which completion of the objectives (actions) has been successful at achieving the goal (for example, monitor annual watershed runoff volume and compare with the performance target established for runoff volume reduction).

Effectiveness monitoring is the key to learning from experience and constantly improving land development and stormwater management practices.

The Role of Effectiveness Monitoring

Chapter 6 included a discussion on performance monitoring in the section about optimization of stormwater system design. Chapter 6 also introduced the need for performance monitoring at different scales. This section elaborates on that discussion.

Proper assessment of the effectiveness of site design practices in a watershed context requires monitoring at three scales:

- **Site Level - Monitor Volume and Frequency of Overflow from Individual Facilities**

  The performance of individual rainfall capture and runoff control facilities must be monitored to determine if targets for runoff volume reduction and rate control are being met.

- **Neighbourhood Level - Monitor the Change in Rainfall-Runoff Response from Development Areas**

  It is important to monitor flow at the drainage outlet (e.g. outfall to a stream) of a development area serving an integrated network of rainfall capture and runoff control facilities. This will enable an assessment of how well this integrated system achieves the performance target for volume reduction.

- **Catchment Level - Monitor Early Warning Indicators of Stream Health**

  It is important to determine how well actions at the site level are maintaining or restoring a healthy catchment. This can be accomplished by monitoring the following indicators:

  - Water Balance - streamflow at the downstream end of the catchment
  - Water quality - turbidity and total suspended solids (TSS)
  - Biophysical - Benthic Index of Biological Integrity (B-IBI)

Managing Drainage from an Ecological Perspective

This section elaborates on indicators that can be used to provide a warning system regarding the impacts of human actions on the environmental health of stream corridors so that corrective action can be taken when they are required.

The governing consideration is that indicators accurately represent the environmental state of both the surface drainage function and the ecological function of the receiving waters.

Elements of an Integrated Program for Monitoring Stream Health

In recent years stormwater managers have recognized the need for a stream health monitoring program that is sensitive to changes in hydrology and habitat. The need arose because traditional chemical and physical monitoring did not produce the type of information needed to understand the overall environmental health of a stream corridor and manage drainage from an ecological perspective.

A comprehensive approach combines simplified chemical and physical monitoring with annual monitoring of physical changes to habitat and a biological index of benthic organisms.

An *Integrated Monitoring Program* would comprise ambient biological monitoring, continuous rainfall and streamflow recording, some chemical and habitat measurements, and possible microbiological monitoring to allow the identification of fecal coliform sources.

Description of Ambient Monitoring

A baseline ambient monitoring program would comprise Benthic Index of Biological Integrity (B-IBI) scores at selected sites, plus concurrent field measurements of conductivity and temperature, plus physical measurements of stream and habitat elements.

For chemical parameters, conductivity has the best correlation with urban impacts. Also, it can be measured inexpensively in the field. TSS and zinc also have good correlation, but provide little additional information over that provided by conductivity alone.

9.10 Synopsis of the Seven-Step Process for ISMP Development and Implementation

Table 9-3 provides a synopsis of the seven-step process. For each step the scope, desired outcome, and deliverables are summarized. The overall aim of this process is to achieve healthier urban watersheds over time.

Build the Vision, Create a Legacy

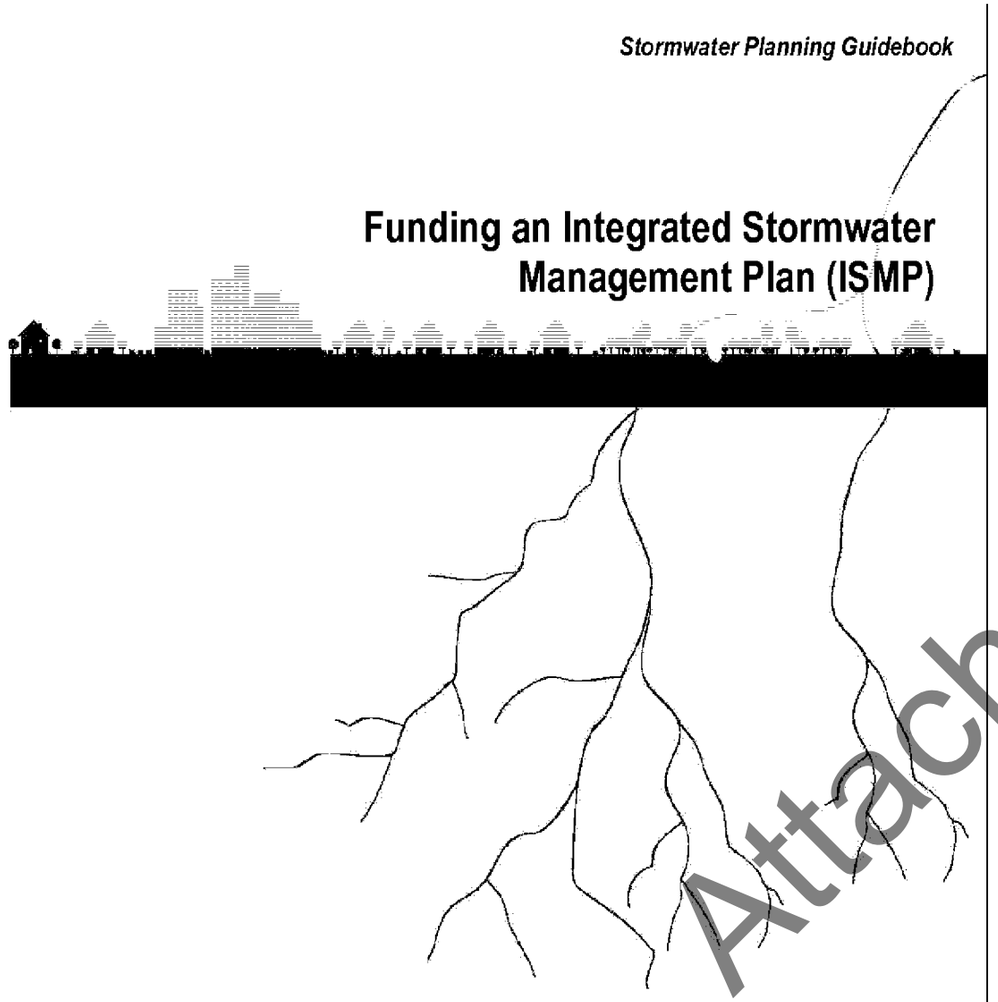
A shared long-term vision is needed to focus the effort that will create a legacy. This vision provides a context for all planning, data collection, sensitivity analyses, capital expenditures and regulatory changes. Prioritizing goals and actions (ideally through consensus) provides a road map for moving towards a target condition by identifying:

- the interconnected nature of goals, values and expectations
- risks and opportunities
- what needs to be done to manage the risks and achieve the opportunities
- who should be responsible
- a general timeline for implementation

This framework addresses the goal of identifying options to change the way that land is developed and re-developed, so that people, property and natural systems can be better protected and over time, infrastructure can be managed more efficiently and watersheds can become healthier.

Table 9-3 Synopsis of the Seven-Step Process for ISMP Development and Implementation

Step	Scope	Outcome	Deliverable
1	Secure Political Interest and Support	❑ Define a guiding philosophy ❑ Formulate supporting policies ❑ Establish design criteria to achieve policies	❑ Document 1 - Policy and Design Criteria Manual
2	Frame the Watershed Problems and Opportunities (Apply the Knowledge-Based Approach) ❑ Land Use Working Session ❑ Drainage Working Session ❑ Ecology Working Session ❑ Interdisciplinary Roundtable Session	❑ Identify resources to be protected ❑ Establish an order of priority for plan development at the sub-watershed scale	❑ Document 2 – Understanding the Watershed • Watershed Base Map • Watershed Issues Summary • Sensitive Ecosystem Inventory • Land Use Map • Drainage System Inventory • Soils and Groundwater Map
3	Develop Objectives and Alternative Scenarios ❑ Flood Management Scenario Modeling ❑ Source Control Scenario Modeling	❑ Identify inadequate drainage facilities ❑ Establish a customized performance target for each sub-watershed	❑ Document 3 – Results of Flood Management Scenario Modeling ❑ Document 4 – Results of Source Control Scenario Modeling
4	Collect Meaningful Data and Refine Scenarios ❑ Concurrent Rainfall and Streamflow Data ❑ Data on Soils and Groundwater ❑ Water Quality Data ❑ Data on Fish and Their Habitats	❑ Identify gaps ❑ Supplement existing programs	❑ Document 5 – Data Collection Framework
5	Evaluate Alternatives and Develop Component Plans	❑ Make decisions	❑ Document 6 – Flood Risk Mitigation Plan ❑ Document 7 – Habitat Enhancement Plan ❑ Document 8 – Land Development Action Plan
6	Develop an Implementation Program	❑ Consolidate supporting documents ❑ Develop financial plan ❑ Create a recommended bylaw approach	❑ Document 9 - Implementation Report
7	Refine Through Adaptive Management	❑ Establish rules of adaptive management ❑ Implement comprehensive monitoring program	❑ Document 10 - Performance Evaluation Plan



Funding an Integrated Stormwater Management Plan (ISMP)

Chapter Ten

10.1 Framing the Question

In developing and funding a stormwater program, local governments are faced with the challenge of balancing risks of flooding and environmental degradation against community willingness to pay. This chapter provides strategies to address this challenge.

Since the primary source of revenue for local government is property taxes, stormwater program budgets will be largely governed by taxpayer 'willingness to pay' and taxpayer 'ability to pay'. Since local governments always face competing priorities, a thorough consideration of risks and consequences becomes critical when establishing spending priorities.

A related issue is due diligence; once a risk is identified, local government has a responsibility and an obligation to address that risk. As introduced in Chapter 1, an Integrated Stormwater Management Plan (ISMP) provides a framework for addressing risk and moving towards a target condition by identifying:

- the risks
- what needs to be done to manage the risks
- who should be responsible
- a general timeline for implementation

Taxpayer Willingness to Pay

Willingness to pay is refers to the level of increase in taxation rate that taxpayers are prepared to accept in order to pay for a particular service, in this case, stormwater planning and management. Willingness to pay will be governed by taxpayers' understanding of what is at risk. Local governments must be proactive in explaining the potential consequences (both in terms of flooding and property damage and habitat and species loss) of delaying or avoiding implementation of stormwater plans, to ensure that taxpayer willingness to pay is balanced against risk.

Taxpayer Ability to Pay

Willingness to pay is linked directly to ability to pay. Hence, it is important to understand the cost implications of what it means to embrace a stream stewardship philosophy. Fundamental questions that will need to be answered when building public understanding and support for a funding plan are:

- What level of aquatic resource protection is achievable and sustainable, and which elements of stream stewardship are applicable?
- What is the local government liability and financial exposure in accepting senior government directives for protection/enhancement of aquatic habitat?
- Will the societal benefits justify the costs incurred? (i.e. is there a payback?)

Addressing these questions upfront will enable a local government to judge what level of stream stewardship is achievable and sustainable at an affordable cost.

10.2 Making Choices

The extent of a stormwater funding program will be influenced by willingness to pay, level of protection versus expenditures, ability to raise revenue, and level of investment versus risk reduction.

Potential sources of revenue for local government are explained in the next section. These sources include general revenue, development cost charges (DCCs), specified area charges, stormwater utilities and senior government grants.

Dealing with Complexity

Two distinct core concepts that must be integrated in any stormwater funding program are summarized below:

- **Expenditures versus Revenue -** There is a cost to taxpayers to construct facilities that protect property and sustain the natural environment. As local government takes on more responsibility, funding must be provided to fulfil the commitments that have been made. This is a comparatively straightforward relationship to quantify.

- **Willingness to Pay versus Environmental Consequences -** The less the public is willing to invest in property and habitat protection, the greater the likelihood that problems will worsen. Conversely, more investment should improve the situation, provided the investment is strategic and addresses the sources of problems. This is a much more complex relationship to quantify because it involves value judgements.

Both components implicitly provide local government with flexibility to match willingness to pay to an affordable level of protection. The third dimension is time, as discussed in Chapter 9. Thinking in terms of a long-term time horizon provides the opportunity to achieve cumulative net benefits over time.

Measuring Risk

The less that the public is willing to pay, the higher the risk there will be of adverse environmental consequences. This is a concept that local governments are only just beginning to consider. Deciding not to invest in stormwater management does not necessarily equate to cost savings, since there is a cost associated with the status quo if it means watershed conditions will deteriorate. Deteriorating watershed conditions result in flood damage and channel stabilization costs, as well as habitat loss and water quality impairment.

Underlying the issue of risk is the question of liability and due diligence. For example, if a local government knows that either the status quo or inaction will result in consequences that can be foreseen, they can be held legally liable for those consequences. On the other hand, if a local government demonstrates due diligence in developing a plan to forestall those consequences, this should normally relieve the liability. It then becomes a matter of matching the timing of plan implementation to ability to pay.

10.3 Who Pays?

The tiered approach is one of the cornerstones of this Guidebook. It provides a logical and appropriate basis for assigning responsibilities and determining who pays for what.

Division of Responsibility

Table 10-1 suggests a division of responsibility (i.e. who pays) for implementing the three stormwater management 'tiers' - retain, detain and convey. The issue of who should pay for stormwater management is directly related to the following question:

- Are stormwater-related problems (habitat degradation, flooding) the result of past development, future development, or some combination?

For new development in an undisturbed watershed or catchment, the land developer would be expected to bear the cost for managing the complete spectrum of rainfall events. For urban retrofit scenarios where there are existing problems (degraded habitat, flooding) as a result of past development, local governments (i.e. existing landowners and taxpayers) would typically be expected to bear much of the cost. In most situations some level of cost sharing between developers and local governments will be appropriate.

For Table 10-1 to be applicable to a regional district, the regional district would first have to apply for drainage authority.

Cost Sharing Between Developers and Local Government

Regardless of the initial land use in a particular catchment, new development or re-development projects should be responsible for managing Tier A events using rainfall capture strategies on private property. The responsibility for new developments should also include designing roads in new subdivisions to be self-mitigating (i.e. provide rainfall capture *and* runoff control) for Tier A events.

Local government would clearly be responsible for retrofitting existing roads as part of a long-term watershed or drainage catchment restoration strategy.

New developments and local government should each contribute a proportionate share of the cost for providing runoff control for Tier B events and flood risk management for Tier C events, depending on the relative impacts of existing and future development.

Table 10-1 Who Pays for Stormwater Management Infrastructure?

Component of Integrated Strategy for Managing the Complete Rainfall Spectrum	Land Development Scenario		
	New subdivision within a mainly undeveloped catchment	New subdivision within a partially developed catchment	Re-development within a fully developed catchment
Rainfall Capture for the small Tier A Events (on-lot retention)	developers/ landowners	developers/ landowners	developers/ landowners
Rainfall Capture for the small Tier A Events (on-street retention)	developers	developers for roads within subdivision local government for existing roads	local government (i.e. municipalities)
Runoff Control for the large Tier B Events (detention)	developers*	cost sharing between developers and local government on an area basis*	local government* (i.e. municipalities)
Flood Risk Management for Tier C Events (contain and convey)	developers	cost sharing between developers and local government (i.e. municipalities)	local government (i.e. municipalities)

* Runoff control targets can either be met by providing larger rainfall capture facilities (Tier A) or by providing community detention facilities.

For re-development scenarios this choice can have implications for who pays. The more on-lot storage that developers/landowners provide, the less local government funded community storage will be required.

Supporting Innovation and Leadership

Innovation and leadership is being provided at the local government level. But moving towards a new standard practice for suburban design requires a considerable investment of staff time and financial resources to successfully implement and monitor demonstration projects.

During the transition period, it seems reasonable to suggest that senior governments should support innovation and leadership by funding demonstration projects. This is the most effective way for senior governments to limit the risk and liability associated with being innovative. The lessons learned will benefit all local governments. Therefore, it seems reasonable that the leaders be supported in their efforts to implement change.

Responsibility for Operation and Maintenance

Table 10-2 parallels the previous table and summarizes who is responsible for operating and maintaining each tier of stormwater infrastructure.

Under the present system, subdivision developers are responsible for infrastructure integrity for a set period of time (typically one year) before a municipality formally takes possession of the completed works. Property owners have responsibility for maintenance of any drainage works that are located on private property.

During the transition period to a new standard practice, local governments have the option to extend the performance monitoring period for rainfall capture and runoff control facilities, for example, from one year to three years. A precedent is the Burnaby Mountain sustainable community that is being built by Simon Fraser University.

Table 10-2 Who Operates and Maintains Stormwater Management Infrastructure?

Component of Integrated Strategy for Managing the Complete Rainfall Spectrum	Land Development Scenario		
	New subdivision within a mainly undeveloped catchment	New subdivision within a partially developed catchment	Re-development within a fully developed catchment
Rainfall Capture for the small Tier A Events (on-lot retention)	property owners	property owners	property owners
Rainfall Capture for the small Tier A Events (on-street retention)	local government (i.e. municipalities)	local government (i.e. municipalities)	local government (i.e. municipalities)
Runoff Control for the large Tier B Events (detention)	local government (i.e. municipalities)	local government (i.e. municipalities)	local government (i.e. municipalities)
Flood Risk Management for Tier C Events (contain and convey)	local government (i.e. municipalities)	local government (i.e. municipalities)	local government (i.e. municipalities)

10.4 Sources of Funding

Five sources of funding that are potentially available to municipalities to pay for implementation of ISMPs are listed as follows:

- General Revenue – from all taxpayers
- Development Cost Charges – from land developers
- Specified Area Charge – from local neighbourhoods
- Stormwater Utility – from all property owners
- Senior Governments – via grant programs

Regional districts are limited in their ability to raise money. Funding must be tied to a specific function that is delegated by the municipalities; that function can only be assigned by referendum.

Overview

From a funding perspective, the focus of local government is on how to pay for runoff control for Tier B events and flood risk management for Tier C events. This applies mainly to a scenario where municipalities must finance the retrofitting of a catchment with detention and conveyance facilities. This also applies to the maintenance of infrastructure that a municipality inherits in new subdivisions.

Each of the potential sources of stormwater funding is described briefly below. Of the five possibilities, a stormwater utility offers the best long-term option for stability and continuity. Hence, a detailed discussion of utilities is provided in the next section.

General Revenue

This refers to a local government's annual budget, which is derived from property taxes. Historically, this is how drainage projects were funded. In many municipalities, this is still the funding source for drainage programs. Implementing a major capital program can therefore have a measurable and noticeable impact on property taxes. Furthermore, drainage then becomes one of a number of competing priorities for Councils to balance. Unless there is a demonstrated threat to life and property, it can be difficult to gain the necessary political support to proceed with major capital programs.

Development Cost Charges

Development cost charges (DCCs) were introduced by the Provincial Government in the 1970s to ensure that new development paid its fair share of the off-site costs required to service the development. In the case of drainage, it may be many years before a municipality collects sufficient money from individual developers to enable a project to proceed. Hence, a watercourse may be subjected to the cumulative adverse effects of erosion and sedimentation.

Specified Area Charge

Local governments have the option to create Specified Areas for the purpose of recovering the cost of providing a specific service. An example would be a *Local Initiatives Program* for road and drainage improvements.

Stormwater Utility

The purpose of any local utility is to provide a self-sustaining source of revenue to fund implementation of capital and maintenance programs over a multi-year period. BC municipalities have historically had both water and sanitary utilities. Funding is raised through a user fee.

Although stormwater utilities are often discussed in BC, there has been a lack of will at the local government level to implement them. In recent years, however, several municipalities (notably the cities of Surrey and North Vancouver) have broadened the scope of their sanitary sewer utilities to encompass drainage. This has enabled those municipalities to proceed with major capital projects.

Washington State municipalities, including Bellingham and Bellevue, have adopted stormwater utilities. The Bellevue utility was one of the first such utilities in North America.

Senior Governments

Historically, senior governments have not provided funding for drainage in BC, other than the Fraser River dyking program and flood disaster response programs. The Federal Government's newly created *Green Municipal Enabling Fund* is the first opportunity for

some local governments to access funding for stormwater management in the suburban regions.

10. 5 Setting Up a Stormwater Utility

A stormwater (or drainage) utility may be defined as a self-liquidating entity that has a focused purpose for stable and dedicated funding for surface water quantity and quality management, operations and maintenance, rehabilitation and enhancements.

The information presented in this section is included courtesy of the District of Maple Ridge. It is adapted from a staff presentation to Council in 2001.

Legislative Authority

A stormwater utility is permitted under the following sections of the *Local Government Act*:

- Section 363.(1) – A Council may, by bylaw, impose a fee or charge payable in respect of full or part of a service of the municipality
- Section 517.(1) – Subject to the specific limitations and conditions established by or under this *Act*, a municipality may operate any service that the Council considers necessary or desirable for all or part of the municipality
- Section 518.(1) – A bylaw under this Part may (a) establish different classes of persons, places, activities or things, and (b) make different provisions for different classes and for different areas of the municipality

Scope of a Utility

Stormwater utilities typically include a network of pipes, streams, ponds and lakes for detention and water quality control. The utility is set up to address both:

- the built stormwater system – pipes, pump stations, outfalls
- the natural stormwater system – creeks and streams

Its purposes are primarily flood protection, erosion control and environmental protection.

Addressing Public Concerns

Public concerns that a utility would typically address include:

- flooding
- water pollution
- property damage
- stream erosion
- habitat impacts
- wetland acquisition
- stormwater detention

Utility Focus

Typical programs for a stormwater utility include:

- water quality control, including education
- operations and maintenance
- development regulation
- capital improvements

Objectives and Services

Stormwater quality protection objectives may include:

- water quality for safety and enjoyment of residents
- preservation of aquatic and wildlife habitat

Particular services a utility may provide include:

- 24-hour emergency response for flooding and hazardous spills
- residential and other built connections to the utility's drainage system
- erosion control
- operation and maintenance of drainage systems
- flood warning systems
- water quality and environmental monitoring

Financing Principles

Financing principles for utilities include:

- user fees (and demand management)
- charge based on benefits or cost of service

The total revenue is derived from utility rates/fees as well as DCCs.

Benefits of a Stormwater Utility

Benefits fall into two categories: environmental and functional.

The environmental benefits are:

- habitat protection
- habitat rehabilitation
- ecological enhancement

The functional benefits include:

- stable and dedicated funding for long-term initiatives and public goals
- equitable distribution of costs to users
- ability to finance and implement innovative technologies and solutions
- ability to upgrade systems and eliminate deficiencies
- long-term strategic planning for sustainability and flexibility

Challenges for a Utility

In setting up a utility, challenges that need to be overcome include:

- perception of 'inflexible' funds
- perception of another tax
- not eligible for Home Owners Grant
- service may not always be transparent
- user ability to pay

Determining the Purpose

In forming a utility, a major consideration is deciding its purpose(s). The choices include:

- flood control
- water quality protection and pollution prevention
- natural stream and water body management
- erosion and sedimentation control
- combined sewers for sanitary and storm drainage

Revenue and Billing

Deciding on the utility purpose(s) leads to revenue and billing considerations:

- Initial revenue requirements –
  - Which programs are to be undertaken first and which will be phased in?
  - Where will the working capital for starting up the utility come from?
- Billing structure and mechanism –
  - What are the classifications or rates?
  - Can the existing billing system accommodate this?

Timing and Rates

Questions related to implementation that must be addressed include:

- Timing – It usually takes two to three years to start up a utility – what is the long-term financial plan for the utility?
- Initial rates – What is the appropriate level, and phase in?

Stormwater Utility Rates

Examples of annual stormwater utility rates include: City of Surrey ($55+); City of Bellevue, Washington State ($130+), and Snohomish County, Washington State ($30+).

10.6 Regional Approach

Local government has responsibility for land use decisions. Local government is also responsible for protection of property. Because it is better positioned to protect the environment, local government is now being called on to play a primary role in aquatic habitat protection, restoration and management. During this period of transition, however, there is uncertainty as to what this change means, and who pays. BC can learn from the Washington State experience.

Cross-Jurisdictional Funding of Watershed Action Plans

Watercourses cross local government boundaries. This raises a host of inter-jurisdictional issues. Commencing in 1994, the thirty-nine cities in King County, Washington State, have been attempting to address watershed management issues (flooding, fish habitat and water quality) through Inter-Local Agreements. Notable accomplishments to date include:

- trust has been built incrementally
- Watershed Forums have been created
- Regional Funding Principles have been adopted (1997)
- policy guidelines have been defined for a co-operative approach

Lessons that can be learned from the King County experience are distilled as follows:

- need regional decision-making for investments
- need regional funding
- need multi-level forums

While a voluntary approach in King County has been successful at developing consensus and community priorities, it has failed to deliver:

- regional funding
- certainty - due to the governance issue
- ability to do new regional projects

Based on the King County experience, ensuring success at the watershed scale means there must be an over-arching decision authority in place plus senior government funding.

Other British Columbia Experience

Three regional districts (Greater Vancouver, Capital Region, and Nanaimo) have developed or are in the process of developing regional approaches to ensure consistency in municipal stormwater management strategies. These are a component of Liquid Waste Management Plans (LWMPs). However, there is no precedent in British Columbia for inter-municipal funding of implementation plans for cross-boundary watershed protection or restoration.

Quasi-precedents for cross-jurisdictional stormwater funding in British Columbia may be found in regional water supply and wastewater treatment systems. Typically, this means that member municipalities have designated responsibility to regional districts (through 'letters patent') for these functions. Based on a cost sharing formula, the municipalities contribute funding for capital improvements and operation and maintenance of the regional function. This arrangement offers a possible template for a regional approach to stormwater funding.

Building Consensus and Implementing Change

Chapter Eleven

11.1 Developing a Shared Vision

- Benchmarking a Watershed Vision to an Official Community Plan
- How Do We Get There?
- Providing a Clear Picture of the Watershed Vision

11.2 Overcoming Barriers to Implementation

- Barriers to Change in Local Government
- Guiding Principles to Overcome Barriers
- Gaining Political Commitment through Consensus-Building

11.3 Moving from Planning to Action

- Critical Success Factors for Moving from Planning to Action
- Accomplishing Institutional Change

11.4 Translating a Shared Vision into Action

- A Three-Track Process
- Stakeholder Involvement

11.5 Using Working Sessions to Build Consensus

- Consensus Explained
- How Adults Take Up New Ideas
- Working Sessions Result in Knowledge Transfer

11.6 Administering an Action Plan

- ❑ Track #3 – Finance and Administration
- ❑ Constant Improvement

11.7 Defining Roles and Aligning Responsibilities

- ❑ Local Government
- ❑ Senior Levels of Government
- ❑ The Private Sector
- ❑ The Public
- ❑ Inter-Governmental Co-operation Agreements

11.8 Creating Change Through Public Communication

- ❑ Communicating the Need for Change
- ❑ Ingredients to Build Consensus

11.1 Developing a Shared Vision

Successful implementation of Integrated Stormwater Management Plans (ISMPs) depends on having the support of the community. If the public and elected officials have a shared vision for integrating stormwater management with land use planning, funding and implementation are far more likely to follow.

With participation of the regulatory agencies in the visioning process, senior governments are far more likely to support a local government's efforts and less likely to impose burdensome requirements.

Benchmarking a Watershed Vision to an Official Community Plan

An Official Community Plan (OCP) presents a vision of the future, and provides a benchmark for referencing the goals and objectives of the stormwater planning process. An OCP is an official statement of policy and reflects community values. A representative OCP Vision Statement is presented below:

> ***"The City shares the goal of sustainable development, and believes that good ecology is fundamental to...preserving the City's vision of an urban community in a sea of green"***

Source: 1990 City of Chilliwack OCP

The purpose of an ISMP is to translate the OCP vision into a stewardship-based watershed vision. Stream stewardship is the act of taking responsibility for the well-being of streams and stream corridors, and carrying out works to protect or restore that well-being.

How Do We Get There?

Protecting property, accommodating growth and development and sustaining natural systems is a balancing act. Achieving this balance through an ISMP process involves a 3-step process:

- first, there has to be a perceived need
- this then establishes the goals in developing a strategy
- finally, implementation requires public support in order to generate political action

To be effective, a watershed (or catchment) strategy must be based on a clear definition of shared goals and realistic expectations for achieving them.

Critical Success Factors for Developing a Watershed Vision

Fundamental ingredients to build consensus and ultimately implement a watershed vision are listed below:

- **Achievable and Affordable Goals** - Apply a science-based approach to create a shared vision for improving the health of individual watersheds over time.
- **Participatory Decision Process** - Build stakeholder consensus and support for implementing change, and agree on expectations and performance targets.
- **Political Commitment** – Secure political agreement on the need for action.

Long-Term Vision and Priorities for Action

A shared long-term vision is required to focus effort. This vision provides a context for all planning, data collection, capital expenditures and regulatory changes that result from an ISMP.

Prioritizing goals and actions (through consensus) provides a roadmap for moving towards the long-term vision.

Providing a Clear Picture of the Watershed Vision

Figure 11-1 provides a picture of the shared 50-year vision for the Como Creek watershed in the City of Coquitlam. This watershed comprises an upper benchland and a lower floodplain. There has been a history of flooding problems in the lowlands. A series of drainage reports on the lowland problems had been completed over a 25-year period. However, the overall picture provided by those reports was complex and confusing.

The first priority was to develop a common understanding of the nature of the problem. Upstream urbanization in the Como Creek watershed has resulted in more surface runoff, flow is concentrated at a single drainage outlet, and the Trans-Canada Highway acts as a barrier that restricts the rate of outflow from the watershed. Once the nature of the problem was understood by all participants, it quickly became possible to reach consensus on how to provide flood relief and restore aquatic habitat.

Figure 11-1 presents the three elements of the Como Watershed Vision, and three supporting actions for one of those elements.

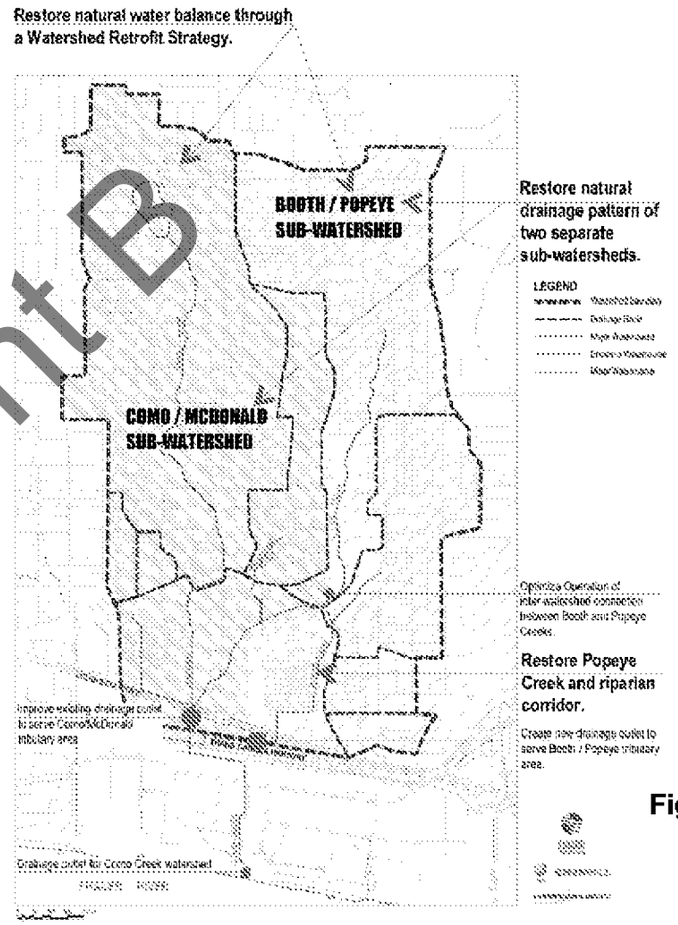


Figure 11-1

11.2 Overcoming Barriers to Implementation

Effective integration of engineering, planning and environmental solutions is often discussed but rarely achieved. Figure 11-2 on the next page illustrates the results of an American survey that identified the top ten reasons that decisions fail. The first four relate directly to human behaviour, with the #1 reason being the lack of a 'decision process'.

Barriers to Change in Local Government

It has been recognized that dealing with stormwater and aquatic habitat issues must be integrated with decisions about land use change. But making this a reality is easier said than done. There are a number of barriers that make bringing about change difficult, including:

- **Lack of a Champion**
- Lack of Trust ("Why should I believe you?")
- Liability ("What if it doesn't work?")
- Access to Resources (staff and money)
- Uncertainty About How to Go Forward
- Attitudinal ("Who cares?" or "Why change?")
- Jurisdictional Conflicts (internal and external)
- Educational (i.e. how new ideas are accepted)

Guiding Principles to Overcome Barriers

The risks and the impacts have become drivers for change in the way stormwater is managed in BC. Once a champion is identified to provide leadership, following these principles will create the momentum needed to build support to implement change:

- **Build Trust**
- Solve the Right Problem
- Avoid Useless Data
- Manage Risk and Liability
- Put Interest and Values First
- Avoid Advocacy Positions
- Find Lowest Cost Solution
- Track Progress
- Ensure Effective Communication
- Learn from Mistakes
- Share Lessons Learned

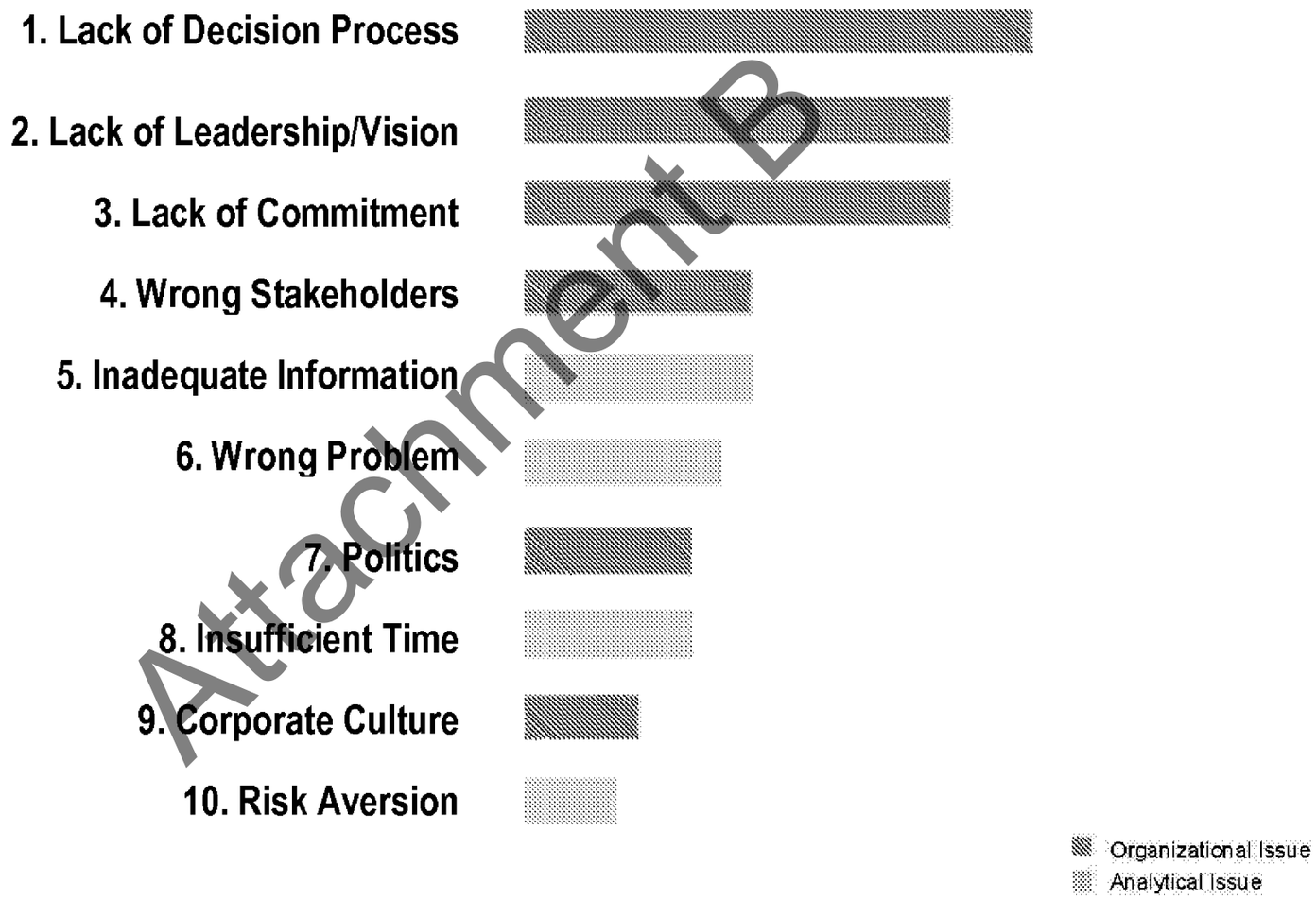
Gaining Political Commitment through Consensus-Building

Bringing about voluntary change by local government involves a systematic process as summarized below:

- **Demonstrate the Need for Action**
- Integrate Diverse Perspectives
- Align Roles and Responsibilities
- Communicate with Stakeholders
- Partner with Regulatory Agencies
- Implement a Participatory Process

Technical people have to demonstrate cost-effectiveness in order to transform political acceptability into the political will needed to implement change and spend money.

Figure 11-2 Most Decisions Fail Because of Organizational Rather than Analytical Issues



11.3 Moving From Planning To Action

The history of drainage is that floods occur, post-mortem reports are written, the sense of urgency wanes, and there is inaction until the next flood serves as a reminder that the issue remains unresolved. This historical reality provides a frame of reference for overcoming the challenges involved in implementing integrated solutions.

Critical Success Factors for Moving from Planning to Action

Bridging the gap between planning and action requires that three critical success factors be in alignment:

- **Political Commitment** – to take action to integrate stormwater management with land use planning
- **A Champion Within Local Government** – to provide energy and organizational drive and to stimulate willingness to change
- **Trust** – between individuals, and between levels of government

Section 11.6 provides guidance for organizing an administrative system and financing strategy for moving from planning to action. The roles and responsibilities of various levels of government, the private sector and the public are defined in Section 11.7.

Integration of OCP and LWMP Processes

The Official Community Planning process is planner-led. The Liquid Waste Management Planning process is engineer-led. Yet the two processes are highly related, and are in fact complementary. This underscores the need for integration to breakdown inter-departmental barriers.

Accomplishing Institutional Change

Risk aversion is usually given as the reason that governments are reluctant to embrace innovation and integrated solutions. However, as demonstrated by Figure 11-2, the #1 organizational factor that results in failure to move from planning to action is the lack of a decision process. Understanding this reality leads to the following principles:

- **Principle #1: Melt the Opposition** – Obtain commitment from key stakeholders to support change (i.e. new values and beliefs).
- **Principle #2: Implement the Change** – A good idea is immediate, but preparation for implementation can take 5 to 10 years. Change will then take place quickly (e.g. within 6 months).
- **Principle #3: Re-Freeze** – Reinforce new values and institutionalize the change.

Principle #1 can only be accomplished through a participatory and collaborative decision process for building consensus as explained in the following sections. A desired outcome is to align the roles and responsibilities of all levels of government to achieve a shared goal.

Organizational Requirements

A lead organization is needed for watershed and drainage catchment planning. The range of possibilities is summarized as follows:

- local government for larger municipalities
- regional districts for smaller municipalities and rural areas
- First Nations on large reserve lands

Other levels of government and stakeholders (besides the lead organization) will be integrated through the consensus process that is discussed next.

A key to future success in ISMP implementation is the ability of departments to communicate with other departments and disciplines to achieve effective changes in the way local governments plan and design neighbourhoods.

11.4 Translating a Shared Vision into Action

A Three-Track Process

ISMP development and implementation requires a three-track process, where technical analysis feeds into working sessions with all stakeholders, and a financing and administration plan is built to support implementation.

- **Track #1: Technical Products** – Identify watershed characteristics, problems and potential management solutions through a technical analysis process that combines the analytical skills and tools from engineering, planning and ecology. Assess strategies and model implementation scenarios. Computer simulation may help identify what is achievable.

- **Track #2: Working Sessions** – Present and refine technical products at a series of workshops and working sessions with all stakeholders. These sessions will improve understanding and enable informed, consensus-based decision making regarding a shared, long-term watershed vision, appropriate strategies for achieving the vision and roles and responsibilities for implementation.

- **Track #3: Finance and Administration** – Organize an administrative system and financial vehicle that is appropriate to the scale of the stormwater management program. In some rural areas, regulation may suffice on its own. In urbanizing areas, a means of collecting and organizing for capital investment and operations will likely be necessary.

Adaptive Process

It is important for all stakeholders to be working towards the same long-term vision (e.g. 50 years) at all stages of the process. The three tracks of effort must work within an adaptive framework to constantly measure success (the effectiveness of technical solutions and progress towards the long-term vision) and optimize management actions.

Integration of Perspectives

The goal and the challenge is to achieve full integration of the engineering, planning and ecological perspectives. The ISMP must be based on science, but it must also achieve consensus among stakeholders at many levels. As a result, Tracks #1 and #2 must happen in parallel to both inform and balance the many perspectives at the table.

Technical analysis in isolation of stakeholder understanding will not survive the agency and political approval processes. Conversely, stakeholder decisions that are made on technically faulty information are at high risk of failure. However, when the two tracks of technical products and working sessions are used together simultaneously, both processes lead to better understanding and better decisions with more stakeholder support.

The remainder of this section outlines how Tracks #1 and #2 work together; Track #3 is discussed further in Section 11-6.

First Priority is to Understand the Watershed

Having an on-the-ground understanding of a watershed is a core critical success factor. Examples of technical products (Track #1) were introduced in Chapter 9 and include:

- Watershed Base Map - the first building block
- Watershed Issues Summary - where and what are the identified problems
- Sensitive Ecosystem Inventory - what is to be protected
- Concurrent Rainfall and Streamflow Data - how the watershed responds to rainfall
- Drainage System Inventory - how the conveyance system functions
- Land Use Map - what are the existing and future generators of runoff
- Soil Infiltration Map – where might infiltration be feasible

Stakeholder Involvement

There are three tiers of stakeholders:

- **Group One: ISMP Steering Committee** – comprises inter-departmental representatives from planning, engineering, development services, parks, environmental planning and finance
- **Group Two: ISMP Focus Group** – comprises representatives from federal and provincial agencies as well as from key community advisory groups (e.g. streamkeepers, neighbourhood associations and local business associations)
- **Group Three: Watershed Forum –** the general public

Working sessions should typically involve both the Steering Committee and the Focus Group. The objective in having the agencies and others participate in a learning environment is to obtain early buy-in to solutions and strategies. Some technical workshops may involve only the Steering Committee where the focus is to be on contract, property or financial issues.

Watershed Forum

Group Three would be only involved at events where the purpose is essentially information presentation, with limited discussion. The size of Group Three would make it difficult for informal discussion. A more structured approach involving questionnaires and small group breakout sessions could make Group Three consultation more focused and productive.

Collaborative Process

Table 11-1 on the next page outlines how Tracks #1 and #2 work together to achieve understanding of and commitment to the ISMP process.

Table 11-1 Adaptive and Collaborative Process for Translating a Shared Vision into Action

Track #1 – Technical Products	Track #2 – Deliverables for Working Sessions
Step 1 - Basic Mapping and Problem Identification Map ecological, drainage and land use information to identify at-risk catchments where land use change: ▪ threatens high-value ecological resources ▪ could cause unacceptable drainage problems. (refer to Chapter 5)	**Step 1 - Shared Vision, Goals, and Priorities** Develop a long-term vision that is shared by all stakeholders, and establish the key goals and objectives that correspond to this vision. Achieve consensus on a priority at-risk catchment to focus early action, as well as the next priorities for action.
Step 2A - Performance targets and site design criteria for achieving shared goals* Analyze site-specific rainfall data to set performance targets for rainfall capture, runoff control and flood risk management. Translate performance targets into design criteria that can be applied at the site level (refer to Chapter 6). **set targets and design criteria for priority catchments first*	**Step 2 – Strategies for achieving performance targets* and long-term vision** Achieve consensus on the strategies that would be most practical and achievable in the context of: ▪ Local conditions ▪ The needs and interests of all stakeholders **appropriate strategies for achieving performance targets should be defined in priority at-risk catchments first*
Step 2B - Alternative strategies for achieving these targets and design criteria Chapters 7 and 8 provide guidance for selecting appropriate strategies at the land use and community planning level, and at the site design level (including specific examples).	
Step 3A - Implementation and monitoring of demonstration projects in at-risk catchments Test the effectiveness (and affordability) of various site design options, while taking immediate action to achieve priority goals.	**Step 3 - Changes to local development standards and regulations:** ▪ to require that development and re-development projects incorporate source control (recommend the most effective and affordable options) ▪ to remove regulatory barriers to better stormwater management and land development practices Change must occur through consultation with all stakeholders, particularly developers and landowners.
Step 3B - Evaluation of local development standards and regulations Identify development standards and regulations that impede better stormwater management and land development practices (e.g. rainfall capture at the source, narrow roads).	
Step 4 - Monitoring of progress towards performance targets and the long-term vision Requires strategic collection of data to track indicators of success and enable ongoing assessment of progress towards performance targets and the long-term vision.	**Step 4 - Optimize stormwater management actions** Improve community planning and site design practices based on stakeholder response to the ongoing assessment process. *Stakeholder participation is key to defining success and developing indicators of success.*

11.5 Using Working Sessions to Build Consensus

Consensus Explained

There are usually complex trade-offs involved in choosing the appropriate integrated solution. Many of the decisions about choice of solution require judgement – about public values and priorities, about the pace of change, and even about environmental conditions based on the currently available scientific information. Choices, especially, involve balance among competing objectives.

The best tool to find this balance is consensus. The word consensus is defined in many different ways, but a working definition can be 'the lack of violent objection'.

The same values might be given different emphasis by different stakeholders – engineering, operations, planning, fisheries, land use development, parks, recreation, homeowners, highways or stewardship groups. The differences in values and emphasis usually stem from what we have been taught and what we have experienced. Consensus is important because it incorporates relevant education and experience from all disciplines and all experience at the table.

How Adults Take Up New Ideas and Approaches

Figure 11-3 illustrates how education leads to implementation. The Figure elements can be read in both the horizontal and vertical directions. Education leads to shared, achievable goals. In turn, these goals culminate in action and implementation.

An understanding of how adults learn can help to explain why and how new ideas are accepted, and why some adults accept them faster than others. Learning is a gradual process. Adults take in new information, reflect on it, blend it with their own experience, test it, and eventually apply it in making decisions.

The differences in the way people accept new ideas, and the fact that learning is a gradual process, underscores the necessity and value of workshops and working sessions. Properly structured, they break down barriers, promote communication and transfer of knowledge, and make it possible to bring people along at different rates of acceptance.

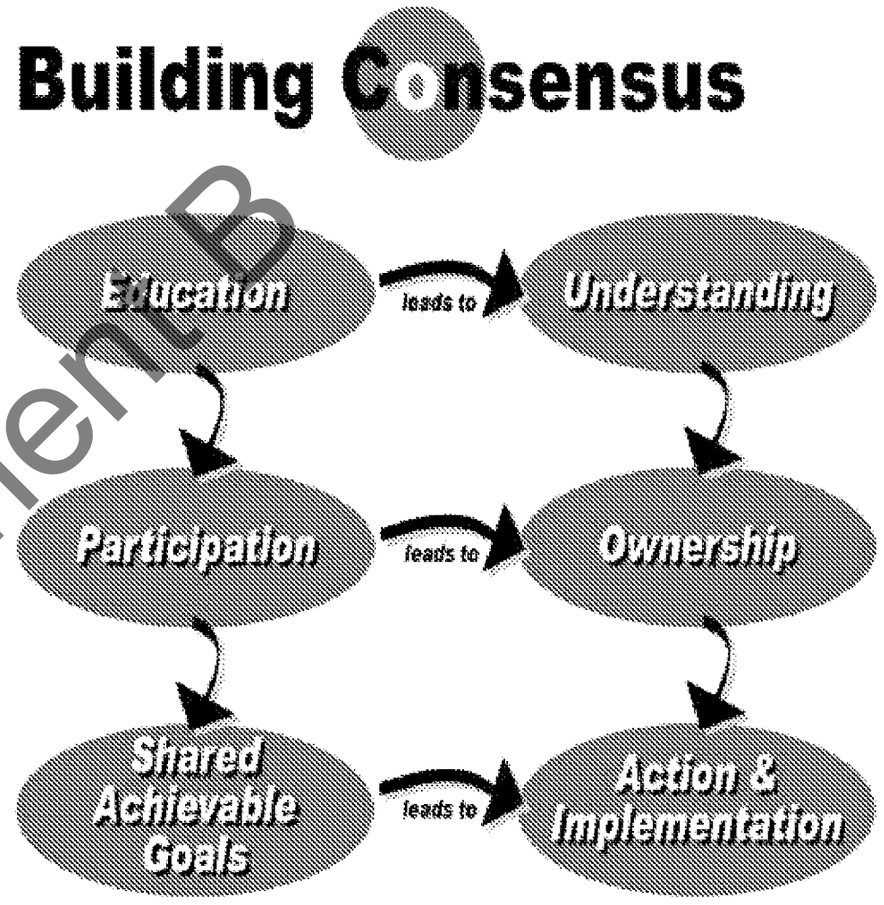


Figure 11-3

Working Sessions Result in Knowledge Transfer

Examples of themes for working sessions to develop consensus around watershed objectives are listed below. Each session would have a product or expected outcome to maintain the focus. Each product is a building block in the broader ISMP process. Since the sessions are interactive, they also provide an effective feedback loop to evaluate the process itself. As well, working sessions facilitate incremental buy-in to a shared vision.

EXAMPLE SESSION THEME	SESSION PURPOSE
Project Initiation and Chartering	Clarify goals, expectations and deliverables
Watershed Issues Workshop	Define issues, needs and driving forces
Hydrology Workshop	Develop a common understanding of issues
Fisheries and Ecology Workshop	Confirm habitat values and limitations
Watershed Vision Workshop	Evaluate performance targets
BMP Workshop	Focus on green infrastructure costs and benefits
Strategy Development Workshop	Develop framework for the integrated plan
Elements of an Integrated Plan - I	Brainstorm pros and cons of the plan elements
Elements of an Integrated Plan - 2	Reach consensus on the plan elements
Regulatory and Communications Plan	Address regulatory and public awareness roles
Implementation Plan	Finalize plan details

This list is only intended to provide a starting point for customizing an appropriate stakeholder program for individual watersheds or catchments. Based on experience, a minimum of four sessions is usually needed for participants to become comfortable with each other and reach consensus.

Structure and Documentation

The agenda for each working session should state the purpose in meeting, define a set of objectives, and indicate the desired outcome. The session should comprise a series of short presentations of the relevant technical analyses, with each presentation segment followed by a question and discussion period. A facilitator can be useful to keep the sessions focused on the desired outcome. Note that:

- **Structure** is provided by a set of presentation slides that guide the discussion. These slides can then become part of the record of the session.
- **Focus** is provided by means of presentation material and/or drawings (i.e. technical products from Track #1).
- **Documentation** is provided through a short-form and succinct session summary that can be included as an appendix to the ISMP.

Working sessions are an effective forum for sharing information, experience and knowledge. Structured sessions foster a learning environment that results in improved communication that in turn leads to enhanced understanding and acceptance.

11.6 Administering an Action Plan

Developing an ISMP is an intensive and extensive process. There is a lot for the participants to remember. The information would be overwhelming if conveyed in its entirety to elected officials. To make decisions related to ISMP implementation, elected officials need relevant information in a concise format.

Track #3 - Finance and Administration

Section 11.4 outlined a three-track approach to building, planning and implementing integrated stormwater management solutions. Table 11-2 is a checklist that summarizes the scope of what is involved in Track #3 - Finance and Administration. The focus is on creating an action plan that identifies the specific activities or projects that need to be completed. The scope of a watershed-specific action plan is summarized below.

Scope of an Action Plan

From an elected official perspective, the key deliverable for any watershed or catchment planning initiative is the action plan that defines the specific activities required to achieve the long-term vision. It is important to provide the following information for each proposed activity:

- Time-frame for implementation
- Management objectives
- Priority (relative to other action items)
- Who takes the lead role?
- Estimated cost and financing strategy

An action plan should cover the 5-year, 20-year and 50-year implementation timeframes. To illustrate this, an Action Plan that resulted from the City of Coquitlam's Como Creek ISMP is presented in Table 11-3.

Table 11-2 Finance and Administration Protocol for Implementing an Action Plan

1. Review existing administrative systems to identify potential departmental organization for stormwater management.
2. Create a summary Action Plan that identifies the actions or projects that need to be completed.
3. Select or create a lead department for integrated stormwater management.
4. Clearly identify what actions are to be led by which department and related budget requirements.
5. Identify the capital and operating financing required, and relate to schedule and other priorities.
6. Review fundraising options and implications.
7. Obtain political and public review in draft form.
8. Refine the Action Plan.
9. Formalize the Action Plan.
10. Consider and adopt the Action Plan.

Constant Improvement

Action plans should be long-term, corresponding to the time frame of the watershed vision, but must be revisited periodically (e.g. every 5 years) and updated based on the ongoing assessment of progress towards the shared vision. This is the foundation of an adaptive approach.

The 50-year vision reflects the long time frame required for change. Over time, as better development practices evolve and as a watershed is gradually retrofitted with rainfall capture and runoff control measures, it will be important to monitor the success of watershed protection and restoration. This is essential for the adaptive approach to work.

The ongoing assessment process will provide better understanding of the policy, science and site design aspects of integrated stormwater management. This will enable constant improvement of integrated solutions.

Table 11- 3 Implementation Actions for the Como Creek ISMP

Time-frame	Action Items	Management Objective	Lead Role	Budget
	Short-term Flood Risk Management	**Provide Immediate Flood Relief**		
Short-term (0-5 years)	**Improve Lowlands Drainage System** a) Remove Booth Creek channel constrictions at and below Lucille Starr Way. b) Expand the rainfall and streamflow monitoring network. c) Build a calibrated hydraulic model for the Lowlands drainage system. d) Upgrade the Booth/Popeye Inter-Watershed Connection. e) Implement the Inter-Watershed Flow Control System at theTrans-Canada Highway. f) Create a separate drainage outlet for Booth Creek under the Lougheed Highway.	a) Eliminate chronic flood overflows onto Schoolhouse Street. b) Monitor watershed changes over time; provide the data needed to calibrate models. c) Develop operating rules for effective flow management in the Lowlands. d) Transfer peak flows and eventually restore two separate sub-watersheds. e) Improve capacity of Como Creek system to reduce risk of flooding above the highways. f) Improve capacity of Como Creek system to reduce flooding; create fish habitat.	Operations Operations Operations Operations Operations Operations	
Short-term (0-5 years)	**Upgrade High-Risk Culverts and Provide Bedload Interception** a) Upgrade the Como Creek culvert at Rochester Ave. and provide bedload interception. b) Upgrade the Booth Creek culvert at Austin Ave. and provide bedload interception. c) Upgrade the Como Creek culvert at Austin Ave. and provide bedload interception.	a) Reduce risk of localized flooding and potential road washout; reduce downstream deposition. b) Reduce risk of localized flooding and potential road washout; reduce downstream deposition. c) Reduce risk of localized flooding and potential road washout; reduce downstream deposition.	Operations Operations Operations	
Short-term (0-5 years)	**Provide Community Storage Facilities** a) Implement the Como Lake Storage and Flow Regulation Modifications. b) Construct Popeye Detention Pond on BC Hydro Site.	a) Reduce erosion in Como Creek Ravine; reduce downstream deposition and flooding risk. b) Improve the effectiveness of the Booth/Popeye inter-watershed connection.	Operations Operations	
	Long-Term Watershed Restoration	**Eventually Restore the Health of the Watershed**		
Short-term (0-5 years)	**Identify Targets & Design Options for Source Storage and Infiltration** a) Implement the Casey Place Bedload Management Plan. b) Build a calibrated hydrology model for the Como Creek watershed. c) Complete a hydrogeologic investigation of the Como Creek watershed. d) Implement and monitor source storage and infiltration pilot projects on public works. e) Establish a consultation process with landowners and the development community. f) Create an on-line technical manual of options for on-lot storage and infiltration.	a) Reduce bedload deposition and flooding risk in the Lowlands. b) Establish target conditions for long-term watershed restoration; optimize management solutions. c) Identify areas within the watershed that are suitable for infiltration at the source. d) Identify appropriate source storage and infiltration targets and identify the best design options. e) Identify design options acceptable to landowners and developers. f) Make design details for source storage retrofit readily available.	Operations Operations Operations Operations Dev. Services Dev. Services	

Table 11- 3 Implementation Actions for the Como Creek ISMP

Time-frame	Action Items	Management Objective	Lead Role	Budget
Short-term (0-5 years)	**Build Support for Watershed Retrofits Through Education** a) Provide a self-guided training program including tours, fact sheets, videos and website information. b) Offer training workshops and seminars to the development community. c) Work with other agencies to design a one-day watershed training and certification program. d) Require that all public works staff and contractors become watershed-certified.	a) Educate development community, city staff and public about the need for changes in development practices. b) Educate development community about how to implement changes in development practices. c) Educate city staff about need for changes in development practices and how to implement them. d) Ensure that City staff can lead by example.	Parks & Env Parks & Env Parks & Env Operations	
Short-term (0-5 years)	**Change Development Regulations to Ensure that Source Storage Retrofit will Occur in Conjunction with Future Re-development** a) Remove barriers to source storage and infiltration in existing development regulations. b) Incorporate the most appropriate targets and design options into the Engineering Standards. c) Incorporate the new Engineering Standards into the Subdivision Bylaw, Building Bylaw, Zoning Bylaw and Development Permit Guidelines.	a) Ensure that the regulatory framework does not discourage source storage retrofit. b) Ensure that the watershed will be restored through source storage retrofit as re-development occurs. c) Ensure that the watershed will be restored through source storage retrofit as re-development occurs.	Dev Services Operations Dev Services	
Short-term (0-5 years)	**Demonstrate a Commitment to Watershed Restoration** a) Implement a water quality source control program in the Lowlands. b) Implement the East Surge Channel Habitat Bank.	a) Improve water quality in the Lowlands by eliminating sources of leachate. b) Create new fish habitat in the Como Creek system; provide compensation for future projects in the watershed.	Operations Operations	
Medium-term (5-20 years)	**Facilitate the Implementation of Source Storage Retrofit Strategy** a) Provide expedited approvals on private sector projects that implement source storage. b) Implement a composting program to provide low-cost organic matter for absorbent soils. c) Implement a program for bulk purchase and resale of storage and infiltration products. d) Continuously monitor rainfall-runoff response and other indicators of watershed health.	a) Facilitate approval process for re-development projects that implement source storage and infiltration. b) Facilitate the procurement of absorbent soils needed to provide infiltration at the source. c) Facilitate the procurement of materials needed to retrofit individual re-development projects. d) Assess the effectiveness of the source storage retrofit strategy in achieving watershed restoration.	Dev Services Parks & Env Operations Operations	
Medium-term (5-20 years)	**Restore the Natural Watershed Drainage Pattern** a) Create a new drainage outlet at the highways for the Booth/Popeye sub-watershed.	a) Achieve the overall vision for two separate sub-watersheds, (Como/MacDonald and Booth/Popeye).	Operations	
Long-term (20-50 years)	**Restore Watercourses to Their Natural State** a) Restore the Popeye Creek stream corridor between Brunette and Lougheed Highway. b) Daylight the piped section of Booth Creek between Sheridan and Myrnam. c) Daylight the piped section of Como Creek below Como Lake. d) Daylight the piped section of Booth Creek below Foster. e) Daylight the piped section of Como Creek below Rochester.	a) Restore healthy aquatic and riparian ecosystems in the Popeye Creek system. b) Restore Booth Creek to its natural state; create a neighbourhood amenity. c) Restore Como Creek to its natural state; create a neighbourhood amenity. d) Restore Booth Creek to its natural state; create a neighbourhood amenity. e) Restore Como Creek to its natural state; create a neighbourhood amenity.	Operations Operations Operations Operations Operations	

11.7 Defining Roles and Aligning Responsibilities

Once there is agreement to move from planning to action, the next step is to define roles and align responsibilities, both for individuals and levels of government.

Local Government

Local governments are the primary players. They control land use decisions, have a comprehensive mandate and are directly accountable to local citizens. Their key responsibilities include:

- Supporting stormwater management objectives through land use planning and growth management.
- Changing municipal development standards and regulations (e.g. engineering standards, zoning bylaws, development permit guidelines, etc.) to enable low impact development and stormwater management.
- Making details of changes readily available to the development community.
- Financing capital works projects (e.g. drainage system improvements, community detention).
- Taking a leadership role by implementing demonstration projects for rainfall capture best management practices (BMPs) on public works.
- Facilitating the procurement of products needed for source-control BMPs.

Senior Levels of Government

Key responsibilities include:

- Providing financial support through provincial and federal programs.
- Providing technical support as required (e.g. the Stewardship series of documents).
- Streamlining the agency approval process.
- Facilitating integration where stormwater management issues cross jurisdictional boundaries.

The Private Sector

The key role for developers is to incorporate rainfall capture BMPs into development and re-development projects. Developers are ultimately responsible for on-the-ground implementation of low impact development and stormwater management practices at the site level. Developers can also play a key role in finding creative and affordable solutions to achieve stormwater performance targets.

The Public

Building public support through education is key. This public support translates into political will for change. An educated public can stimulate action. All levels of government have a role in building public support through stormwater education initiatives.

Inter-Governmental Co-operation Agreements

Inter-Governmental Co-operation Agreements (IGCA) provide a vehicle for aligning responsibilities among all levels of government. The intent of an IGCA is to bring all parties which share a goal – or who are essential players in achieving other jurisdictions' goals – together so that they can apply their various mandates, resources, and capabilities to do the job both efficiently and effectively for all concerned. Important principles and factors to consider in developing such agreements are listed below:

1. **Define Reasons for Intergovernmental Collaboration -** Purpose, topic, scope, benefits to be gained (in 'whereas' statements).

2. **Recognition of Roles and Responsibilities -** By definition, collaboration is not about hierarchical power-based relationships, but partnerships irrespective of who has power. Acknowledge independence (with respect to constituency and related accountabilities) and then deal with collaboration among independent parties acting with reference to mutual interests.

3. **Principles and points for consideration in collaboration -**

   - commitment to action with reference to jurisdictional roles, responsibilities and accountability (clarity on who does what, where, when)
   - partnerships based on strengths and capabilities (co-operation and harmonization with respect to legislation, regulations, policies, programs and projects)
   - consultation on and confirmation of resources needed to do job (impact assessment of costs and benefits and their incidence and resolution of potential issues regarding funding, liability and resources)
   - flexibility (to adapt to conditions that may arise in the administration of a collaborative initiative)
   - notification and consultation (to address any changes that may emerge)
   - information sharing
   - dispute resolution
   - involvement of civil society (who, how, when, by whom)
   - implementation sub-agreements (to address specific topics or actions)
   - administration of agreement (committee(s) and review process to monitor performance and renew, revise or refine agreement(s))

Local governments have now been unequivocally called on by senior governments and the public to protect fish habitat in British Columbia. Principle-based agreements will receive increasing attention as a key ingredient in achieving multi-jurisdictional community development and stream health protection objectives.

11.8 Creating Change through Public Communication

An ISMP may identify required changes to land use regulations in order to implement a stormwater strategy. But public support and the political system will determine the timing and phasing of those changes.

Furthermore, public attitudes and the ability of the development community to adapt will set the pace of change. The pace can be accelerated by intensive public awareness and information campaigns. Accordingly, a communications strategy is an essential element of an ISMP. Such a strategy starts by determining what type of information and training are needed to support the associated Land Development Action Plan.

Communicating the Need for Change

Once BMPs that are appropriate for a catchment have been selected by consensus, and their target areas identified, it is natural to assume that the 'job is done'. Although ISMP development may be largely complete, the job of protection and restoration has just begun. Table 11-4 presents guidelines for creating change through public communication to sustain these protection and restoration efforts.

Initial flood risk management may be accomplished largely by government capital projects. However, the long-range reduction of environmental risk in a catchment will require a permanent change in the way that land is developed and/or re-developed. To accomplish this requires fundamental changes in development, construction and operations standards.

This can only be achieved if there is a broad understanding, within the development community in particular, and the public in general, about best management practices – what they are, why they are needed and how they can be practically accomplished. To create this fundamental change requires reaching a large number of people, many of whom may not be a motivated audience.

Table 11-4 Creating Change Through Public Communication

- There are many different audiences (e.g. politicians, various disciplines of professionals and scientists, students of different levels, volunteer groups, homeowners, construction supervisors and machine operators, builders and labourers). Education materials must be appropriate for each audience, in terms of their prior knowledge and their learning level. Educators must understand the audience, and begin at their level of understanding.
- Different people have different learning styles. Some learn best by seeing, others by hearing, and others still by doing. An education program must therefore target each of these learning styles.
- Most adults will not remember a message until they have heard it at least three times, presented in three different ways.
- Awareness fades with time, and as new people enter the system. A message needs to be repeated to refresh memories, increase awareness and to reach new participants.
- The choice of educational media should respect the audience's preferences, time and available technology.
- Motivation is a key to learning. What's in it for me? When is the teachable moment? For example, in addition to an awareness workshop, a bylaw review may create a teachable moment. So might a requirement for a permit.

Ingredients to Build Consensus

Public awareness will not be changed in a single event. There is an ongoing need for a stewardship communication campaign that is designed to reach the spectrum of audiences in the watershed. This awareness program needs to allow for repetition and reinforcement over time. A communications campaign needs to draw from the experience of educators. It also includes ingredients of marketing. Both bodies of knowledge support the concepts summarized in Table 11-5.

Change in behaviour comes hard and slow. But adaptable human behaviour has been the secret to human success over the millennia. The key to change lies in understanding why change is necessary.

Effective communication, using a variety of media and a series of events with increasing levels of detail, is fundamental to implementing watershed stewardship. When one considers actions with a 20-year or 50-year time horizon, a communication plan must provide for rapid advances in technology, including increased reliance on the Internet. However, the strategy must also consider the role of traditional school and university education, as well as adult education and 'tail-gate' contractor instruction in creating change.

Table 11-5 Ingredients to Build Consensus

- Respect each other's objectives and responsibilities.
- Use plain English and eliminate jargon.
- Create understanding by using practical examples (e.g. flooding hot spots, developer complaints, Councillor representations, fish kills, etc.).
- Focus on problems and solutions, not on personalities.
- Target solutions to specific areas; many solutions will work in only part of the watershed (e.g. infiltration on favourable soils).
- Target solutions by timeline; some can be achieved immediately, some require 20-year or 50-year time horizons.
- Set clear priorities as a group, based on need and cost-benefit analysis, but also on 'full-cost accounting' that also recognizes non-monetary values.
- Recognize solutions that overlap jurisdictions or disciplines; use this process as a way to co-ordinate across departments; what can not be achieved by one department may be possible with two or more departments working in tandem.
- Give solutions a home; for inter-departmental solutions, it is especially important to define the sub-tasks and roles that each department will contribute in detail; otherwise, there is a chance of inertia or duplication if departmental mandates are unclear.
- Focus on what needs to change; watershed management is so broad, it can feel like everything is being reinvented; focus instead on items that need to change; this might mean a series of minor wording changes to bylaws, or relatively minor changes to construction practices that are phased in as the industry is educated to be prepared for them.

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Land Title Act
Declaration

Related Document Number: **CB215820**
Fee Collected for Document: **$0.00**

Please see attached corrective declaration.

Electronic Signature

Your electronic signature is a representation that

(a) You are a subscriber under section 168.6 of the *Land Title Act*, RSBC 1996 c.250, and that you are authorized to electronically sign this document by an e-filing direction made under section 168.22(2) of the act, or

(b) You are a designate authorized to certify this application under section 168.4 of the *Land Title Act*, RSBC 1996, c.250, that you certify this application under section 168.43(3) of the act, and that the supporting document or a true copy of the supporting document, if a true copy is allowed under an e-filing direction, is in your possession, or

(c) If the purpose of this declaration is to bring to the attention of the registrar an error, omission or misdescription in a previously submitted document under section 168.55 of the act, you certify that, based on your personal knowledge or reasonable belief, this declaration sets out the material facts accurately.

James Hamilton McBeath SX41M4

Digitally signed by James Hamilton McBeath SX41M4
Date: 2022-09-19 11:09:03 -07:00

Note: A Declaration cannot be used to submit a request to the Registrar for the withdrawal of a document.

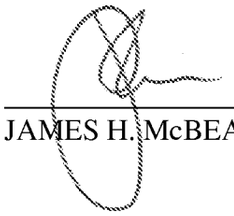
I, JAMES H. McBEATH, Barrister and Solicitor, declare that:

1. A Priority Agreement under item #3 of Document No. CB215820 was inadvertently omitted.

2. A Priority Agreement granting Document No.CB215820 priority over Mortgage No.CA8158028 and Assignment of Rents No.CA8158029 should have been inserted.

3. We are applying for 1 additional number with respect to this filing and that the LTSA filing fee of $76.32 is paid with this declaration.

I make this declaration and know it to be true based on reasonable belief.



JAMES H. McBEATH

{02649986;1}

TOWN OF LADYSMITH
DEVELOPMENT VARIANCE PERMIT

(Section 498 *Local Government Act)*

FILE NO: 3090-24-08

DATE: December 17, 2024

Name of Owner(s) of Land (Permittee):
OYSTER HARBOUR DEVELOPMENT CORP INC.NO. BC1242155
3790 ST. PAULS AVENUE NORTH, VANCOUVER, BC
V7N 1T3

Subject Property (Civic Address): 1130 Rocky Creek Road

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1. This Development Variance Permit is issued subject to compliance with all of the bylaws of the Town of Ladysmith applicable thereto, except as specifically varied or supplemented by this Permit.

2. This Development Variance Permit applies to and only to those lands within the Town of Ladysmith described below and any and all buildings, structures and other development thereon:

   LOT 1 DISTRICT LOTS 24 AND 38 OYSTER DISTRICT PLAN EPP110197
   PID: 031-792-022
   (1130 Rocky Creek Road)

3. Section 5.19.c) "Retaining Walls Regulations" of the "Town of Ladysmith Zoning Bylaw 2014, No. 1860", as amended, is varied for the subject property by increasing the maximum Height for engineered retaining walls from 3.0 metres to 4.0 metres as shown in Schedule A to allow the construction of two over-height retaining walls.

4. Pursuant to section 502(2) of the *Local Government Act* the Land described herein shall be developed strictly in accordance with terms, conditions and provisions of this Permit and any plans and specifications attached to this Permit which shall form a part thereof.

5. The following plans and specifications are attached:

   a) **Schedule A – Retaining Wall Plans**

6. Pursuant to section 504(1) of the *Local Government Act,* if the Permittee does not substantially start any construction permitted by this Permit within **two years** of the date of this Permit as established by the authorizing resolution date, this Permit shall lapse.

7. For the purposes of section 6, "substantially start":

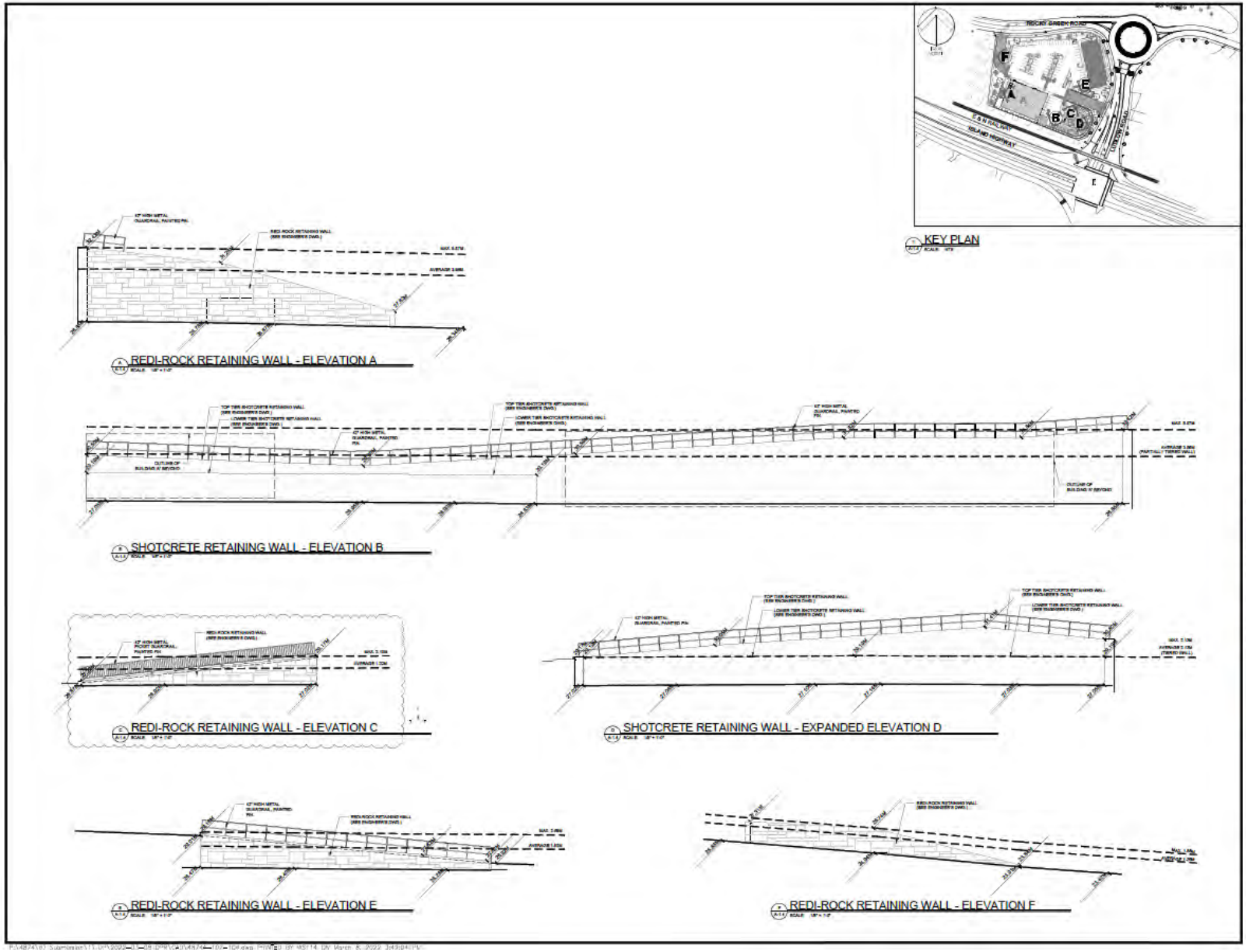
   a. means works undertaken in compliance with this permit and the bylaws of the Town for which a valid building permit has been issued; and
   b. does not include clearing, grubbing or excavation work.

8. Notice of this Permit shall be filed in the Land Title Office at Victoria under section 503 of the *Local Government Act,* and upon such filing, the terms of this Permit or any amendment hereto shall be binding upon all persons who acquire an interest in the land affected by this Permit.

9. THIS PERMIT IS NOT A BUILDING PERMIT. No occupancy permit shall be issued until all items of this Development Variance Permit have been complied with to the satisfaction of the Town.

AUTHORIZED BY RESOLUTION NO. _____ PASSED BY THE COUNCIL OF THE TOWN OF LADYSMITH ON THE ____ DAY OF _____2024.

SCHEDULE A - Retaining Wall Plans
DVP 3090-24-08
1130 Rocky Creek Road



TOWN OF LADYSMITH
DEVELOPMENT PERMIT

(Section 489 *Local Government Act)*

FILE NO: 3060-24-20

DATE: December 17, 2024

Name of Owner(s) of Land (Permittee): OYSTER HARBOUR DEVELOPMENT CORP., INC.NO. BC1242155

Applicant: OYSTER HARBOUR DEVELOPMENT CORP., INC.NO. BC1242155

Subject Property (Civic Address): 1130 Rocky Creek Road

1. This Development Permit is subject to compliance with all of the bylaws of the Town of Ladysmith applicable thereto, except as specifically varied by this Permit.

2. This Permit applies to, and only to, those lands within the Town of Ladysmith described below, and any and all buildings, structures and other development thereon:

   LOT 1 DISTRICT LOTS 24 AND 38 OYSTER DISTRICT PLAN EPP110197

   PID: 031-792-022

   (referred to as the "Land")

3. This Permit has the effect of authorizing the issuance of a building permit for the construction of buildings and structures on the Land and related land alteration, in accordance with the plans and specifications attached to this Permit, subject to all applicable laws except as varied by this Permit and the conditions, requirements and standards imposed and agreed to in this Permit.

4. With respect to the Land:

   (a) Town of Ladysmith Zoning Bylaw 2014, No. 1860 is hereby varied, in accordance with section 490(1) of the *Local Government Act,* as follows:
      i. Section 11.5.4(c) is varied to reduce the minimum setbacks to the following:

Parcel Line	Minimum Setback
Front Parcel Line	3.0 Meters
Interior Side Parcel Line	3.0 Meters
Exterior Parcel Side Line	3.0 Meters
Rear Parcel Line	3.0 Meters

5. This Permit does not have the effect of varying the use or density of the Land specified in Zoning Bylaw 2014, No. 1860.

6. The Permittee, as a condition of the issuance of this Permit, agrees to:

   (a) Develop the land in accordance with the Plans in Schedule A

   (b) Provide high efficiency/water saving irrigation to all landscaped areas.

   (c) Construct solid waste enclosures to fully screen solid waste storage bins from view, including from overhead views

   (d) Notwithstanding the plans in Schedule A, provide bike parking in accordance with section 8.3 of Zoning Bylaw 2014, No. 1860 as follows:
      i. provide 7 short-term bicycle parking spaces, 2 of which must be within 1.5 meters of a 110v electrical outlet for electric bike charging;
      ii. provide 1 long-term bike parking space per employee, this may be determined for each commercial unit as tenant improvements occur; and
      iii. provide 1 shower and 0.5 lockers per required long-term bike parking space under (ii).

7. The Permittee agrees that the sequence and timing of the construction described in this Permit shall take place as follows:
   (a) The development may proceed in two phases as shown in the phasing plan in Schedule A.

   (b) The community bulletin board shown in Schedule A must be installed in Phase 1 in a temporary location and may be relocated once Phase 2 is complete.

   (c) A temporary gravel pedestrian pathway on the frontage of the property along Rocky Creek Road and Ludlow Road and connecting existing sidewalks, as shown in Schedule A, shall be provided in Phase 1. This will be converted to, or replaced by, sidewalk by the Town upon completion of the Ludlow Road/Rocky Creek Road Roundabout.

(d) Prior to occupancy of Phase 1, opaque fencing, such as construction fencing with fabric scrim, must be installed and maintained around the Phase 2 area.

8. This Permit is issued on the condition that the Permittee has provided to the Town of Ladysmith security in the form of one or more irrevocable Letters of Credit to guarantee the performance of the conditions in this Permit respecting landscaping and/or to correct any unsafe condition which may result from a contravention of this Permit. All Letters of Credit shall be for a period of two years, shall be automatically extended, and shall be payable at each phase upon issuance of a building permit or alteration of land, whichever occurs first. The amount of the letter of credit(s) shall be as follows:
   (a) Phase 1: $84,147.29
   (b) Phase 2: $24,835.39

9. Should the Permittee fail to satisfy the conditions of this Permit, the Town of Ladysmith may undertake and complete the works required to satisfy the landscaping condition(s) or carry out any work required to correct any unsafe condition, at the cost of the Permittee, and may apply the security in payment of the cost of the works, with any excess to be returned to the Permittee. Requests for the release of the security shall be accompanied by a report from a landscape architect confirming that the landscaping conditions in this permit have been met.

10. Should there be no default as herein provided, or where a Permit lapses, the Town of Ladysmith shall return any security provided to the Permittee.

11. Pursuant to section 504(1) of the *Local Government Act,* if the Permittee does not substantially start any construction permitted by this Permit within two years of the date of this Permit as established by the authorizing resolution date, this Permit shall lapse.

12. The plans and specifications attached to this Permit are an integral part of this Permit.

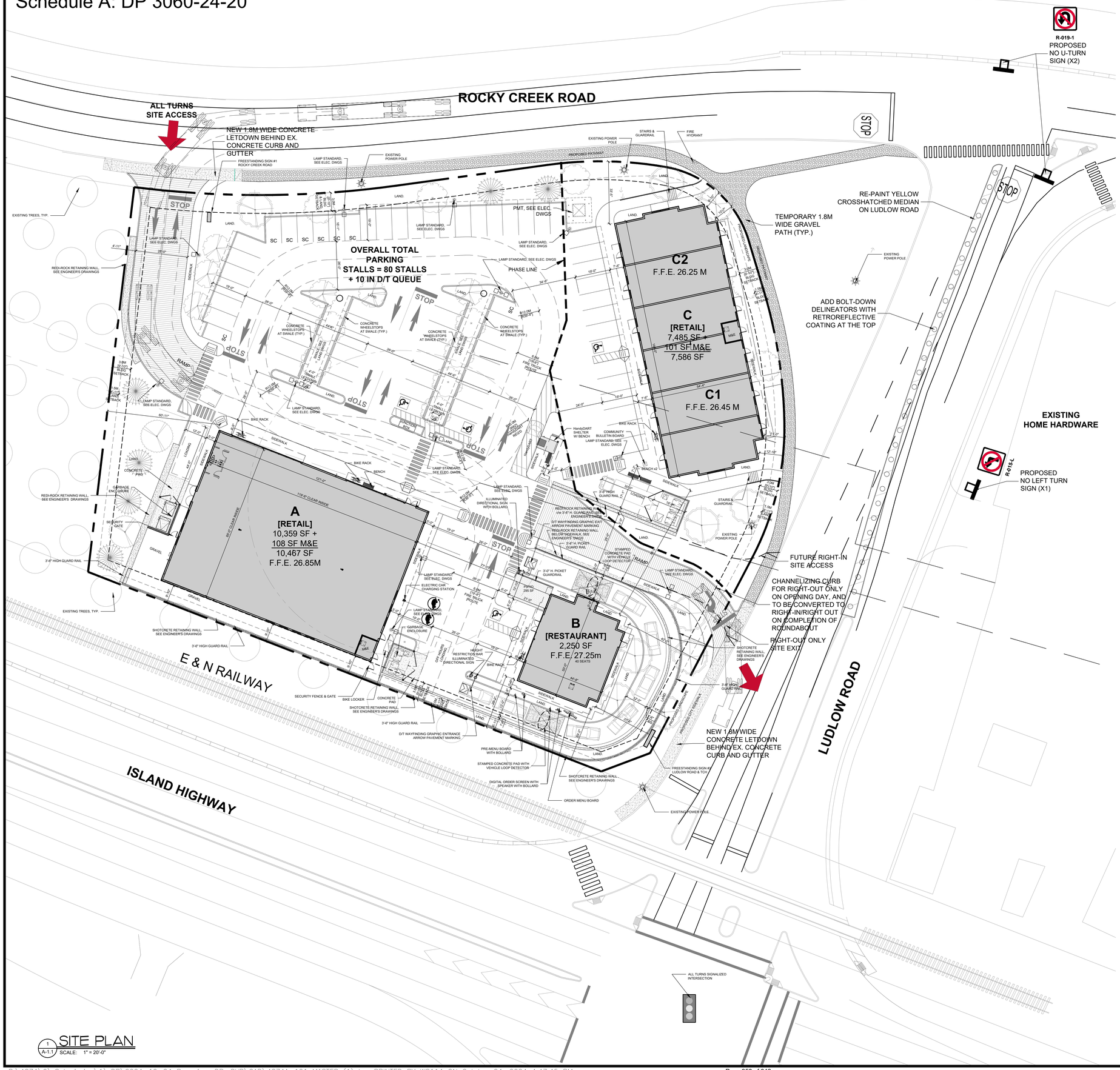
13. Pursuant to section 502(2) of the *Local Government Act* the Land described herein shall be developed strictly in accordance with terms, conditions and provisions of this Permit and any plans and specifications attached to this Permit which shall form a part thereof.

14. Notice of this Permit shall be filed in the Land Title Office at Victoria under section 503 of the *Local Government Act,* and upon such filing, the terms of this Permit or any amendment hereto shall be binding upon all persons who acquire an interest in the land affected by this Permit.

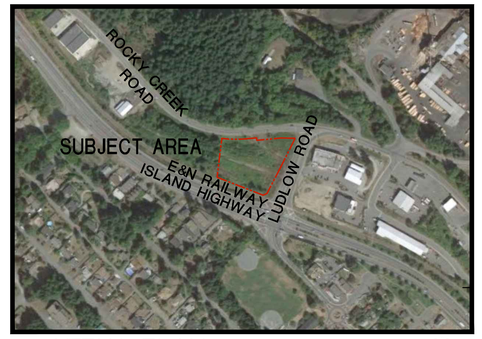
15. This Permit prevails over the provisions of the zoning bylaw in the event of a conflict.

16. Despite issuance of this permit, construction may not start without a Building Permit or other necessary permits.

AUTHORIZED BY RESOLUTION NO. _____ PASSED BY THE COUNCIL OF THE TOWN OF LADYSMITH ON THE ____ DAY OF _____, 202__.



1 SITE PLAN
A-1.1 SCALE: 1" = 20'-0"



1 AERIAL PLAN
A-1.1 SCALE: NTS

NORTH

SITE INFORMATION:

LEGAL DESCRIPTION:	LOT A, DISTRICT LOTS 24 AND 38, OYSTER DISTRICT, PLAN VIP71248
CIVIC ADDRESS:	1130 ROCKY CREEK ROAD, LADYSMITH, BC
EXISTING ZONING:	CD1 (TOURIST SERVICE)
EXIST. LOT AREA (DL 38 & DL 24):	87,177 SF (8,099 SM)
PROPOSED LOT AREA:	94,021 SF (8,735 SF)
BUILDING AREA (G.F.A.):	20,303 SF (1,886 SM)
LOT COVERAGE:	20,303 SF / 94,021 SF x 100 = 21.6%
FLOOR AREA RATIO: (MAX. 0.6)	0.216

GROSS FLOOR AREAS:

PROPOSED BUILDING AREAS:	
BUILDING A [RETAIL]:	10,467 SF (972 SM)
BUILDING B [RESTAURANT]:	2,250 SF (209 SM)
BUILDING C [RETAIL]:	7,586 SF (705 SM)
TOTAL GROSS FLOOR AREA:	20,303 SF (1,886 SM)

PARKING REQUIREMENTS:

TOTAL PARKING REQUIRED:	64 STALLS
TOTAL PARKING PROVIDED:	80 STALLS + 9 IN D/T QUEUE
PARKING RATIO (NOT INCL. D/T QUEUE):	3.9 / 1,000 SF & 4.2 / 100 SM
PARKING RATIO (INCL. D/T QUEUE):	4.4 / 1,000 SF & 4.7 / 100 SM
PARKING PROV'D BREAKDOWN:	REGULAR STALLS = 66 (82.5%)
	HANDICAPPED STALLS = 4 (5%)
	SMALL CARS = 8 (10%)
	ELECTRIC VEHICLE = 2 (2.5%)

PARKING REQUIREMENTS & CALCULATIONS:

RETAIL OR OFFICE (1 PER 323 SF (30 SM) GFA) = 18,053 SF /323 SF = 55.89 STALLS
RESTAURANT OR COFFEE SHOP (1 PER 5 SEATS) = 40 SEATS /5 = 8 STALLS
TOTAL PARKING REQUIRED (ROUND NEAREST) = 63.89 STALLS

COMMERCIAL LOADING: 2 PER 5,393SF (501 SM) TO 26,910 SF (2500 SM) = 2

BICYCLE, CLASS A (LOCKERS): 1 PER 10 EMPLOYEES; 0.6m W. x 1.8m L.

BICYCLE, CLASS B (RACKS): 10% OF REQUIRED PARKING SPACES = 64 x 10% = 6.4

PARKING SIZES:

REGULAR CAR STALL	2.6m (8'-6")	x	5.8m (19'-0")
HANDICAP CAR STALL (MIN. 5% OF REQ'D)	3.7m (12'-2")	x	5.8m (19'-0")
SMALL CAR STALL (MAX 25% OF REQ'D)	2.5m (8'-3")	x	4.9m (16'-1")
LOADING SPACE	3.0m (9'-10")	x	9.0m (29'-6")
MANOEUVERING AISLE	7.3m (24'-0")		

*ADD 0.6m (2'-0") TO ANY PARKING STALL ADJACENT TO A FENCE, WALL, STRUCTURE

GENERAL NOTE:

BOUNDARIES SHOWN HEREON ARE DERIVED FROM EXISTING RECORDS AND MUST BE CONFIRMED BY SURVEY PRIOR TO THE DETERMINATION OF DIMENSIONS OR AREAS FOR DEVELOPMENT PURPOSES.

no	yyyy-mm-dd	description
5	2024-10-24	ISSUED FOR REZONING/DP/DVP
4	2022-03-08	RE-ISSUED FOR DP
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
-	2020-07-21	ISSUED FOR DP

revisions

NORTH

consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2024-10-24 BRITISH COLUMBIA

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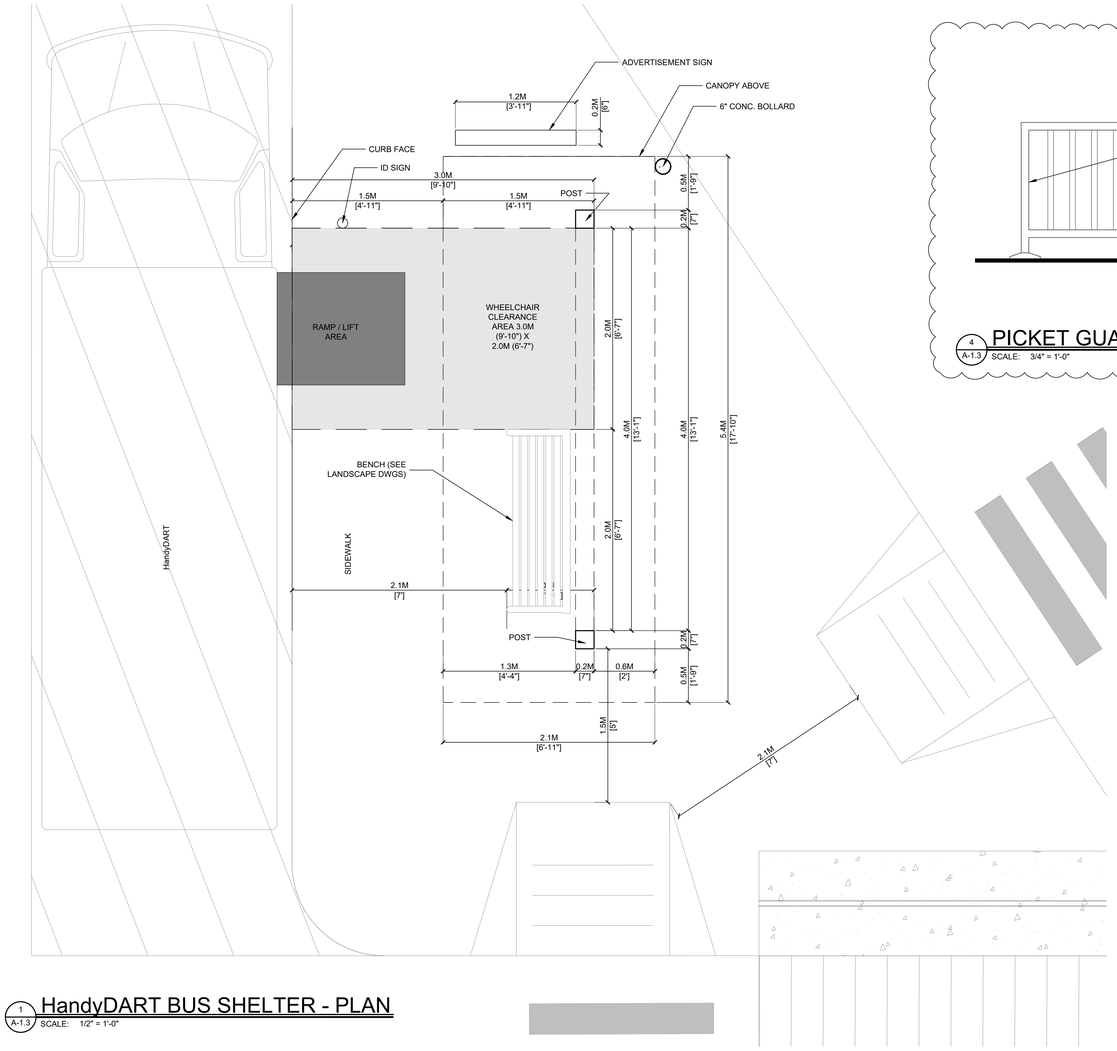
project number 4874

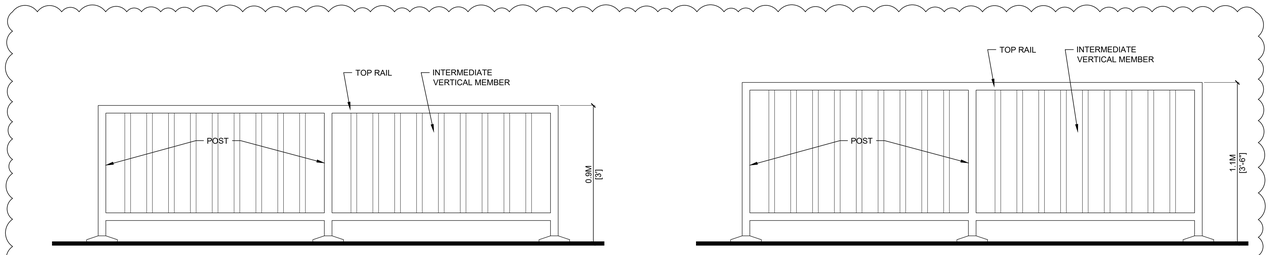
sheet title
SITE PLAN

date	2020-07-16	sheet number	A-1.1
scale	AS NOTED		
drawn	CDC		
checked	AV		

Schedule A: DP 3060-24-20

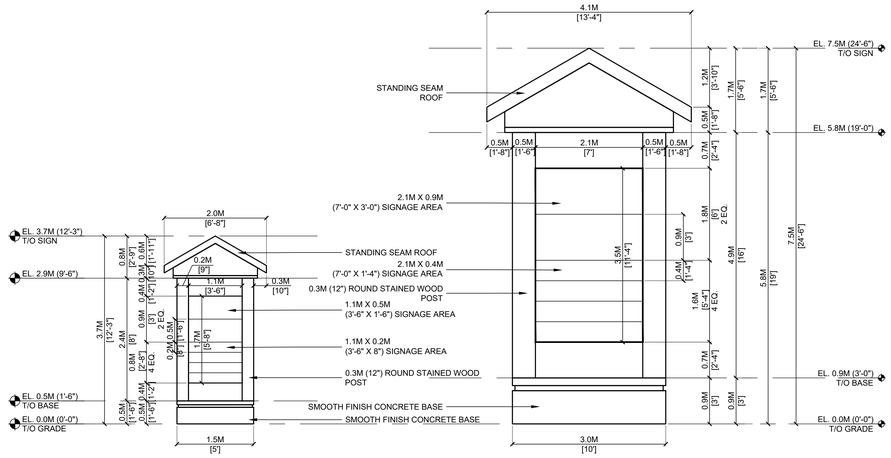


1 A-1.3 HandyDART BUS SHELTER - PLAN
SCALE: 1/2" = 1'-0"



4 A-1.3 PICKET GUARDRAIL AT PATIO (BLACK)
SCALE: 3/4" = 1'-0"

5 A-1.3 PICKET GUARDRAIL AT RETAINING WALL (BLACK)
SCALE: 3/4" = 1'-0"



FREESTANDING SIGN #1 - ROCKY CREEK ROAD:

PROPOSED COPY AREA (PER SIDE) =
1.1m X 1.7m (3'-6" X 5'-8") = 1.87 SM (19.83 SF)

PERMITTED COPY AREA (PER SIDE) =
7.4 SM (79.65 SF)

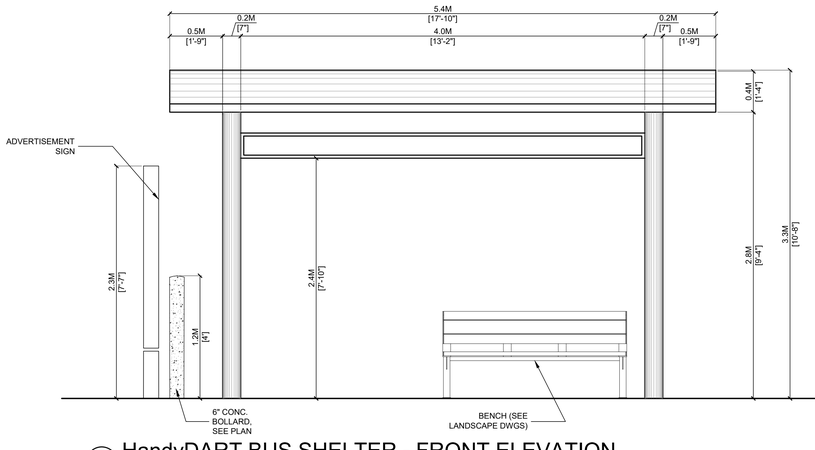
FREESTANDING SIGN #2 - LUDLOW ROAD & TCH:

PROPOSED COPY AREA (PER SIDE) =
2.1m X 3.5m (7'-0" X 11'-4") =7.35 SM (79.33 SF)

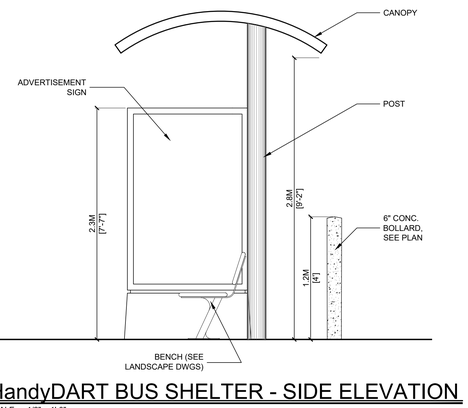
PERMITTED COPY AREA (PER SIDE) =
7.4 SM (79.65 SF)

FREESTANDING SIGN #1
ROCKY CREEK ROAD
6 A-1.2 SCALE: 1/4"=1'-0"

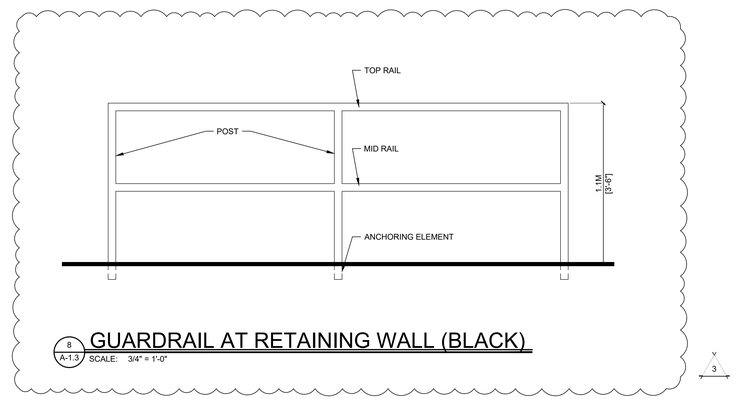
FREESTANDING SIGN #2
LUDLOW ROAD & TCH
7 A-1.2 SCALE: 1/4"=1'-0"



2 A-1.3 HandyDART BUS SHELTER - FRONT ELEVATION
SCALE: 1/2" = 1'-0"



3 A-1.3 HandyDART BUS SHELTER - SIDE ELEVATION
SCALE: 1/2" = 1'-0"



8 A-1.3 GUARDRAIL AT RETAINING WALL (BLACK)
SCALE: 3/4" = 1'-0"

no	yyyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
–	2020-07-21	ISSUED FOR DP

revisions

consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL CHIU 2021-12-17 BRITISH COLUMBIA

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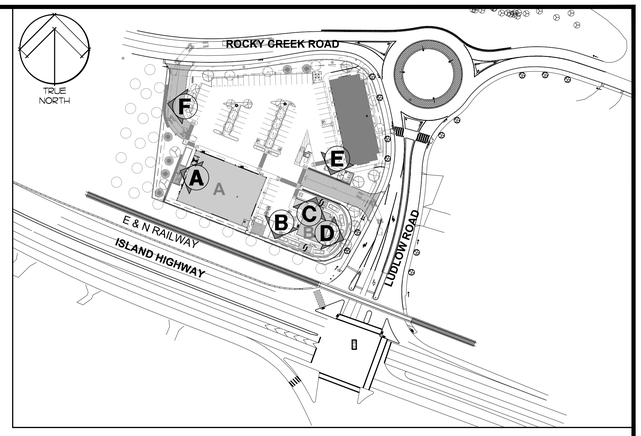
project number 4874

sheet title
SITE DETAILS

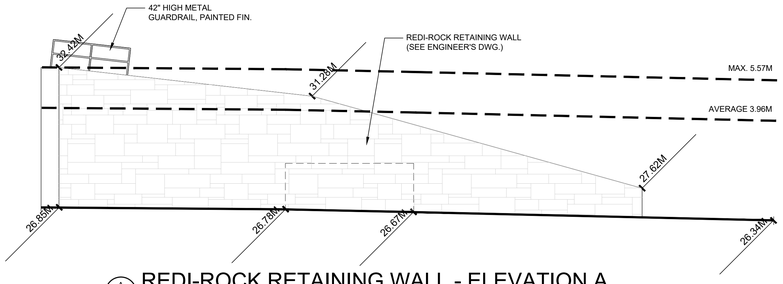
date 2021-08-30
scale AS NOTED
drawn NS
checked PC,JH

sheet number A-1.3

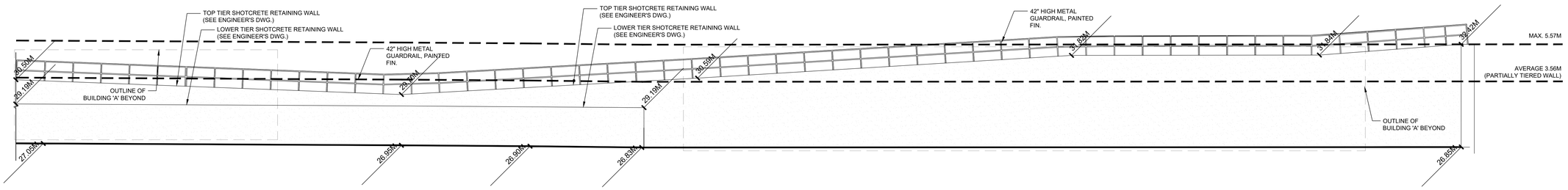
Schedule A: DP 3060-24-20



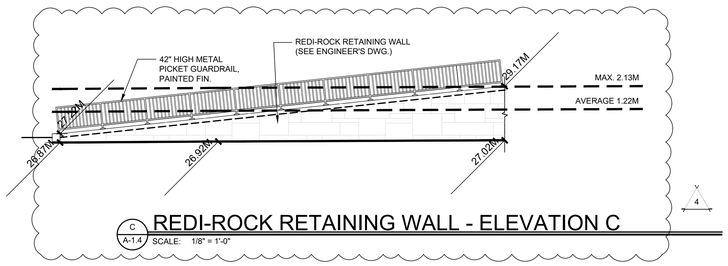
1 A-1.4 KEY PLAN
SCALE: NTS



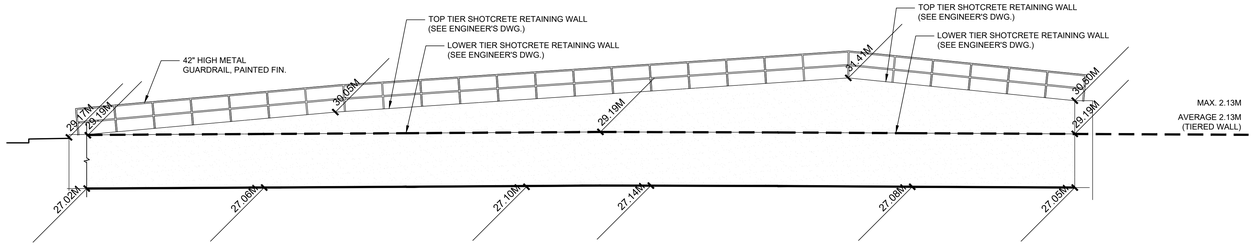
A A-1.4 REDI-ROCK RETAINING WALL - ELEVATION A
SCALE: 1/8" = 1'-0"



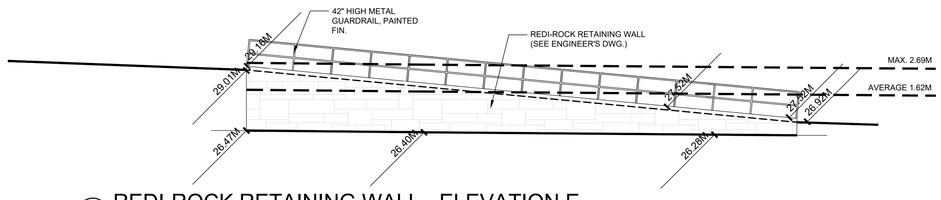
B A-1.4 SHOTCRETE RETAINING WALL - ELEVATION B
SCALE: 1/8" = 1'-0"



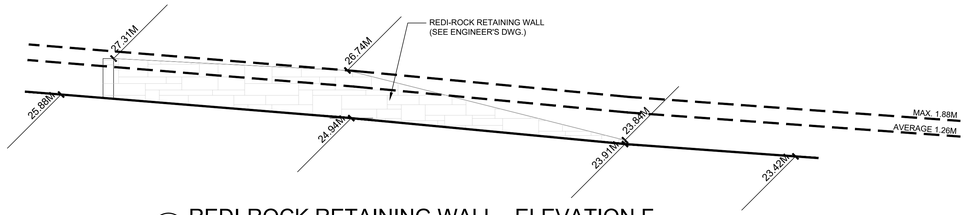
C A-1.4 REDI-ROCK RETAINING WALL - ELEVATION C
SCALE: 1/8" = 1'-0"



D A-1.4 SHOTCRETE RETAINING WALL - EXPANDED ELEVATION D
SCALE: 1/8" = 1'-0"



E A-1.4 REDI-ROCK RETAINING WALL - ELEVATION E
SCALE: 1/8" = 1'-0"



F A-1.4 REDI-ROCK RETAINING WALL - ELEVATION F
SCALE: 1/8" = 1'-0"

4	2022-03-08	RE-ISSUED FOR DP
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
—	2020-07-21	ISSUED FOR DP
no	yyyy-mm-dd	description

revisions

consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2022-03-08 BRITISH COLUMBIA

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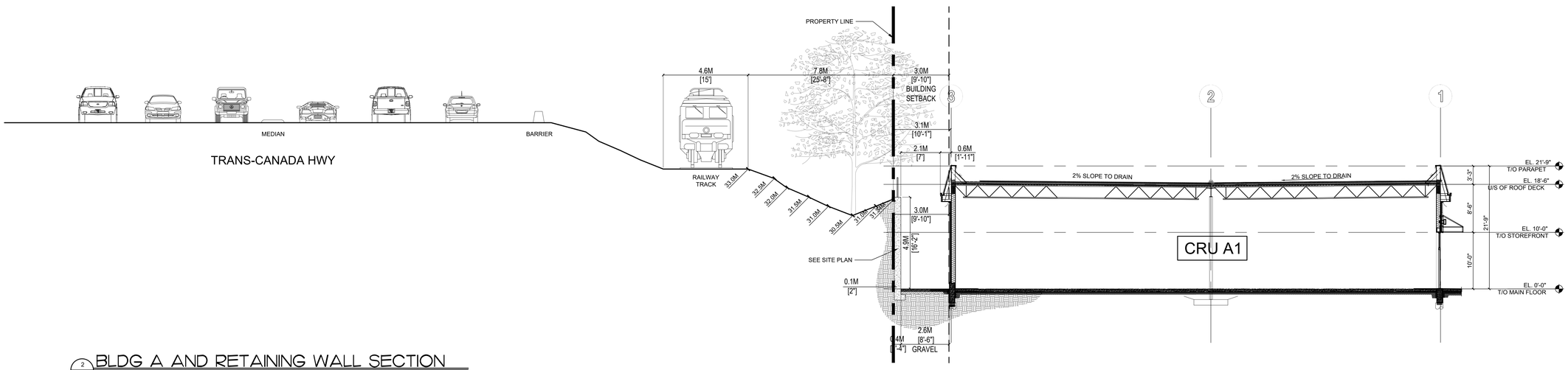
project number 4874

sheet title
RETAINING WALL ELEVATIONS

date	2021-08-30	sheet number	
scale	AS NOTED		A-1.4
drawn	AH		
checked	PC/JB		

Schedule A: DP 3060-24-20

1 STREETSCAPE
SCALE: NTS



2 BLDG A AND RETAINING WALL SECTION
SCALE: 1/8"=1'-0"

no	yyyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
-	2020-07-23	ISSUED FOR DP

revisions

consultant

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1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2021-12-17 BRITISH COLUMBIA

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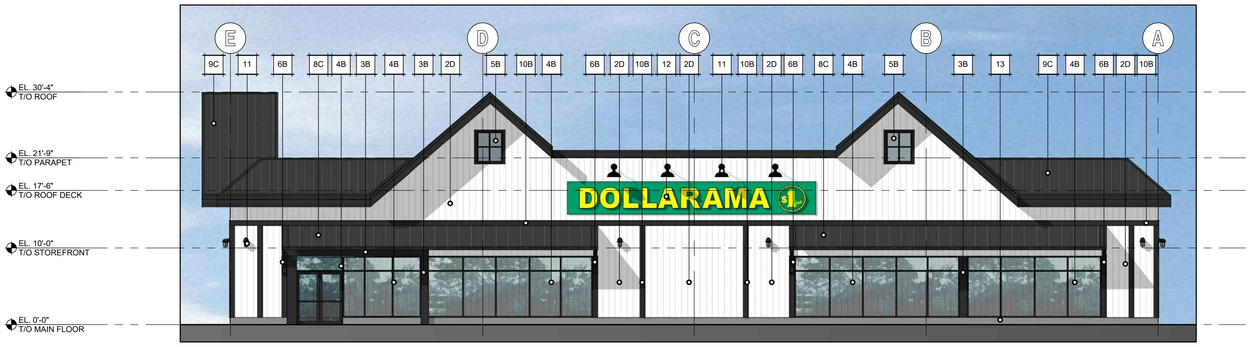
project number 4874

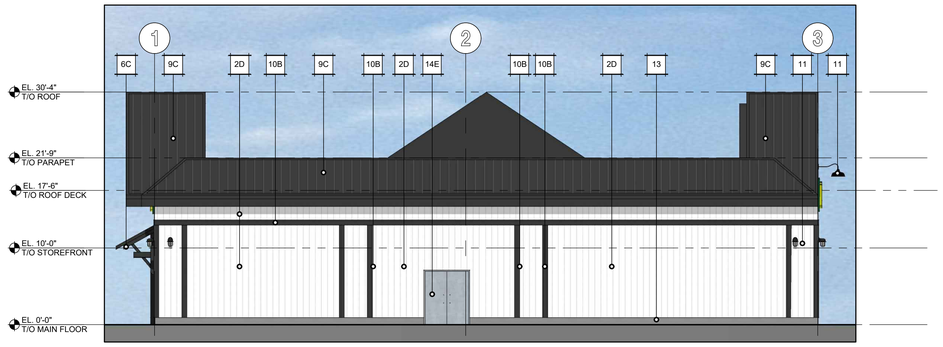
sheet title
STREETSCAPE & SITE SECTION

date 2020-07-23
scale AS NOTED
drawn AP/IW
checked BL

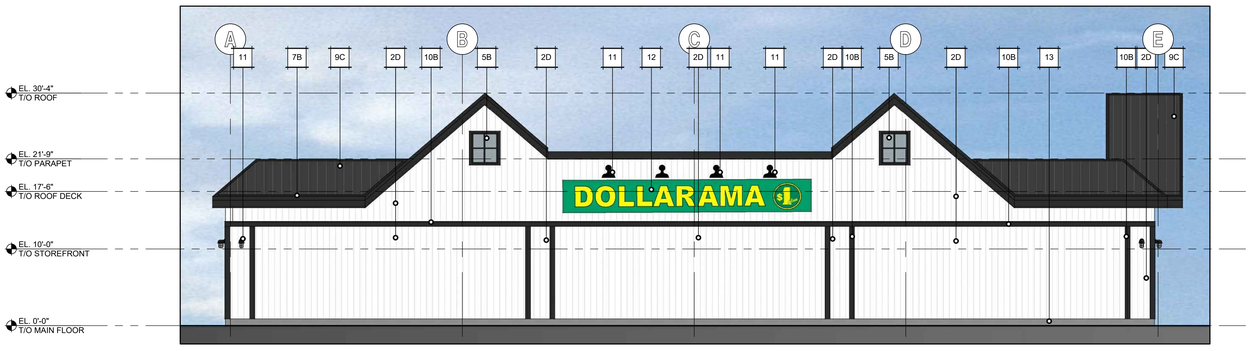
sheet number A-1.5



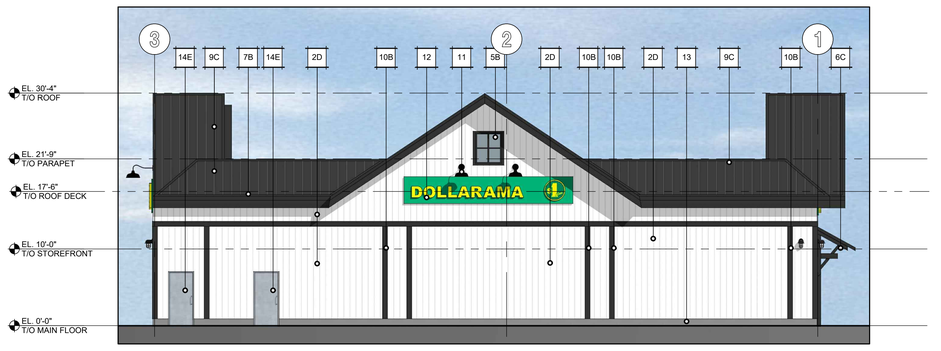
1 A-A-3.1 NORTH ELEVATION
SCALE: 1/8" = 1'-0"



2 A-A-3.1 WEST ELEVATION
SCALE: 1/8" = 1'-0"



3 A-A-3.1 SOUTH ELEVATION
SCALE: 1/8" = 1'-0"



4 A-A-3.1 EAST ELEVATION
SCALE: 1/8" = 1'-0"

EXTERIOR MATERIALS

1	EIFS	9	METAL ROOF STANDING SEAM
2	VERTICAL METAL SIDING	10	METAL TRIM
3	BREAKSHAPE	11	LIGHT FIXTURE, SEE ELECTRICAL
4	ANODIZED ALUMINUM STOREFRONT GLAZING / WINDOWS / DOORS	12	SIGNAGE, BY TENANT (INDIVIDUALLY LIT CHANNEL LETTERS)
5	SPANDREL GLASS	13	SMOOTH FINISH NATURAL CONCRETE UPSTAND
6	DECORATIVE METAL BRACING, PAINTED	14	METAL DOOR
7	METAL FLASHING CASCADIA	15	PAINT FINISH
8	STANDING SEAM METAL CANOPY		

EXTERIOR COLOURS

A	NOT USED
B	BLACK
C	CHARCOAL
D	CASCADIA SURF, WHITE
E	REGENT GREY
F	BM 2125-30 GRAY SHOWER
G	NOT USED

no	yyyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
–	2020-07-21	ISSUED FOR DP

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COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2021-12-17 BRITISH COLUMBIA

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project number 4874

sheet title
BLDG A ELEVATIONS

date	2021-12-17	sheet number	A-A3.1
scale	AS NOTED		
drawn	CDC		
checked	AV		

Schedule A: DP 3060-24-20

1 A-A3.2 NORTHWEST VIEW
SCALE: 1/8" = 1'-0"

2 A-A3.2 SOUTHEAST VIEW
SCALE: 1/8" = 1'-0"

no	yyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
–	2020-07-27	ISSUED FOR DP

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COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
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REGISTERED ARCHITECT PAUL T. CHIU 2021-12-17 BRITISH COLUMBIA

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project number 4874

sheet title
BLDG A
MATERIALS & FINISHES

date	2020-04-03	sheet number
scale	N/A	A-A3.2
drawn	AP	
checked	BI	

Schedule A: DP 3060-24-20

1 A-A-3.3 NORTHEAST VIEW
SCALE: 1/8" = 1'-0"

2 A-A-3.3 SOUTHEAST VIEW
SCALE: 1/8" = 1'-0"

3 A-A-3.3 NORTHWEST VIEW
SCALE: 1/8" = 1'-0"

4 A-A-3.3 SOUTHWEST VIEW
SCALE: 1/8" = 1'-0"

no	yyyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
–	2020-07-21	ISSUED FOR DP

revisions

consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2021-12-17 BRITISH COLUMBIA

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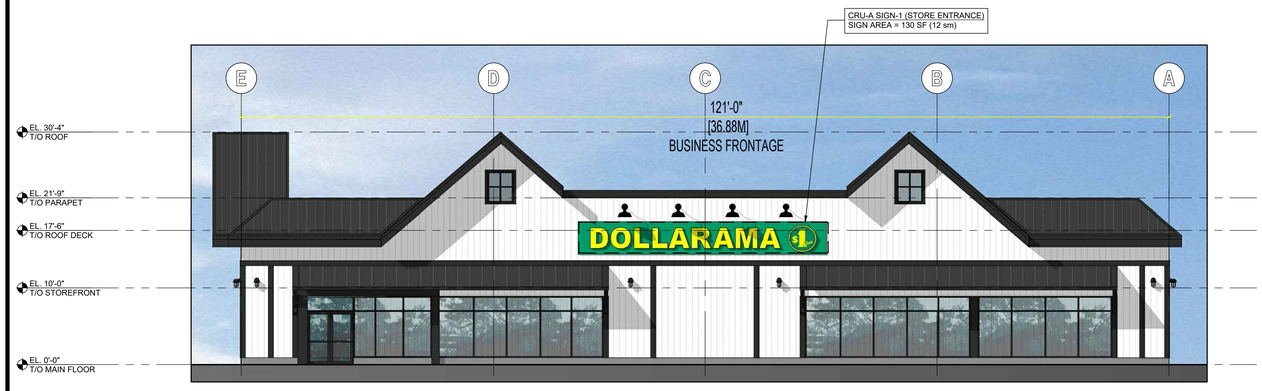
project number 4874

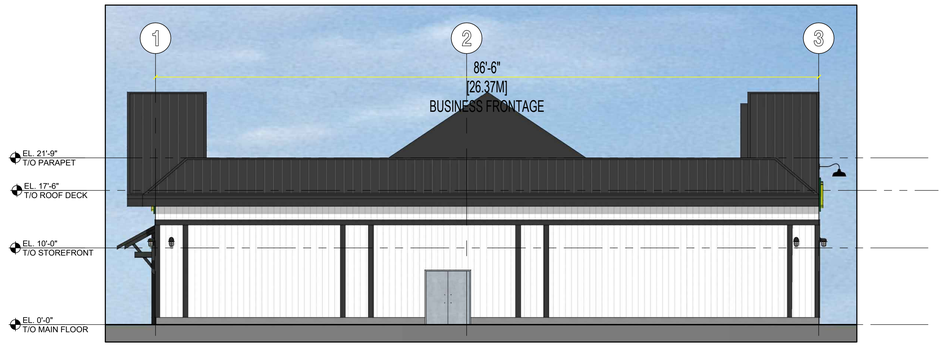
sheet title
BLDG A RENDERINGS

date	2020-04-03
scale	N/A
drawn	AP
checked	BI

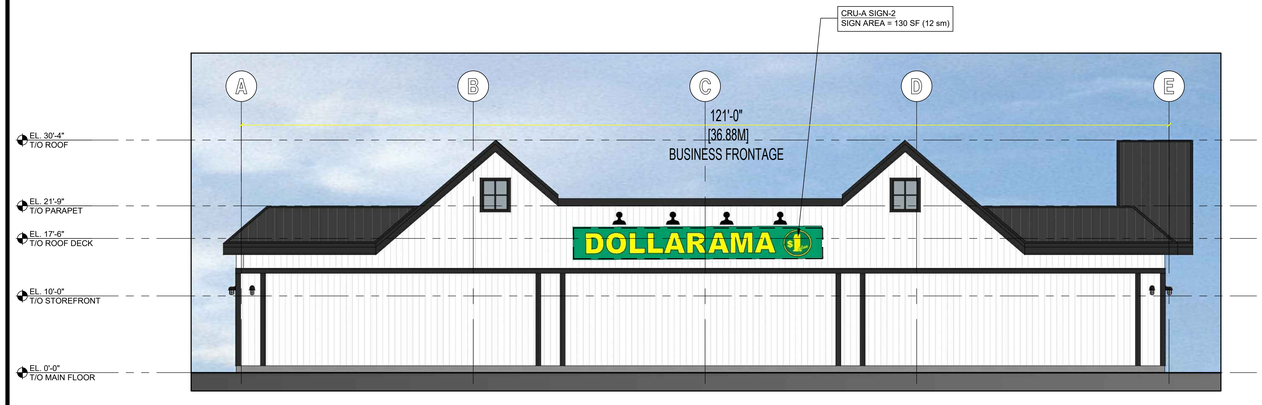
sheet number A-A-3.3



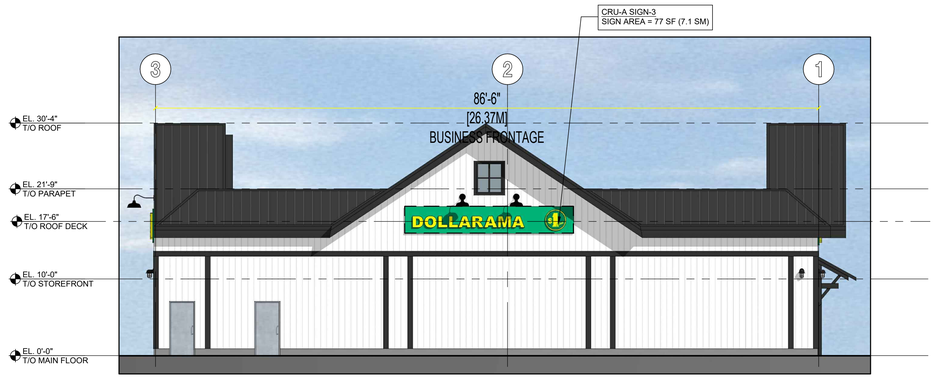
1 A-A-3.4 NORTH ELEVATION
SCALE: 1/8" = 1'-0"



2 A-A-3.4 WEST ELEVATION
SCALE: 1/8" = 1'-0"



3 A-A-3.4 SOUTH ELEVATION
SCALE: 1/8" = 1'-0"



4 A-A-3.4 EAST ELEVATION
SCALE: 1/8" = 1'-0"

FREEFORM CONNECTED
CHANNEL LETTERS

FREEFORM
CUTOUT LOGO

INDIVIDUAL
CHANNEL LETTERS

NOTE: BACKGROUND MUST BE OPAQUE.
BACKLIT SIGNS SHALL NOT BE PERMITTED.

4 A-A-3.4 FASCIA SIGN EXAMPLES
SCALE: 1/8" = 1'-0"

FASCIA SIGNAGE CALCULATION

BYLAW 1176: MAX. PERMISSIBLE SIGN AREA
= 0.1 SM FOR EVERY 0.30 M OF THE OCCUPANT'S BUSINESS FRONTAGE

WEST AND EAST BUSINESS FRONTAGE = 26.37 M
PERMITTED MAX. SIGN AREA = 0.1 (26.37 / 0.3) = 8.8 SM (95 SF)

SOUTH AND NORTH BUSINESS FRONTAGE = 36.88 M
PERMITTED MAX. SIGN AREA = 0.1 (36.88 / 0.3) = 12.3 SM (132.4 SF)

PROPOSED SIGN AREA

NORTH ELEVATION (STORE ENTRANCE)
CRU-A SIGN-1 = 12 SM (130 SF)

SOUTH ELEVATION
CRU-A SIGN-2 = 12 SM (130 SF)

SOUTH ELEVATION
CRU-A SIGN-3 = 7.1 SM (77 SF)

no	yyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
-	2020-07-23	ISSUED FOR DP

revisions

consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2021-12-17 BRITISH COLUMBIA

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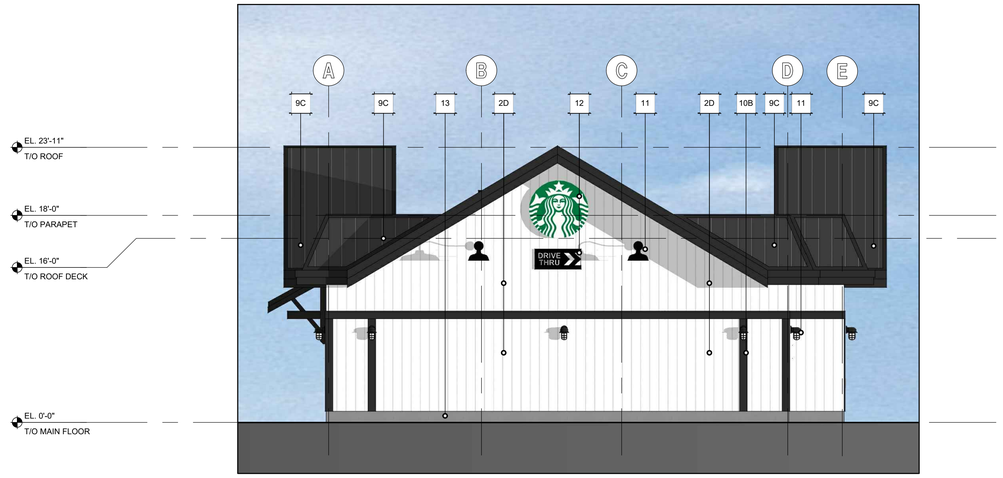
project number 4874

sheet title
BLDG A SIGNAGE

date	2020-07-23
scale	AS NOTED
drawn	MM
checked	BI

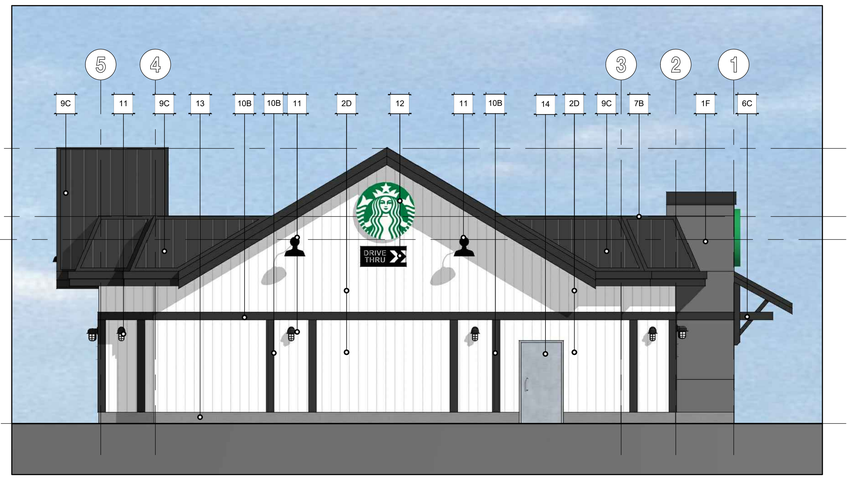
sheet number A-A-3.4

1 A-B-3.1 WEST ELEVATION
SCALE: 3/16" = 1'-0"



2 A-B-3.1 SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

3 A-B-3.1 NORTH ELEVATION
SCALE: 3/16" = 1'-0"



4 A-B-3.1 EAST ELEVATION
SCALE: 3/16" = 1'-0"

EXTERIOR MATERIALS			
1	EIFS	9	METAL ROOF STANDING SEAM
2	VERTICAL METAL SIDING	10	METAL TRIM
3	BREAKSHAPE	11	LIGHT FIXTURE, SEE ELECTRICAL
4	ANODIZED ALUMINUM STOREFRONT GLAZING / WINDOWS / DOORS	12	SIGNAGE, BY TENANT (INDIVIDUALLY LIT CHANNEL LETTERS)
5	SPANDREL GLASS	13	SMOOTH FINISH NATURAL CONCRETE UPSTAND
6	DECORATIVE METAL BRACING, PAINTED	14	METAL DOOR
7	METAL FLASHING CASCADIA	15	PAINT FINISH
8	STANDING SEAM METAL CANOPY	16	READY ACCESS SECURITY WINDOW 600 SERIES FLUSH MOUNT DRIVE THRU WINDOW (INSULATED)

EXTERIOR COLOURS	
A	NOT USED
B	BLACK
C	CHARCOAL
D	CASCADIA SURF, WHITE
E	REGENT GREY
F	BM 2125-30 GRAY SHOWER
G	NOT USED

no	yyyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
-	2020-07-21	ISSUED FOR DP

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consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2021-12-17 BRITISH COLUMBIA

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project number 4874

sheet title
BLDG B ELEVATIONS

date	2021-07-21	sheet number	
scale	AS NOTED		A-B-3.1
drawn	AP/CDC		
checked	BT		

Schedule A: DP 3060-24-20

1 A-B-3.2 NORTHWEST VIEW
SCALE: 1/8" = 1'-0"

2 A-B-3.2 NORTHEAST VIEW
SCALE: 1/8" = 1'-0"

no	yyyy-mm-dd	description
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2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
–	2020-07-21	ISSUED FOR DP

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TELEPHONE 604 687 2334

project number 4874

sheet title
BLDG B
MATERIALS & FINISHES

date	2020-04-03
scale	N/A
drawn	AP
checked	BI

sheet number A-B-3.2

Schedule A: DP 3060-24-20

1 A-B-3.3 NORTHEAST VIEW
SCALE: 1/8" = 1'-0"

2 A-B-3.3 NORTHWEST VIEW
SCALE: 1/8" = 1'-0"

3 A-B-3.3 SOUTHEAST VIEW
SCALE: 1/8" = 1'-0"

4 A-B-3.3 SOUTHWEST VIEW
SCALE: 1/8" = 1'-0"

no	yyy-mm-dd	description
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2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-19	RE-ISSUED FOR DP
—	2020-07-27	ISSUED FOR DP

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COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

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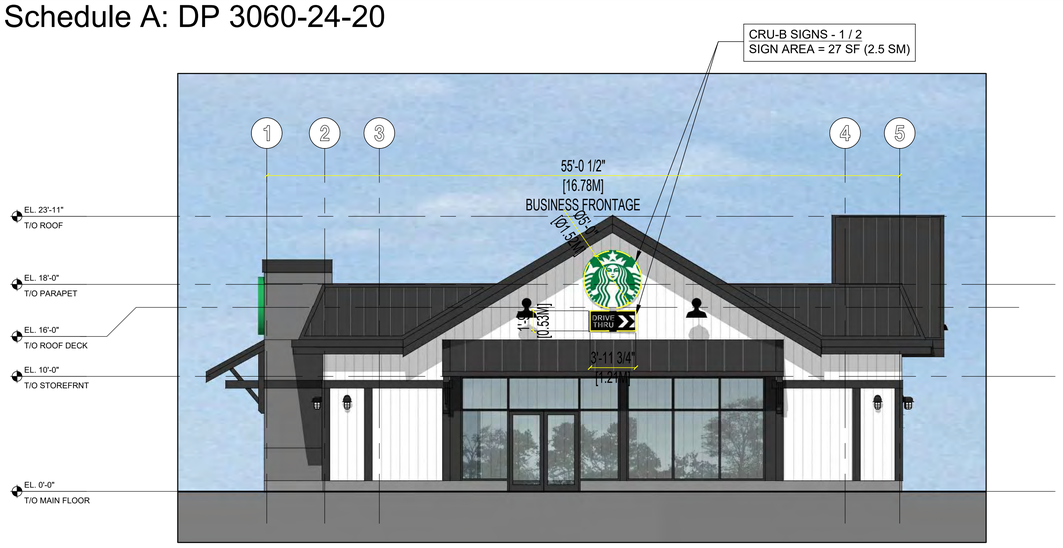
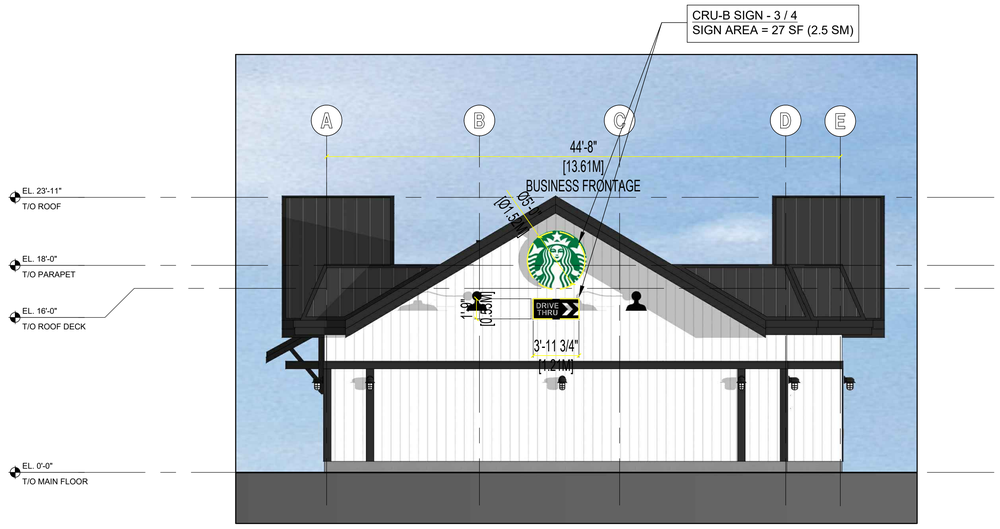
project number 4874

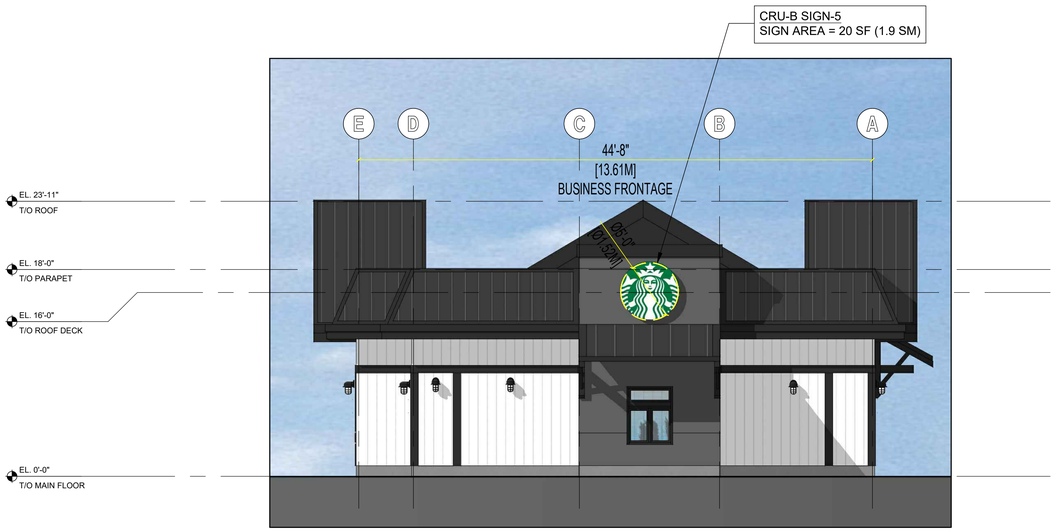
sheet title
BLDG B
RENDERINGS

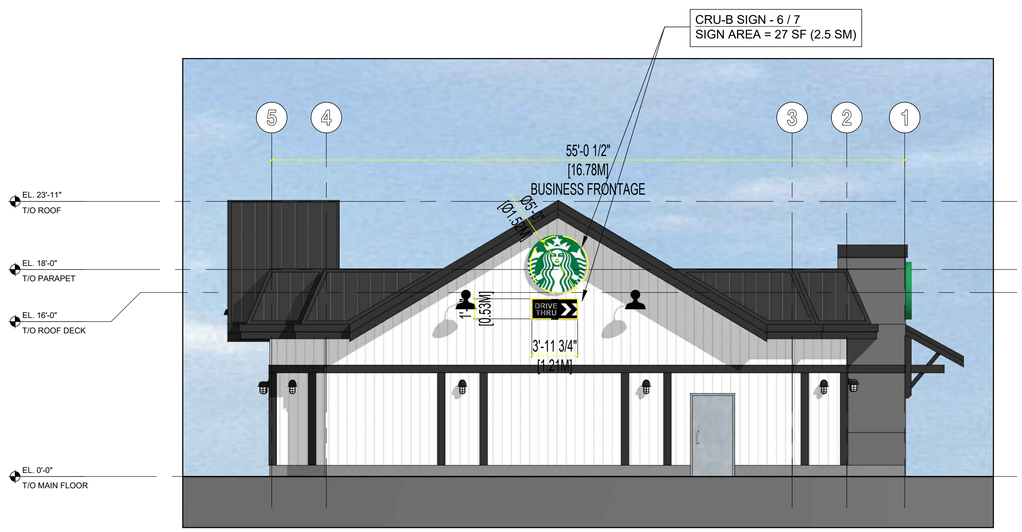
date	2020-04-03
scale	AS NOTED
drawn	AP
checked	BI

sheet number A-B-3.3









FREEFORM CONNECTED
CHANNEL LETTERS

FREEFORM
CUTOUT LOGO

INDIVIDUAL
CHANNEL LETTERS

NOTE: BACKGROUND MUST BE OPAQUE.
BACKLIT SIGNS SHALL NOT BE PERMITTED.

FASCIA SIGNAGE CALCULATION

BYLAW 1176: MAX. PERMISSIBLE SIGN AREA
= 0.1 SM FOR EVERY 0.30 M OF THE OCCUPANT'S BUSINESS FRONTAGE

WEST AND EAST BUSINESS FRONTAGE = 16.78 M
PERMITTED MAX. SIGN AREA = 0.1 (16.78 / 0.3) = 5.6 SM (60.3 SF)

SOUTH AND NORTH BUSINESS FRONTAGE = 13.61 M
PERMITTED MAX. SIGN AREA = 0.1 (13.61 / 0.3) = 4.5 SM (48.4 SF)

PROPOSED SIGN AREA

WEST ELEVATION (STORE ENTRANCE)
CRU-A SIGNS-1/2 = 2.5 SM (27 SF)

SOUTH ELEVATION
CRU-A SIGN-3/4 = 2.5 SM (27 SF)

NORTH ELEVATION
CRU-A SIGN-5 = 1.9 SM (20 SF)

EAST ELEVATION
CRU-A SIGN-6/7 = 2.5 SM (27 SF)

no	yyyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
-	2020-07-23	ISSUED FOR DP

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consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT
PAUL T. CHIU
2021-12-17
BRITISH COLUMBIA

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architects ltd.
810-675 WEST HASTINGS
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TELEPHONE 604 6872334

project number 4874

sheet title
BLDG B
SIGNAGE

date 2020-07-23
scale AS NOTED
drawn MM
checked BI
sheet number A-B-3.4

1 A-C-3.1 EAST ELEVATION
SCALE: 1/8" = 1'-0"

3 A-C-3.1 SOUTH ELEVATION
SCALE: 1/8" = 1'-0"

2 A-C-3.1 WEST ELEVATION
SCALE: 1/8" = 1'-0"

4 A-C-3.1 NORTH ELEVATION
SCALE: 1/8" = 1'-0"

EXTERIOR MATERIALS			
1	EIFS	9	METAL ROOF STANDING SEAM
2	VERTICAL METAL SIDING	10	METAL TRIM
3	BREAKSHAPE	11	LIGHT FIXTURE, SEE ELECTRICAL
4	ANODIZED ALUMINUM STOREFRONT GLAZING / WINDOWS / DOORS	12	SIGNAGE, BY TENANT (INDIVIDUALLY LIT CHANNEL LETTERS)
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8	STANDING SEAM METAL CANOPY	16	READY ACCESS SECURITY WINDOW 600 SERIES FLUSH MOUNT DRIVE THRU WINDOW (INSULATED)

EXTERIOR COLOURS	
A	NOT USED
B	BLACK
C	CHARCOAL
D	CASCADIA SURF, WHITE
E	REGENT GREY
F	BM 2125-30 GRAY SHOWER
G	NOT USED

no	yyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
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1	2021-02-17	RE-ISSUED FOR DP
-	2020-07-27	ISSUED FOR DP

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COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT
RAUL Y. CHIU
2021-12-17
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project number 4874

sheet title
BLDG C
ELEVATIONS

date	2020-04-03
scale	AS NOTED
drawn	AP
checked	BI

sheet number A-C-3.1

Schedule A: DP 3060-24-20

1 A-C-32 NORTHWEST VIEW
SCALE: N.T.S

2 A-C-32 NORTHEAST VIEW
SCALE: N.T.S

no	yyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
–	2020-07-27	ISSUED FOR DP

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COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL T. CHIU 2021-12-17 BRITISH COLUMBIA

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TELEPHONE (604) 6872334

project number 4874

sheet title
BLDG C
MATERIALS & FINISHES

date	2020-04-03	sheet number	
scale	AS NOTED		A-C-32
drawn	AP		
checked	BI		

1 A-C-3.3 NORTHEAST VIEW
SCALE: N.T.S

2 A-C-3.3 NORTHWEST VIEW
SCALE: N.T.S

3 A-C-3.3 SOUTHEAST VIEW
SCALE: N.T.S

4 A-C-3.3 SOUTHWEST VIEW
SCALE: N.T.S

no	yyy-mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
-	2020-07-22	ISSUED FOR DP

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FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT PAUL Y. CHIU 2021-12-17 BRITISH COLUMBIA

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architects ltd.
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VANCOUVER, BC V6B 1N2
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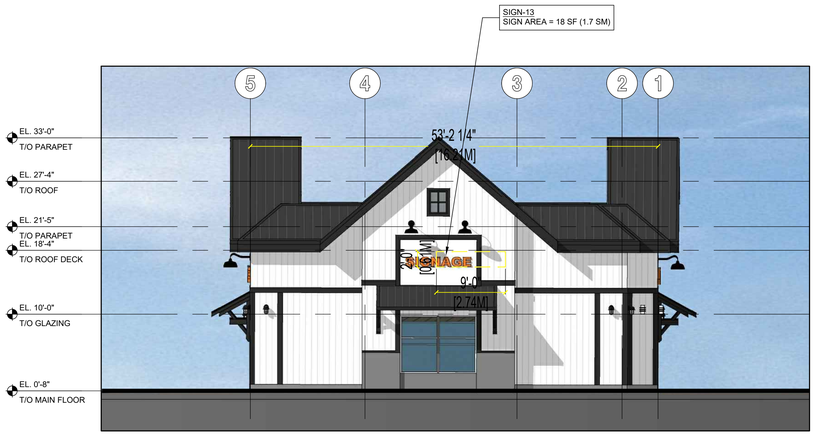
project number 4874

sheet title
BLDG C
RENDERINGS

date	2020-07-22
scale	AS NOTED
drawn	AP
checked	BI

sheet number A-C-3.3



1 A-C-3.4 EAST ELEVATION
SCALE: 1/8" = 1'-0"

3 A-C-3.4 SOUTH ELEVATION
SCALE: 1/8" = 1'-0"

2 A-C-3.4 WEST ELEVATION
SCALE: 1/8" = 1'-0"

4 A-C-3.4 NORTH ELEVATION
SCALE: 1/8" = 1'-0"

FREEFORM CONNECTED
CHANNEL LETTERS

FREEFORM
CUTOUT LOGO

INDIVIDUAL
CHANNEL LETTERS

NOTE: BACKGROUND MUST BE OPAQUE.
BACKLIT SIGNS SHALL NOT BE PERMITTED.

4 A-C-3.4 FASCIA SIGN EXAMPLES
SCALE: N.T.S.

FASCIA SIGNAGE CALCULATION

BYLAW 1176: MAX. PERMISSIBLE SIGN AREA
= 0.1 SM FOR EVERY 0.30 M OF THE OCCUPANT'S BUSINESS FRONTAGE

SOUTH & NORTH BUSINESS FRONTAGE = 43.89 M (OVERALL)
PERMITTED MAX. SIGN AREA = 0.1 (43.89 / 0.3) = 14.63 SM (157.5 SF)

SOUTH & NORTH BUSINESS FRONTAGE = 7.11 M (FOR 6 EQUAL CRU'S)
PERMITTED MAX. SIGN AREA = 0.1 (7.11 / 0.3) = 2.37 SM (25.5 SF)

WEST & EAST BUSINESS FRONTAGE = 16.21 M
PERMITTED MAX. SIGN AREA = 0.1 (16.21 / 0.3) = 5.40 SM (58.1 SF)

PROPOSED SIGN AREA

SOUTH ELEVATION (STORE ENTRANCE) = 13.2 SM (144 SF) OVERALL
SIGN-1 = 2.2 SM (24 SF)
SIGN-2 = 2.2 SM (24 SF)
SIGN-3 = 2.2 SM (24 SF)
SIGN-4 = 2.2 SM (24 SF)
SIGN-5 = 2.2 SM (24 SF)
SIGN-6 = 2.2 SM (24 SF)

NORTH ELEVATION (STORE ENTRANCE) = 13.2 SM (144 SF) OVERALL
SIGN-7 = 2.2 SM (24 SF)
SIGN-8 = 2.2 SM (24 SF)
SIGN-9 = 2.2 SM (24 SF)
SIGN-10 = 2.2 SM (24 SF)
SIGN-11 = 2.2 SM (24 SF)
SIGN-12 = 2.2 SM (24 SF)

EAST ELEVATION
SIGN-13 = 2.2 SM (24 SF)

WEST ELEVATION
SIGN-14 = 2.2 SM (24 SF)

no	mm-dd	description
3	2021-12-17	RE-ISSUED FOR DP
2	2021-11-18	RE-ISSUED FOR DP
1	2021-02-17	RE-ISSUED FOR DP
–	2020-07-21	ISSUED FOR DP

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consultant

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

REGISTERED ARCHITECT
PAUL Y. CHIU
2021-12-17
BRITISH COLUMBIA

urban design group
architects ltd.
810-675 WEST HASTINGS
VANCOUVER, BC V6B 1N2
TELEPHONE 1604) 687-2334

project number 4874

sheet title
BLDG C
SIGNAGE

date	2020-07-21
scale	AS NOTED
drawn	MM
checked	BI

sheet number A-C-3.4

WATT VICTORIA
302 - 740 Hillside Ave
Victoria, BC V8T 1Z4
250-388-9877

MEMORANDUM

Date: March 11, 2024
To: Ashley Garib, Oyster Harbour Development Corp
Cc: Ryan Bouma, Town of Ladysmith
Nadine King, WATT Consulting Group
Kristen Machina, WATT Consulting Group
Patrick Ryan, Herold Engineering
From: Noah Reeder, EIT, WATT Consulting Group
Our File No: 3686.B01
Subject: Addendum to 1130 Rocky Creek Road Transportation Impact Assessment Update

1.0 INTRODUCTION

WATT Consulting Group (WATT) has prepared a Transportation Impact Assessment (TIA) Update to Oyster Harbour Development Corp, dated February 22, 2024, for the proposed commercial development at 1130 Rocky Creek Road in Ladysmith, BC. A comment regarding the TIA Update was received from the Town of Ladysmith ("the Town") stating:

> *"Our biggest concern is what should happen at the Ludlow/Rocky intersection, which remains unresolved . . . The report recommends and the MOTI requires a median to prevent left turns; however, this will direct traffic to the Ludlow/Rocky intersection. Are drivers to do a U-turn? . . . Should this be prevented?"*

As in the TIA Update, this memo will consider Highway 1, Rocky Creek Road, and the leg of Ludlow Road parallel to them to run north/south and the roads intersecting them to run east/west.

2.0 WATT RECOMMENDATIONS

Regarding the Ludlow Road site access as shown on the site plan submitted to WATT, section 2.0 of the TIA Update states:

> *"Right-in/right-out access control is proposed to be enforced by a concrete median assuming the Ludlow Road / Rocky Creek Road intersection is converted to a roundabout."*

The TIA Update went on to recommend in section 5.0:

> *"Add a splitter island to the Ludlow Road site access to enforce the right-in/right-out movements in the absence of a concrete median barrier, prior to the construction of the roundabout at Ludlow Road / Rocky Creek Road."*

The TIA Update did not recommend a concrete median along Ludlow Road; rather, it recommended that left turns into and out of the Home Hardware upper lot access continue to be permitted. 95th percentile queues for westbound left turn traffic at Highway 1 / 1st Avenue-Ludlow Road are as follows:

- Existing AM: 25 m
- Existing PM: 25 m
- Opening Day (2026) Background AM: 25 m
- Opening Day (2026) Background PM: 30 m
- Opening Day (2026) Post-Development AM: 35 m
- Opening Day (2026) Post-Development PM: 35 m
- 2036 Background AM: 30 m
- 2036 Background PM: 35 m
- 2036 Post-Development AM: 35 m
- 2036 Post-Development PM: 40 m

These queue lengths do not reach the Home Hardware upper lot access, which is approximately 50 m from the stop bar before the railroad crossing. The queues for thru and right turn traffic are shorter than the left turn queues in each scenario.

The TIA Update also did not recommend a roundabout at Ludlow Road / Rocky Creek Road. All movements at the Ludlow Road / Rocky Creek Road intersection, as well as the site accesses, operate at LOS A in the 2026 and 2036 horizon years.

3.0 ALTERNATIVES IF MEDIAN IS REQUIRED

If the Town of Ladysmith or the BC Ministry of Transportation and Infrastructure (MoTI) ultimately require a median along Ludlow Road between the existing railroad and Rocky Creek Road, alternatives to a roundabout are available to mitigate the possibility of unsafe U-turns at Ludlow Road / Rocky Creek Road.

3.1 U-Turn Area

A U-turn area could be provided along the northbound side of Ludlow Road or Rocky Creek Road for vehicles exiting the Home Hardware upper lot to turn around. This would consist of a roughly semicircular paved area sized appropriately for a vehicle to make a safe U-turn. The size of the U-turn area would depend on the design vehicle required to be accommodated; it is unknown at this time if the area would need to accommodate delivery trucks or larger lumber trucks attempting to exit the Home Hardware, or if those vehicles are able to exit directly onto the north-south portion of Ludlow Road. There is a steep downgrade adjacent to the northbound side of Ludlow Road and Rocky Creek Road. Additional right-of-way and significant re-grading would likely be required for a U-turn area in this location.

The U-turn area should be well-signed and placed as closely as possible to the intersection to encourage its use. Eastbound traffic should be banned from making U-turns in the intersection and directed to the U-turn area with signage as shown in **Figure 1**. The opportunity for geometric improvements at this intersection to discourage U-turn movements without compromising logging truck movements are limited.

Delivery vehicles exiting the upper lot which are too large for the U-turn area would need to proceed to Highway 1 via the Transfer Beach Boulevard or Malamos Road accesses, a driving distance of 1.7 km or 2.0 km from the upper lot access respectively.

Figure 1: No U-Turn and U-Turn Route signs (R-019 and R-019-3)

3.2 Home Hardware Access via Oyster Bay Drive

In this scenario, shown in **Figure 2**, the existing access to the Home Hardware upper lot is restricted to inbound traffic only and a new inbound/outbound access is added from Oyster Bay Drive. Outbound motorists may then turn left or right onto Ludlow Road from Oyster Bay Drive. This access would serve as the exit route for delivery vehicles and should be designed accordingly. Inbound motorists who currently turn left into the existing upper lot access may instead enter via Oyster Bay Drive. The location of this access is currently obstructed by a guy pole supporting an existing hydro pole. Although the hydro pole itself would not obstruct the access, the guy pole would require adjustment.

Alternatively, Home Hardware may seek a covenant guaranteeing access through the 1030 Oyster Bay Drive parking lot. The lots are currently connected and separated by a gate. Both options would require adjustments to the current lumber yard security fencing and/or gates to permit vehicle through travel to Oyster Bay Drive.

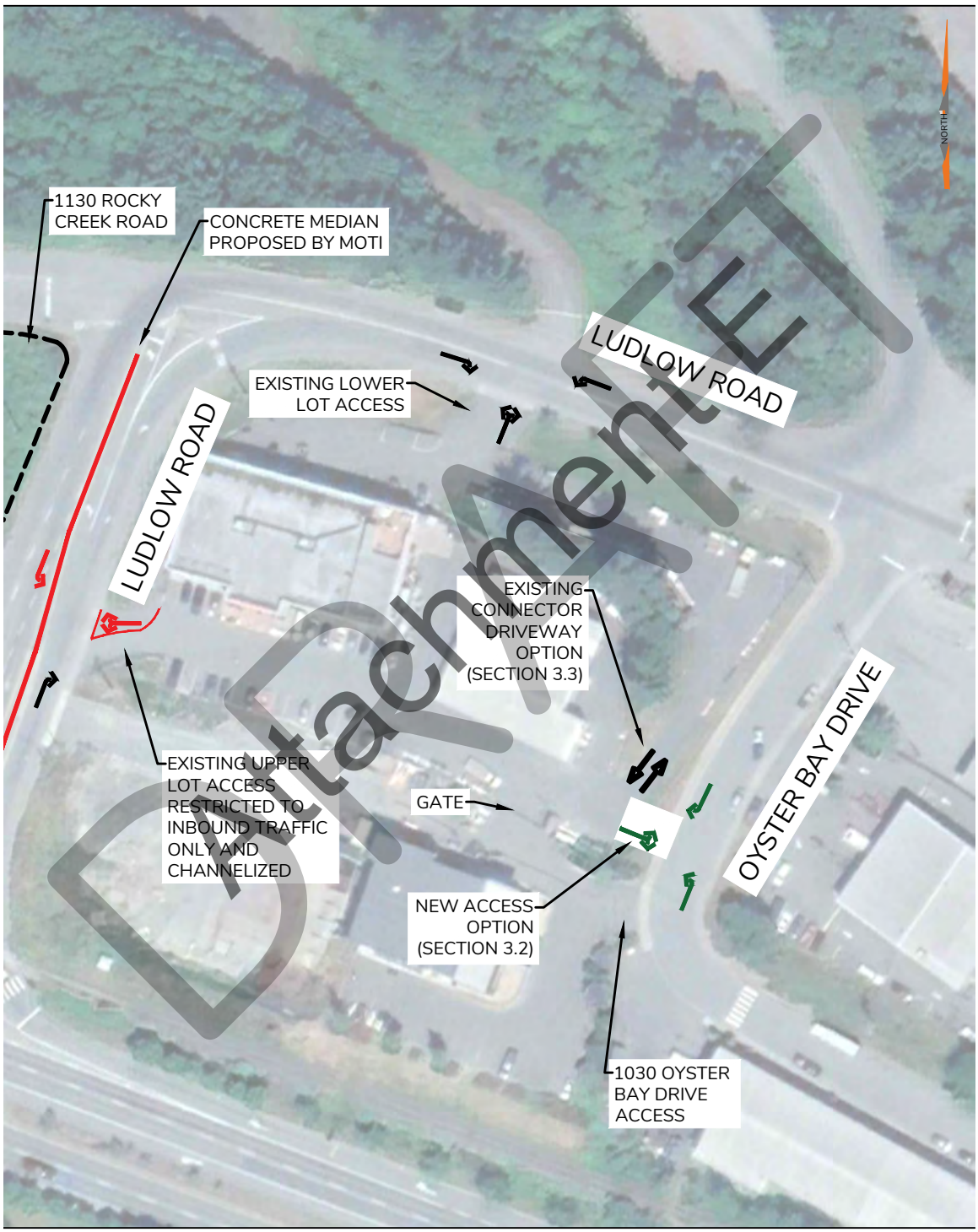
This scenario requires changes to private property not included in the proposed development, and the changes are not necessary to support efficient traffic operations. Rather, the changes would be made to comply with a MoTI and/or Town requirement. For this reason, MoTI and/or the Town should assist with their implementation.

3.3 Existing Home Hardware Upper/Lower Lot Connection

A connector driveway currently exists between the upper and lower Home Hardware parking lots. The proposed median, if constructed, would only pass the upper lot access and would not affect left turns from the lower lot access onto Ludlow Road. Designating the connector driveway as the exit from the upper lot, as shown in **Figure 2**, would allow the inbound only restriction at the existing upper lot access without the need for a new access.

Minor improvements may be needed to accommodate increased vehicle traffic and exiting delivery vehicles. Two-way operations are not necessarily required on the connector driveway, however it may be desirable to provide a convenient entrance for drivers who currently turn left into the existing upper lot access. The driveway's current width (approximately 5-6 m at its narrowest point) may be suitable for two-way operations, for which a width of at least 5.5 m should be provided. In this case, driveway traffic entering the upper lot may need to be stopped while delivery vehicles are exiting.

As with the Oyster Bay Drive access scenario, adjustments to the current lumber yard security fencing and/or gates would be required to permit vehicle traffic to travel along this route. Also, changes to private property not included in the proposed development are required, so MoTI and/or the Town should assist with their implementation.



3.4 Recommendations

If the Town or MoTI ultimately require a concrete median, WATT recommends that the Town work with Home Hardware to:

- Restrict the existing upper lot access to inbound traffic only with appropriate channelization, and
- Designate the existing connector driveway between the upper and lower lot as the exit route for all vehicles from the upper lot, including delivery vehicles
    - Investigate whether widening and/or parking restrictions are necessary, particularly if two-way operations are desired.

While a U-turn area and a ban on U-turns in the intersection would reduce the number of unsafe U-turns, it is unlikely to achieve 100% compliance as drivers would have to first drive through the intersection to reach the U-turn area. Also, construction of the U-turn area would likely require right-of-way expansion and extensive re-grading. The inbound only restriction and channelization on the existing Home Hardware upper lot access would physically discourage eastbound approaches to Rocky Creek Road / Ludlow Road by exiting drivers. Use of the existing upper/lower lot connector driveway will likely be more cost-effective than a new Oyster Bay Drive access and does not require access to 1030 Oyster Bay Drive.

As this recommendation calls for changes to private property not included in the proposed development, and is made strictly to comply with a MoTI and/or Town requirement, MoTI and/or the Town should assist with its implementation.

Sincerely,
WATT Consulting Group

Noah Reeder, *EIT*
Transportation Engineer-in-Training

D 778-309-1843
E nreeder@wattconsultinggroup.com
#WEAREWATT

1130 ROCKY CREEK ROAD

Transportation Impact Assessment Update

2024-10-15

Noah Reeder – Transportation Engineer-in-Training
Author

Kristen Machina, P.Eng. – Senior Transportation Engineer
Reviewer

PERMIT TO PRACTICE:
Number 1001432

Prepared For: Oyster Harbour Development Corp
Date: 2024-10-15
Our File No: 3686.B01

WATT VICTORIA
302 – 740 Hillside Ave
Victoria, BC V8T 1Z4
250-388-9877

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

WATT Consulting Group is retained by Oyster Harbour Development Corp to prepare an updated Traffic Impact Assessment (TIA) for a proposed commercial development at 1130 Rocky Creek Road in Ladysmith, BC. WATT previously prepared a TIA for the site in 2020-2021. The site location is illustrated in **Figure 1**.

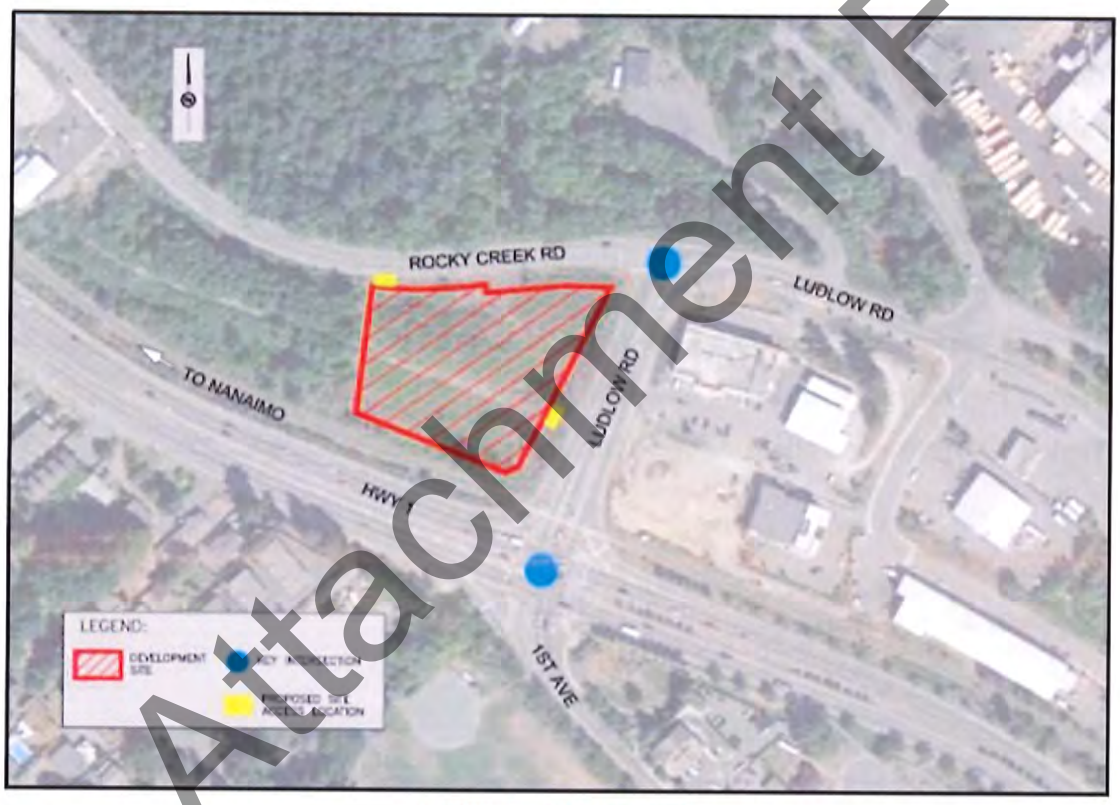


Figure 1 – Site Location

1.1 Proposed Development

The proposed development includes 1,886 m^2 (20,303 ft^2) of retail and drive-through restaurant space. This represents a 20 m^2 (219 ft^2) increase in floor space over the site plan used in the previous TIA.

The current site plan is provided in **Appendix A**. Changes since the previous TIA include removal of the crosswalk across Rocky Creek Road at Ludlow Road. No other significant changes have been made.

1.2 This Report

This report is provided as part of the rezoning application being submitted to the Town.

This report provides the following:

- An overview of the proposed site plan's vehicular access
- A projection of the site's trip generation, distribution, and assignment potential
- An assessment of existing traffic patterns and volumes in the study area during the weekday AM and PM peak periods
- A review of the vehicular traffic volume changes that may occur in the study area in the future due to growth in the waterfront area
- An operational assessment of vehicular traffic operations in the study area under existing, background, and post-development conditions

2.0 SITE ACCESS

The proposed right-in/right-out access on Ludlow Road is located 55m from the Highway 1 / 1st Avenue-Ludlow Road intersection, which complies with TAC's suggested minimum corner clearance of 55m for collector roads from a major signalized intersection. The access is located 40m from the railroad crossing preceding the intersection, which complies with TAC's guideline of at least 30m driveway spacing from a railroad crossing. Right-in/right-out access control is proposed to be enforced by a concrete median assuming the Ludlow Road / Rocky Creek Road intersection is converted to a roundabout. These treatments are considered and discussed **in Section 3.7**.

The proposed full movement access on Rocky Creek Road is at the western edge of the property, approximately 110m west of the Ludlow Road / Rocky Creek Road intersection. This complies with TAC's suggested minimum distance of 25m along collector roads from the stop-controlled intersection.

3.0 TRAFFIC OPERATIONS ANALYSIS

3.1 Traffic Analysis Scenarios and Time Periods

Traffic operations analysis has been undertaken during the weekday AM and PM periods under the following scenarios:

- Existing Conditions (Section 3.4)
- 2026 Background Conditions (Section 3.5)
- 2026 Post-Development Conditions (Section 3.6)
- 2036 Background Conditions (Section 3.5)
- 2036 Post-Development Conditions (Section 3.6)

Due to an expected closure of the eastbound left turn movement at the Highway 1 / Grouhel Road intersection, traffic was reassigned to make the same movement at Highway 1 / 1st Avenue-Ludlow Road in all 2026 and 2036 scenarios.

In post-development scenarios, the Rocky Creek Road site access was assumed to allow all turning movements while the Ludlow Road access was assumed to be right-in/right-out only. This configuration avoids a left turn queue entering the Ludlow Road

access which may extend onto the railroad or into the Highway 1 / 1st Ave-Ludlow Road intersection.

3.2 Methodology and Performance Evaluation Criteria

Intersection capacity analysis for the existing and proposed conditions was completed using the Synchro/SimTraffic 11 software package, which uses the Highway Capacity Manual (HCM) evaluation methodology. HCM results are measured in delay (seconds) and level of service (LOS). 95th percentile queue lengths (metres) for all scenarios, as well as delay and LOS for the Ludlow Road / Rocky Creek Road intersection, were determined through simulation of each scenario in SimTraffic.

The LOS for unsignalized (stop-controlled and roundabout) intersections is determined by the calculated delay for each critical movement. The LOS for a signalized intersection includes additional factors such as geometry, traffic and pedestrian volumes, and signal phasing / timing. LOS is broken down into six letter grades, with LOS A being excellent operation, and LOS F being unstable / failing operations. **Table 1** summarizes the delay per vehicle with the corresponding LOS for both signalized and unsignalized intersections.

Table 1 – Level of Service Criteria

Level of Service (LOS)	Unsignalized Intersections: Average Vehicle Delay (sec / veh)	Signalized Intersections: Average Vehicle Delay (sec / veh)
A	0-10	0-10
B	> 10-15	>10-20
C	>15-25	>20-35
D	>25-35	>35-55
E	>35-50	>55-80
F	>50	>80

3.3 Input and Calibration Parameters

Cardinal Directions

For the purposes of this analysis, Highway 1 is considered to operate per the BC Ministry of Transportation and Infrastructure (MoTI)'s classification as a north-south highway. Rocky Creek Road and the leg of Ludlow Road running parallel to the highway are considered to operate in the same direction, and roads intersecting the highway are considered to operate east-west.

Heavy Vehicle Percentage

The percentage of heavy vehicles for each movement was based on the information provided as part of the turning movement counts. Where not available, a default value of 2 percent heavy vehicles was assumed.

Peak Hour Factor

The Peak Hour Factor (PHF) was based on the information provided as part of the turning movement counts. PHFs were calculated for each intersection using the overall intersection volumes. Where not available, a default PHF of 0.80 was used.

Signal Timings

Existing signal timings were used for all scenarios.

Speed Limit of Ludlow Road

The posted speed limit along Ludlow Road at the Home Hardware access is 40 km/h, however the speed limit was assumed to be 41 km/h as this is the minimum operating speed for the HCM evaluation methodology.

SimTraffic Calibration and Simulation

Five (5) runs of SimTraffic simulation were performed for each scenario, with 5 minutes of seeding and 60 minutes of simulation in each run. Results from all runs of each scenario were averaged for reporting purposes.

3.4 Existing Conditions

3.4.1 Existing Traffic Volumes

Turning movement counts were established for intersections in the study area for the weekday AM and PM periods. Traffic counts adopted as the basis for this study are summarized in **Table 2**.

Table 2 – Existing Turning Movement Counts

Intersection	Count Date	Time Period	Source
Highway 1 / 1st Avenue – Ludlow Road	Thursday, January 25, 2024 Wednesday, January 24, 2024	8:00 – 9:00 AM 4:00 – 5:00 PM	WATT
Ludlow Road / Rocky Creek Road	Thursday, January 25, 2024 Wednesday, January 24, 2024	8:00 – 9:00 AM 4:00 – 5:00 PM	WATT
Ludlow Road / Home Hardware Access	Thursday, January 25, 2024 Wednesday, January 24, 2024	8:00 – 9:00 AM 4:00 – 5:00 PM	WATT

The existing turning movement counts were reviewed in detail to ensure general consistency in traffic volumes between intersections. The existing thru vehicle movements at Ludlow Road / Home Hardware Access and Rocky Creek Road / Future Site Access were determined by balancing vehicle volumes with neighbouring intersections. The existing and balanced baseline traffic volumes for the weekday AM and PM period(s) are illustrated in **Figure 2**.

In addition, a 2018 turning movement count of the Highway 1 / Grouhel Road intersection conducted by TransTech Data Services Ltd. was used to determine the volume of traffic to reassign after an expected closure of the eastbound left turn movement.

- AM PEAK HOUR
(##) - PM PEAK HOUR

3.4.2 Existing Traffic Operations

Intersection analysis results for existing conditions are summarized in **Table 3**.

Table 3 – Existing Intersection Operations

Movement	LOS	Delay (s)	95% Queue (m)
Highway 1 / 1st Avenue-Ludlow Road			
NBL	C (C)	24.0 (24.2)	10 (15)
NBT	C (C)	26.1 (26.2)	55 (70)
NBR	A (A)	0.3 (0.2)	0 (0)
SBL	B (B)	14.8 (14.1)	20 (20)
SBT	B (B)	17.8 (18.6)	50 (65)
SBR	A (A)	3.1 (2.9)	0 (0)
EBL	D (D)	37.4 (40.9)	65 (50)
EBT	C (D)	34.8 (36.5)	75 (70)
EBR	A (A)	0.0 (0.0)	75 (70)
WBL	D (D)	40.6 (42.7)	25 (25)
WBT	D (D)	38.4 (40.2)	15 (25)
WBR	A (A)	0.7 (1.1)	0 (0)

Movement	LOS	Delay (s)	95% Queue (m)
Ludlow Road / Rocky Creek Road			
NBL	A (A)	0.2 (0.3)	0 (0)
NBT	A (A)	0.6 (0.4)	0 (0)
SBT	A (A)	5.5 (6.0)	15 (15)
SBR	A (A)	2.6 (2.7)	15 (15)
EBL	A (A)	5.1 (4.5)	15 (10)
EBR	A (A)	1.0 (1.1)	0 (0)

Notes:
1. ## (##) = AM (PM)
2. ## = Value exceeding threshold

All movements at Highway 1 / 1st Avenue-Ludlow Road currently operate at LOS D or better in both peak hours. Thru movements along the highway (NBT and SBT) meet MoTI's standard of LOS C or better. The eastbound left, eastbound thru, westbound left, and westbound thru movements operate at LOS D during one or both peak hours. All movements at Ludlow Road / Rocky Creek Road operate at LOS A.

3.5 Background Conditions

3.5.1 Corridor Growth

Annual corridor growth rates were applied to most roads in the study area to account for population growth and resulting new development in the region. A growth rate was not applied to the south leg of Ludlow Road as the waterfront development trip generation accounts for all growth expected in the foreseeable future. An annual growth rate of 2% was applied to movements passing exclusively between Rocky Creek Road, Highway 1, and 1st Avenue. An annual growth rate of 1% was applied to movements that include some traffic passing between the south leg of Ludlow Road and the other legs exiting the study area. A growth factor of 1.36 was applied to existing (2018) eastbound left turn traffic reassigned from Highway 1 / Grouhel Road to Highway 1 / 1st Ave-Ludlow Road.

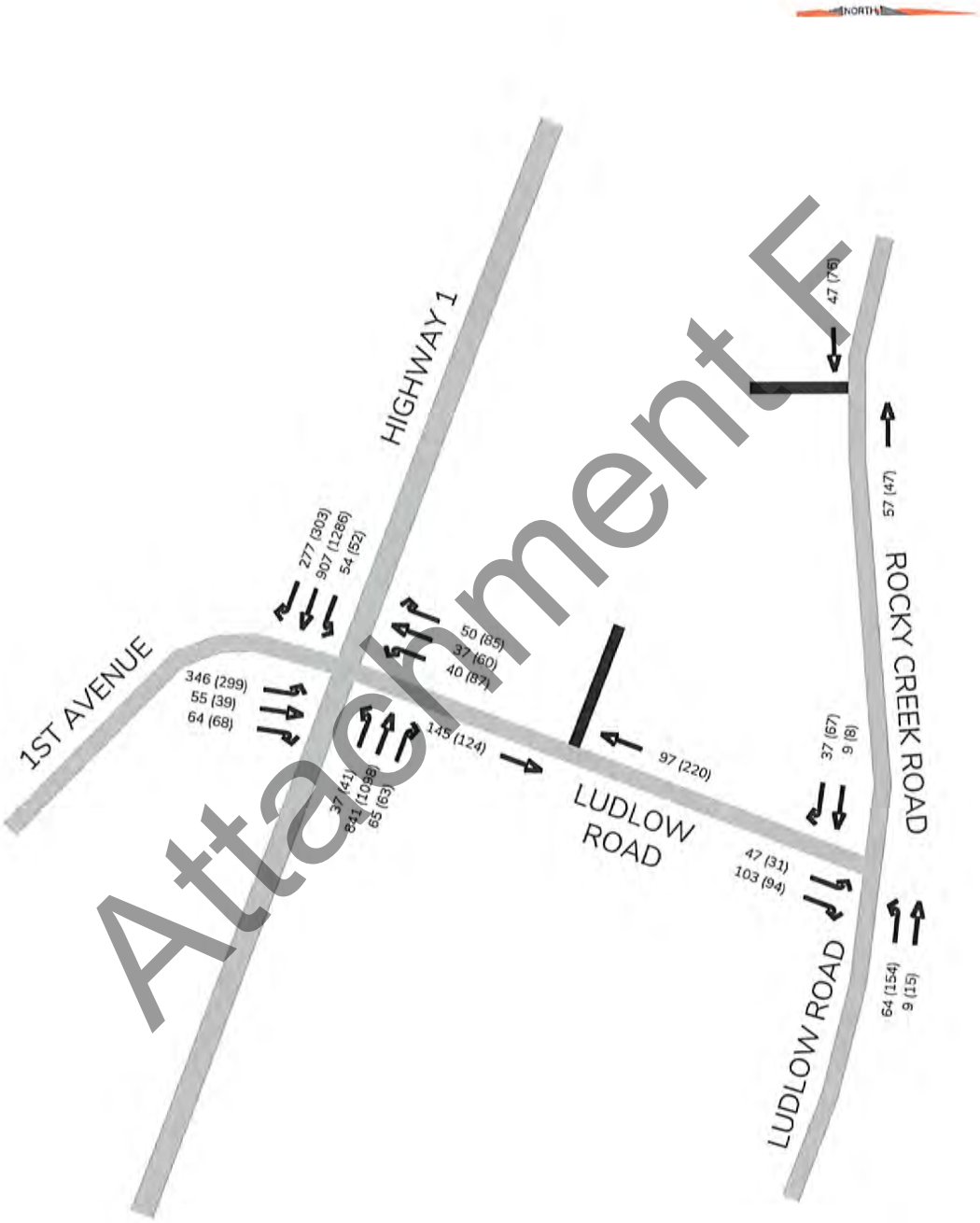
3.5.2 Concurrent Developments

The 2036 background and post-development scenarios account for new traffic to be generated by expected future development in the Waterfront Area, as defined in Binnie's 2018 *Waterfront Area Plan: Transportation Review* report. Trip generation rates and land use categories were updated to conform to the 11th edition of the *ITE Trip Generation* manual.

3.5.3 Background Traffic Volumes

Background traffic volumes are the sum of existing traffic volumes, corridor growth, and concurrent development traffic. Background traffic volumes for 2026 and 2036 are illustrated in **Figure 3** and **Figure 4**, respectively.

- AM PEAK HOUR
(##) - PM PEAK HOUR



- AM PEAK HOUR
(##) - PM PEAK HOUR

3.5.4 Background Traffic Operations

Intersection analysis results for background conditions for 2026 and 2036 are summarized in **Table 4** and **Table 5**, respectively.

Table 4 – Background Intersection Operations - 2026

Movement	LOS	Delay (s)	95% Queue (m)
Highway 1 / 1st Avenue-Ludlow Road			
NBL	C (C)	24.1 (25.0)	15 (15)
NBT	C (C)	27.0 (27.2)	60 (70)
NBR	A (A)	0.3 (0.2)	0 (0)
SBL	B (B)	15.0 (14.4)	25 (15)
SBT	B (B)	18.5 (19.5)	55 (70)
SBR	A (A)	3.1 (2.9)	0 (0)
EBL	D (D)	38.1 (42.5)	65 (70)
EBT	D (D)	36.0 (38.7)	80 (75)
EBR	A (A)	0.0 (0.0)	85 (75)
WBL	D (D)	41.4 (43.9)	25 (30)
WBT	D (D)	39.1 (41.1)	15 (25)
WBR	A (A)	0.7 (1.1)	0 (0)

Movement	LOS	Delay (s)	95% Queue (m)
Ludlow Road / Rocky Creek Road			
NBL	A (A)	0.2 (0.3)	0 (0)
NBT	A (A)	0.2 (0.4)	0 (0)
SBT	A (A)	4.2 (6.1)	15 (15)
SBR	A (A)	2.5 (2.7)	15 (15)
EBL	A (A)	4.6 (4.8)	15 (10)
EBR	A (A)	1.1 (1.0)	0 (0)

Notes:
1. ## (##) = AM (PM)
2. ## = Value exceeding threshold

Table 5 – Background Intersection Operations - 2036

Movement	LOS	Delay (s)	95% Queue (m)
Highway 1 / 1st Avenue-Ludlow Road			
NBL	C (D)	27.4 (44.6)	25 (30)
NBT	C (D)	31.6 (36.5)	70 (100)
NBR	A (A)	0.4 (0.3)	0 (15)
SBL	B (B)	17.1 (17.7)	30 (30)
SBT	B (C)	18.9 (23.6)	70 (95)
SBR	A (A)	2.7 (2.8)	0 (0)
EBL	D (E)	53.5 (56.7)	90 (85)
EBT	D (D)	50.0 (50.0)	110 (105)
EBR	A (A)	0.0 (0.0)	110 (105)
WBL	D (D)	47.4 (52.1)	30 (35)
WBT	D (D)	43.6 (45.8)	20 (25)
WBR	A (A)	1.9 (2.6)	0 (0)
Ludlow Road / Rocky Creek Road			
NBL	A (A)	0.2 (0.4)	0 (0)
NBT	A (A)	0.5 (0.5)	0 (0)
SBT	A (A)	4.9 (6.0)	15 (15)
SBR	A (A)	2.6 (3.0)	15 (15)
EBL	A (A)	4.8 (5.3)	15 (10)
EBR	A (A)	1.2 (1.2)	0 (0)

Notes:
1. ## (##) = AM (PM)
2. ## = Value exceeding threshold

Under background conditions, the eastbound left, eastbound thru, westbound left, and westbound thru movements at Highway 1 / 1st Avenue-Ludlow Road will operate at LOS D or worse during both peak hours in 2026 and 2036. The eastbound left turn movement will operate at LOS E during the PM peak hour in 2036. In addition, the northbound thru movement will operate at LOS D during the 2036 PM peak hour, which does not meet MoTI's standard of LOS C or better for highway thru movements. All movements at Ludlow Road / Rocky Creek Road operate at LOS A.

3.6 Post-Development Conditions

3.6.1 Existing Site Trip Generation

As the existing site is undeveloped, it is assumed to generate zero trips. No existing trips were removed from the road network.

3.6.2 New Site Trip Generation

The proposed development includes 1,677 m^2 (18,053 ft^2) of retail space and 209 m^2 (2,250 ft^2) of indoor space for a drive-through restaurant. Vehicular trip generation rates are generally based on the *ITE Trip Generation Manual (11th Edition)*. The trip generation forecast for the site is provided in **Table 6**. The proposed development is forecast to generate 193 new trips during the weekday AM and PM peak periods of surrounding street traffic.

Table 6 – New Site Trip Generation

Use	AM Peak Hour			PM Peak Hour		
	In[1]	Out[1]	2-Way	In[1]	Out[1]	2-Way
Trip Generation Rates						
Strip Retail Plaza (ITE LU 822)[2]	1.42	0.94	2.36	3.30	3.30	6.59
Fast-Food Restaurant with Drive-Through Window (ITE LU 934)[2]	22.75	21.86	44.61	17.18	15.86	33.03
Vehicular Trip Generation						
Strip Retail Plaza (18,053 ft²)	26	18	43	60	60	119
Fast-Food Restaurant with Drive-Through Window (2,250 ft²)	52	50	100	39	36	74
Total	**78**	**68**	**143**	**99**	**96**	**193**

Notes:
1. Sums may exceed 2-way total as in/out trips were rounded up for analysis
2. Trip rates are per 1,000 ft² GFA

3.6.3 Internal and Pass-by Trips

As a mixed-use development, some of the trips generated would be internal trips between the drive-through restaurant and retail land uses. An internal capture rate is a percentage reduction that is applied to the trip generation estimates for individual land uses to account for internal trips on the site.

The National Cooperative Highway Research Program (NCHRP) Report 684 provides a methodology for estimating internal capture rates for mixed use sites. **Table 7** shows the external trips the development is expected to generate, calculated by subtracting the internal trips from the trip generation forecast.

Table 7 – Internal Trip Capture

Use	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
Internal Trip Capture Rate				
Retail	8%	11%	25%	18%
Restaurant	4%	4%	28%	42%
External Trips				
Strip Retail Plaza (18,053 ft²)	24	16	45	49
Fast-Food Restaurant with Drive-Through Window (2,250 ft²)	50	48	28	21
Total	**74**	**64**	**73**	**70**
Total 2-Way	**138**		**143**	

The proposed development generates two types of external trips: primary and pass-by (diverted) trips. Primary trips are new trips to/from the site (i.e. additional vehicles on the road). Pass-by trips are those made by vehicles already passing the site on an adjacent roadway, but still enter/exit the site. For the purposes of this study all pass-by trips are assumed to be from Highway 1.

Pass-by trips will be generated by the retail and drive-through restaurant. Average peak hour pass-by trip rates were based on the ITE manual and a previous study for MoTI: **22%** (AM) and **34%** (PM) for the retail traffic, and **49%** (AM) and **50%** (PM) for the drive-through restaurant. The estimated pass-by trips to the site are **57** in the AM peak hour and **57** in the PM peak hour. **Table 8** shows the primary and pass-by trips generated by each land use.

Table 8 – Primary and Pass-by Trips

Use	AM Peak Hour			PM Peak Hour		
	In	Out	2-Way	In	Out	2-Way
Primary Trips						
Strip Retail Plaza (18,053 ft²)	19	12	31	30	32	62
Fast-Food Restaurant with Drive-Through Window (2,250 ft²)	25	24	49	14	10	24
Total Primary Trips	**44**	**36**	**80**	**44**	**42**	**86**
Pass-by Trips						
Strip Retail Plaza (18,053 ft²)	5	4	9	15	17	32
Fast-Food Restaurant with Drive-Through Window (2,250 ft²)	24	24	48	14	10	24
Total Pass-by Trips	**29**	**28**	**57**	**29**	**27**	**56**

3.6.4 Trip Distribution and Assignment

The trip distribution pattern for site traffic was established based on the existing trip distributions and key origins and destinations in the area. The distribution of inbound and outbound primary trips adopted for the proposed development is outlined in **Table 9**.

Table 9 – Primary Trip Distribution

Street	Direction	AM	PM
Highway 1 / 1st Avenue	North, South, and West (primary trips evenly divided)	85% In / Out	85% In / Out
Rocky Creek Road	North	10% In / Out	8% In / Out
Ludlow Road	South	5% In / Out	7% In / Out

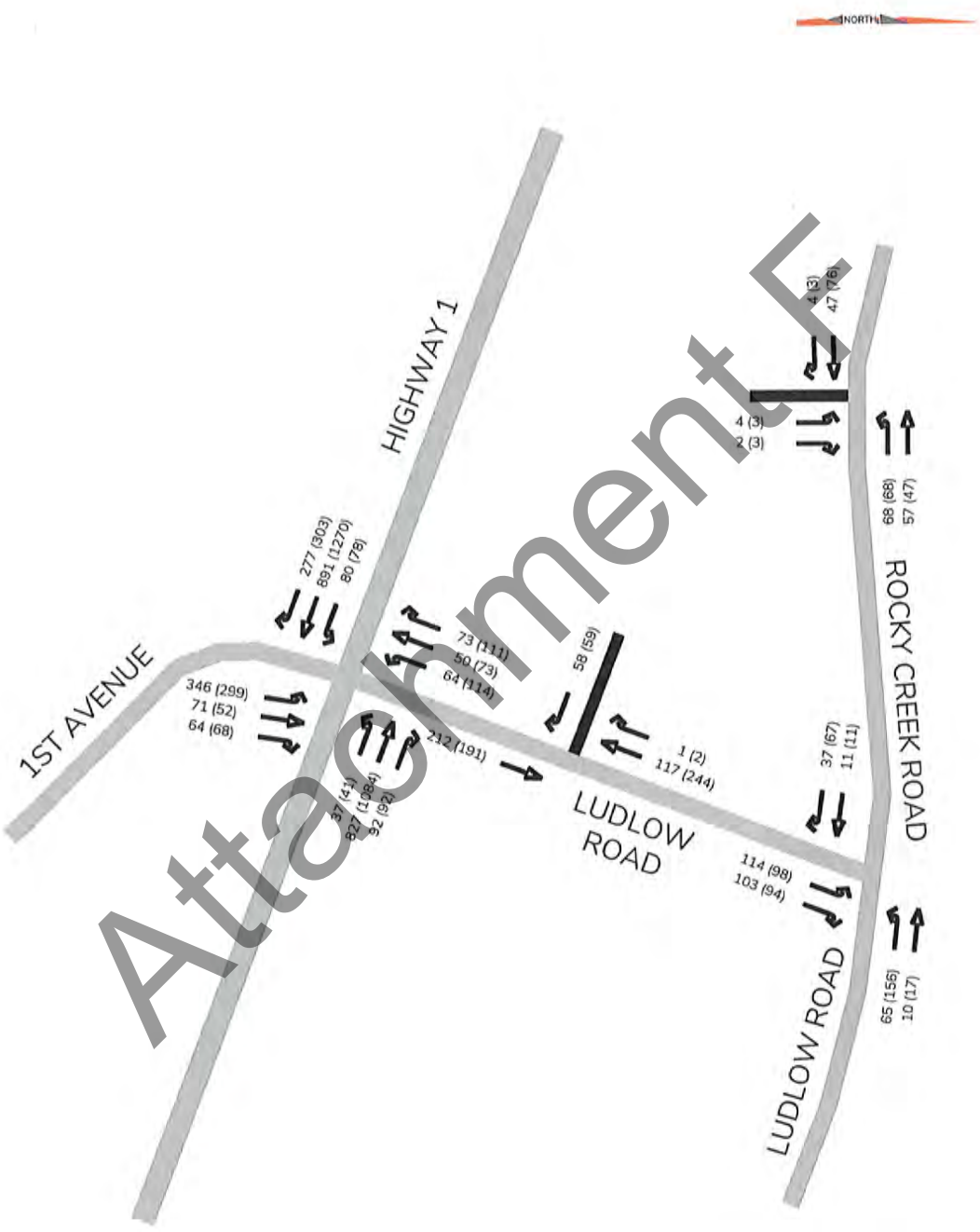
The new site traffic volumes assigned to the area road network are illustrated in **Figure 5**.

- AM PEAK HOUR
(##) - PM PEAK HOUR

3.6.5 Post-Development Traffic Volumes

Post-development traffic volumes are the sum of background traffic volumes and new site traffic volumes. Post-development traffic volumes for 2026 and 2036 are illustrated in **Figure 6** and **Figure 7**, respectively.

- AM PEAK HOUR
(##) - PM PEAK HOUR



- AM PEAK HOUR
(##) - PM PEAK HOUR

3.6.6 Post-Development Traffic Operations

Intersection analysis results for post-development conditions for 2026 and 2036 are summarized in **Table 10** and **Table 11**, respectively.

Table 10 – Post-Development Intersection Operations - 2026

Movement	LOS	Delay (s)	95% Queue (m)
Highway 1 / 1st Avenue-Ludlow Road			
NBL	C (C)	26.4 (27.2)	15 (15)
NBT	C (C)	30.4 (33.0)	65 (75)
NBR	A (A)	0.6 (0.5)	0 (0)
SBL	B (B)	17.4 (17.2)	30 (25)
SBT	B (C)	18.2 (20.8)	60 (70)
SBR	A (A)	3.0 (2.9)	0 (0)
EBL	D (D)	43.3 (48.3)	80 (75)
EBT	D (D)	41.2 (44.1)	95 (85)
EBR	A (A)	0.0 (0.0)	95 (85)
WBL	D (D)	45.5 (48.2)	35 (35)
WBT	D (D)	40.1 (42.4)	20 (25)
WBR	A (A)	1.5 (1.8)	0 (0)

Movement	LOS	Delay (s)	95% Queue (m)
Ludlow Road / Rocky Creek Road			
NBL	A (A)	0.1 (0.2)	0 (0)
NBT	A (A)	0.2 (0.3)	0 (0)
SBT	A (A)	5.1 (6.6)	15 (15)
SBR	A (A)	2.5 (3.1)	15 (15)
EBL	A (A)	4.8 (4.9)	20 (15)
EBR	A (A)	1.1 (1.0)	0 (0)
Ludlow Road / Site Access			
SBR	A (A)	8.8 (9.2)	15 (15)
EBT	A (A)	0.0 (0.0)	0 (0)
WBT	A (A)	0.0 (0.0)	5 (0)
WBR	A (A)	0.0 (0.0)	0 (0)
Rocky Creek Road / Site Access			
NBL	A (A)	7.5 (7.5)	5 (5)
NBT	A (A)	0.0 (0.0)	5 (5)
SBT	A (A)	0.0 (0.0)	0 (0)
SBR	A (A)	0.0 (0.0)	0 (0)
EBL	A (A)	9.8 (9.6)	5 (5)
EBR	A (A)	9.8 (9.6)	5 (5)

Notes:
1. ## (##) = AM (PM)
2. ## = Value exceeding threshold

Table 11 – Post-Development Intersection Operations - 2036

Movement	LOS	Delay (s)	95% Queue (m)
Highway 1 / 1st Avenue-Ludlow Road			
NBL	C (D)	29.5 (44.6)	25 (25)
NBT	C (D)	33.8 (38.8)	80 (100)
NBR	A (A)	1.2 (0.7)	15 (15)
SBL	C (C)	20.8 (21.2)	40 (35)
SBT	B (C)	19.5 (23.9)	70 (90)
SBR	A (A)	2.8 (2.8)	0 (10)
EBL	E (E)	60.7 (61.5)	100 (95)
EBT	E (D)	56.0 (53.9)	120 (110)
EBR	A (A)	0.0 (0.0)	120 (110)
WBL	D (E)	50.8 (55.4)	35 (40)
WBT	D (D)	44.0 (46.3)	30 (30)
WBR	A (A)	2.7 (6.1)	0 (0)
Ludlow Road / Rocky Creek Road			
NBL	A (A)	0.2 (0.4)	0 (0)
NBT	A (A)	0.6 (0.5)	0 (0)
SBT	A (A)	5.9 (5.4)	20 (15)
SBR	A (A)	2.8 (3.1)	20 (15)
EBL	A (A)	4.9 (5.6)	20 (15)
EBR	A (A)	1.2 (1.2)	0 (0)

Movement	LOS	Delay (s)	95% Queue (m)
Ludlow Road / Site Access			
SBR	A (A)	8.8 (9.4)	15 (15)
EBT	A (A)	0.0 (0.0)	10 (10)
WBT	A (A)	0.0 (0.0)	0 (5)
WBR	A (A)	0.0 (0.0)	0 (0)
Rocky Creek Road / Site Access			
NBL	A (A)	7.5 (7.6)	5 (5)
NBT	A (A)	0.0 (0.0)	5 (5)
SBT	A (A)	0.0 (0.0)	0 (0)
SBR	A (A)	0.0 (0.0)	0 (0)
EBL	A (A)	9.9 (9.8)	10 (10)
EBR	A (A)	9.9 (9.8)	10 (10)

Notes:
1. ## (##) = AM (PM)
2. ## = Value exceeding threshold

Under post-development conditions, the eastbound left, eastbound thru, westbound left, and westbound thru movements at Highway 1 / 1st Avenue-Ludlow Road will operate at LOS D during both 2026 peak hours. In 2036, three (3) of the four (4) movements will operate at LOS E during at least one peak hour. In addition, the northbound thru movement will operate at LOS D during the 2036 PM peak hour, which does not meet MoTI's standard of LOS C or better for highway thru movements. All movements at the other intersections continue to operate at LOS B or better, with most operating at LOS A.

3.7 Traffic Operations Analysis Summary and Discussion

A summary of the key operational changes from existing to background to post-development conditions is provided in **Table 12** and **Table 13** for the 2026 and 2036 horizon years, respectively.

Table 12 – Traffic Operations Analysis Summary – 2026

Movement	LOS	Delay (s)	95% Queue (m)
Highway 1 / 1st Avenue-Ludlow Road			
NBL	C => C => C (C => C => C)	24.0 => 24.1 => 26.4 (24.2 => 25.0 => 27.2)	10 => 15 => 15 (15 => 15 => 15)
NBT	C => C => C (C => C => C)	26.1 => 27.0 => 30.4 (26.2 => 27.2 => 33.0)	55 => 60 => 65 (70 => 70 => 75)
NBR	A => A => A (A => A => A)	0.3 => 0.3 => 0.6 (0.2 => 0.2 => 0.5)	0 => 0 => 0 (0 => 0 => 0)
SBL	B => B => B (B => B => B)	14.8 => 15.0 => 17.4 (14.1 => 14.4 => 17.2)	20 => 25 => 30 (20 => 15 => 25)
SBT	B => B => B (B => B => C)	17.8 => 18.5 => 18.2 (18.6 => 19.5 => 20.8)	50 => 55 => 60 (65 => 70 => 70)
SBR	A => A => A (A => A => A)	3.1 => 3.1 => 3.0 (2.9 => 2.9 => 2.9)	0 => 0 => 0 (0 => 0 => 0)
EBL	D => D => D (D => D => D)	37.4 => 38.1 => 43.3 (40.9 => 42.5 => 48.3)	65 => 65 => 80 (50 => 70 => 75)
EBT	C => D => D (D => D => D)	34.8 => 36.0 => 41.2 (36.5 => 38.7 => 44.1)	75 => 80 => 95 (70 => 75 => 85)
EBR	A => A => A (A => A => A)	0.0 => 0.0 => 0.0 (0.0 => 0.0 => 0.0)	75 => 85 => 95 (70 => 75 => 85)
WBL	D => D => D (D => D => D)	40.6 => 41.4 => 45.5 (42.7 => 43.9 => 48.2)	25 => 25 => 35 (25 => 30 => 35)
WBT	D => D => D (D => D => D)	38.4 => 39.1 => 40.1 (40.2 => 41.1 => 42.4)	15 => 15 => 20 (25 => 25 => 25)
WBR	A => A => A (A => A => A)	0.7 => 0.7 => 1.5 (1.1 => 1.1 => 1.8)	0 => 0 => 0 (0 => 0 => 0)

Movement	LOS	Delay (s)	95% Queue (m)
Ludlow Road / Rocky Creek Road			
NBL	A => A => A (A => A => A)	0.2 => 0.2 => 0.1 (0.3 => 0.3 => 0.2)	0 => 0 => 0 (0 => 0 => 0)
NBT	A => A => A (A => A => A)	0.6 => 0.2 => 0.2 (0.4 => 0.4 => 0.3)	0 => 0 => 0 (0 => 0 => 0)
SBT	A => A => A (A => A => A)	5.5 => 4.2 => 5.1 (6.0 => 6.1 => 6.6)	15 => 15 => 15 (15 => 15 => 15)
SBR	A => A => A (A => A => A)	2.6 => 2.5 => 2.5 (2.7 => 2.7 => 3.1)	15 => 15 => 15 (15 => 15 => 15)
EBL	A => A => A (A => A => A)	5.1 => 4.6 => 4.8 (4.5 => 4.8 => 4.9)	15 => 15 => 20 (10 => 10 => 15)
EBR	A => A => A (A => A => A)	1.0 => 1.1 => 1.1 (1.1 => 1.0 => 1.0)	0 => 0 => 0 (0 => 0 => 0)

Notes:
1. ## ⇒ ## ⇒ ## = Existing ⇒ Background ⇒ Post-Development
2. ## (##) = AM (PM)
3. ## = Value exceeding threshold

Table 13 – Traffic Operations Analysis Summary – 2036

Movement	LOS	Delay (s)	95% Queue (m)
Highway 1 / 1st Avenue-Ludlow Road			
NBL	C => C => C (C => D => D)	24.0 => 27.4 => 29.5 (24.2 => 44.6 => 44.6)	10 => 25 => 25 (15 => 30 => 25)
NBT	C => C => C (C => D => D)	26.1 => 31.6 => 33.8 (26.2 => 36.5 => 38.8)	55 => 70 => 80 (70 => 100 => 100)
NBR	A => A => A (A => A => A)	0.3 => 0.4 => 1.2 (0.2 => 0.3 => 0.7)	0 => 0 => 15 (0 => 15 => 15)
SBL	B => B => C (B => B => C)	14.8 => 17.1 => 20.8 (14.1 => 17.7 => 21.2)	20 => 30 => 40 (20 => 30 => 35)
SBT	B => B => B (B => C => C)	17.8 => 18.9 => 19.5 (18.6 => 23.6 => 23.9)	50 => 70 => 70 (65 => 95 => 90)
SBR	A => A => A (A => A => A)	3.1 => 2.7 => 2.8 (2.9 => 2.8 => 2.8)	0 => 0 => 0 (0 => 0 => 10)
EBL	D => D => E (D => E => E)	37.4 => 53.5 => 60.7 (40.9 => 56.7 => 61.5)	65 => 90 => 100 (50 => 85 => 95)
EBT	C => D => E (D => D => D)	34.8 => 50.0 => 56.0 (36.5 => 50.0 => 53.9)	75 => 110 => 120 (70 => 105 => 110)
EBR	A => A => A (A => A => A)	0.0 => 0.0 => 0.0 (0.0 => 0.0 => 0.0)	75 => 110 => 120 (70 => 105 => 110)
WBL	D => D => D (D => D => E)	40.6 => 47.4 => 50.8 (42.7 => 52.1 => 55.4)	25 => 30 => 35 (25 => 35 => 40)
WBT	D => D => D (D => D => D)	38.4 => 43.6 => 44.0 (40.2 => 45.8 => 46.3)	15 => 20 => 30 (25 => 25 => 30)
WBR	A => A => A (A => A => A)	0.7 => 1.9 => 2.7 (1.1 => 2.6 => 6.1)	0 => 0 => 0 (0 => 0 => 0)

Movement	LOS	Delay (s)	95% Queue (m)
Ludlow Road / Rocky Creek Road			
NBL	A => A => A (A => A => A)	0.2 => 0.2 => 0.2 (0.3 => 0.4 => 0.4)	0 => 0 => 0 (0 => 0 => 0)
NBT	A => A => A (A => A => A)	0.6 => 0.5 => 0.6 (0.4 => 0.5 => 0.5)	0 => 0 => 0 (0 => 0 => 0)
SBT	A => A => A (A => A => A)	5.5 => 4.9 => 5.9 (6.0 => 6.0 => 5.4)	15 => 15 => 20 (15 => 15 => 15)
SBR	A => A => A (A => A => A)	2.6 => 2.6 => 2.8 (2.7 => 3.0 => 3.1)	15 => 15 => 20 (15 => 15 => 15)
EBL	A => A => A (A => A => A)	5.1 => 4.8 => 4.9 (4.5 => 5.3 => 5.6)	15 => 15 => 20 (10 => 10 => 15)
EBR	A => A => A (A => A => A)	1.0 => 1.2 => 1.2 (1.1 => 1.2 => 1.2)	0 => 0 => 0 (0 => 0 => 0)

Notes:
1. ## ⇒ ## ⇒ ## = Existing ⇒ Background ⇒ Post-Development
2. ## (##) = AM (PM)
3. ## = Value exceeding threshold

In the 2026 horizon year, the study area will experience few operational changes. Under background and post-development scenarios, all study intersections operate acceptably with existing geometry and signal timing.

In the 2036 horizon year, the eastbound left and thru movements at Highway 1 / 1st Avenue-Ludlow Road operate at LOS E during at least one peak hour in post-development conditions. 95th percentile queues in the left turn lane exceed its capacity by up to 15 m, and queues in the thru-left turn lane would at times extend past the Tim Hortons parking lot access. Operational improvements may not be possible with signal timing alone, as the corresponding westbound movements' operations are marginal and highway thru traffic must be prioritized.

The westbound left turn 95th percentile queues at Highway 1 / 1st Avenue-Ludlow Road are expected to be up to 40m in 2036. As the stop bar for this lane is located 5m before the railroad, the queues may delay some vehicles exiting the site from the Ludlow Road access.

The northbound thru movement on Highway 1 operates at LOS D in 2036 background and post-development conditions. MoTI's standard of LOS C or better can likely be

restored by adding green time, however this may decrease LOS and increase queuing for westbound and eastbound movements.

No operational issues are expected at other study intersections in the 2036 horizon year. Under background and post-development conditions, all movements operate at LOS A with existing geometry. Operations do not nessecitate a right-in/right-out restriction at the site access or a roundabout at Ludlow Road / Rocky Creek Road.

95th percentile queue lengths for the eastbound left turn movement at Ludlow Road / Rocky Creek Road are up to 20 m, leaving an additional 20 m of storage length largely unused. If this space were repurposed for the westbound left turn lane from Highway 1 / 1st Avenue-Ludlow Road, the lane would extend past the existing Home Hardware access. This would improve safety for vehicles turning left into or out of the existing Home Hardware access.

4.0 CONCLUSIONS

The proposed development at 1130 Rocky Creek Road will cause minimal operational impact on opening day, assumed to be the 2026 horizon year. All study intersections operate at LOS B or better with existing geometry and permitted turning movements.

The combined impact of the development, growth in the surrounding area, and closure of the eastbound left turn at Highway 1 / Grouhel Road will cause some operational impacts to eastbound and northbound traffic at Highway 1 / 1st Avenue-Ludlow Road. All other study intersections continue to operate at LOS B or better with existing geometry and permitted turning movements. Operations do not nessecitate a right-in/right-out restriction at the site access or a roundabout at Ludlow Road / Rocky Creek Road.

5.0 RECOMMENDATIONS

WATT makes the following recommendations to Oyster Harbour Development Corp:

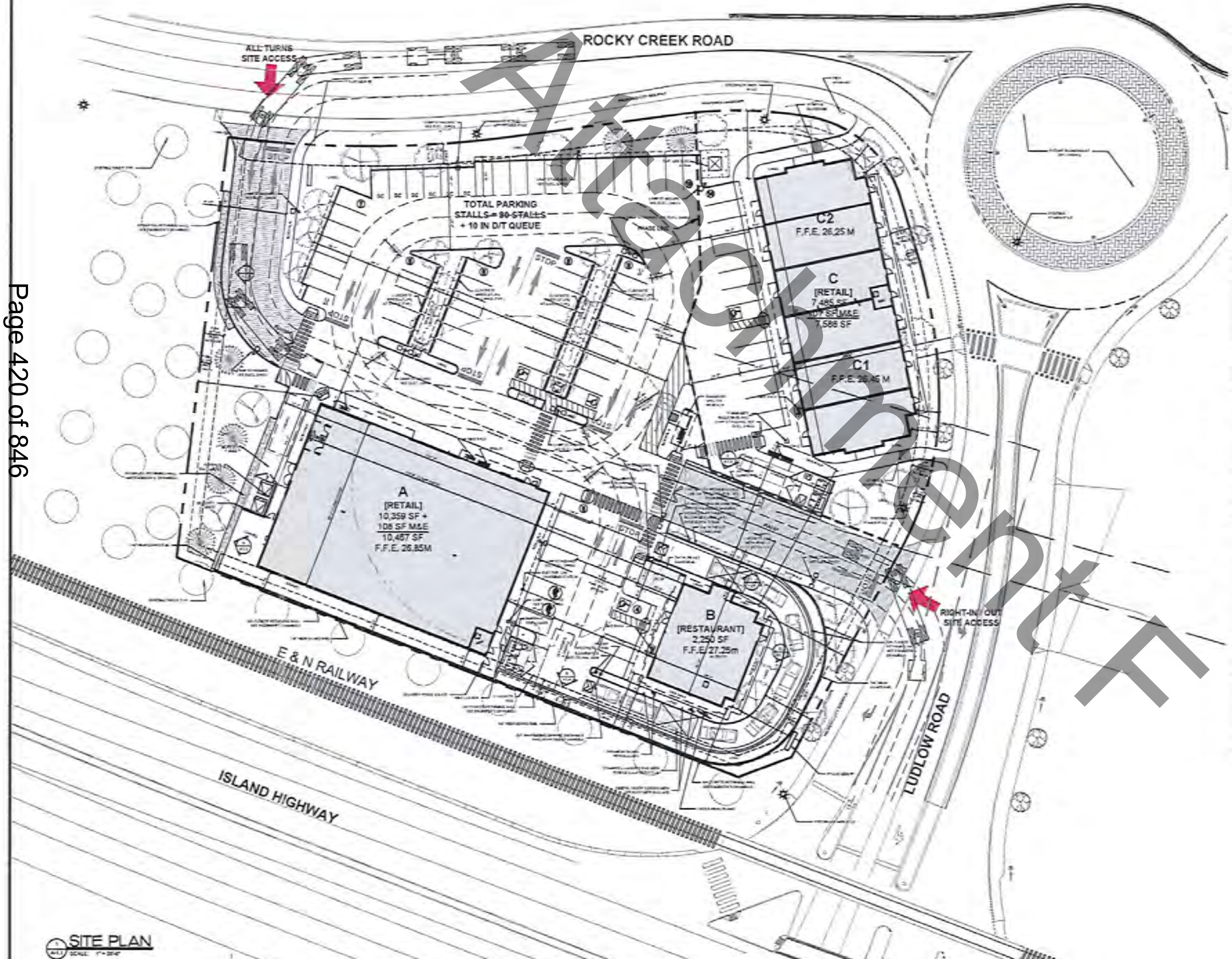
1. Work with the Town of Ladysmith to add sidewalks to the Rocky Creek Road and Ludlow Road site frontages. The sidewalk should connect across the railroad to the nearest crosswalk at the Highway 1 / 1st Avenue-Ludlow Road intersection. This will ensure pedestrians can safely cross the highway to access the 1st Avenue / Highway 1 bus stop, which is now served by BC Transit's Route 70 between Nanaimo and Duncan.
2. Add a splitter island to the Ludlow Road site access to enforce the right-in/right-out movements in the absence of a concrete median barrier, prior to the construction of the roundabout at Ludlow Road / Rocky Creek Road.

WATT recommends that MoTI re-time the Highway 1 / 1st Avenue-Ludlow Road signal prior to the 2036 horizon year. More green time would be required for northbound thru traffic on the highway to continue operations at LOS C or better.

WATT makes the following recommendations to the Town of Ladysmith:

1. Monitor queues in the eastbound left turn lane at Highway 1 / 1st Avenue-Ludlow Road. The left turn lanes serving the Tim Hortons and Canco site accesses currently restrict the ability to extend the eastbound left turn lane within the existing road width. Eastbound queue spillback may begin to obstruct these accesses during peak times. It may be necessary to work with these businesses to explore alternatives to the westbound left turn lane.
2. Consider extending the westbound left turn lane at Highway 1 / 1st Avenue-Ludlow Road by shortening the eastbound left turn lane at Ludlow Road / Rocky Creek Road. If the westbound lane can be extended to before the existing Home Hardware access, it would improve safety for vehicles turning left into and out of the access. A minimum of 20 m of storage length should be maintained for the eastbound lane.

APPENDIX A – SITE PLAN



SITE PLAN
SCALE: 1" = 20'-0"

AERIAL PLAN
SCALE: NTS

NORTH

SITE INFORMATION:

LEGAL DESCRIPTION:	LOT A, DISTRICT LOTS 24 AND 38, OYSTER DISTRICT, PLAN VIP71248
CIVIC ADDRESS:	1130 ROCKY CREEK ROAD, LADYSMITH, BC
EXISTING ZONING:	CD1 (TOURIST SERVICE)
EXIST. LOT AREA (DL 38 & DL 24):	87,177 SF (8,099 SM)
PROPOSED LOT AREA:	94,021 SF (8,735 SF)
BUILDING AREA (G.F.A.):	20,303 SF (1,886 SM)
LOT COVERAGE:	20,303 SF / 94,021 SF x 100 = 21.6%
FLOOR AREA RATIO: (MAX. 0.6)	0.216

GROSS FLOOR AREAS:

PROPOSED BUILDING AREAS:	
BUILDING A [RETAIL]	10,467 SF (972 SM)
BUILDING B [RESTAURANT]	2,250 SF (209 SM)
BUILDING C [RETAIL]	7,586 SF (705 SM)
TOTAL GROSS FLOOR AREA	20,303 SF (1,886 SM)

PARKING REQUIREMENTS:

TOTAL PARKING REQUIRED:	64 STALLS
TOTAL PARKING PROVIDED:	80 STALLS + 9 IN D/T QUEUE
PARKING RATIO (NOT INCL. D/T QUEUE):	3.9 / 1,000 SF & 4.2 / 100 SM
PARKING RATIO (INCL. D/T QUEUE):	4.4 / 1,000 SF & 4.7 / 100 SM
PARKING PROV'D BREAKDOWN:	REGULAR STALLS = 66 (82.5%)
	HANDICAPPED STALLS = 4 (5%)
	SMALL CARS = 8 (10%)
	ELECTRIC VEHICLE = 2 (2.5%)

PARKING REQUIREMENTS & CALCULATIONS:

RETAIL OR OFFICE: (1 PER 323 SF (30 SM) GFA) = 18,053 SF /323 SF = 55.89 STALLS
RESTAURANT OR COFFEE SHOP: (1 PER 5 SEATS) = 40 SEATS /5 = 8 STALLS
TOTAL PARKING REQUIRED (ROUND NEAREST) = 63.89 STALLS

COMMERCIAL LOADING: 2 PER 5,393SF (501 SM) TO 26,910 SF (2500 SM) = 2

BICYCLE, CLASS A (LOCKERS): 1 PER 10 EMPLOYEES; 0.6m W x 1.8m L.

BICYCLE, CLASS B (RACKS): 10% OF REQUIRED PARKING SPACES = 64 x 10% = 6.4

PARKING SIZES:

REGULAR CAR STALL	2.6m (8'-6")	x	5.8m (19'-0")
HANDICAP CAR STALL (MIN. 5% OF REQ'D)	3.7m (12'-2")	x	5.8m (19'-0")
SMALL CAR STALL (MAX 25% OF REQ'D)	2.5m (8'-3")	x	4.9m (16'-1")
LOADING SPACE	3.0m (9'-10")	x	9.0m (29'-6")
MANOEUVERING AISLE	7.3m (24'-0")		

*ADD 0.6m (2'-0") TO ANY PARKING STALL ADJACENT TO A FENCE, WALL, STRUCTURE

GENERAL NOTE:

BOUNDARIES SHOWN HEREON ARE DERIVED FROM EXISTING RECORDS AND MUST BE CONFIRMED BY SURVEY PRIOR TO THE DETERMINATION OF DIMENSIONS OR AREAS FOR DEVELOPMENT PURPOSES.

COMMERCIAL DEVELOPMENT
1130 ROCKY CREEK ROAD, LADYSMITH, BC
FOR OYSTER HARBOUR DEVELOPMENT CORP.

PRELIMINARY

urban design group architects ltd
810-675 WEST HASTINGS
VANCOUVER, BC V6B 1N2
TELEPHONE 604-687-2334

4674

SITE PLAN

A-1.1

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WATT VICTORIA
302 - 740 Hillside Ave
Victoria, BC V8T 1Z4
250-388-9877

MEMORANDUM

Date:	October 15, 2024
To:	Ashley Garib, Oyster Harbour Development Corp
Cc:	Ryan Bouma, Town of Ladysmith Jake Belobaba, Town of Ladysmith Nadine King, WATT Consulting Group Patrick Ryan, Herold Engineering
From:	Noah Reeder, EIT and Kristen Machina, P.Eng.
Our File No:	3686.B01
Subject:	Ludlow Road / Rocky Creek Road Roundabout Condition for 1130 Rocky Creek Road

1.0 INTRODUCTION

WATT Consulting Group was retained by Oyster Harbour Development Corp to provide transportation consulting services in support of a proposed commercial development at 1130 Rocky Creek Road in the Town of Ladysmith. WATT previously prepared a transportation impact assessment for the site in 2021, and an update to this study in February 2024. WATT has also provided an addendum to the updated TIA in March 2024.

The Town of Ladysmith ("the Town") has indicated that the Ludlow Road / Rocky Creek Road intersection would need to be converted to a roundabout as a condition of this proposed development. This memorandum provides a discussion of the background and rationale for the removal of this requirement. As in the updated TIA and subsequent addendum, this memo will consider Highway 1, Rocky Creek Road, and the leg of Ludlow Road parallel to them to run north/south and the roads intersecting them to run east/west. This differs from true north.

2.0 BINNIE REPORT

The Town had previously retained R.F. Binnie & Associates Ltd. ("Binnie") to conduct a transportation review of the Waterfront Area Plan.

2.1 Extended Median

The Binnie review, dated September 21, 2018, recommended that the Ludlow Road median be extended past the undeveloped 1060 Oyster Bay Drive (then a part of 1030 Oyster Bay Drive), the existing upper/west access to Home Hardware (1010 Ludlow Road), and a proposed opposing access to 1130 Rocky Creek Road to enforce right-in/right-out (RIRO) movements. The proposed 1130 Rocky Creek Road access is now offset west of the Home Hardware access by 15 m. The median has since been extended beyond this proposed access location and along the entire Ludlow Road frontage of 1060 Oyster Bay Drive, which will restrict left turns into the proposed development, however the extended median does not restrict left turns out of the Home Hardware access.

2.2 Roundabout

A roundabout upgrade was also recommended for the Ludlow Road / Rocky Creek Road intersection "to allow for vehicles to make a U-turn to access Highway 1 from Home Hardware." Binnie noted that this "would help enforce the RIRO configuration at the Home Hardware access and the [now known as 1060 Oyster Bay Drive] access. A large volume of U-turn traffic (up to 126 vehicles per hour) was projected on the assumption that 1130 Rocky Creek Road would have a RIRO access on Ludlow, that the roundabout would be in place, and that as a result virtually all site traffic would use the Ludlow access.

The Ludlow access to 1130 Rocky Creek Road is now proposed to be right-out only until the roundabout is constructed. With the right-out only configuration, all site traffic will be required to enter through the Rocky Creek Road access. For this reason no U-turn volume is expected from 1130 Rocky Creek Road traffic, rendering the forecasted U-turn volumes in the Binnie review an overestimation of actual traffic volumes.

3.0 SITE ACCESS REQUIREMENTS

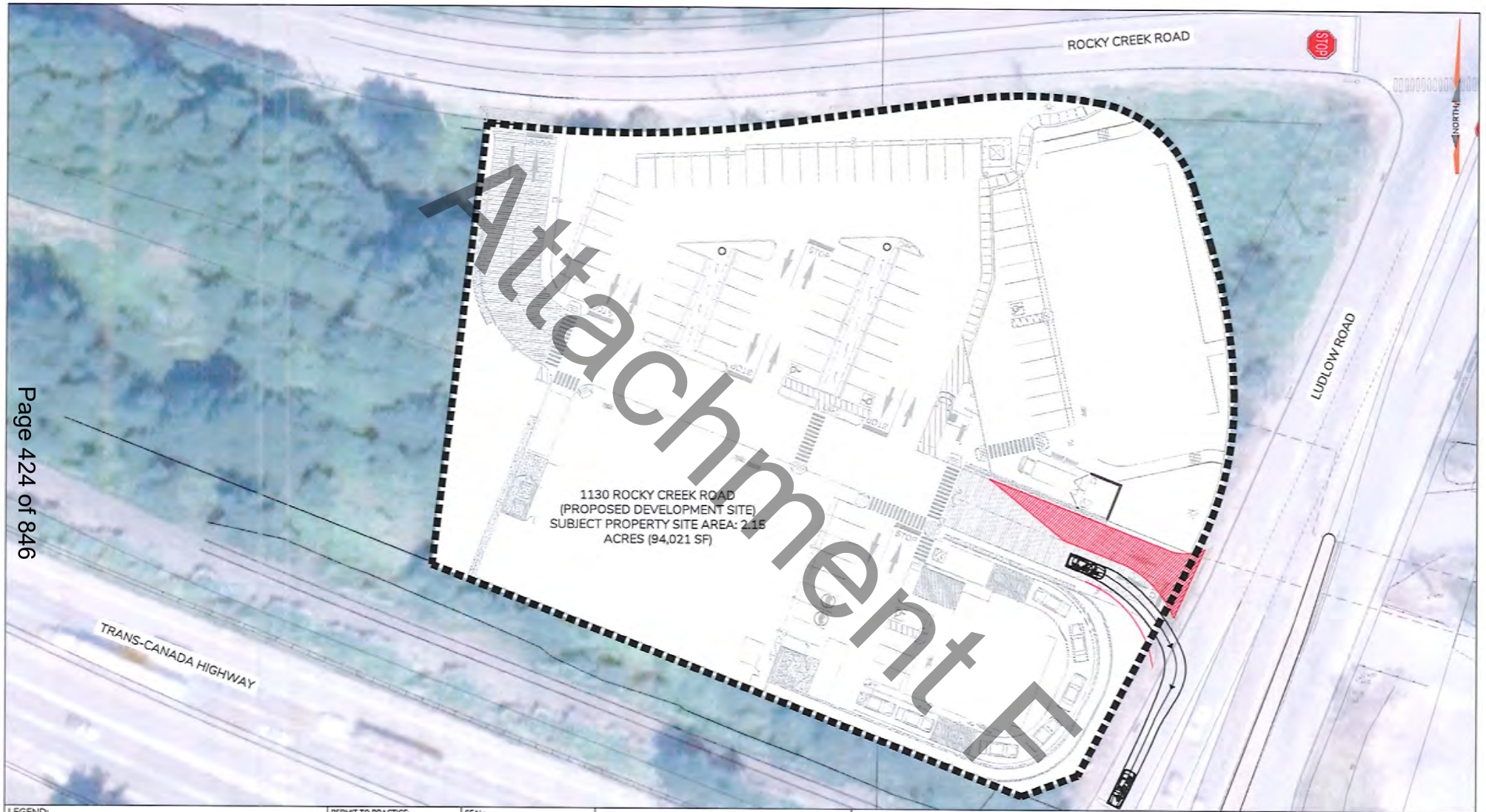
The proposed Ludlow Road access to 1130 Rocky Creek Road is located approximately 55 m from the Highway 1 intersection. For this reason, the Ministry of Transportation and Infrastructure (MoTI) requires that left turns entering the access, which may cause queue spillback onto Highway 1, be physically prohibited. In comments dated October 16, 2020, MoTI indicated that this can be satisfied with an out-only access restriction or "aggressive traffic islands".

The Town has expressed concerns about unsafe left turns exiting the proposed access, as well as unsafe through movements between it and the Home Hardware access. The existing median would strongly discourage exiting left turns and through movements to Home Hardware, as vehicles would need to travel approximately 15 m on the wrong side of the median to circumvent it. A channelized one-lane, right-out-only configuration as shown in **Figure 1** will physically prevent entering through movements from Home Hardware. The proposed delineators and pavement markings from the existing median to 10m before Rocky Creek Road / Ludlow Road intersection will limit left turns from the Home Hardware access and any potential through movements from Home Hardware to 1130 Rocky Creek Road. Once the roundabout is constructed and a concrete median replaces the delineators the site access on Ludlow Road can become a right in/right out access (from right out only).

Per WATT's TIA update, all entering traffic will use the full-movement Rocky Creek Road access. Entering traffic that was forecasted to use the proposed Ludlow Road access can safely re-route to the Rocky Creek Road access.

There is currently no dedicated pedestrian or cyclist infrastructure along the site's Rocky Creek Road and Ludlow Road frontages. However, sidewalks will be provided on-site from the Rocky Creek Road access to the Ludlow Road access. Crosswalks at the Highway 1 / 1st Avenue / Ludlow Road intersection provide connection to the existing sidewalk on the east side of 1st Avenue. There are no bicycle facilities on Rocky Creek Road, Ludlow Road or 1st Avenue. Cyclists can cycle through the lower volume site or continue to share the road with vehicles. **Figure 2** shows the cyclist and pedestrian routes through the site.

As of August 9, 2024, the Town has indicated that it will require permanent sidewalk and curb along the site frontages that can be easily incorporated into the future roundabout. Herold Engineering has indicated that it is not possible to provide this prior to roundabout construction. In the interim, pedestrians may use sidewalks through the site from the Rocky Creek Road access to the Ludlow Road access and Highway 1.



LEGEND:

PERMIT TO PRACTICE:

THESE DESIGN DOCUMENTS ARE PREPARED SOLELY FOR THE USE BY THE PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS ENTERED INTO A CONTRACT, AND THERE ARE NO REPRESENTATIONS OF ANY KIND MADE BY THE DESIGN PROFESSIONAL TO ANY PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS NOT ENTERED INTO CONTRACT.

SEAL:

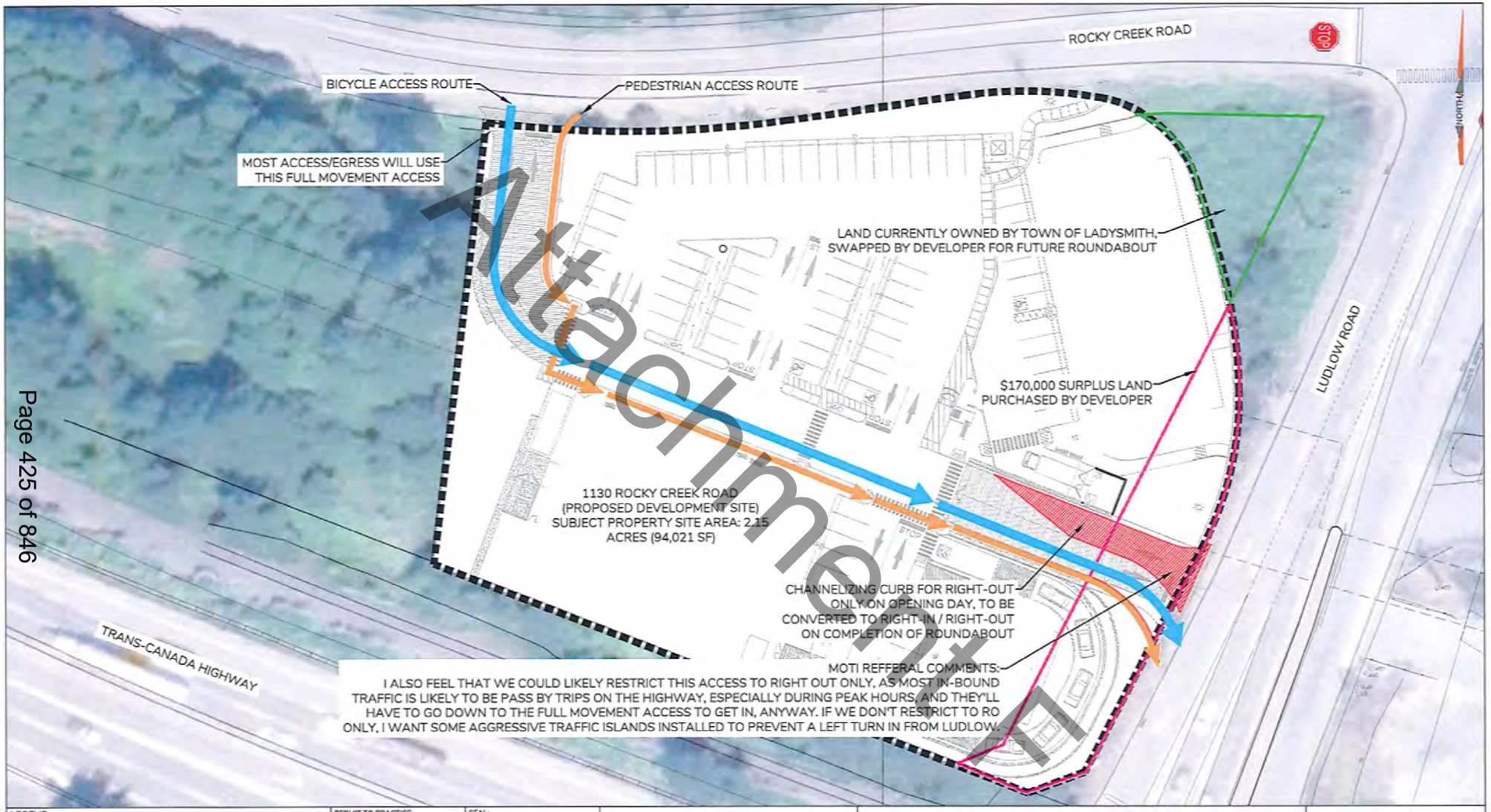
REVISIONS		
2	ISSUED FOR REVIEW	2024-05-27
3	ISSUED FOR REVIEW	2024-05-30
4	ISSUED FOR REVIEW	2024-06-26
5	ISSUED FOR REVIEW	2024-07-09
6	ISSUED FOR REVIEW	2024-07-09
7	ISSUED FOR REVIEW	2024-07-18
8	ISSUED FOR REVIEW	2024-10-04
9	ISSUED FOR SUBMISSION	2024-10-15

1130 ROCKY CREEK ROAD
ACCESS CONCEPT DRAWINGS
SITE ACCESS VEHICLE MOVEMENTS

DRAWING NO:	SCALE:	DRAWN:
FIGURE 1	1:500	NR
DESIGN SPEED:	DESIGN VEHICLE:	CHECKED:
10 KM/H	P	KM

WATT Consulting Group
WATTCONSULTINGGROUP.COM

PROJECT NO: 3686.B01



LEGEND:
- BICYCLE ACCESS ROUTE
- PEDESTRIAN ACCESS ROUTE

PERMIT TO PRACTICE:

SEAL:

REVISIONS

2	ISSUED FOR REVIEW	2024-05-27
3	ISSUED FOR REVIEW	2024-05-30
4	ISSUED FOR REVIEW	2024-06-26
5	ISSUED FOR REVIEW	2024-07-09
6	ISSUED FOR REVIEW	2024-07-09
7	ISSUED FOR REVIEW	2024-07-18
8	ISSUED FOR REVIEW	2024-10-04
9	ISSUED FOR SUBMISSION	2024-10-15

1130 ROCKY CREEK ROAD ACCESS CONCEPT DRAWINGS PROPOSED DEVELOPMENT SITE

DRAWING NO:	SCALE:	DRAWN:
FIGURE 2	1:500	NR
DESIGN SPEED:	DESIGN VEHICLE:	CHECKED:
-	-	KM

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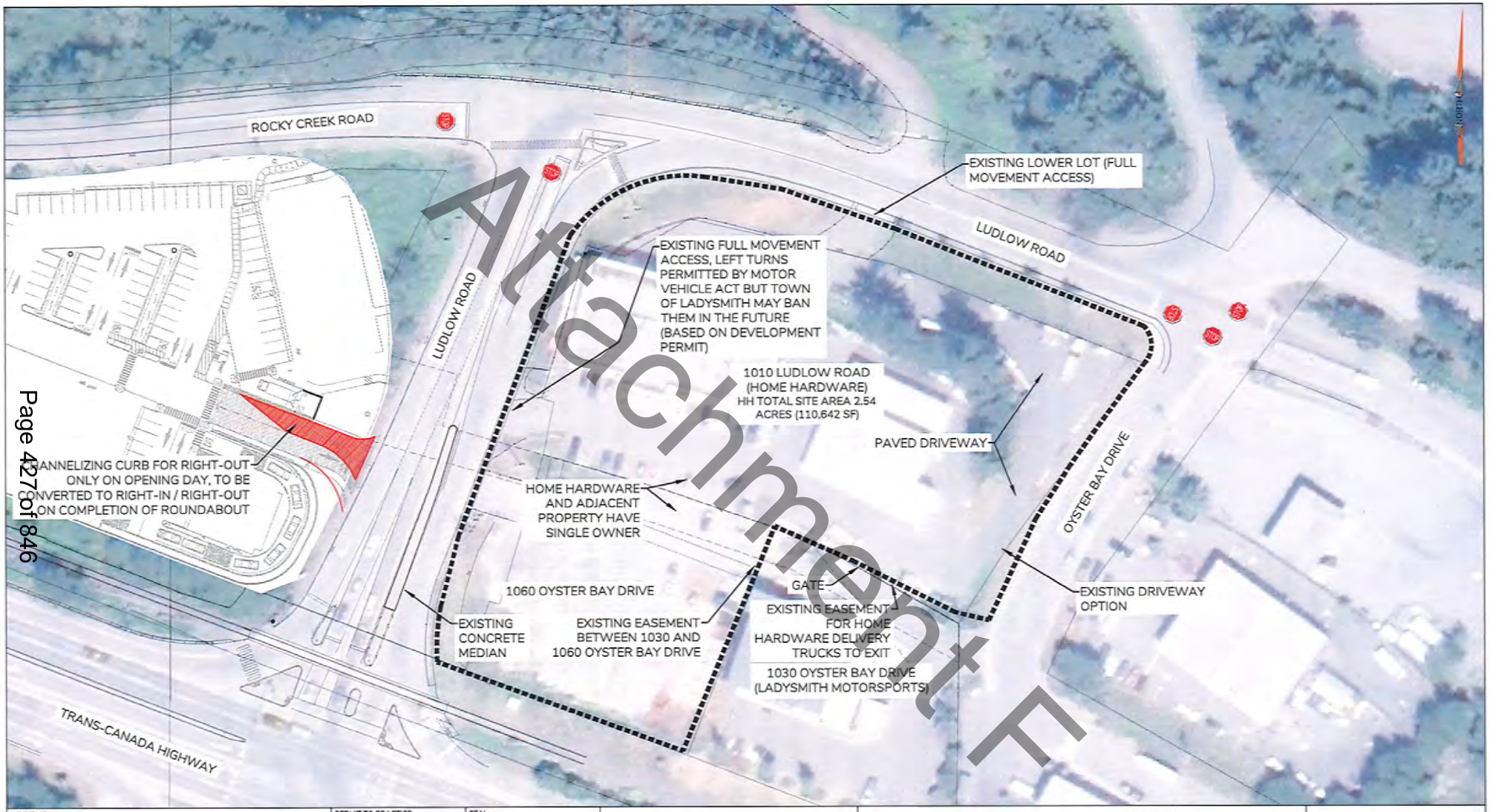
PROJECT NO: 3686.B01

4.0 EXISTING HOME HARDWARE ACCESSES

4.1 Historical Context

The Town originally approved Home Hardware's upper (west) Ludlow Road access as right-in / right-out only in Development Permit 07-06, noting that "while the left-out functions today it may not in the future and the ability to make a left-out may be eliminated". Historical images show a crosshatched painted island extending from the end of the Ludlow Road median to the Rocky Creek Road intersection.

A subsequent Development Permit 12-02 required "a minimum 10 metre wide driveway for future access to Oyster Bay Drive for large delivery vehicles and to permit efficient and safe, on-site vehicular and pedestrian circulation as approved by DP 07-06". The Ladysmith Motorsports property, located at 1030 Oyster Bay Drive, has reciprocal access easements registered with the Home Hardware property and 1060 Oyster Bay Drive as shown in **Figure 3**.



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6	ISSUED FOR REVIEW	2024-07-09
7	ISSUED FOR REVIEW	2024-07-18
8	ISSUED FOR REVIEW	2024-10-04
9	ISSUED FOR SUBMISSION	2024-10-15

1130 ROCKY CREEK ROAD
ACCESS CONCEPT DRAWINGS
HOME HARDWARE AND ADJACENT PROPERTIES

DRAWING NO:	SCALE:	DRAWN:
FIGURE 3	1:800	NR
DESIGN SPEED:	DESIGN VEHICLE:	CHECKED:
-	-	KM

WATT Consulting Group
WATTCONSULTINGGROUP.COM

PROJECT NO: 3686.B01

4.2 Current Conditions

4.2.1 Upper Ludlow Access

Legality of Left In/Out

Although the median has been extended across the entire Ludlow Road frontage of 1060 Oyster Bay Drive (per Binnie's recommendation), it does not extend past the Home Hardware access. Although it is understood that a crosshatched painted island once existed between the median and the Rocky Creek Road intersection, historical satellite imagery shows the crosshatch markings fading over the years from 2006 to 2014. When WATT visited the site in January 2024, the existence of crosshatch markings between the lines was not noted as they were no longer visible at all on the wet road.

The Town has requested confirmation of "whether a driver making [a left turn exiting Home Hardware] would be contravening the Motor Vehicle Act". Both double yellow lines and crosshatched painted islands are intended to discourage unsafe turning movements and encourage drivers who do turn to exercise caution. Neither legally bans safe turning movements under the Motor Vehicle Act, only passing movements that cross the yellow line.

Safety of Left In/Out

The Town has also requested confirmation of "whether not preventing [a left turn exiting Home Hardware] would be safe from a traffic engineering perspective". For legal purposes, whether or not the movement is "safe" at any given time is to be determined by the driver. The Act does not specifically define what conditions are "safe", however if the turn results in a collision, it can be considered unsafe and therefore illegal. WATT offers the following considerations on the safety of the left turn out of Home Hardware:

Time Gaps

As conflicting through traffic volumes on Ludlow Road increase, the opportunities for "safe" (and therefore legal) left turns entering and exiting the upper Ludlow Home Hardware access will decrease. Very high through traffic volumes may encourage unsafe (and therefore illegal) left turns by exiting traffic. Per WATT's TIA Update, when the 1130 Rocky Creek Road site is occupied (assumed to be 2026), Ludlow Road is expected to see a peak of 297 vehicles per hour in both directions combined at the access. This represents an average of one conflicting vehicle every 12 seconds. The

actual time gaps between vehicles may vary significantly due to gaps created by the signalized intersection at Highway 1 / 1st Avenue-Ludlow Road.

In 2036 (assuming full build-out of the waterfront development described in Binnie's report) the TIA Update expects a peak of 435 vehicles per hour in both directions combined. This represents an average of 1 conflicting vehicle every 8 seconds.

Turning movement data for traffic using the upper Ludlow Home Hardware access was collected by WATT on Wednesday, January 24, 2024 from 4:00 PM to 5:00 PM and on Thursday, January 25, 2024 from 8:00 AM to 9:00 AM. The results are shown in **Table 1**.

Table 1 – Vehicle Turning Movements Using Home Hardware Upper Ludlow Access

Movement	AM	PM
EBR (Right In)	24	25
NBR (Right Out)	2	2
WBL (Left In)	4	1
NBL (Left Out)	**18**	**22**

The forecasted peak of thru traffic on Ludlow Road occurs during the PM peak hour, so it would conflict with 22 vehicles turning left out of the upper Ludlow Home Hardware access. It is believed that sufficient gaps in thru traffic exist for these vehicles to turn left out of Home Hardware safely in the 2026 horizon year.

In the 2036 horizon year, the number of safe gaps available for vehicles turning left out of Home Hardware will be reduced. As there are currently no active development applications for the waterfront area, however, there is no clear indication of when the forecasted 2036 horizon volumes will actually occur.

Ludlow Road Queuing

The upper Ludlow Home Hardware access is located approximately 50 m from the westbound stop bar on Ludlow Road's railway crossing, which immediately precedes the Highway 1 / 1st Avenue-Ludlow Road intersection. Westbound queues at Highway 1 / 1st Avenue-Ludlow Road will extend toward the Home Hardware access. Of all turning movements, which each have their own lane, the left turn movement consistently has the longest queues. 95th percentile queues for this movement are as follows:

- Existing AM: 25 m
- Existing PM: 25 m
- Opening Day (2026) Background AM: 25 m
- Opening Day (2026) Background PM: 30 m
- Opening Day (2026) Post-Development AM: 35 m
- Opening Day (2026) Post-Development PM: 35 m
- 2036 Background AM: 30 m
- 2036 Background PM: 35 m
- 2036 Post-Development AM: 35 m
- 2036 Post-Development PM: 40 m

These queue lengths do not reach the access and will not obstruct safe exiting left turns from the access.

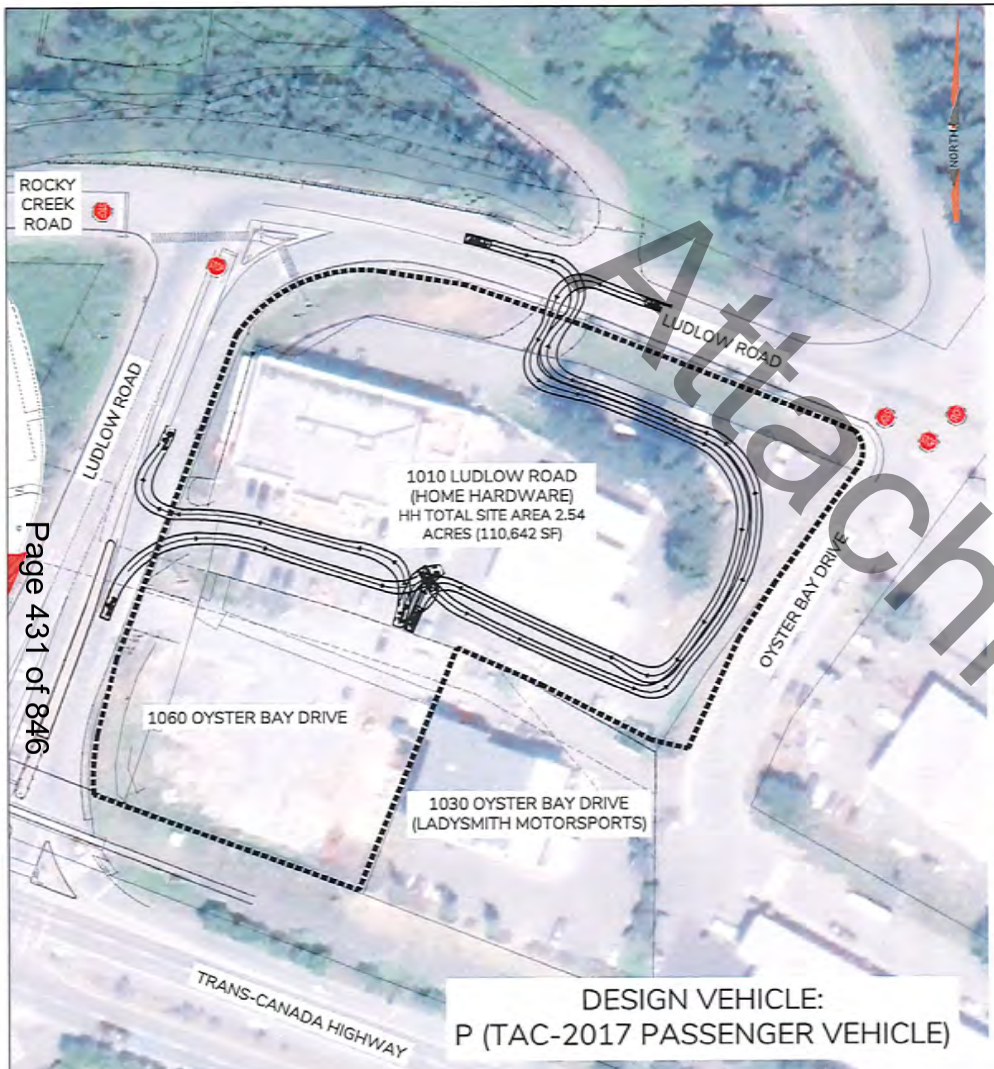
Based on the above time gap and queuing conditions, it is foreseeable that the left turn out of the Home Hardware access is and will remain safe until such time as development along the waterfront actually occurs.

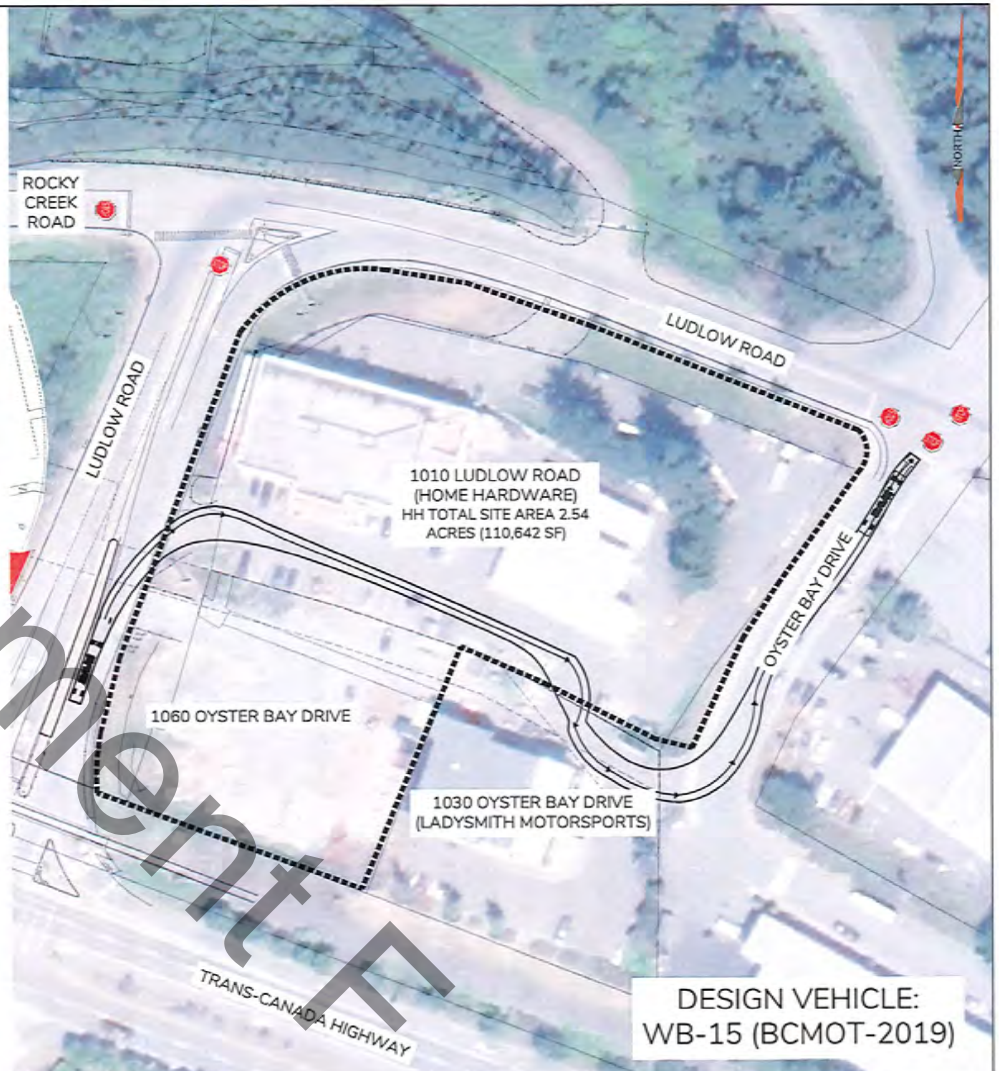
4.2.2 Oyster Bay Drive Access

Oyster Bay Drive can only be accessed from Home Hardware through the Ladysmith Motorsports property (1030 Oyster Bay Drive). This access is legally guaranteed by an easement on the titles of both properties. However, as shown in **Figure 3**, a gate currently exists between the properties to provide additional safety for Ladysmith Motorsports patrons in the parking lot while their vehicles are being serviced. Egress from the Home Hardware upper lot through the gate as shown in **Figure 4** is being permitted for Home Hardware delivery truck traffic on an as-needed basis.

4.2.3 Lower Ludlow Access

A full movement access is available from Home Hardware's lower (east) parking lot to Ludlow Road, south of the Rocky Creek Road intersection. The two parking lots are connected by a paved driveway as shown in **Figure 4**. This connecting driveway is fully within the Home Hardware property but is not readily visible to drivers in the upper lot.





LEGEND:

PERMIT TO PRACTICE:

THESE DESIGN DOCUMENTS ARE PREPARED SOLELY FOR THE USE BY THE PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS ENTERED INTO A CONTRACT, AND THERE ARE NO REPRESENTATIONS OF ANY KIND MADE BY THE DESIGN PROFESSIONAL TO ANY PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS NOT ENTERED INTO CONTRACT.

SEAL:

REVISIONS		
2	ISSUED FOR REVIEW	2024-05-27
3	ISSUED FOR REVIEW	2024-05-30
4	ISSUED FOR REVIEW	2024-06-26
5	ISSUED FOR REVIEW	2024-07-09
6	ISSUED FOR REVIEW	2024-07-09
7	ISSUED FOR REVIEW	2024-07-18
8	ISSUED FOR REVIEW	2024-10-04
9	ISSUED FOR SUBMISSION	2024-10-15

1130 ROCKY CREEK ROAD
ACCESS CONCEPT DRAWINGS
HOME HARDWARE UPPER LOT ACCESS

DRAWING NO:	SCALE:	DRAWN:
FIGURE 4	1:1000	NR
DESIGN SPEED:	DESIGN VEHICLE:	CHECKED:
5-10 KM/H	P, WB-15	KM

WATT Consulting Group
WATTCONSULTINGGROUP.COM

PROJECT NO: 3686.B01

5.0 CONCLUSIONS

The proposed access configuration to the 1130 Rocky Creek Road development addresses MoTI and the Town's requirements for 1130 Rocky Creek Road traffic without the need for a roundabout. The access will be right out only with the delineators along the centreline of the road from the existing median to within 10m of the Rocky Creek Road / Ludlow Road intersection. Once the roundabout is built and the delineators replaced with concrete/raised medians the site access can be right in / right out.

Binnie's transportation review of the Town's Waterfront Area Plan recommended a roundabout to allow safe and legal U-turns by traffic exiting Home Hardware, 90% of which currently turns left out onto Ludlow Road near the proposed 1130 Rocky Creek Road access (on the opposing side of the road). While originally restricted in Development Permit 07-06, this (Home Hardware access on Ludlow Road) left turn is currently legal from the perspective of the Motor Vehicle Act, and WATT does not believe that it will be made unsafe by forecasted traffic to and from the 1130 Rocky Creek Road development.

Elimination the left turn movement from the Home Hardware upper lot access, with the delineators would enforce the right-in/right-out only as contemplated in the original Home Hardware access approval. Paved egress from the upper lot is currently available to Ludlow Road (south segment) via the property's own lower access and to Oyster Bay Drive via existing easement on 1030 Oyster Bay Drive.

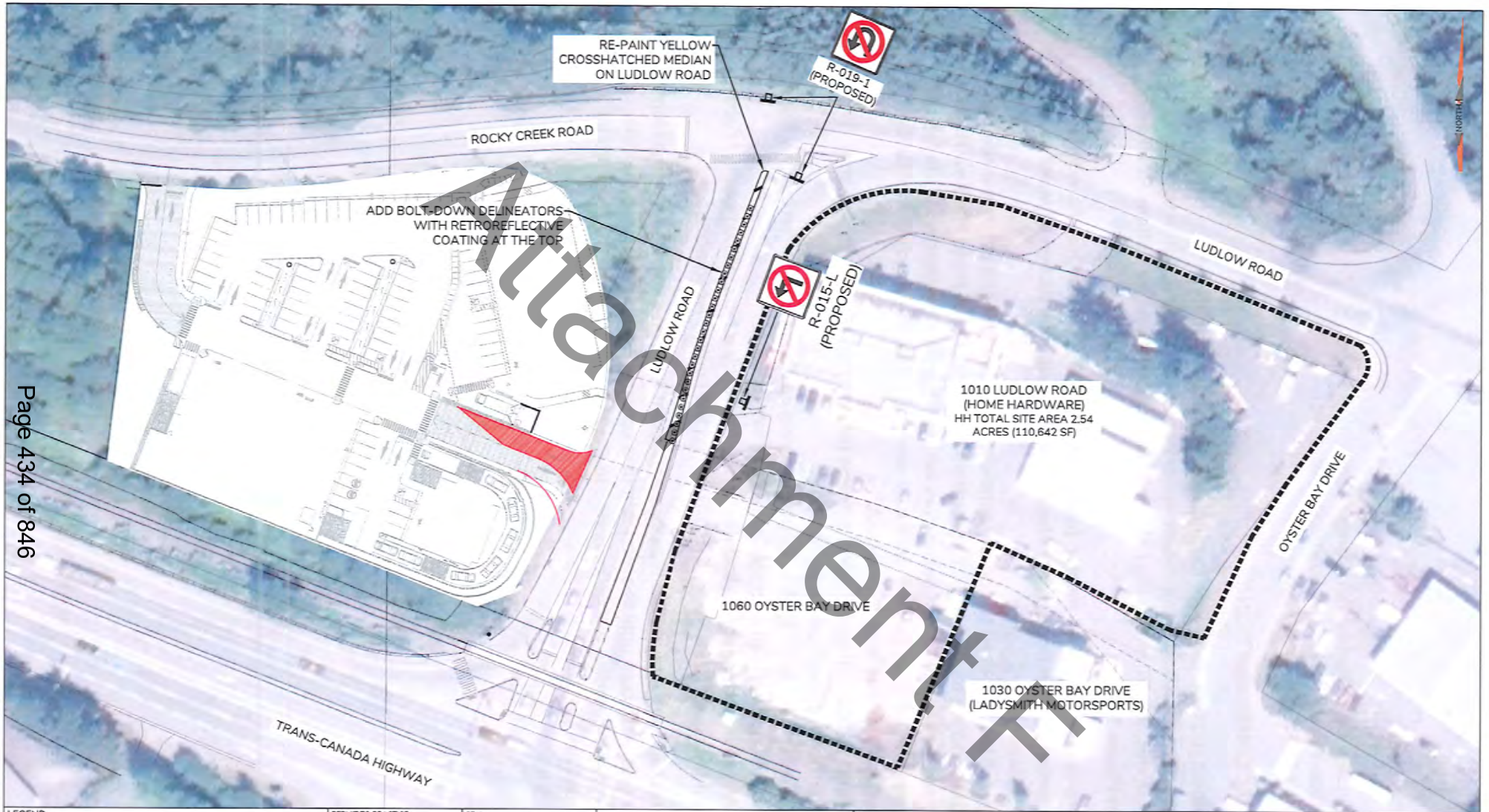
There is considerable development potential in the area and, as such, several sites are forecasted to add traffic through the Ludlow Road / Rocky Creek Road intersection in the coming years. As traffic volumes increase, a roundabout may be considered to improve safety at this intersection.

6.0 RECOMMENDATIONS

As of August 9, 2024, the Town has indicated that they wish to enforce the ban on left turns entering and exiting Home Hardware prior to roundabout construction. To accomplish this, WATT makes the following recommendations for Ludlow Road as shown in **Figure 5**:

1. Re-paint the hatched median between the existing Ludlow Road concrete median and the Rocky Creek Road / Ludlow Road intersection to make it visible to drivers
2. Install the proposed temporary centreline barrier within the painted median from the concrete median to 10 metres from the Rocky Creek Road / Ludlow Road intersection. Bolt-down delineators with a retroreflective coating at the top are recommended as they can be easily removed when the concrete median is extended to the new roundabout.
3. Install R-015-L (No Left Turn) signage facing exiting traffic at the Home Hardware upper Ludlow Road access.
4. Install R-019-1 (No U-Turn) signage facing eastbound traffic (on Ludlow Road) at the Ludlow Road / Rocky Creek Road intersection.
5. When the roundabout is installed in the future, by others, allow right in / right out access to 1130 Rocky Creek Road on the Ludlow Road access.

These measures are intended to temporarily prevent left turn movements at the Home Hardware upper access until the roundabout is constructed. It is expected that the existing concrete median will be extended to the roundabout when the roundabout is constructed.



LEGEND:

PERMIT TO PRACTICE:

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SEAL:

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8	ISSUED FOR REVIEW	2024-10-04
9	ISSUED FOR SUBMISSION	2024-10-15

1130 ROCKY CREEK ROAD ACCESS CONCEPT DRAWINGS HOME HARDWARE AND SITE ACCESS

DRAWING NO:	SCALE:	DRAWN:
FIGURE 5	1:800	NR
DESIGN SPEED:	DESIGN VEHICLE:	CHECKED:
-	-	KM

WATT Consulting Group
WATTCONSULTINGGROUP.COM

PROJECT NO: 3686.B01

Sincerely,
WATT Consulting Group

Noah Reeder

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Senior Transportation Engineer
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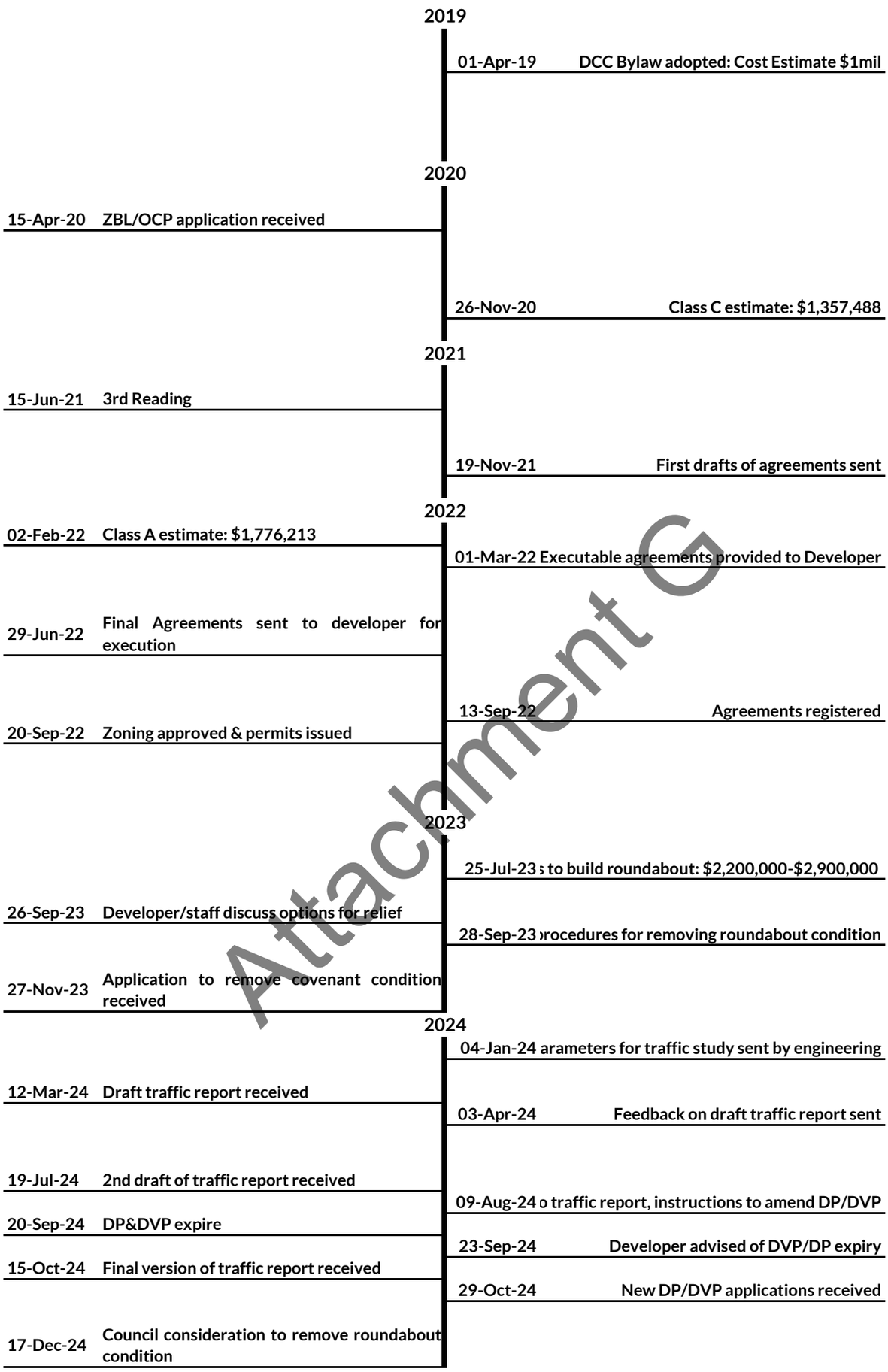
E kmachina@wattconsultinggroup.com

PERMIT TO PRACTICE:
Number 1001432

Attachment F

Project/Roundabout Cost Estimation Timeline: 1130 Rocky Creek Road



Rationale Letter for 1130 Rocky Creek Road, Rezoning Application

Oyster Harbour Development Corp. is applying to rezone 1130 Rocky Creek Road. We are proposing to amend the Covenant registered on title of our property to remove Clause 3, 4 and 5 pertaining to construction of a roundabout at the intersection of Ludlow Road and Rocky Creek Road.

It's important to understand the history of how the roundabout became a requirement of our project as a part of the rationale to request this amendment/rezoning application.

History and Timeline

- We began working on the project in 2017 and engaged with the Town of Ladysmith (the "Town") in April 2018 to begin preliminary discussions about the development. We did two years of due diligence engaging regularly with various Town Staff and had proposed many site plans etc. prior to purchasing the property. We subsequently submitted our application in April 2020.
- From 2018 – 2020 the roundabout was discussed on many occasions as something that the Town would potentially build at some point in the future. There were many scenarios the Town was contemplating but none included us building it.
- In February 2021, to accommodate the potential future roundabout, the Town required some land from the corner of our site. We proposed a "land swap" for the surplus lands on Ludlow Rd which resulted in us purchasing additional land from the Town at a cost of $170,000. This surplus property was no value to any other buyer, so it would remain a surplus if we didn't purchase it. This netted the Town $170,000.
- April 2021 we were notified that the roundabout would be a requirement for our project. At that time, the estimated cost of the roundabout was $1,350,000 and the Town would contribute $1,050,000. Our cost would be $300,000. A Latecomers was highly promoted as a way to recover the Developer portion.
- By then we had already been working on the project for 3 years. This included purchasing the property, doing the "land swap" to accommodate the future roundabout for the Town, engaging numerous stakeholders, securing two national tenants who had also spent 3 years of time and money working with us and we had a substantial amount of money invested in the project.
- We did not have the opportunity in 3 years to factor how the economics of building the roundabout would impact our project costs and timing. But given we had submitted our application a year prior, we didn't want to risk delaying any potential approvals, so we agreed to build the roundabout. At this point we were so far invested in project and felt that we had no choice.
- Prior to April 2021, we had no reason to believe the roundabout would have ever been a requirement for our development as we had already been in discussions with the Town for 3 years with no mention of it being our responsibility or requirement. All the Traffic/Transportation Reports and MOTI Letters made no reference of the roundabout being necessary for our project.

Cost

- In 2018, the cost to build the roundabout was estimated at approximately $1,000,000.

- In April 2021 the estimated cost to build it was $1,350,000. The Town committed to contributing $1,050,000 to the cost which made our contribution $300,000.
- In October 2022 the estimated cost to construct the roundabout was $1,950,000. We had to put the project on hold because the cost of the roundabout was too expensive.
- As of September 2023, the average cost to build the roundabout confirmed through a tender process of 5 qualified local civil contractors is $2.6 million.
- The onerous cost of the roundabout is too much for any one developer to take on, making this project completely unattainable.
- If we were to lose the project and be forced to sell the property, the next developer would not be able to build the roundabout either and the property will continue to sit vacant. We will lose a substantial amount of money at no fault of our own.
- The Town has not procured more funding for the roundabout to date.

Reports

- Numerous traffic and transportation reports have been conducted and none of them indicated that a roundabout is a requirement for this project to operate safely and efficiently.
- Transportation Review was prepared for the Town in September 2018. The report concluded that the only recommendations for 1130 Rocky Creek Road referred to the driveway access of the project. "Two driveway accesses are recommended for the 1130 Rocky Creek Road development. The first driveway location is suggested to be directly across from the existing Home Hardware access with a RIRO restriction. The second driveway is suggested on Rocky Creek Road to be at least 85 m from the center of the access width." These access recommendations have been designed and accommodated.
- This report also refers to the projection that by 2023, there would be approximately 300 residential units constructed, or under construction, at the waterfront area. This is obviously not the case and given the latest setbacks, it may be some time for any new significant development to occur.
- Traffic Operations Review was prepared for MOTI and completed in September 2019. The report makes no mention of the roundabout being a requirement at all.
- Traffic Impact Assessment was prepared for Oyster Harbour Development Corp and completed in April 2021. It states, "The proposed development does not trigger the need for any mitigation measures based on the 2030 post development analysis." The report also states that "At Ludlow Road/Rocky Creek Road all movements operate at a LOS A in the long term with the existing stop control or as a roundabout."
- MOTI Referral Response Letter dated October 2020 does not require a roundabout for the project.
- In October 2023 we had a meeting with Brendan Stevenson, the Traffic Engineer and one of the Authors for the Transportation Review and Nadine King, the Traffic Engineer and Author of the Traffic Impact Assessment. Both confirmed again that the roundabout is not required for our project to function at a high level of service.
- Subsequent to that meeting, in November 2023, Nadine King re-confirmed with the MOTI Development Services Officer (Vancouver Island District – SA02) by email that the roundabout is not a requirement for our project.

- Three separate traffic studies and MOTI all confirm that this project causes no traffic or safety issues without the roundabout.

Conclusion

- The roundabout is not required for our development to operate safely and efficiently; a fact that has been clearly stated in 3 separate Traffic Reports and by MOTI
- The roundabout was unfairly added as a requirement to our project when the reports clearly state otherwise. It was also added very late in the process and long after we had completed our due diligence and made our application.
- The cost to construct the roundabout has increased from $1,350,000 to $2,624,000 since we the time it made to be our responsibility in order to maintain Staff support for our project.
- The construction cost of the roundabout is too expensive to proceed with our project.
- If we can't proceed with our project because of the roundabout cost, the Town will lose both the project and all it's economic benefits.
- The property is currently unsellable because no other Buyer would be able to afford the construction of the roundabout and any potential future project would be nonviable due to the roundabout clauses in the Covenant.

STAFF REPORT TO COUNCIL

Report Prepared By: Vidhi Kyada, Planning Technician
Reviewed By: Jake Belobaba RPP, MCIP, Director of Development Services
Meeting Date: December 17, 2024
File No: **DVP 3090-24-06 and DP 3060-21-10**
RE: **Development Variance Permit and Development Permit – 128 Rollie Rose Drive**

RECOMMENDATION:

That Council**:**

1. Issue Development Variance Permit 3090-24-06 to vary the following provisions of "Town of Ladysmith Zoning Bylaw 2014, No. 1860" for a proposed multi-unit residential development at 128 Rollie Rose Drive (Lot 12, District Lot 103, Oyster District, Plan EPP75579; PID: 030-477-620):
    a. Section 7.2.2. (c) to reduce the minimum landscape buffer from 1.5 metres to 0.5 metres; and
    b. Section 10.12.5. (d) to reduce the minimum front parcel line setback from 6.0 metres to 2.7 metres;
2. Issue Development Permit Number 3060-21-10 to allow construction of a three-unit townhouse building and two duplex buildings at 128 Rollie Rose Drive; and
3. Require as a condition of the issuance of Development Permit 3060-21-10 that the applicant provide landscape security in the amount of $23,382.00, as stated in the Development Permit (3060-21-10).

EXECUTIVE SUMMARY:

The purpose of this report is to introduce a proposal to construct 7 residential units at 128 Rollie Rose Drive consisting of a two-storey, three-unit townhome building and two, three-storey duplex buildings. The proposed development requires a development variance permit and a development permit.

The applicant is requesting a variance to reduce the front parcel line setback from 6.0 metres to 2.7 metres and the landscape buffer from 1.5 metres to 0.5 metres.

Staff recommend approval of DVP 3090-24-06 (Attachment B) based on the impact analysis, and approval of DP 3060-21-10 (Attachment C) based on consistency with the Multi-Unit Residential ESA - Development Permit Area 8 and Riparian - Development Permit Area 6 guidelines.

PREVIOUS COUNCIL DIRECTION:

N/A

INTRODUCTION/BACKGROUND:

Subject property

The subject property is a 1,903 square metre parcel located at 128 Rollie Rose Drive. The property is currently designated Neighbourhood Residential under the "Official Community Plan Bylaw 2022, No. 2200" (OCP) and falls within the Riparian (DPA 6) and Multi-Unit Residential ESA (DPA 8) development permit areas. The parcel is zoned Low Density Residential (R-3-A) in the "Town of Ladysmith Zoning Bylaw 2014, No. 1860". The property is currently undeveloped and was previously cleared of most mature trees and vegetation outside of the Streamside Protection and Enhancement Area (SPEA). The riparian area within the SPEA contains mature, mixed vegetation. The cleared portion of the lot has been naturally revegetated with low-lying shrubs, immature trees, and some invasive plant species.

Surrounding land-uses include:

- Northwest: Single-detached housing and a Multi-Unit Residential development.
- Northeast: Single-detached housing zoned R-1-A.
- Southeast: Parkland with mature and mixed forest cover.
- Southwest: Holland Creek Phase 6 subdivision vacant land zoned for Low Density Residential (R-3-A).

The subject property is located approximately a 6-minute walking distance to the transit stop at Dogwood and Arbutus, a 6-minute walk to Holland Creek Park, a 4-minute drive to the Ladysmith Primary School and Ladysmith Secondary School, and a 16- to 19-minute walk to Coronation Mall.

A map of the subject property is provided in Attachment A.

Background

The subject property is a part of the Phase 1 subdivision at Holland Creek that was approved in April 2018. Site preparation activities were conducted between 2017 and 2020 by the previous owner of the property, which included vegetation clearing without an approved riparian development permit. These activities occurred within the Riparian Assessment Area (RAA) of Tributary 1. A Condition and Impact Assessment (CIA) report was required to address the historical site alteration, which included further measures to protect, maintain, and enhance the SPEA. The CIA report is attached to the RAPR and forms part of the DP 21-10.

PROPOSAL:

The applicant proposes to construct a total of 7 residential units: one three-unit townhouse building and two duplex buildings. The site plan and building design plans show details of the proposal and are attached as Schedules to DP 21-10. The application includes Front Parcel Line Setback variance and Landscape Buffer variance. These variances are summarized below.

Table 1: Summary of proposed variance

Zoning Regulation	Permitted	Proposed	Variance	Variance Type
Front Parcel Line Setback	6.0 m	2.7 m	3.3 m (55%)	Minor[1]
Landscape Buffer	1.5 m	0.5 m	1.0 m (66.66%)	Minor[2]

The proposed development complies with all other regulations of the R-3-A zone.

In accordance with "Official Community Plan Bylaw 2022, No. 2200" (OCP), a DP is required prior to construction as the property is also located within Development Permit Area 6 – Riparian (DPA 6) and Development Permit Area 8 – Multi-Unit Residential ESA (DPA 8).

A letter of rationale from the applicant is provided as Attachment D.

ANALYSIS:

For the reasons outlined below, staff recommend the proposal be approved.

Official Community Plan

The subject property is located in the Neighbourhood Residential land use designation in the OCP. The Neighbourhood Residential designation is intended to provide residential areas with diverse housing types, tenures and densities.

The proposal is consistent with the OCP Designation. The property is also located within Development Permit Area 6 – Riparian (DPA 6) and Development Permit Area 8 – Multi-Unit Residential ESA (DPA 8) under the OCP. Therefore, a DP is required.

The following OCP policies are relevant to the proposal:

- Policy 2.3 Land Use Designation Policies:
  - q. The built form of this designation should be single-detached dwellings, duplexes, triplexes, fourplexes, townhouses, limited multi-family housing up to three storeys, and limited mixed use buildings of up to four storeys with upper storeys stepped back.
  - s. Multi-family housing is supported on lots that are within a ten minute walk of all of the following: a park, a transit stop, and either a school or commercial area.
  - t. Maximum FSR should be 1.3 for residential uses excluding single-detached dwellings.

- Policy 2.4 General Land Use Policies:
  - j. Support the provision of a range of housing types, tenures, densities – as well as affordable and attainable housing opportunities – to meet the diverse needs of individuals and families of varying needs and levels of incomes, in all neighbourhoods.

[1] Minor variance means a reduction of any setback regulation of the zoning bylaw, to a maximum reduction of 75%.
[2] Minor variance a variance to a landscaping or screening requirement in a bylaw under section 527(1)(a) or 527(1)(b) of the Local Government Act where an equivalent area or type of landscaping is provided on the same site.

m. Give priority to multi-family housing near parks, schools and other public facilities, shops and services, and transit.

Zoning Bylaw

The subject property is zoned R-3-A in the Zoning Bylaw. However, due to a mapping error on the Zoning Bylaw Map in the "Town of Ladysmith Zoning Bylaw 2014, No. 1860" the parcel is split-zoned into Low Density Residential (R-3-A) and Single Dwelling Residential – Small Lot A (R-1-A).

The R-3-A zone requires a minimum front parcel line setback of 6.0 metres and a landscape Buffer of 1.5 metres. The proposed development has a 2.7m front setback and 0.5m landscape buffer, therefore a variance is required. The proposal meets all other Zoning Bylaw regulations.

Variance Proposal

The applicant is requesting a minor variance to vary the front parcel line setback from 6.0 metres to 2.7 metres and landscape buffer from 1.5 metres to 0.5 metres. The reduction in the setback and landscape buffer is to accommodate the existing site grading, geometry constraints and to maximize the utility of the property. No negative impacts are anticipated on the adjacent properties.

The reduction in the front parcel line setback allows for additional separation distance from the environmentally sensitive area and places construction further from the SPEA boundary. Utilizing the existing driveway letdown location for site access allows for stepping of the retaining walls on the west frontage of the parcel, reducing the individual wall height and providing additional areas for plantings, and improving the overall aesthetics of the site.

The existing positioning and grading of the driveway does not allow for the required 1.50-metre width for a landscaped buffer. The offsite letdown was completed previously as part of the subdivision works, and the steep driveway grading and spatial constraints for the buildings does not allow for additional landscape buffer width along the northeastern property line. The applicant is proposing to supplement the reduced landscaped buffer with five (5) additional Maple trees along the southern portion of the site.

Based on the analysis, staff do not expect negative impacts from the proposed variance, and, therefore, recommend approval of DVP 24-06.

The issuance of a "Minor Variance" is delegated to the Director of Development Services under "Ladysmith Officers and Delegation of Authority Bylaw 2016, No.1905 Amendment Bylaw No. 2180." However, since there is also a Development Permit for DPA-8 required for this proposal, both permits are being presented to Council so they can be considered simultaneously.

Development Permit Guidelines

The issuance of DPs in DPA 6 is delegated to the Director of Development Services. Since DPA 8 is applicable to this property, the development proposal is being presented to Council for consideration conjunctively as one package.

DPA 6 – Riparian:

The purpose of DPA 6 is to protect the natural environment, ecosystems and biological diversity of fish bearing and non-fish bearing riparian areas. On October 2nd, 2024, the Town received notice that the RAPR report was approved by the Province. The conditions in the DP are based on the recommendations in the RAPR report and its attachments.

Table 2 summarizes the analysis of the applicant's proposal against the DPA 6 guidelines.

Table 2: Summary of DPA6 guidelines and staff comments.

DPA 6 Guidelines	Staff Comments
QEP shall prepare a riparian assessment report and should be submitted to the Province.	• A RAPR report drafted by a Qualified Environmental Professional (QEP) with the revised drawings was submitted to the province and subsequently approved and forwarded to the Town on October 2, 2024. Condition and Impact Assessment received May 2, 2023.
No development activities within SPEA.	• Areas designated as the SPEA will be flagged with high visibility flagging tape, permanent fencing and drip zone buffers. • No stormwater infrastructure is permitted to be sited in the SPEA unless associated with an approval to discharge to Tributary 1 under the Water and Sustainability Act (WSA).
Long term protection of SPEA.	• The QEP proposed permanent fencing and signage along the boundary of the SPEA.
Strict compliance with mitigating measures recommended by report.	• SPEA protection measures recommended by the RAPR and CIA are included as conditions of the DP.
Exceed minimum standards where possible.	• Provincial RAPR standards have been met, according to the Provincial Review.

DPA 8 – Multi-Unit Residential ESA:

The purpose of DPA 8 is to protect the natural environment and biodiversity, achieve high level of design and livability for future residents that is consistent with the Ladysmith vision and to promote energy and water conservation as well as the reduction of greenhouse gas emissions.

Table 3 summarizes the analysis of the applicant's proposal against the DPA 8 guidelines.

Table 3: Summary of DPA8 guidelines and staff comments.

DPA 8 Guidelines	Staff Comments
Form, Character and Exterior Design	
Building Design in the aesthetic of the neo-traditional, Pacific Northwest or eco-responsive themes.	• The proposal uses some neo-traditional elements such as multiple gable roofs and raised porches along the Rollie Rose Drive. • The proposed building utilizes professional knowledge of hillside design, natural area conservation and multi-family building design.
Scale/neighbourhood identity	• The proposed buildings are of a human scale and the architectural theme and massing are consistent throughout the building's design. • The reduction in front parcel line setback enhances the street edge and follows eyes-on-the-street principles.
Response to site topography	• The buildings and retaining walls are stepped with the site's topography.

Façade	• Building facades are articulated through the use of varying colours, finishes, projections and rooflines.
Exterior materials	• Exterior cladding consists of high quality, cement board horizontal plank, cement board lap siding, fibre cement (“Hardie-board”) shingle and asphalt roofing shingles.
Private outdoor space	• Building A contains private deck for all the units. • Building B and C contains private patios for all the units. • All the decks and patios are screened from each other with shrubs like Salal and Red-flowering Currant.
Underground/underbuilding parking areas	• A two-car garage is proposed for each unit.
Parking garage entries	• The entries are oriented towards the inner side of the property, avoiding the garage entrance on the main street (Rollie Rose Drive).
Building Siting and Conservation	
Building & Window placement	• The proposed development is close to the forested SPEA. • All units will have views of the forested SPEA on the south side as well as the north side. • Windows are large and plentiful, maximizing views to the outside and allowing for natural ventilation.
Building orientation	• Building B is south facing; however, presence of the nearby SPEA, which contains tall trees, and proposed landscaping on the south and west side may provide some shading.
Site Design and Circulation	
Orientation towards street & semi-public space	• Building A is oriented towards the street and the other two buildings are oriented onto the common open space or internal road. • The reduction in front parcel line setback enhances the street edge and follows the principles of “eyes on the street”. • Semi-public space between the building and the street is provided with the landscaped front yard and the existing Town boulevard.
Outdoor common space	• An outdoor common space for residents is provided and may include a shelter with picnic tables.
Surface parking	• Two surface parking spots for visitors are provided at the rear of the property, one near building B and the other near building C. • The proposal includes landscaping surrounding each of the parking spots.
Pedestrian circulation & linkages	• A pedestrian pathway linking Rollie Rose Drive to the interior of the site is proposed. • Pedestrian pathways in front of the building and connecting to the parking areas are visually separated from the driveway through use of different paving materials.
Bicycle Parking	• Two short-term outdoor and 7 indoor long-term bicycle parking spots will be provided. • Outdoor bicycle parking is provided on the rear of the property near building B.
Natural Environment and Sensitive Ecosystems	
Land clearing	• The subject property was previously altered, and vegetation was cleared inside the RAA of Tributary 1; however, the SPEA component of the RAA remained intact as confirmed during the detailed 2021 RAPR field assessment and November 1st, 2022, CIA Site inspection.

	• The Condition and Impact Assessment was received on May 2, 2023, addressing the historical vegetation clearing as well as identifying mitigation measures if warranted.
Protection of SPEA	• A 10 metre SPEA setback located on the edge of the site will be protected in accordance with DP 21-10 and the Provincial Riparian Areas Protection Regulation. • No development activities are permitted within the SPEA.
Riparian Assessment Area	• See Table 2.
Identify SPEA during construction	• QERP to delineate the riparian buffer with snow fencing. • Flag out rooting zones (length = 6 x tree dbh) and clearly delineate rooting zones around perimeter trees along the SPEA/riparian setback.
Construction environmental management plan	• A construction environmental management plan forms a part of DP 21-10.
Sediment and erosion control plan	• A sediment and erosion control plan is included in the RAPR report, which forms a part of DP 21-10.
Fire smart (landscaping)	• Proposed plantings are listed within the FireSmart BC plant chart.
Tree preservation plan	• The applicant has submitted a Windthrow and Hazard Tree Assessment prepared by a Registered Professional Forester and a certified Arborist, which is attached to the RAPR report and DP 21-10. • The assessment identifies protection measures for SPEA trees with root zones that fall within the construction area, as well as including recommendations such as retaining trees that require removal as coarse woody debris within the SPEA, and treatment of hazard trees.
Landscaping, Energy & Water Conservation, and Greenhouse Gas Emissions Reductions	
Landscape Plan	• A landscape plan for the site has been prepared by a Landscape Architect and is included as a schedule in DP 21-10.
6.0 m landscape buffer along hydro corridor	• Not applicable.
Native and drought tolerant plants	• New landscaping plantings consist of native and drought tolerant species.
Rainwater collection	• The applicant is proposing 2,800 GAL tank (concrete precast, specifically built for rainwater collection) which translates to +/-12,000 liters of rainwater storage that can be effectively reused for irrigation and is a condition of DP 21-10.
Refuse, recycling and organics areas	• Waste collection areas are located within each unit.
Exterior lighting	• Exterior lighting will be downcast, following “dark sky” principles and is a condition of DP 21-10.
Retaining walls	• Stepped retaining walls are proposed to be cast-in-place concrete. • Vegetation will be incorporated into the retaining wall design.
Monetary security	• DP 21-10 requires a bond of $23,382 to ensure landscaping is carried out in accordance with the landscape plan and RAPR report recommendations.
Landscaping standards	• The proposed landscaping conforms to the BC Landscape Standard.
Passive Design Strategies	• Windows are proposed on all the four sides for cross ventilation.

	• Roof overhangs are proposed for all the windows to provide shade. • Landscaping with trees on the South and West side of the property for passive cooling.
Monitoring	
Conditions included in DP	• DP 21-10 requires a post-construction monitoring report prior to issuance of an occupancy permit to ensure that SPEA protection measures are followed.
Monitoring by a QEP during site clearing and construction	• The RAPR assessment (Schedule D in DP 21-10) requires the QEP to undertake regular monitoring during construction.
Release of landscaping security to be accompanied by a report	• A report from the Landscape Architect is required prior to release of the required landscape security.

ALTERNATIVES:

Council can choose to:

1. Not issue DVP 3090-24-06 and refer DP 3060-21-10 back to staff.
2. Not issue DP 3060-21-10 and specify the reasons for refusal citing specific development permit guidelines.
3. Defer consideration of the application and refer the proposal to a subsequent meeting of Council.
4. Amend the conditions of the proposed permits and approve the issuance of the permits as amended.
5. Refer the application back to staff for further review, as specified by Council.

FINANCIAL IMPLICATIONS:

N/A

LEGAL IMPLICATIONS:

Standard requirements for Council consideration and referrals under provincial legislation have been accounted for in staff's review and processing of the application and in the recommendations of this report.

The *Local Government Act* allows Council to vary Zoning Bylaw regulations (excluding regulations for use, density and rental tenure) through issuance of a DVP. Development Variance Permits are discretionary decisions of Council, and Council has no obligation to approve the proposed variance. If the proposed variance is denied, the proposed Development Permit must either be approved as amended (see Alternative 4) or denied. If only the Development Permit is refused, reasons must be given based on the DPA 6 and DPA 8 Guidelines as the issuance of a DP is not a completely discretionary decision of Council.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:

Mail notification for the proposed development variance permit pursuant to section 499 of the *Local Government Act,* was carried out on December 6, 2024. The notice was mailed and delivered to property owners/residents within 60m of the subject property. No written submissions were received prior to the time of writing.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:

The application was circulated amongst Town departments for review. Their comments are summarized below:

Table 4: Department Comments

Referred (Yes/No)	Department	Comments
Yes	Infrastructure Services	Provide updated detailed design drawings at the building permit stage to ensure post construction flows meet pre-construction flows for a 10-year event. All work shall comply with the Construction Environmental Management Plan at time of construction.
Yes	Building Inspection	Separate building permits will be required for Buildings A, B and C, and retaining walls.
No	Parks Recreation and Culture	N/A
No	Financial Services	N/A
No	Legislative Services/Corporate Services	N/A
Yes	Fire/Protective Services	No concerns.

COMMUNITY PLANNING ADVISORY COMMITTEE (CPAC) REVIEW:

Under CPAC Terms of Reference a CPAC review of this application is not required.

ALIGNMENT WITH STRATEGIC PRIORITIES:

☐ Core Infrastructure ☐ Economy
☒ Official Community Plan Implementation ☐ Leadership
☐ Waterfront Area Plan ☐ Not Applicable

I approve the report and recommendation(s).

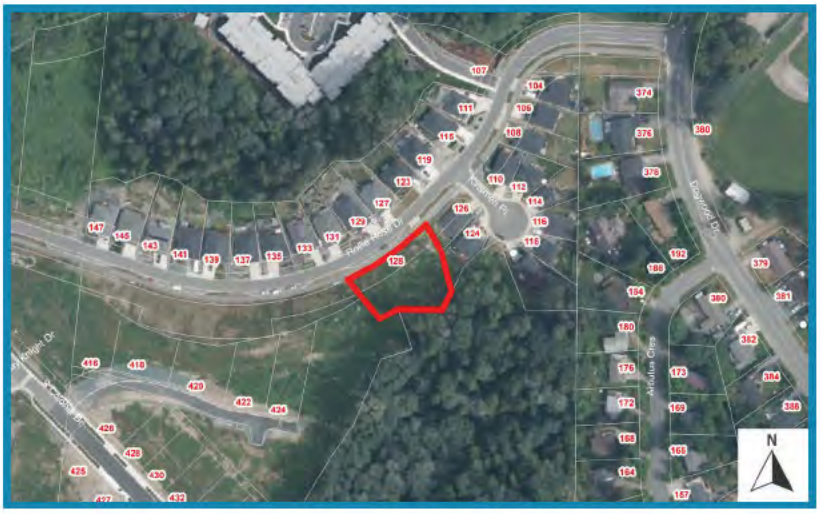
Allison McCarrick, Chief Administrative Officer

ATTACHMENTS:

A. Subject Property Map
B. Draft DVP 3090-24-06
C. Draft DP 3060-21-10
D. Applicant Letter of Rationale

128 ROLLIE ROSE DRIVE

ATTACHMENT - A



Subject Property

LOCATION MAP

Subject Property

ZONING MAP

Subject Property

DPA MAP

TOWN OF LADYSMITH
DEVELOPMENT VARIANCE PERMIT

(Section 498 *Local Government Act*)

FILE NO: 3090-24-06

DATE: December 17, 2024

Name of Owner(s) of Land (Permittee): 1447227 BC LTD., INC.NO. BC1447227

Applicant: Chris Sharpe (Sharpe Sites Inc.)

Subject Property (Civic Address): 128 Rollie Rose Drive

1. This Development Variance Permit is issued subject to compliance with all of the bylaws of the Town of Ladysmith applicable thereto, except as specifically varied or supplemented by this Permit.

2. This Development Variance Permit applies to and only to those lands within the Town of Ladysmith described below and any and all buildings, structures, and other development thereon:

   Lot 12, District Lot 103, Oyster District, Plan EPP75579
   PID# 030-477-620
   (128 Rollie Rose Drive)
   (referred to as the "Land")

3. Section 7.2.2 (c) of "Landscape Standards" of the "Town of Ladysmith Zoning Bylaw 2014, No. 1860", as amended, is varied for the Land by reducing the *Landscape Buffer* from 1.5 metres to 0.5 metres for the construction of a driveway, a three-unit townhouse building and two duplex buildings, as shown on **Schedule A – Landscape Plan.**

4. Section 10.12.5. (d) of "Low Density Residential (R-3-A)" zone of the "Town of Ladysmith Zoning Bylaw 2014, No. 1860", as amended, is varied for the Land by reducing the minimum *Front Parcel Line setback* from 6.0 metres to 2.7 metres for the construction of three-unit townhouse building and two duplex buildings as shown in **Schedule B – Site Plan.**

5. Pursuant to section 502(2) of the *Local Government Act* the land described herein shall be developed strictly in accordance with terms and conditions and provisions of this Permit and any plans and specifications attached to this Permit which shall form a part thereof.

6. The following plans and specifications are attached:

   a) **Schedule A – Landscape Plan**

b) **Schedule B – Site Plan**

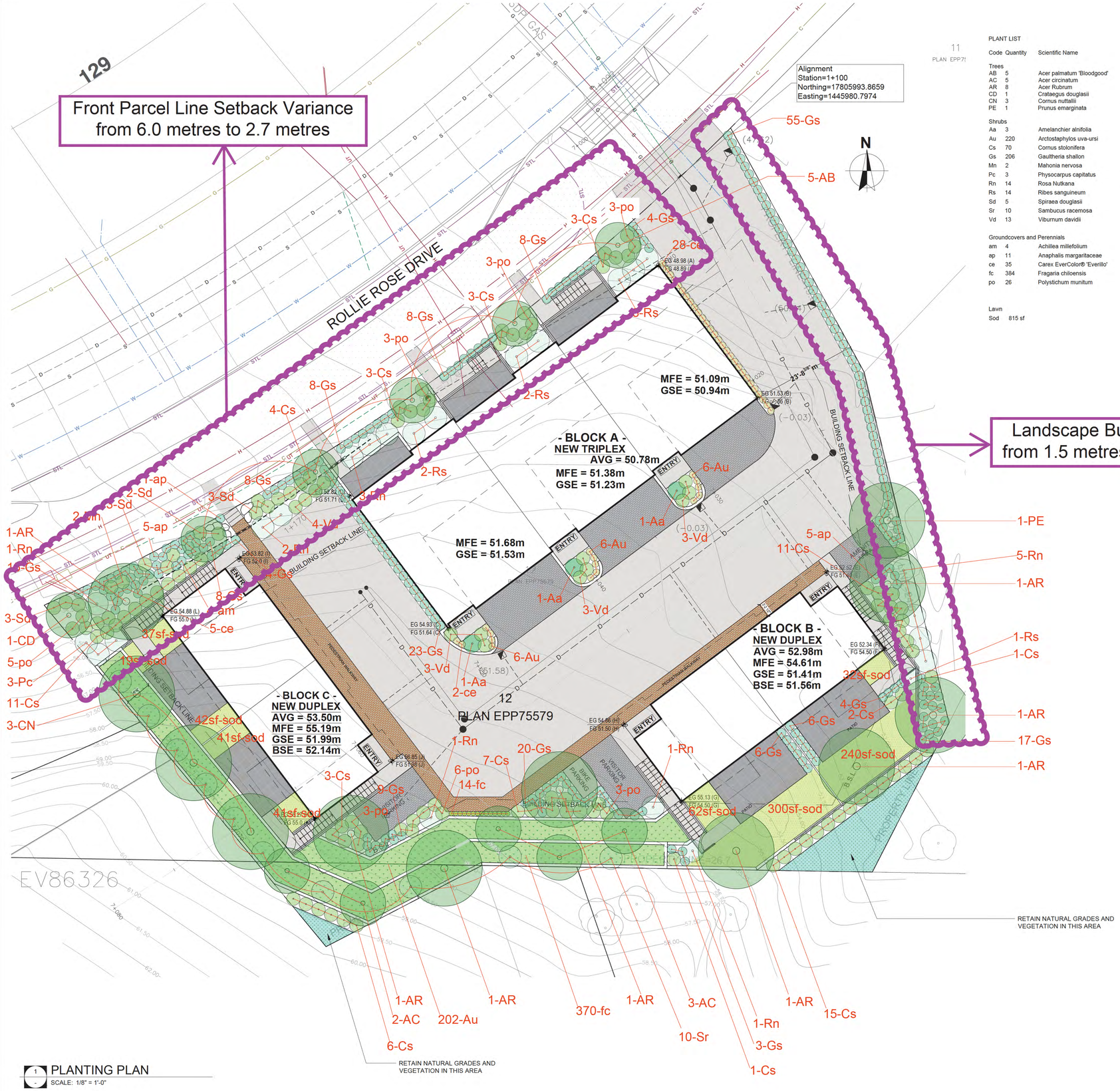
7. Pursuant to section 504(1) of the *Local Government Act*, if the Permittee does not substantially start any construction permitted by this Permit within **two years** of the date of this Permit as established by the authorizing resolution date, this Permit shall lapse.

8. For the purposes of section 7, "substantially start":
   a. means works undertaken in compliance with this permit and the bylaws of the Town for which a valid building permit has been issued; and
   b. does not include clearing, grubbing or excavation work.

9. Notice of this Permit shall be filed in the Land Title Office at Victoria under section 503 of the *Local Government Act*, and upon such filing, the terms of this Permit **(3090-24-06)** or any amendment hereto shall be binding upon all persons who acquire an interest in the land affected by this Permit.

10. THIS PERMIT IS NOT A BUILDING PERMIT. No occupancy permit shall be issued until all items of this Development Variance Permit have been complied with to the satisfaction of the Corporate Officer.

AUTHORIZED BY RESOLUTION NO. _____ PASSED BY THE COUNCIL OF THE TOWN OF LADYSMITH ON THE 17th DAY OF DECEMBER 2024.



PLANTING PLAN
SCALE: 1/8" = 1'-0"

PLANT LIST

Code	Quantity	Scientific Name	Common Name	Size	Spacing	Note
Trees						
AB	5	Acer palmatum 'Bloodgood'	Bloodgood Japanese Maple	Cal. 6cm	As Shown	Adaptive, drought tolerant
AC	5	Acer circinatum	Vine Maple	Cal. 6cm	As Shown	Native,drought tolerant
AR	8	Acer Rubrum	Red Maple	Cal. 8cm	As Shown	Adaptive, drought tolerant
CD	1	Crataegus douglasii	Black Hawthorn	Cal. 6cm	As Shown	Adaptive, highly drought tolerant
CN	3	Cornus nuttallii	Pacific Dogwood	Cal. 8cm	As Shown	Native,drought tolerant once established
PE	1	Prunus emarginata	Bitter Cherry	Cal. 6cm	As Shown	Native drought tolerant
Shrubs						
Aa	3	Amelanchier alnifolia	Saskatoon Serviceberry	#3 pot	As Shown	Native,drought tolerant once established
Au	220	Arctostaphylos uva-ursi	Kinnikinnick	#1 pot	450mm O.C	Native, drought tolerant once established
Cs	70	Cornus stolonifera	Red-osier Dogwood	#1 pot	900mm O.C.	Native, drought tolerant once established
Gs	206	Gaultheria shallon	Salal	10cm pot	300mm O.C.	Native, drought tolerant
Mn	2	Mahonia nervosa	Oregon Grape	#1 pot	450mm O.C.	Native, drought tolerant once established
Pc	3	Physocarpus capitatus	Pacific Ninebark	#3 pot	As Shown	Native, drought tolerant
Rn	14	Rosa Nutkana	Nootka Rose	#3 pot	450mm O.C.	Native, drought tolerant
Rs	14	Ribes sanguineum	Red-Flowering Currant	#3 pot	As Shown	Native, drought tolerant
Sd	5	Spiraea douglasii	Rose spirea	#3 pot	450mm O.C.	Native, drought tolerant
Sr	10	Sambucus racemosa	Red Elderberry	#3 pot	As Shown	Native, moderate tolerance to drought once established
Vd	13	Viburnum davidii	David viburnum	#3pot	As Shown	Adaptive, drought tolerant
Groundcovers and Perennials						
am	4	Achillea millefolium	Yarrow	4" Pot	450mm O.C.	Native, drought tolerant
ap	11	Anaphalis margaritaceae	Pearly Everlasting	4" Pot	600mm O.C.	Native, drought tolerant
ce	35	Carex EverColor® 'Everillo'	Yellow Sedge	#1 Pot	450mm O.C.	Adaptive, drought tolerant
fc	384	Fragaria chiloensis	Coastal Strawberry	#1 pot	450mm O.C.	Native, drought tolerant
po	26	Polystichum munitum	Western Swordfern	#1 pot	900mm O.C.	Native, drought tolerant
Lawn						
Sod	815 sf					

SCHEDULE A - Landscape Plan
DVP 3090-24-06
128 Rollie Rose Drive

POINT LANDSCAPE STUDIO INC.

7788682378

YYU@POINTLASTUDIO.COM

WWW.POINTLASTUDIO.COM

ISSUANCE:

No.	Date	Details	By
1	FEB 08, 2024	ISSUED FOR COORDINATION	YY
2	MAY 09, 2024	ISSUED FOR DP	YY
3	NOV 21, 2024	ISSUED FOR REVISED DP	YY

PERMIT DRAWING ONLY, NOT FOR CONSTRUCTION

STAMP:

PROJECT NAME:
128 ROLLIE RD.
LADYSMITH

DRAWING TITLE:
PLANTING PLAN

PLS PROJECT NUMBER: 23012
DATE: 2023 AUG 23

DRAWN BY: YY

SCALE: 1/8"=1'

DWG. NO.: L2

OF: 3

BUILDING AND HEIGHT CALCULATIONS	BUILDING A	BUILDING B	BUILDING C
Average Natural Grade (NG)	52.02 m	53.65 m	55.96 m
Average Finished Grade (FG)	50.78 m	52.98m	53.50 m
Maximum Permitted Building Height	10.00 m	10.00 m	10.00 m
Proposed Building Height	9.95 m	9.44 m	9.62 m
Maximum Roof Peak Elevation	60.78 m	62.98 m	63.50 m
Proposed Roof Peak Elevation	60.73 m	62.42 m	63.12 m

SCHEDULE B - Site Plan
DVP 3090-24-06
128 Rollie Rose Drive

Front Parcel Line Setback Variance from 6.0 metres to 2.7 metres

Landscape Buffer Variance from 1.5 metres to 0.5 metres

ROLLIE ROSE DRIVE

11
PLAN EPP75579

12
PLAN EPP75579

10
PLAN EPP75579

19
PLAN EPP117682

Rem 1
PLAN EPP67741

SITE PLAN OF LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579.

TOWN OF LADYSMITH
INTEGRATED SURVEY AREA 43
CIVIC ADDRESS: 128 ROLLIE ROSE DRIVE
PID: 030-477-620
ZONE: R-3-A

SCALE 1:125
2 1 0 1 2 5
ALL DISTANCES ARE IN METRES AND DECIMALS THEREOF.

LEGEND:

- ● - DENOTES STANDARD IRON POST FOUND
- 47.72 - DENOTES SPOT ELEVATION OF 47.72m (TYPICAL)
- CB - DENOTES CATCH BASIN
- IC - DENOTES INSPECTION CHAMBER WITH DESCRIPTION
- LS - DENOTES LAMP STANDARD
- MH - DENOTES MANHOLE WITH DESCRIPTION
- WV - DENOTES WATER VALVE
- PFA - DENOTES PERIMETER OF FLOOR ABOVE
- TW EL = 1.00 - DENOTES 1m HIGH RETAINING WALL (REFER TO LANDSCAPE ARCHITECT PLAN FOR RETAINING WALL ELEVATIONS)
- 0.60Ø DEC - DENOTES 0.60m Ø DECIDUOUS TREE
- 1.1Ø CON - DENOTES 1.1m Ø CONIFEROUS TREE

DATUM:

ELEVATIONS ARE GEODETIC AND DERIVED FROM CONTROL MONUMENT 87H3632.

CONTOUR INTERVAL = 1 METRE.

PROPERTY:

PROPERTY DIMENSIONS SHOWN ARE DERIVED FROM: PLAN EPP75579.

OFFSETS TO PROPERTY LINES ARE NOT TO BE USED TO DEFINE BOUNDARIES.

REFER TO CURRENT CERTIFICATE(S) OF TITLE FOR ADDITIONAL, EXISTING OR PENDING CHARGES.

GENERAL:

THIS PLAN SHOWS THE LOCATION OF VISIBLE FEATURES ONLY, AND DOES NOT INDICATE BURIED SERVICES THAT MAY EXIST ON OR AROUND THE SUBJECT SITE.

FEATURES SHOWN WITHOUT DIMENSIONS SHOULD BE CONFIRMED WITH BENNETT LAND SURVEYING LTD.

TREE SPECIES AND DIMENSIONS SHOULD BE CONFIRMED BY A QUALIFIED ARBORIST. SHADED AREA IS NOT AN INDICATION OF DRIP LINE LOCATION UNLESS SPECIFICALLY LABELLED .

NOTE;

BUILDINGS SHOWN ARE BASED ON DETAILS OR INFORMATION RECEIVED FROM ADAPT DESIGN, RECEIVED: 2024-06-13.
RETAINING WALLS SHOWN ARE BASED ON DETAILS OR INFORMATION RECEIVED FROM APLIN MARTIN DATED: 2023 AUG 23.

bennett ©
LAND SURVEYING LTD.
BC LAND SURVEYORS
2339-UNIT B DELINEA PLACE NANAIMO, BC V9T 5L9
TEL 250-754-5518 www.bennettsurveys.com

DATE:	BY:
2024-09-09	TDM
2024-11-26 UPDATE RETAINING WALL HEIGHTS & LOCATIONS	TDM
REVISION:	1

CERTIFIED CORRECT

Digitally signed by Danu Kane Van Der Mark -- BCLS - ABCLS
Date: 2024.11.27 15:35:56 '-08'00

BRITISH COLUMBIA CANADA DANU KANE VAN DER MARK NO. 1008 LAND SURVEYOR

FIELD SURVEY COMPLETED ON THE 8TH DAY OF JULY, 2024.

THIS DOCUMENT IS NOT VALID UNLESS ORIGINALLY SIGNED AND SEALED OR DIGITALLY CERTIFIED.

G:\SHARED DRIVES\NANAIMO - JOBS\2024\110834.00-128-ROLLIE-ROSE-DRIVE-LAD-TOPO\110834.00-DRAWINGS\110834.00-TOPOGRAPHIC ASBUILT\ST110834 2024-11-26.DWG

TOWN OF LADYSMITH
DEVELOPMENT PERMIT

(Section 489 *Local Government Act)*

FILE NO: 3060-21-10

DATE: December 17, 2024

Name of Owner(s) of Land (Permittee): 1447227 BC LTD., INC.NO. BC1447227

Applicant: Chris Sharpe (Sharpe Sites Inc.)

Subject Property (Civic Address): 128 Rollie Rose Drive

---

1. This Development Permit is subject to compliance with all of the bylaws of the Town of Ladysmith applicable thereto, except as specifically varied by this Permit.

2. This Permit applies to and only to those lands within the Town of Ladysmith described below, and any and all buildings structures and other development thereon:

   Lot 12, District Lot 103, Oyster District, Plan EPP75579
   PID: 030-477-620
   (128 Rollie Rose Drive)
   (referred to as the "Land")

3. This Permit has the effect of authorizing the issuance of a building permit for the construction of a residential development consisting of one two-storey 3-unit townhouse building and two 3-storey duplex buildings, the alteration of land and vegetation, and construction of accessory buildings and structures on the Land, located within Development Permit Area 6 – Riparian and Development Permit Area 8 – Multi-Unit Residential ESA as designated within the Official Community Plan under section 488 of the *Local Government Act*, in accordance with the plans and specifications attached to this Permit, and subject to the conditions, requirements, and standards imposed and agreed to in this Permit and all applicable laws.

4. This Permit does not have the effect of:

(a) Authorizing the alteration of any other Riparian Assessment Areas on the Land, except the Riparian Assessment Areas shown in **Schedule D – Riparian Areas Protection Regulation Assessment Report**; or

(b) Varying the use or density of the Land specified in Town of Ladysmith Zoning Bylaw 2014, No. 1860.

5. The Permittee, as a condition of the issuance of this Permit, agrees to:

(a) Develop the land in accordance with:

Schedule A – Site Plan
Schedule B – Landscape Plan
Schedule C – Building Elevations
Schedule D – Riparian Areas Protection Regulation Assessment Report
Schedule E – Strom Water Management Plan
Schedule F – Tree Preservation Plan
Schedule G – Construction Environmental Management Plan
Schedule H – Erosion and Sediment Control Plan

(b) All exterior lighting on the site should be directed down and away from adjacent residential areas and park areas. Pedestrian corridors shall be lit with pedestrian scaled lighting.

(c) Install 2,800 GAL (+/- 12,000 liters) rainwater collection tank to store rainwater that can effectively reused for irrigation.

(d) Protect the 10m Streamside Protection and Enhancement Area (SPEA) by adhering to all the measures and recommendations in **Schedule D – Riparian Areas Protection Regulation Assessment Report** and its appendices, including the following:

PRIOR TO CONSTRUCTION AND CLEARING:

i. Flag out tree rooting zones (length = 6 times tree dbh) and clearly delineate rooting zones around perimeter trees along the SPEA for additional protection.

ii. Install permanent fencing along SPEA buffers to ensure trees are maintained and implement a 7.5m drip zone beyond the marked SPEA to protect tree rooting zone. Permanent fencing shall also be established along the drip zone buffers to ensure the trees are maintained.

iii. A certified arborist/danger tree assessor shall be retained to conduct a visual survey to identify any hazardous trees within and along the perimeter of the SPEA that may have resulted from conditions (natural and/or manmade) occurring after inspections took place in July 2024. Should any trees be designated as

hazardous, appropriate mitigation must be done to abate the hazard.

iv. Where forest cover has been inadvertently (or previously) reduced along edges of the forest stand, under-plant ecologically suitable, native herbs and shrubs (e.g., snowberry, Pacific dogwood, baldhip rose, salal, sword fern). The number of plantings shall be calculated pending a post-clearing survey (RPF).

v. Clearing and grubbing shall take place outside the bird nesting season, or a bird nesting survey will be required prior to the clearing and grubbing. If an active nest or protected inactive nest is encountered by the Environmental Monitor or Contractor on or near the Site, bird and bird nest survey protection and protocols will be followed as per Section 4.2 of **Schedule G – Construction Environmental Management Plan**.

vi. Install snow fencing along the extent of the Riparian Assessment Area boundary.

vii. Flag and mark the SPEA and install signage along the SPEA indicating that the public shall stay out of and respect the sensitive riparian habitat.

viii. Catch basins protection measures shall be installed and maintained where applicable on the site to precent the transport of sediment to the stormwater system and to the nearby aquatic environment.

ix. Install, maintain and monitor erosion and sediment control measures as laid out in **Schedule H – Erosion and Sediment Control Plan**, including the following:

a. Areas of no disturbance and/or vegetation to be retained shall be fenced off and/or flagged for protection. These measures shall remain in place throughout the construction period.

b. If possible, clearing and grubbing shall be completed in stages to limit the disturbance and possible erosion to the site.

c. Site grading and drainage control installations shall direct surface run-off to on-site sediment control pond(s) for dispersal and infiltration.

d. If site grading is completed during the wet season (October to April), the graded areas shall be revegetated and/or surface erosion measures shall be installed within one week of grading completion.

e. Silt fencing shall be installed as indicated on **Schedule H – Erosion and Sediment Control Plan** to direct turbid waters to sediment control facilities.

DURING CONSTRUCTION:

i. The SPEA areas shall not be encroached, altered, or impacted by construction, clearings, people, domestic animals or vehicles in any way.

ii. Removal of any danger trees in the SPEA will require the services of a professional danger tree assessor. Work identified as being harmful to the SPEA, such as excavation, clearing, erection of permanent structures must be done in a way to protect the SPEA trees from harm.

iii. Hand digging is required when roots greater than 50mm in diameter are encountered.

iv. Identified Danger Trees shall be treated outside the bird nesting window for the region (no felling March 15- August 15).

v. Any hazard trees identified to be felled that have trunks > 40 cm dbh should be placed in forested buffer area as coarse woody debris.

vi. Tree protection barriers must be built to ensure trees are not damaged during construction. Barriers are required around any protected/retained trees that could be impacted by development.

vii. Treatment to prevent windthrow shall follow standard strategies to minimize disturbance to rooting layers during clearing and construction, including not creating windthrow, protecting trees in the SPEA (especially along the SPEA boundary), and retaining wildlife trees in the SPEA.

viii. Construct a permanent fence along the SPEA boundary, which does not contain a gate, gap or other opening that would allow direct access from the property to the SPEA.

ix. Drainage and runoff in the work site shall be managed and detained, filtered, or infiltrated ensure that runoff patterns and

water quality are not altered and such that it is clean when it leaves the lot and enters a SPEA.

x. Prevent the tracking of sediment by construction vehicles by maintaining all site entrance locations.

xi. Install silt fencing at the perimeter of the disturbed work areas and upgradient slope areas. Ensure the bottom of the silt fence is buried, and stormwater should not flow around the silt fence.

xii. Install a temporary gravel access pad to reduce offsite sedimentation. Install the pad prior to use of heavy equipment or site grading operations and maintain the pad throughout construction operations. The gravel pad shall be no less than the full width of point of ingress or egress and, in any case, shall be no less than 6.0 metres wide with a minimum length of 20.0 metres. The gravel pad shall have a minimum thickness of 200mm of coarse granular material, 40 to 75mm of shot rock or fractured drain rock underlain with geotectile fabric is required. The access pad may be removed during preparations for paving.

xiii. Use a vacuum street sweeper after work stoppage each day to clean sediment off the street caused by construction on an as-needed basis. Do not use street washing as it carries sediment into the storm drainage system.

xiv. Stockpiles of silty soils shall always be covered with a tarp or plastic sheeting when the stockpiles will not be used within 2-3 days, or when rain is expected.

xv. All works shall be monitored by the QEP during land clearing and construction.

xvi. A planting plan for the site with planting locations must be completed by a QEP at the time of development.

xvii. For additional erosion control, apply a thin (25 – 50mm) layer of organic/biodegradable material to disturbed areas. The material shall be spread uniformly and be free of weeds and coarse matter, air dried, and applied with a mulch blower, chip handler, or by hand then “tracked-in” using an excavator or suitable heavy equipment.

xviii. The contractor shall routinely inspect and maintain all erosion and sediment control system components on-site. At a minimum, the contractor shall inspect all Best Management

Practices weekly and provide a report to the consultant for review.

xix. During and/or following each significant storm event, the contractor shall observe the sediment pond(s) and/or the downstream storm drains to confirm that turbid waters from the construction are not entering the stormwater drainage system. The contractor shall record inspection dates and any significant observations and actions taken, and then inform the consultant and Town of Ladysmith.

xx. Qualified Environmental Professionals shall visit the site to assist the contractor with the implementation of the Erosion and Sediment Control Plan (ESCP) during storm events, and to provide independent ESCP review and documentation. Modifications to the ESCP, if necessary, shall be provided in a written memo format.

POST CONSTRUCTION AND LOND TERM PROTECTION:

i. Promptly re-vegetate any areas of soil disturbed during clearing and construction with approved landscaping materials and/or native plant species to prevent encroachment from invasive plant species.

ii. Incorporate FireSmart landscaping by using certified native and drought tolerance plantings in accordance with **Schedule B – Landscape Plan**.

iii. Prior to building permit occupancy, the QEP shall submit to the Town a post-construction monitoring report which confirms that the requirements and measures to protect the SPEA were completed and that the SPEA was adequately protected.

iv. Property owners shall be advised about SPEA locations on bills of sale with copies of the RAPR report.

v. Avoid damaging retained trees by not loading rock fill on roots, not typing ropes or wires around the tree stems, and not hammering nails into trees.

6. This Permit is issued on the condition that the Permittee has provided to the Town of Ladysmith security in accordance with section 502 of the *Local Government Act* to guarantee the performance of the conditions in section 5 of this Permit respecting landscaping. The security shall be for a period of two years, shall be automatically extended, and shall be payable upon application of a Building Permit or prior to alteration of land; whichever occurs first. The amount of security shall be **$23,382.00**.

7. Should the Permittee fail to satisfy the conditions referred to in section 5 and 6 of this Permit, the Town of Ladysmith may undertake and complete the works required to satisfy the condition(s) or carry out any construction required to correct the unsafe condition(s), at the cost of the Permittee, and may apply the security in payment of the cost of the work, with any excess to be returned to the Permittee.

8. Requests for the release of the security shall be accompanied by a report from a landscape architect or QEP as applicable confirming that the landscaping conditions in section 5 of this permit have been met.

9. Should there be no default as herein provided, or where a Permit lapses, the Town of Ladysmith shall return any security provided to the Permittee.

10. The Permittee agrees that the sequence and timing of the construction described in this Permit shall take place as follows, subject to section 12 of this Permit.

11. Pursuant to section 504(1) of the *Local Government Act*, if the Permittee does not substantially start any construction permitted by this Permit within two years of the date of this Permit as established by the authorizing resolution date, this Permit shall lapse.

12. For the purposes of section 11, construction is considered to be substantially started where:

    (a) a valid building permit has been issued for the development;

    (b) a foundation has been constructed ; and

    (c) all works that have occurred on site are in compliance with this permit and the bylaws of the Town.

13. For certainty, any retaining walls or vegetation clearing outside of the immediate development area are subject to an additional Development Permit.

14. The plans and specifications attached to this Permit are an integral part of this Permit.

15. This Permit prevails over the provisions of the Bylaw in the event of conflict.

16. Pursuant to section 502(2) of the *Local Government Act,* the Land described herein shall be developed strictly in accordance with terms, conditions and provisions of this Permit and any plans and specifications attached to this Permit which shall form a part thereof.

17. Pursuant to section 503 of the *Local Government Act*, notice of this Permit shall be filed in the Land Title Office. Upon such filing, the terms of this Permit (**3060-21-10**) or any amendment hereto shall be binding upon all persons who acquire an interest in the land affected by this Permit.

18. Despite issuance of this permit, construction may not start without a Building Permit or other necessary permits.

AUTHORIZED BY RESOLUTION NO. _____ PASSED BY THE COUNCIL OF THE TOWN OF LADYSMITH ON THE 17th DAY OF DECEMBER 2024.

BUILDING AND HEIGHT CALCULATIONS	BUILDING A	BUILDING B	BUILDING C
Average Natural Grade (NG)	52.02 m	53.65 m	55.06 m
Average Finished Grade (FG)	50.78 m	52.98m	53.50 m
Maximum Permitted Building Height	10.00 m	10.00 m	10.00 m
Proposed Building Height	9.95 m	9.44 m	9.62 m
Maximum Roof Peak Elevation	60.78 m	62.98 m	63.50 m
Proposed Roof Peak Elevation	60.73 m	62.42 m	63.12 m

SCHEDULE A - Site Plan
DP 3060-21-10
128 Rollie Rose Drive

ROLLIE ROSE DRIVE

11
PLAN EPP75579

12
PLAN EPP75579

10
PLAN EPP75579

19
PLAN EPP117682

Rem 1
PLAN EPP67741

UNIT A1
UNIT A2
UNIT A3
UNIT B1
UNIT B2
UNIT C1
UNIT C2

PROPERTY ARC=57.4

PROPERTY LINE=12.0

PROPERTY LINE=11.5

10m RAA BOUNDARY

10m SPEA SETBACK

TOP OF BANK

TOE OF BANK

TOP OF LOOSE ROCK WALL

CENTERLINE OF TRIBUTARY 1

COVENANT CA4115777

SRW EV86326

PFA 2ND AND 3RD FLOORS

PFA 2ND FLOOR

PATIO

DECK

CONCRETE DRIVEWAY

PAVED SIDEWALK

EDGE OF ASPHALT

GUTTER

CURB

ELECTRICAL KIOSK

TELUS VAULT

SHAW VAULT

MH HYDRO
RIM EL=50.06

IC SANITARY
EL=48.29

IC STORM
EL=48.26

MH WATER
RIM EL=48.43

CB
RIM EL=50.19

LS

WV

0.30Ø CON

1.00Ø CON

0.17Ø CON

1.10Ø CON

TWIN 0.60Ø DEC
1.20Ø BASE

SCALE 1:125

2 1 0 1 2 5

ALL DISTANCES ARE IN METRES AND DECIMALS THEREOF.

SITE PLAN OF LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579.

TOWN OF LADYSMITH
INTEGRATED SURVEY AREA 43
CIVIC ADDRESS: 128 ROLLIE ROSE DRIVE
PID: 030-477-620
ZONE: R-3-A

LEGEND:

- ● – DENOTES STANDARD IRON POST FOUND
- × 47.72 – DENOTES SPOT ELEVATION OF 47.72m (TYPICAL)
- CB – DENOTES CATCH BASIN
- IC – DENOTES INSPECTION CHAMBER WITH DESCRIPTION
- LS – DENOTES LAMP STANDARD
- MH – DENOTES MANHOLE WITH DESCRIPTION
- WV – DENOTES WATER VALVE
- PFA – DENOTES PERIMETER OF FLOOR ABOVE
- TW EL = 1.00 – DENOTES 1m HIGH RETAINING WALL (REFER TO LANDSCAPE ARCHITECT PLAN FOR RETAINING WALL ELEVATIONS)
- 0.60Ø DEC – DENOTES 0.60m Ø DECIDUOUS TREE
- 1.1Ø CON – DENOTES 1.1m Ø CONIFEROUS TREE

DATUM:

ELEVATIONS ARE GEODETIC AND DERIVED FROM CONTROL MONUMENT 87H3632.

CONTOUR INTERVAL = 1 METRE.

PROPERTY:

PROPERTY DIMENSIONS SHOWN ARE DERIVED FROM: PLAN EPP75579.

OFFSETS TO PROPERTY LINES ARE NOT TO BE USED TO DEFINE BOUNDARIES.

REFER TO CURRENT CERTIFICATE(S) OF TITLE FOR ADDITIONAL EXISTING OR PENDING CHARGES.

GENERAL:

THIS PLAN SHOWS THE LOCATION OF VISIBLE FEATURES ONLY, AND DOES NOT INDICATE BURIED SERVICES THAT MAY EXIST ON OR AROUND THE SUBJECT SITE.

FEATURES SHOWN WITHOUT DIMENSIONS SHOULD BE CONFIRMED WITH BENNETT LAND SURVEYING LTD.

TREE SPECIES AND DIMENSIONS SHOULD BE CONFIRMED BY A QUALIFIED ARBORIST. SHADED AREA IS NOT AN INDICATION OF DRIP LINE LOCATION UNLESS SPECIFICALLY LABELLED .

NOTE:

BUILDINGS SHOWN ARE BASED ON DETAILS OR INFORMATION RECEIVED FROM ADAPT DESIGN, RECEIVED: 2024-08-13.
RETAINING WALLS SHOWN ARE BASED ON DETAILS OR INFORMATION RECEIVED FROM APLIN MARTIN DATED: 2023 AUG 23.

bennett
LAND SURVEYING LTD.
BC LAND SURVEYORS
2339 UNIT B DELINEA PLACE NANAIMO, BC V9T 5L9
TEL 250-754-5518 www.bennettsurveys.com

DATE:	BY:
2024-09-09	TDM
2024-11-26 UPDATE RETAINING WALL HEIGHTS & LOCATIONS	TDM
REVISION:	1

CERTIFIED CORRECT

Digitally signed by Danu Kane Van Der Mark – BCLS - ABCLS
Date: 2024.11.27 15:35:56 -08'00'

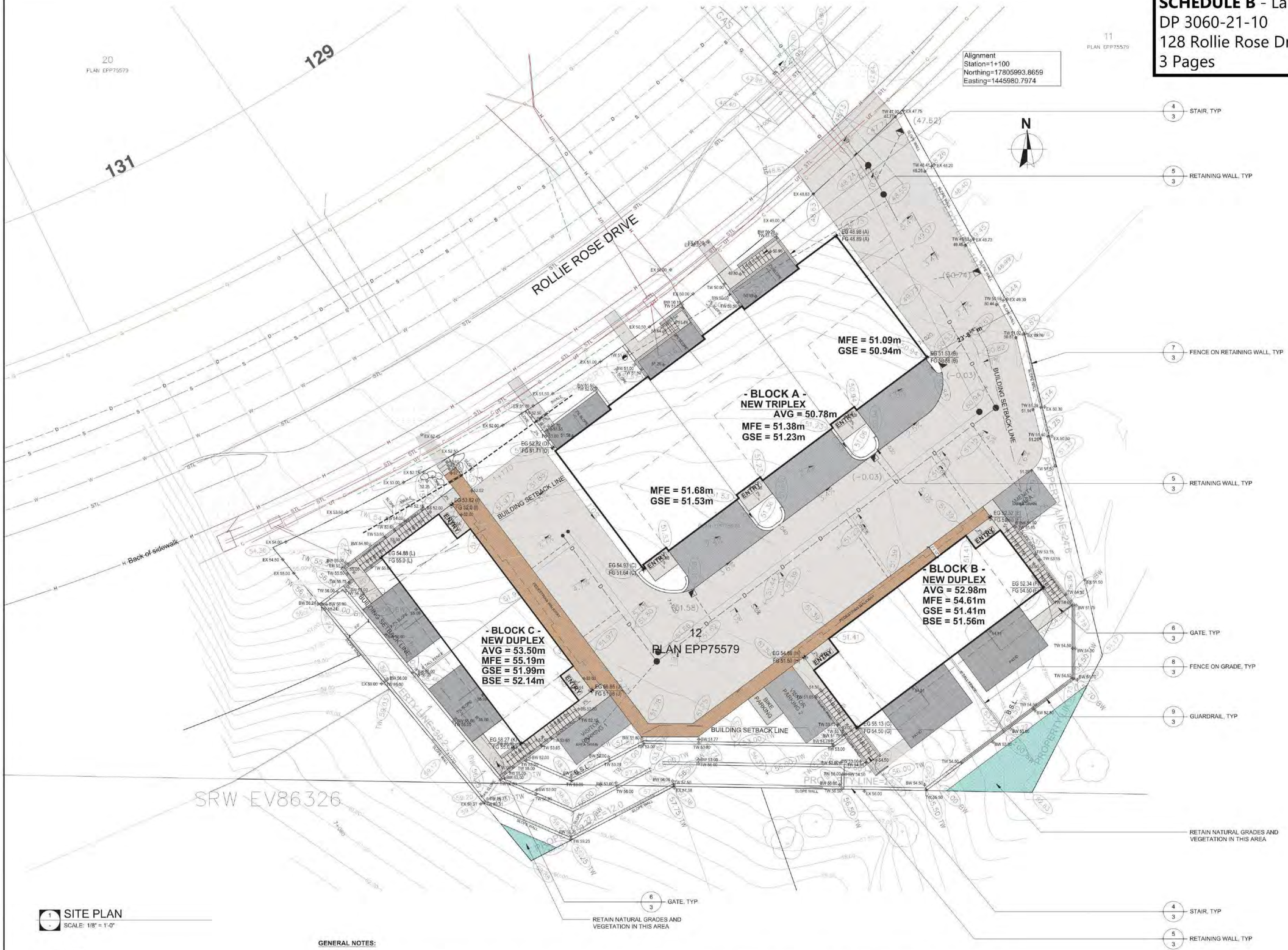
DANU KANE VAN DER MARK

FIELD SURVEY COMPLETED ON THE 8TH DAY OF JULY, 2024.

THIS DOCUMENT IS NOT VALID UNLESS ORIGINALLY SIGNED AND SEALED OR DIGITALLY CERTIFIED.

G:\SHARED DRIVES\NANAIMO - JOBS\2024\110834.00-128-ROLLIE-ROSE-DRIVE-LAD-TOPO\110834.00-DRAWINGS\110834.00-TOPOGRAPHIC ASBUILTS\T 110834 2024-11-26.DWG

SCHEDULE B - Landscape Plan
DP 3060-21-10
128 Rollie Rose Drive
3 Pages



SITE PLAN
SCALE: 1/8" = 1'-0"

LEGEND

- CIP. CONCRETE PAVING SEE DETAIL 1 IN SHEET L3
- 4 4/8" X 8 2/8" X 2 2/8" CLASSIC STANDARD SERIES PAVER BY BELGARD HARVEST COLOR SEE DETAIL 2 IN SHEET L3
- 4 4/8" X 8 2/8" X 2 2/8" CLASSIC STANDARD SERIES PAVER BY BELGARD NATURAL COLOR SEE DETAIL 2 IN SHEET L3
- 24"X24", 2" THICK TEXADA HYDRAPRESSED SLAB BY BELGARD NATURAL COLOR SEE DETAIL 3 IN SHEET L3
- RETAIN NATURAL GRADES AND VEGETATION IN THIS AREA

GENERAL NOTES:

1. **Retaining Walls**
All retaining walls shall be approved by GEOTECH & STRUCTURAL ENGINEER. Refer to ARCHITECTURAL for layout & grading and retaining walls. Contractor shall insure positive drainage behind all retaining walls and throughout the site.

2. Area Drains
Refer to Civil engineer's drawings

3. Automatic Irrigation System
All planting and lawn areas shall be provided with an automatic irrigation system. Provide PVC sleeving below walkway paving as required for irrigation system. Insure good coverage for all planting and lawn areas. Contractor shall be responsible for irrigation design and construction and provision of as-builit irrigation plan following completion of the work.

4. Landscape Lighting
Landscape lighting locations and power supply shall be approved by ELECTRICAL. Contractor shall supply and install recessed wall mounted stair lights

5. BCSLA/BCLNA Standards
All landscaping and plant material shall be in accordance with BCSLA/BCLNA Standards, current edition.

6. Minimum growing medium depths:
Lawn 6" (150mm)
Shrubs 24" (600mm)
Trees 36" (1000mm)

7. Mulch
Apply 3" thick pine bark mulch in all planting areas

POINT LANDSCAPE STUDIO INC.

7788682378
YYU@POINTLASTUDIO.COM
WWW.POINTLASTUDIO.COM

ISSUANCE:

No.	Date	Details	By
1	FEB 06, 2024	ISSUED FOR COORDINATION	YY
2	MAY 06, 2024	ISSUED FOR DP	YY
3	NOV 21, 2024	ISSUED FOR REVISED DP	YY

PERMIT DRAWING ONLY, NOT FOR CONSTRUCTION

STAMP:

PROJECT NAME:
128 ROLLIE RD.
LADYSMITH

DRAWING TITLE:
SITE & GRADING PLAN

PLS PROJECT NUMBER: 23012
DATE: 2023 AUG 23

DRAWN BY: YY

SCALE: 1/8"=1'

DWG. NO.: L1 OF: 3

PLANT LIST

Code	Quantity	Scientific Name	Common Name	Size	Spacing	Note
Trees						
AB	5	Acer palmatum 'Bloodgood'	Bloodgood Japanese Maple	Cal. 6cm	As Shown	Adaptive, drought tolerant
AC	5	Acer circinatum	Vine Maple	Cal. 6cm	As Shown	Native,drought tolerant
AR	8	Acer Rubrum	Red Maple	Cal. 6cm	As Shown	Adaptive, drought tolerant
CD	1	Crataegus douglasii	Black Hawthorn	Cal. 6cm	As Shown	Adaptive, highly drought tolerant
CN	3	Cornus nuttallii	Pacific Dogwood	Cal. 8cm	As Shown	Native,drought tolerant once established
PE	1	Prunus emarginata	Bitter Cherry	Cal. 6cm	As Shown	Native drought tolerant
Shrubs						
Aa	3	Amelanchier alnifolia	Saskatoon Serviceberry	#3 pot	As Shown	Native,drought tolerant once established
Au	220	Arctostaphylos uva-ursi	Kinnikinnick	#1 pot	450mm O.C	Native, drought tolerant once established
Cs	70	Cornus stolonifera	Red-osier Dogwood	#1 pot	900mm O.C.	Native, drought tolerant once established
Gs	206	Gaultheria shallon	Salal	10cm pot	300mm O.C.	Native, drought tolerant
Mn	2	Mahonia nervosa	Oregon Grape	#1 pot	450mm O.C.	Native, drought tolerant once established
Pc	3	Physocarpus capitatus	Pacific Ninebark	#3 pot	As Shown	Native, drought tolerant
Rn	14	Rosa Nutkana	Nootka Rose	#3 pot	450mm O.C.	Native, drought tolerant
Rs	14	Ribes sanguineum	Red-Flowering Currant	#3 pot	As Shown	Native, drought tolerant
Sd	5	Spiraea douglasii	Rose spirea	#3 pot	450mm O.C.	Native, drought tolerant
Sr	10	Sambucus racemosa	Red Elderberry	#3 pot	As Shown	Native, moderate tolerance to drought once established
Vd	13	Viburnum davidii	David viburnum	#3pot	As Shown	Adaptive, drought tolerant
Groundcovers and Perennials						
am	4	Achillea millefolium	Yarrow	4" Pot	450mm O.C.	Native, drought tolerant
ap	11	Anaphalis margaritaceae	Pearly Everlasting	4" Pot	600mm O.C.	Native, drought tolerant
ce	35	Carex EverColor® 'Everillo'	Yellow Sedge	#1 Pot	450mm O.C.	Adaptive, drought tolerant
fc	384	Fragaria chiloensis	Coastal Strawberry	#1 pot	450mm O.C.	Native, drought tolerant
po	26	Polystichum munitum	Western Swordfern	#1 pot	900mm O.C.	Native, drought tolerant
Lawn						
Sod	815 sf					

PLANTING PLAN
SCALE: 1/8" = 1'-0"

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ISSUANCE:

No.	Date	Details	By
1	FEB 06, 2024	ISSUED FOR COORDINATION	YY
2	MAY 06, 2024	ISSUED FOR DP	YY
3	NOV 21, 2024	ISSUED FOR REVISED DP	YY

PERMIT DRAWING ONLY, NOT FOR CONSTRUCTION

STAMP:

PROJECT NAME:
128 ROLLIE RD.
LADYSMITH

DRAWING TITLE:
PLANTING PLAN

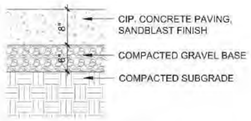
PLS PROJECT NUMBER: 23012
DATE: 2023 AUG 23

DRAWN BY: YY

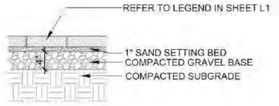
SCALE: 1/8"=1'

DWG. NO.: L2

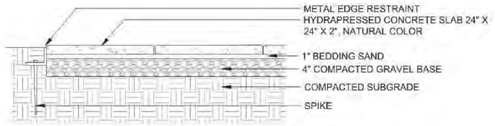
OF: 3



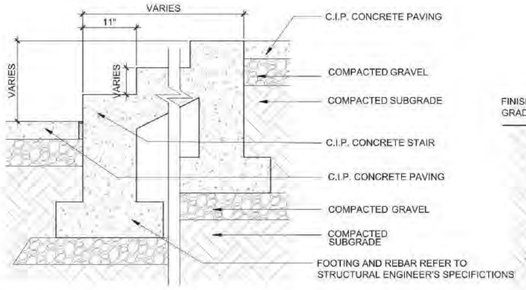
1 - CIP. CONCRETE PAVING
SCALE: 1" = 1'-0"



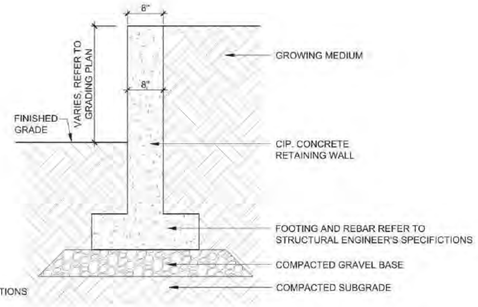
2 - CONCRETE UNIT PAVER ON GRADE
SCALE: 1" = 1'-0"



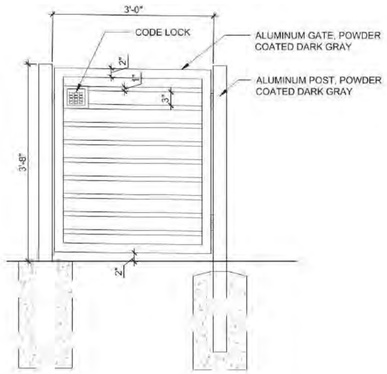
3 - HYRAPRESSED CONCRETE SLAB PAVING
SCALE: 1" = 1'-0"



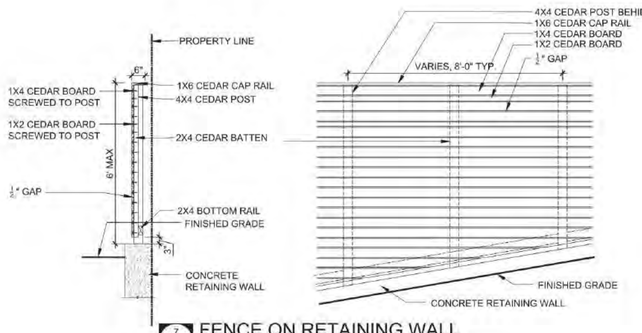
4 - C.I.P. CONCRETE STAIR
SCALE: 1" = 1'-0"



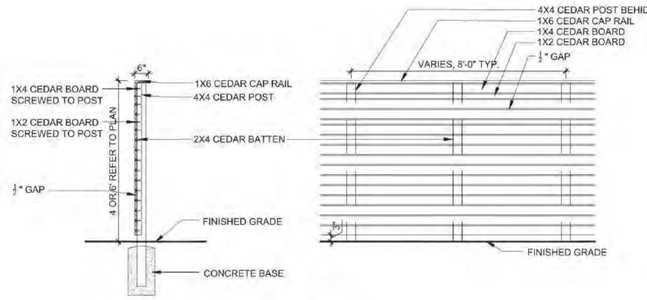
5 - CIP. CONCRETE RETAINING WALL, TYP.
SCALE: 1" = 1'-0"



6 - GATE
SCALE: 1" = 1'-0"

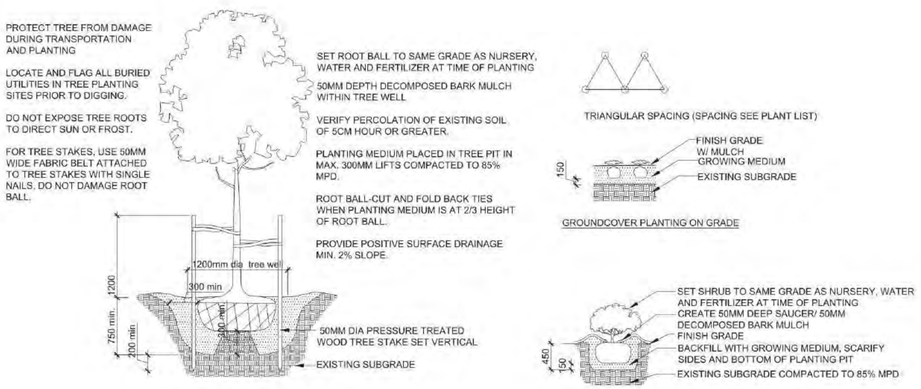


7 - FENCE ON RETAINING WALL
SCALE: 1/2" = 1'-0"



8 - FENCE ON GRADE
SCALE: 1/2" = 1'-0"

9 - GUARDRAIL
SCALE: 1/2" = 1'-0"



10 - PLANTING DETAILS - TYP.
SCALE: NTS

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ISSUANCE:

No.	Date	Details	By
1	FEB 05, 2024	ISSUED FOR COORDINATION	YY
2	MAY 09, 2024	ISSUED FOR DP	YY
3	NOV 21, 2024	ISSUED FOR REVISED DP	YY

PERMIT DRAWING ONLY, NOT FOR CONSTRUCTION.

STAMP:

PROJECT NAME:
128 ROLLIE RD.
LADYSMITH

DRAWING TITLE:
DETAILS

PLS PROJECT NUMBER: 23012
DATE: 2023 AUG 23

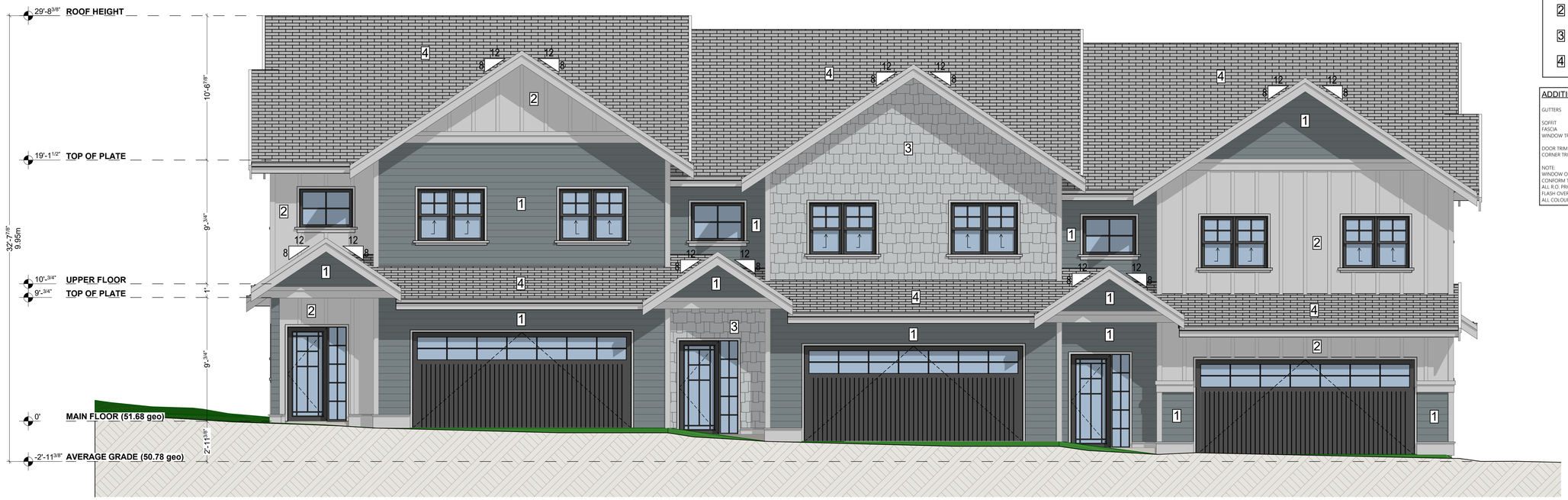
DRAWN BY: YY

SCALE: AS SHOWN

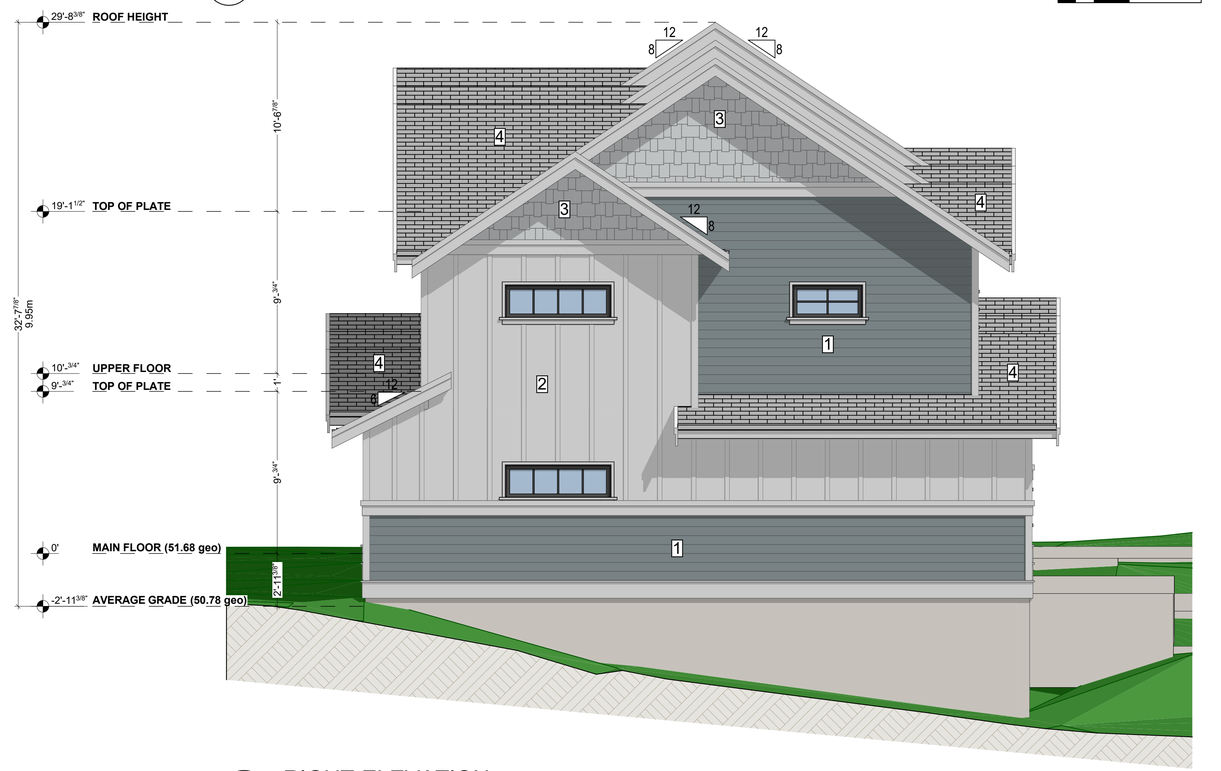
DWG. NO.: L3

OF: 3

BLOCK A



1 FRONT ELEVATION
SCALE: 1/4" = 1'-0"



2 RIGHT ELEVATION
SCALE: 1/4" = 1'-0"

EXTERIOR CLADDING LEGEND

1. CEMENT BOARD LAP SIDING PAINTED
2. CEMENT BOARD PANEL C/W 1X3 CFS BATTENS - PAINTED
3. HARDIESHINGLE PAINTED
4. ASPHALT ROOFING SHINGLES

ADDITIONAL EXTERIOR FINISHINGS

GUTTERS	5" CONTINUOUS ALUMINUM (PREFINISHED) C/W 4"X3" ALUMINUM DOWNSPOUT (PREFINISHED)
SOFFIT	VENTED ALUMINUM (PREFINISHED)
FASCIA	2X12 COMB FACED SPF (PAINTED)
WINDOW TRIM	2X4 COMB FACED SPF TOP/SIDES C/W 2X4 SLOPED SILL & 2X4 SUBSILL (PAINTED)
DOOR TRIM	2X4 COMB FACED SPF (PAINTED)
CORNER TRIM	1X4 COMB FACED SPF (PAINTED)

NOTE:
WINDOW OPERATION SHALL BE AS PER OWNERS DIRECTION AND CONFORM TO BCBC EGRESS REQUIREMENTS. CONTRACTOR TO VERIFY ALL R.O. PRIOR TO ORDERING WDW'S
FLASH OVER ALL MATERIAL TRANSITIONS, DOOR AND WINDOW HEADERS
ALL COLOURS AS PER OWNER

SCHEDULE C - Building Elevations
DP 3060-21-10
128 Rollie Rose Drive
4 Pages

ADAPT DESIGN
1500 Shorncliffe Road Victoria BC Canada
250.893.8127
www.adaptdesign.ca

ROLLIE ROSE DRIVE DUPLEXES & TRIPLEX

ISSUED FOR DP

ISSUED:

BLOCK A - ELEVATIONS

A-201

Printed: 4/5/2024

BLOCK A

3 REAR ELEVATION
SCALE: 1/4" = 1'-0"

0 2' 4' 8'

EXTERIOR CLADDING LEGEND

1. CEMENT BOARD LAP SIDING PAINTED
2. CEMENT BOARD PANEL C/W 1X3 CFS BATTENS - PAINTED
3. HARDIESHINGLE PAINTED
4. ASPHALT ROOFING SHINGLES

ADDITIONAL EXTERIOR FINISHINGS

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DOOR TRIM	2X4 COMB FACED SPF (PAINTED)
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NOTE:
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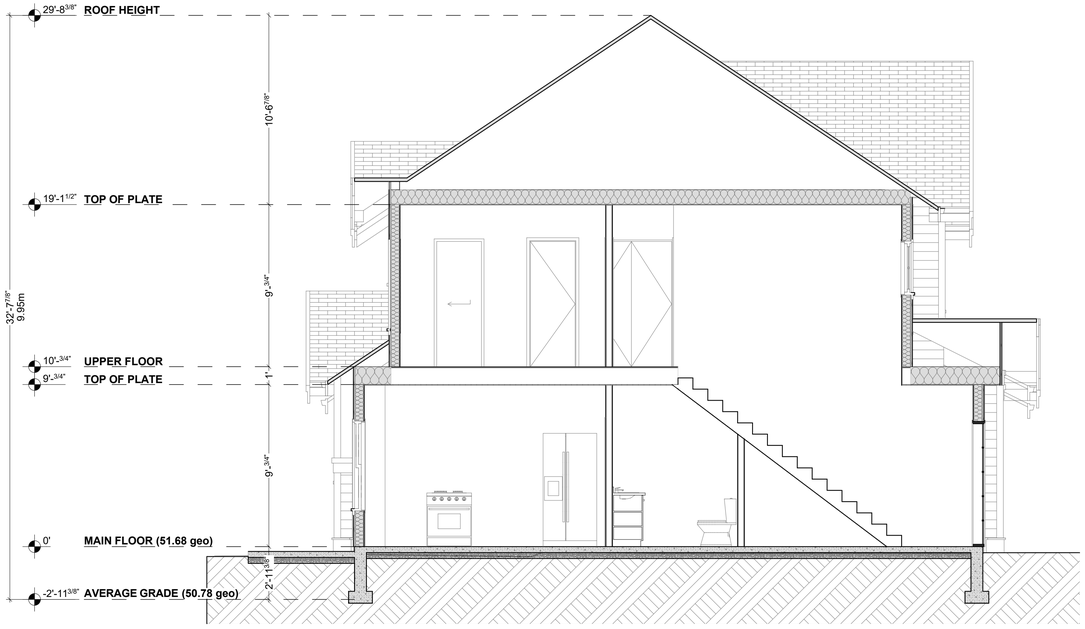
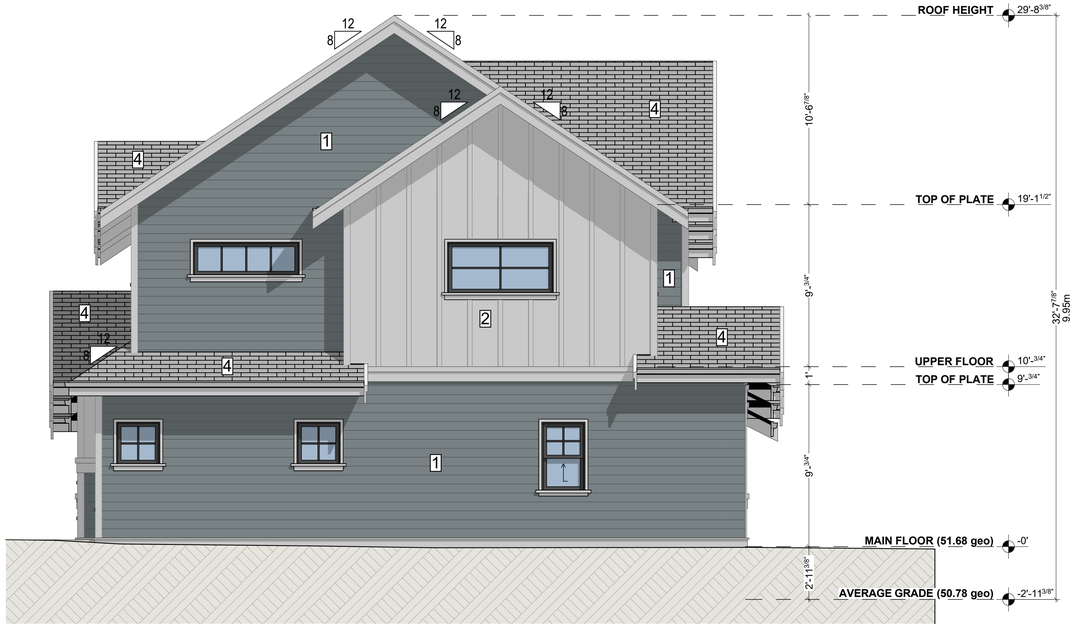
ALL COLOURS AS PER OWNER



- CROSS SECTION 01
SCALE: 1/4" = 1'-0"

0 2' 4' 8'



4 LEFT ELEVATION
SCALE: 1/4" = 1'-0"

0 2' 4' 8'

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ROLLIE ROSE DRIVE DUPLEXES & TRIPLEX

ISSUED FOR DP

ISSUED:

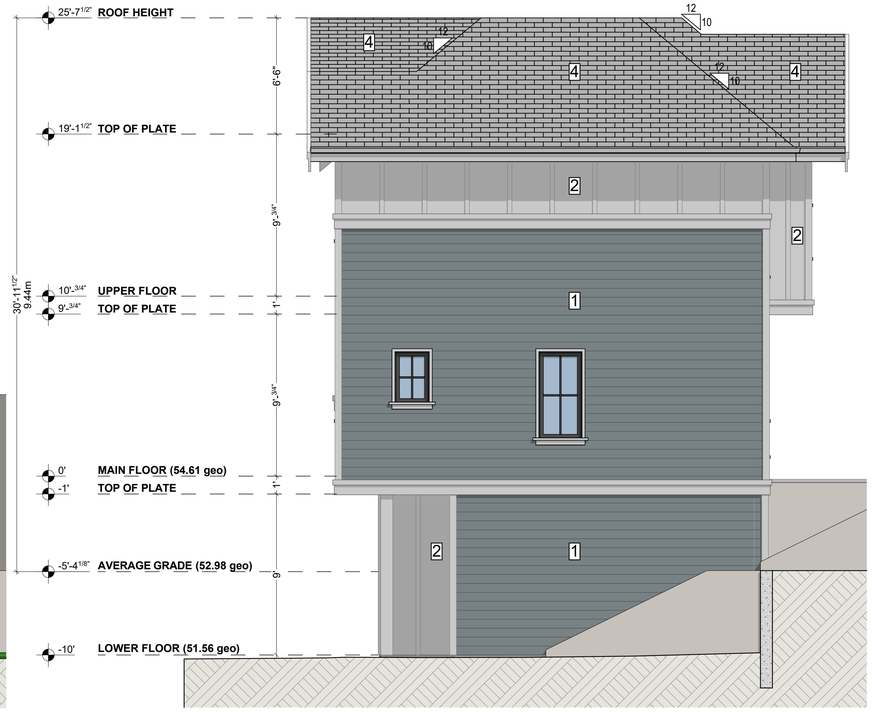
BLOCK A - ELEVATIONS AND CROSS SECTION

A-202

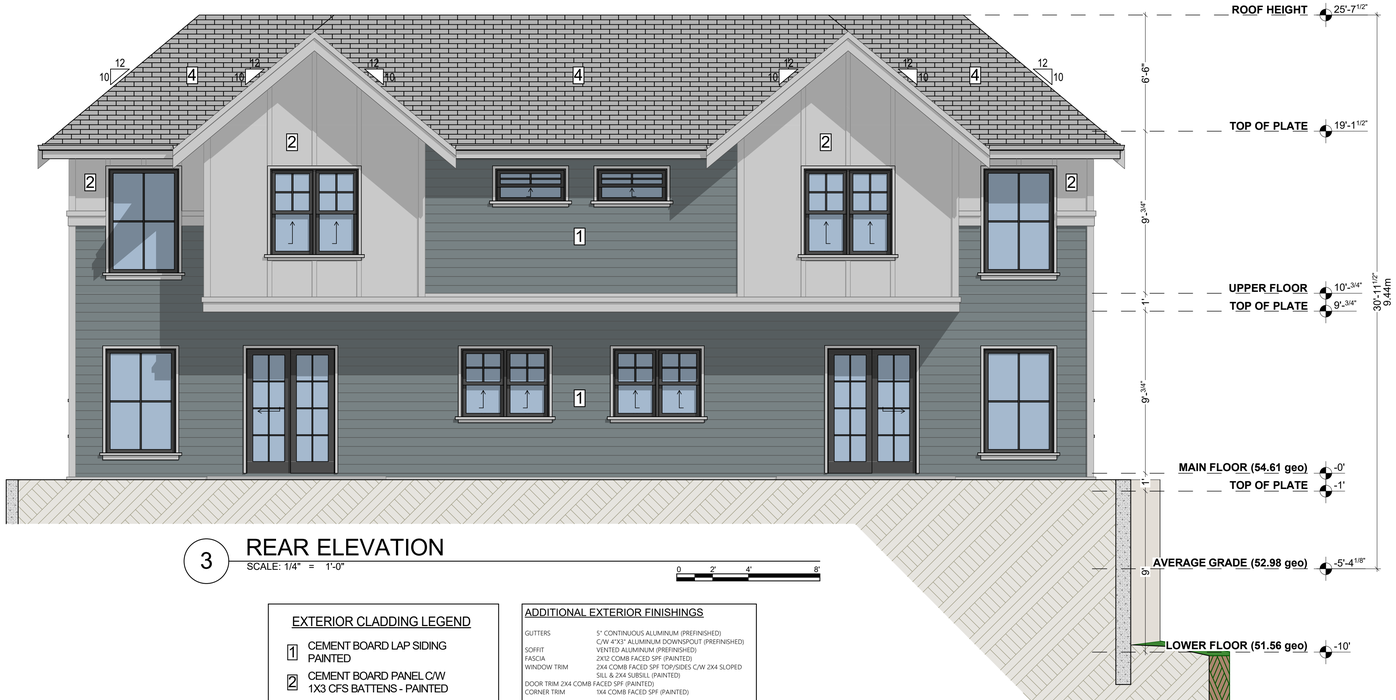
Printed: 4/5/2024

BLOCK B

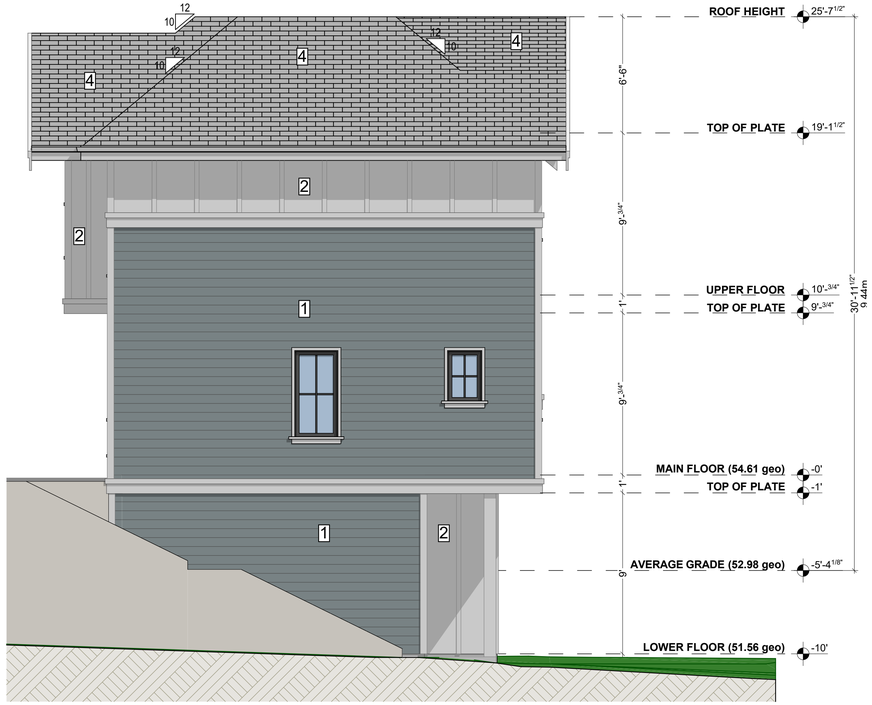
1 FRONT ELEVATION
SCALE: 1/4" = 1'-0"



2 RIGHT ELEVATION
SCALE: 1/4" = 1'-0"



3 REAR ELEVATION
SCALE: 1/4" = 1'-0"



4 LEFT ELEVATION
SCALE: 1/4" = 1'-0"

EXTERIOR CLADDING LEGEND

1. CEMENT BOARD LAP SIDING PAINTED
2. CEMENT BOARD PANEL C/W 1X3 CFS BATTENS - PAINTED
3. HARDIESHINGLE PAINTED
4. ASPHALT ROOFING SHINGLES

ADDITIONAL EXTERIOR FINISHINGS

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SOFFIT	VENTED ALUMINUM (PREFINISHED)
FASCIA	2X12 COMB FACED SPF (PAINTED)
WINDOW TRIM	2X4 COMB FACED SPF TOP/SIDES C/W 2X4 SLOPED SILL & 2X4 SUBSILL (PAINTED)
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NOTE:
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ALL COLOURS AS PER OWNER

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ROLLIE ROSE DRIVE DUPLEXES & TRIPLEX

ISSUED FOR DP

ISSUED:

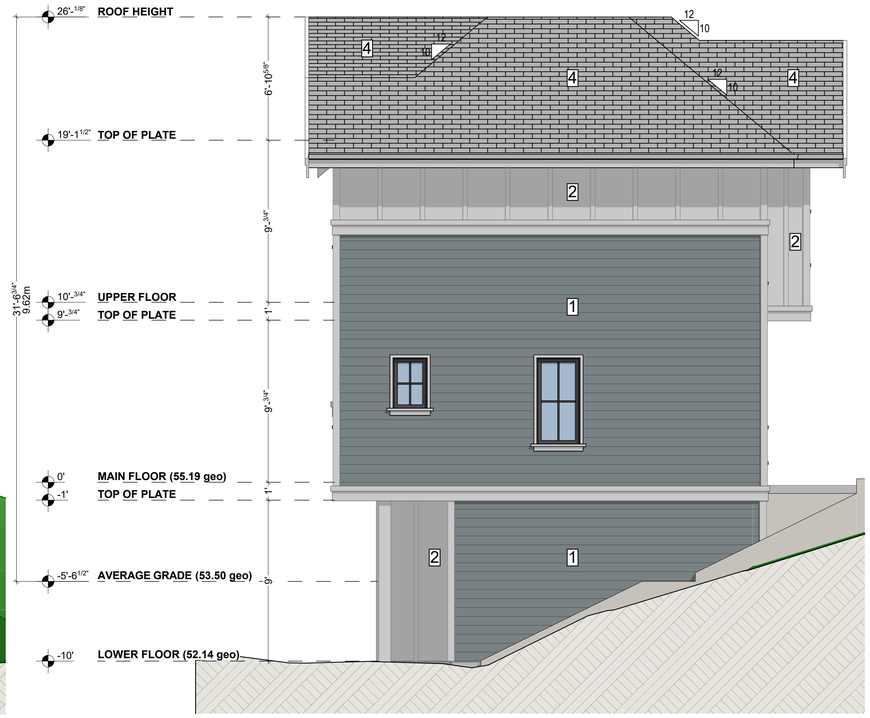
BLOCK B - ELEVATIONS

B-201

Printed: 4/5/2024

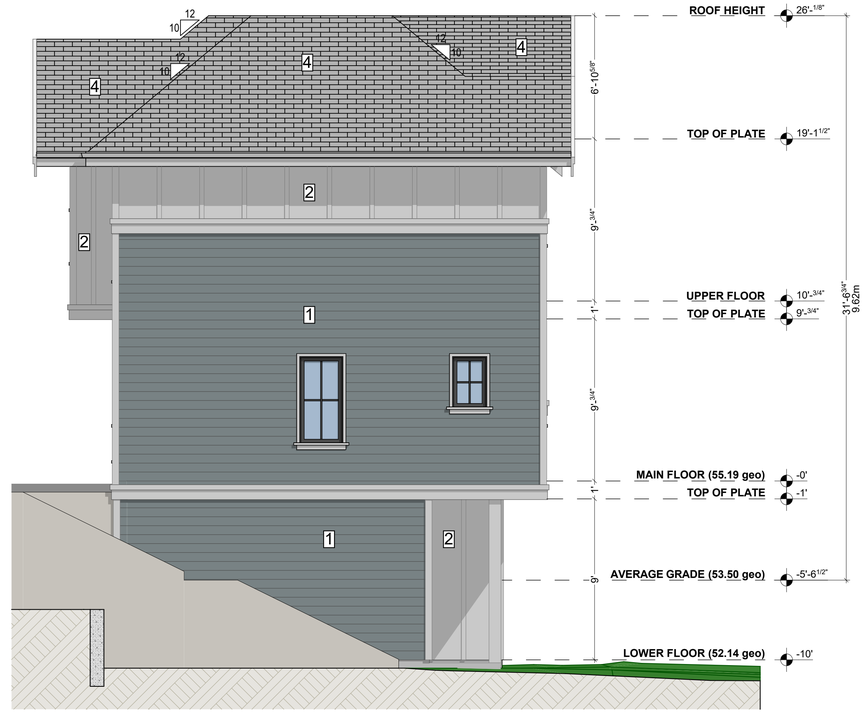
BLOCK C

1 FRONT ELEVATION
SCALE: 1/4" = 1'-0"
0 2' 4' 8'



2 RIGHT ELEVATION
SCALE: 1/4" = 1'-0"
0 2' 4' 8'

3 REAR ELEVATION
SCALE: 1/4" = 1'-0"
0 2' 4' 8'



4 LEFT ELEVATION
SCALE: 1/4" = 1'-0"
0 2' 4' 8'

EXTERIOR CLADDING LEGEND

1. CEMENT BOARD LAP SIDING PAINTED
2. CEMENT BOARD PANEL C/W 1X3 CFS BATTENS - PAINTED
3. HARDIESHINGLE PAINTED
4. ASPHALT ROOFING SHINGLES

ADDITIONAL EXTERIOR FINISHINGS

GUTTERS	5" CONTINUOUS ALUMINUM (PREFINISHED) C/W 4"X3" ALUMINUM DOWNSPOUT (PREFINISHED)
SOFFIT	VENTED ALUMINUM (PREFINISHED)
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CORNER TRIM	1X4 COMB FACED SPF (PAINTED)

NOTE:
WINDOW OPERATION SHALL BE AS PER OWNERS DIRECTION AND CONFORM TO BCBC EGRESS REQUIREMENTS. CONTRACTOR TO VERIFY ALL R.O. PRIOR TO ORDERING WDW'S.
FLASH OVER ALL MATERIAL TRANSITIONS, DOOR AND WINDOW HEADERS
ALL COLOURS AS PER OWNER

ADAPT DESIGN
1500 Shorncliffe Road Victoria BC Canada
250.893.8127
www.adaptdesign.ca

ROLLIE ROSE DRIVE DUPLEXES & TRIPLEX

ISSUED FOR DP

ISSUED:

BLOCK C - ELEVATIONS

C-201

Printed: 4/5/2024

FORM 1
Riparian Areas Protection Regulation - Qualified Environmental Professional - As

Riparian Areas Protection Regulation: Assessment Report

Please refer to submission instructions and assessment report guidelines when completing this report.

Date: 2024-09-23

I. Primary QEP Information

First Name	Derek	Middle Name	Alexander		
Last Name	Nickel				
Designation	R.P.Bio.	Company	TerraWest Environmental Inc.		
Registration #	3004	Email	dnickel@terrawest.ca		
Address	4176 Departure Bay Road				
City	Nanaimo	Postal/Zip	V9T 4B7	Phone #	250-216-4313
Prov/state	BC	Country	Canada		

II. Secondary QEP Information (use Form 2 for other QEPs)

First Name	Margaret	Middle Name			
Last Name	Symon				
Designation	R.F.P.	Company	Strathcona Forestry Consulting		
Registration #	1485	Email	strathcona.fc@shaw.ca		
Address	PO Box 387 Stn Mn				
City	Duncan	Postal/Zip	V9L 3X5	Phone #	250-715-6983
Prov/state	BC	Country	Canada		

III. Developer Information

First Name	Chris	Middle Name	
Last Name	Sharpe		
Company	Sharpe Sites Inc.		
Phone #	250-327-1617	Email	chris.sharpe@shaw.ca
Address	2092 Skaha Drive		
City	Nanaimo	Postal/Zip	V9R 6R8
Prov/state	BC	Country	Canada

IV. Development Information

Development Type	Construction: Low density (< 15 units per ha) multi family residential		
Area of Development (ha)	0.130	Riparian Length (m)	40
Lot Area (ha)	0.190	Nature of Development	New
Proposed Start Date	2024-10-31	Proposed End Date	2026-12-31

V. Location of Proposed Development

Street Address (or nearest town)	128 Rollie Rose Drive, Ladysmith, BC						
Local Government	Town of Ladysmith			City	Ladysmith		
Stream Name	Holland Creek – unnamed tributary						
Legal Description (PID)	030-477-620	Region	Lot 12, Block 192, District Lot 103, Land District 43, Plan EPP75579				
Stream/River Type	Stream	DFO Area	17-7				
Watershed Code	920-321500						
Latitude	48	58	38.86	Longitude	123	48	42.42

Completion of Database Information includes the Form 2 for the Additional QEPs, if needed. Insert that form immediately after this page.

II. Additional QEP Information

First Name	Louis	Middle Name	Robert	
Last Name	Chapdelaine			
Designation	P.Geo.	Company	Lewkowich Engineering Associates Ltd.	
Registration #	48335	Email	lchapdelaine@lewkowich.com	
Address	1900 Boxwood Road			
City	Nanaimo	Postal	V9S 5Y2	Phone # 250-756-0355
Prov/state	BC	Country	Canada	

First Name	Chris	Middle Name	Michael	
Last Name	Hudec			
Designation	P.Eng.	Company	Lewkowich Engineering Associates Ltd.	
Registration #	29249	Email	chudec@lewkowich.com	
Address	1900 Boxwood Road			
City	Nanaimo	Postal	V9S 5Y2	Phone # 250-756-0355
Prov/state	BC	Country	Canada	

First Name	Danu	Middle Name	Kane	
Last Name	Vandermark			
Designation	BCLS, ABCLS	Company	Bennett Land Surveying (Coastal) Ltd.	
Registration #	1006	Email	danu@bennettsurveys.com	
Address	152 Cliff Street			
City	Nanaimo	Postal	V9R 5E7	Phone # 250-754-5518
Prov/state	BC	Country	Canada	

First Name	David	Middle Name	Robert	
Last Name	Clough			
Designation	R.P.Bio.	Company	D.R. Clough Consulting	
Registration #	815	Email	drclough@shaw.ca	
Address	6966 Leland Road			
City	Lantzville	Postal	V0R 2H0	Phone # 250-714-5416
Prov/state	BC	Country	Canada	

II. Additional QEP Information

First Name	Scott		Middle Name	
Last Name	Lewis			
Designation	P. Eng.		Company Aplin & Martin Consultants Ltd.	
Registration #	1001018	Email	general@aplinmartin.com	
Address	#104-6596 Applecross Road			
City	Nanaimo	Postal	V9V 0A4	Phone # 778-841-0484
Prov/state	BC	Country	Canada	

First Name	Yong		Middle Name Xu	
Last Name	Yu			
Designation	MLA, MSc, BSc, BCSLA, CSLA, LEED AP		Company Point Landscape Studio Inc.	
Registration #		Email	yongxuyu@pointlastudio.com	
Address	1851 Appin Road			
City	North Vancouver	Postal	V7J 2T8	Phone # 778-868-2378
Prov/state	BC	Country	Canada	

Table of Contents for Assessment Report

Page Number

Section 1. Description of Fisheries Resources Values and a Description of the Development proposal

(Provide as a minimum: Species present, type of fish habitat present, description of current riparian vegetation condition, connectivity to downstream habitats, nature of development, specific activities proposed, timelines)

Description of Proposed Development

The proposed development of 128 Rollie Rose Drive (Lot 12), of the Phase 1 Holland Creek Residential Development Project is situated on a total lot area of 0.190 ha located in the Cowichan Valley Regional District by the Town of Ladysmith. The proposed development along Tributary 1 (T1), will be adjacent to and about 40 m of riparian habitat on the northwest side of T1, which eventually discharges into Holland Creek. The proposed development includes the construction of low density multi family residential homes consisting of three townhouses with a total of seven units, other portions will remain as greenspace or be used as roads/right of ways. The total area covered by housing footprints, access roads and other structures is proposed to be 0.130 ha. Full servicing will be supplied from the road right of way (Rollie Rose Drive), and completed as per the site grading, servicing, and stormwater management plans from Aplin & Martin Consultants Ltd. Landscape design for the Site will be completed as per the plans from Point Landscape Studio Inc. while general layout/design plans for the Site will be carried out as per the plan from Bennett Land Surveying Ltd. (Full PFD plans available in appendices). The RAPR site plans created by Bennett Land Surveying Ltd. are available in Section 3 of this report and will be used in conjunction will all above aforementioned plans. A detailed RAPR was completed as part of the process for a development permit of multi family residential for the proposed development. The RAPR will be used as a planning document for the measures to protect and maintain the SPEA required for the proposed development.

T1 falls within the Development Permit Area (DPA) 6 of the Town of Ladysmith. A detailed Riparian Areas Protection Regulation (RAPR) is required to obtain a Development Permit (DP) for the proposed construction of low density multi family residential homes consisting of three townhouses with a total of seven units in Phase I of the Holland Creek Residential Development Project. Recently site preparation activities including clearing vegetation occurred between 2017 and 2020, without an approved development permit in DPA 6. These activities occurred within the RAA of T1 within Lot 12 of Phase I. A Condition and Impact Assessment (CIA) report was required to address the historically completed site preparation activities with further detailed measures to protect, maintain, and enhance the SPEA. The CIA report is attached to this detailed RAPR.

This detailed RAPR with supporting reports/documents and CIA will be used as a planning document for the DP process with the Town of Ladysmith. This document sets the framework for SPEA protection, maintenance, and enhancement associated with the proposed development activities within Phase I Lot 12.

Description of Fisheries Resources Value

A site visit was completed on the 2nd of December 2021. A second Site visit for the CIA was completed on the 1st of November 2022. The CIA Site inspection focused on assessing potential impacts to the SPEA from unauthorized historical vegetation clearing in the RAA/DPA of Tributary 1 as well as identifying mitigation measures.

The proposed development area and associated riparian assessment area (RAA) has previous disturbance and alteration in and around T1. This non fish tributary flows into Holland Creek over

a falls near the Dogwood Avenue bridge. The T1 channel is comprised of several reach segments (R1-3): T1-R1, T1-R2, T1-R3; however, the proposed development area only occurs along T1-R1. The area was logged in the past using clear-cut methods and allowed to regenerate naturally. This RAPR required a Condition and Impact Assessment report as requested by the Town of Ladysmith and the Ministry. This is due to previous clearing operations during the Phase 1 Holland Creek Residential Development Project within the RAA from 2017 to 2020. Clearing did not occur within the previous SPEA as determined by the 2014 RAR completed for the overall project area, which included T1. A mixture of regenerating Red Cedar, Douglas Fir, Red Alder and Broad Leaf Maple comprise the dominant tree species in the RAA as well as the surrounding area. No old growth trees were observed in the RAA. Extensive areas of the RAA were dominated by moss (in and near T1-R1), salal and ferns as well as by weedy species such as Spurge-Laurel, Foxglove, Himalayan Blackberry, Canada Thistle, and Queen Anne's Lace. In and around T1-R1 and the proposed development area, the channel was historically redirected for logging, service of BC Hydro electrical lines, a water line corridor, as well as access for a garbage dump. In the upper reaches above the proposed development area, the BC Hydro transmission line, Fortis Natural Gas line and forestry road corridors disrupted the channels with poorly located culverts or lack of culverts, alternate routes, drainage ditches and braiding.

Reach 1 begins at the confluence with Holland Creek above an 8 m bedrock waterfall which flows year-round from ground water seepage and provides critical summer flow to Holland Creek; this lower portion of Reach 1 is outside of the proposed development area. The reach is 370 m in length, has an average width of 2.1 m, and a relatively low gradient of 4-12%. It is comprised of step pool complexes. Large woody debris is scattered throughout the reach, in channel and along the banks. This reach ends above the proposed development area, when T1 becomes confined in a small valley and gradient increases indicating a reach break into Reach 2[1].

The proposed development area is within the Coastal Douglas Fir Biogeoclimatic Zone which is a Red Listed Plant Community. No specific Red or Blue listed plants other than the CDF Community are found in the B.C. Government Ecosystem Explorer for this site. Coastal Cutthroat Trout and Red Legged Frogs are two provincial blue listed endangered species historically observed during the previous study[2,4] around the lower fish bearing drainages.

Fish Assessment

T1 does not support anadromous or residential fish populations. It is located above the 8 m bedrock waterfall which acts as a fish barrier located at the confluence with Holland Creek. The steep gradients in Reach 2 and intermittently dry channel in Reach 1 eliminate the potential for resident fish. An electroshock of the wetted areas of the lower end of T1 in 2010 confirmed there were no fish[3].

Holland Creek, the downstream receiving waters from T1 is located outside of the proposed development area. The creek has perennial flow and anadromous fish access from its' lower reaches to water falls upstream which act as a fish barrier. The creek supports a diverse mix of anadromous and resident fish species including cutthroat and rainbow trout along with chum and coho salmon[5]. There has been enhancement of coho and chum salmon through small numbers of hatchery fry augmentation as well as extensive and successful habitat restoration with

[1] D.R. Clough Consulting. 2014. Holland Creek Watershed, Ladysmith B.C. Environmental Assessment.
[2] D.R. Clough Consulting. 2014. Holland Creek Watershed, Ladysmith B.C. Environmental Assessment.
[3] Dave Clough R.P.Bio. Personal Communication [October 04, 2021]
[4] D.R. Clough Consulting. 2014. Holland Creek Watershed, Ladysmith B.C. Environmental Assessment.
[5] https://maps.gov.bc.ca/ess/hm/habwiz/ [accessed December 08, 2021]

construction of four different off channel sites as well as much instream work to stabilize the banks and create fish habitat[6].

Section 2. Results of Riparian Assessment (SPEA width)

Attach or Insert the Form 3 or Form 4 assessment form(s). Use enough duplicates of the form to produce a complete riparian area assessment for the proposed development

2. Results of Detailed Riparian Assessment

Refer to Section 3 of Technical Manual

Date: 2021-12-02

Description of Water bodies involved (number, type): Tributary 1 (T1) Reach 1 (R1)

Stream	T1
Wetland	
Lake	
Ditch	
Number of reaches	3
Reach #	1

Channel width and slope and Channel Type (use only if water body is a stream or a ditch, and only provide widths if a ditch)

	Channel Width(m)		Gradient (%)
starting point	2.15		-
upstream	0.90		12
	5.79		18
	3.30		25
	3.30		18
downstream	1.93		12
	1.56		8
	1.08		40
	3.33		12
	1.98		6
	3.00		-
Total: minus high /low	21.63		105
mean	2.40		15
	R/P	C/P	S/P
Channel Type			X

I, Derek Nickel, R.P.Bio., hereby certify that:

a) I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;

b) I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.;

c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and

d) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

Site Potential Vegetation Type (SPVT)

	Yes	No	
SPVT Polygons		X	Tick yes only if multiple polygons, if No then fill in one set of SPVT data boxes

I, Derek Nickel, R.P.Bio., hereby certify that:

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c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and

d) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

[6] Personal communication. D.R. Clough.

Polygon No:	n/a		
	LC	SH	TR
SPVT Type			X

Method employed if other than TR
n/a

Zone of Sensitivity (ZOS) and resultant SPEA

Segment No:	1	Tributary 1 Reach 1					
LWD, Bank and Channel Stability ZOS (m)	10						
Litter fall and insect drop ZOS (m)	10						
Shade ZOS (m) max	7.20	South bank	Yes		No	X	
SPEA maximum	**10**	Northwest Bank					

I, Derek Nickel, R.P.Bio., hereby certify that:

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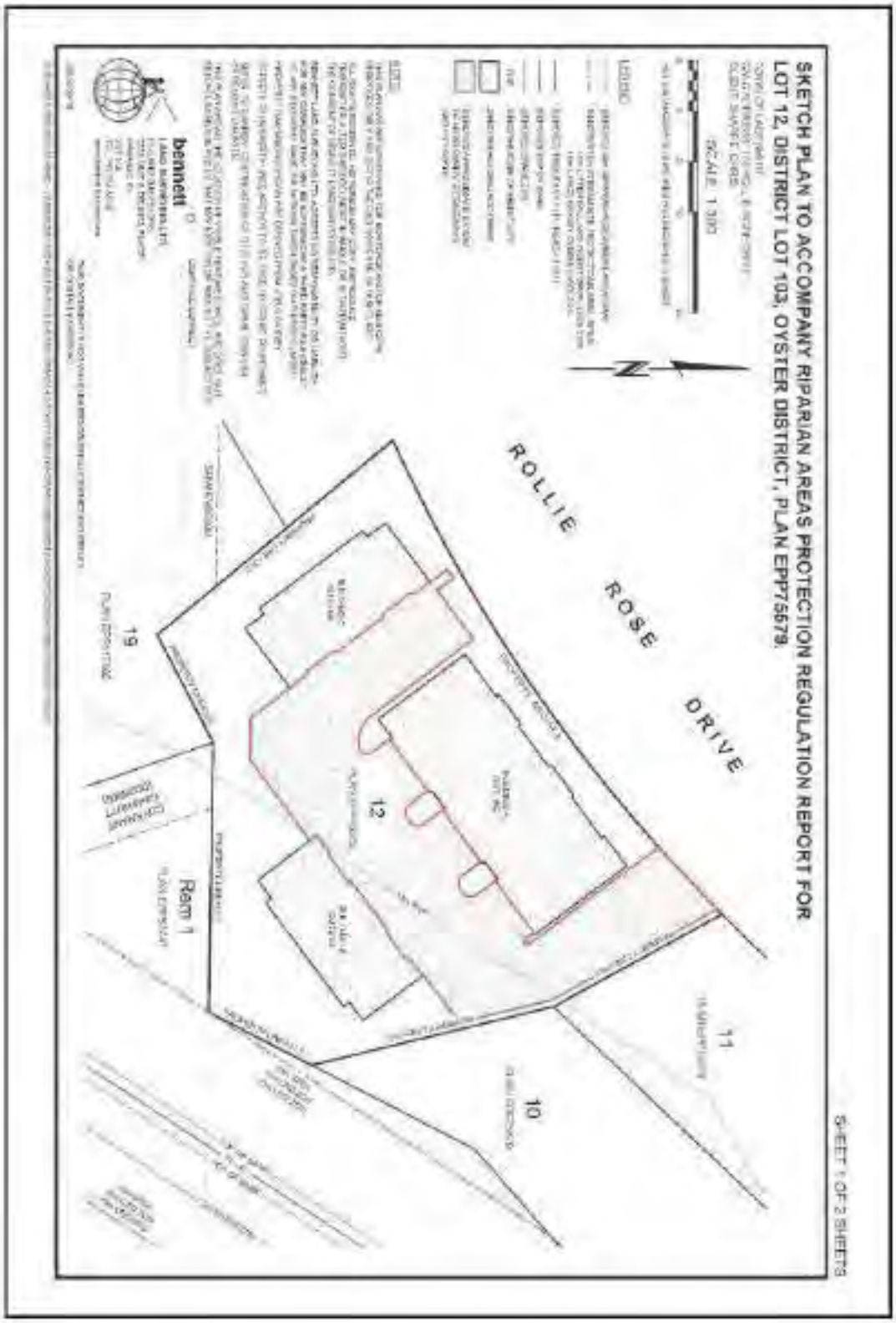
c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and

d) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

Comments

Reach 1 begins at the confluence with Holland Creek above an 8 m bedrock waterfall which flows year-round from ground water seepage and provides critical summer flow to Holland Creek. The reach is 370 m in length, has an average width of 2.1 m, and an average gradient of 4-12%. It is comprised of step pool complexes. Large woody debris is scattered throughout the reach, in channel and along the banks.

Section 3. Site Plan




SKETCH PLAN TO ACCOMPANY RIPARIAN AREAS PROTECTION REGULATION REPORT FOR LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579.
SCALE 1:300
LEGEND
NOTES
bennett
ROSE DRIVE
11
10
12
19

Section 4. Measures to Protect and Maintain the SPEA

This section is required for detailed assessments. Attach text or document files, as need, for each element discussed in Part 4 of the RAPR. It is suggested that documents be converted to PDF *before* inserting into the assessment report. Use your "return" button on your keyboard after each line. You must address and sign off each measure. If a specific measure is not being recommended a justification must be provided.

1. Danger Trees	Five trees were assessed as potential hazard trees, two of the trees were recommended for removal, two were recommended for coppicing, and the one remaining assessed tree was deemed safe to retain. Recommended hazard mitigation includes felling (into the SPEA where no damage is to occur to the intact ecosystem). Where safe, high stumping and coppicing of maples is recommended to retain value for wildlife. Where not safe, consider retaining Coarse Woody Debris for SPEA to enhance biodiversity. Vegetation management and mitigation measures will be undertaken in multiple ways such as tree replacement planting and enhancement to bolster the vegetation in and around the SPEA which will increase biodiversity and habitat values. Implementation of mitigative actions will be overseen by a QEP (e.g., hazard tree treatment and remediation of the SPEA) as discussed in the windthrow and hazard tree assessment with recommended guidelines in conjunction with the provincial RAR Revegetation Guidelines will yield a net environmental improvement. In the case of needing to replace trees, BC provincial criteria must be followed for tree replacement as per the guidelines below with Diameter at Breast Height (DBH). •0 mm - 151 mm (6") DBH — 2 replacement trees (min height 1.5 m), or, 4 shrubs (for up to 50% of trees being replaced in this range); •152 mm - 304 mm (12") DBH — 3 replacement trees (min height 1.5 m); •305 mm - 456 mm (18") DBH — 4 replacement trees (min height 2.0 m); •457 mm - 609 mm (24") DBH — 6 replacement trees (min height > 2.0 m); •610 mm - 914 mm (36") DBH — 8 replacement trees (min height > 2.0 m) oTrees > 914 mm DBH (36") will require individual approval and replacement criteria prior to removal. oEvery effort must be made to retain 20% of trees > 304 mm DBH (12") as wildlife snags at minimum height of 3 m. Based on the two recommended trees for complete removal in the hazard tree assessment, six replacement trees of >2.0 m and three replacement trees with a minimum height of 1.5 m are to be replanted. A planting plan with planting locations will be completed at the time of development by a QEP. If the measures identified in the windthrow and hazard tree assessment are followed and implemented by the developer to protect the integrity of the SPEA and surrounding riparian habitat, it is determined there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in (and/or downstream of) the riparian assessment area. The riparian area has the potential for further danger trees over time, however the SPEA area is generally incised putting the trees in the SPEA at lower

	elevations than potential building areas. It is recommended that development be located to allow for setbacks away from the SPEA beyond the effect of potential new danger trees over time as determined by a QEP. A Windthrow & Hazard Tree Assessment by Strathcona Forestry Consulting was completed for the proposed project area[7]. See attached. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith. The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Section 4.1 in the attached assessment[8].
I, Derek Nickel R.P.Bio., hereby certify that: e) I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; f) I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; g) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	
2. Windthrow	Forest cover on the northwest side of Tributary 1 was assessed. Windthrow risk was rated as MODERATE. Likelihood of windthrow was rated MODERATE. The eastern portion of the RAA along Tributary 1 is windward to prevailing winds, and more prone to wind damage; both the windward and leeward segments contained hazardous trees according to the assessment. No trees were recommended for windthrow treatment by topping, top pruning, spiral pruning, or edge feathering within the remaining RAA outside of the SPEA. No windthrow mitigation measures are to take place within the SPEA. Treatment to prevent windthrow should follow standard strategies to minimize disturbance to rooting layers during clearing and construction, including not creating windthrow, protecting trees in the SPEA (especially along the SPEA boundary), and retaining wildlife trees in the SPEA. Care must be taken during development to avoid disturbance within the drip line of trees in and along the SPEA and overlap area with the remaining RAA. Management and mitigation measures will be undertaken to avoid disturbance to existing trees, plant new vegetation, increase coarse woody debris, all of which will decrease the potential for additional hazard trees, enhance biodiversity, and help to maintain a carbon sink. A Windthrow & Hazard Tree Assessment by Strathcona Forestry Consulting was completed for the proposed project area[9]. See attached. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith.

[7] Strathcona Forestry Consulting. 2021. 128 Rollie Rose Drive, Ladysmith, BC, Windthrow & Hazard Tree Assessment.
[8] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.
[9] Strathcona Forestry Consulting. 2021. 128 Rollie Rose Drive, Ladysmith, BC, Windthrow & Hazard Tree Assessment.

	The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Section 4.1 in the attached assessment[10].
I, Derek Nickel R.P.Bio., hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	
3. Slope Stability	The property has been surveyed by Lewkowich Engineering Associates Ltd. (LEA). The land was considered safe for the proposed development. A Geotechnical Assessment was prepared by Lewkowich Engineering Associates Ltd. for the proposed project area[11]. See attached. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith. The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Section 4.2 in the attached assessment[12].
I, Derek Nickel R.P.Bio., hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	
4. Protection of Trees	It is important to take steps and protect trees within the SPEA as they can be damaged by construction activities. Tree roots may extend outwards from their base to multiple times their own height, thus making them susceptible even if ground disturbance is outside the SPEA and within the remaining RAA approved for development. Activities that must not take place near SPEA trees are: significant changes to ground level, release of pollutants, moving equipment, parking or storing construction equipment. A QEP will observe for compliance during inspections and any other practices that may impact SPEA tree health. The trees within the SPEA are not to be disturbed. Removal of any danger trees in the SPEA will require the services of a professional danger tree assessor. Work identified as being harmful to the SPEA but not within such as excavation, clearing, erection of permanent structures has to be done in such a way to protect the SPEA trees from harm. A drip zone from the SPEA perimeter trees is to be marked and implemented to protect trees and their roots from harm. The drip zone will be calculated for each SPEA perimeter tree (a distance equivalent to 6 x DBH of each tree from their bole) which will be adhered to for root zone protection. Placement of fencing along SPEA buffers should be implemented to ensure trees and their drip zones are maintained.

[10] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.
[11] Lewkowich Engineering Associates Ltd. 2021. Geotechnical Assessment.
[12] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.

	The placement of permanent fencing along SPEA and drip zone buffers is recommended and should be implemented to ensure trees and their drip zones are maintained. A Windthrow & Hazard Tree Assessment by Strathcona Forestry Consulting was completed and covers management and mitigation measures for the proposed project area[13]. See attached. A Tree Preservation Plan by Strathcona Forestry Consulting was completed and provides further management and mitigation measures for the proposed project area[14]. See attached. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith. The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Section 4.3 in the attached assessment[15].
I, Derek Nickel R.P.Bio., hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	
5. Encroachment	SPEA encroachment by residents of adjacent and neighbouring properties is a significant cause of riparian habitat loss and stream degradation. Plant disturbance and loss due to construction activities, dumping and yard waste, trampling due to hiking, and domesticated animals all contribute to riparian degradation. As plants and stream bank stabilization decrease due to disturbance, run off and siltation may occur harming the aquatic ecosystem including fish, their spawning gravels, and aquatic invertebrates (fish food sources). This application covers the proposed plans for low density multi family residential homes. The developer understands that the access to SPEAs in the long term needs to be restricted. There should be no encroachment into SPEAs including any dwellings, clearings, people, domestic animals or vehicles. The SPEAS will be flagged and marked with signage along the lot boundaries asking that the public stay out of and respect the sensitive riparian habitat, as well permanent fencing is recommended as a barrier. Property owners will be advised about SPEA locations on bills of sale with copies of the RAPR report. As discussed in Section 1, previous clearing occurred within the RAA between 2017 and 2020, the Town of Ladysmith requires that these activities only proceed after a RAPR is completed and a approved DP is obtained. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith.

[13] Strathcona Forestry Consulting. 2021. 128 Rollie Rose Drive, Ladysmith, BC, Windthrow & Hazard Tree Assessment.
[14] Strathcona Forestry Consulting. 2024. 128 Rollie Rose Drive: Tree Preservation Plan.
[15] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.

	The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Section 4.4 in the attached assessment[16].
I, Derek Nickel R.P.Bio., hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	
6. Sediment and Erosion Control	The SPEA areas and stream channels must be protected from the proposed property developments from erosion and sediment issues. A QEP will complete Site inspections to ensure the implementation of erosion and sediment control measure are correctly in place prior to development activities, and maintained throughout the duration of the project. Further guidance on sediment and erosion control as lots are developed can be taken from the Develop With Care – Environmental Guidelines for Urban and Rural Land Development in B.C. Best Management. Within the geotechnical assessment LEA mentions a "drainage ditch". This is in fact a small man-made erosion and sediment control drainage created after historical land clearing took place within the RAA to control Site runoff. The ESC drainage measure identified followed the gradual slope on the south side of the Site. The drainage extended northeast across the Site before exiting near the southeast side of the Site and discharged to ground. The majority of the ESC drainage did not appear to exist at the time of this Assessment Report, with remaining remnants being non functional. A Geotechnical Assessment was prepared by Lewkowich Engineering Associates Ltd. for the proposed project area[17]. See attached. An erosion and sediment control plan by Lewkowich Engineering Associates Ltd. was developed for the proposed project area[18]. See attachment. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith. The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Sections 4.2 and 4.5 in the attached assessment[19].
I, Derek Nickel R.P.Bio., hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	
7.	The majority of the RAA/DPA area around T1 consists of low-lying vegetation in

[16] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.
[17] Lewkowich Engineering Associates Ltd. 2021. Geotechnical Assessment.
[18] Lewkowich Engineering Associates Ltd. 2022. Erosion and Sediment Control Plan, 128 Rollie Rose Drive, Ladysmith, BC.
[19] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.

Stormwater Management	Lot 12 of Phase I, and is considered raw and undeveloped land. Clearing activities within the RAA/DPA have not appeared to cause increases in stormwater runoff into the SPEA and subsequently T1. The future development of the proposed project area must ensure that runoff patterns and water quality are not altered. Impermeable surfaces increase stormwater runoff and could impact Tributary 1 if not managed correctly. No stormwater infrastructure is permitted to be sited in the SPEA unless associated with an approval to discharge to Tributary 1 under the WSA. Further guidance and practices as lots are developed can be found in the publication; Stormwater Planning; A Guide for British Columbia[20]. Site servicing and stormwater management plans were prepared by Islander Engineering Ltd. for the proposed project area in their Drainages and Servicing Plan[21]. See attachment. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith. The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Section 4.6 in the attached assessment[22].
I, Derek Nickel R.P.Bio., hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	
8. Floodplain Concerns (highly mobile channel)	There are no floodplain concerns outside the SPEA areas. The channels and active floodplains were confined within the SPEA. The proposed plans for low density multi family residential homes are well above stream channel and should pose no concerns to flooding outside the SPEA. A Condition and Impact Assessment was completed for the proposed development of Lot 12 in Phase I and was approved by the Town of Ladysmith. The report discusses in further detail the Measures to Protect and Maintain the SPEA. See Section 4.7 in the attached assessment[23].
I, Derek Nickel R.P.Bio., hereby certify that: a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*; b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Coastal Legacy Developments Ltd.; c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation.	

[20] Stormwater Planning: A Guidebook for British Columbia. 2002. https://www.toolkit.bc.ca/resource/stormwater-planning-guidebook-british-columbia.
[21] Islander Engineering Ltd. 2022. Drainages and Servicing Plan.
[22] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.
[23] TerraWest Environmental. 2023. Condition and Impact Assessment - Lot A Block 192 Plan EPP63594 District Lot 103 Land District 43 Except Plan EPP67741 & EXC PL EPP75579, EPP80490, AND EPP89460.

Section 5. Environmental Monitoring

Attach text or document files explaining the monitoring regimen Use your "return" button on your keyboard after each line. It is suggested that all document be converted to PDF *before* inserting into the PDF version of the assessment report. Include actions required, monitoring schedule, communications plan, and requirement for a post development report.

A qualified environmental professional will be retained as the environmental monitor by the developer. The environmental monitor will be available in the event of significant rainfall, drainage problems, erosion and sediment control problems, and general project area wide conditions during emergency events. The qualified environmental professional will be experienced in sediment and erosion control measures, and will have the authority to shut down project area works if necessary to protect the SPEA. The qualified environmental professional will ensure all development activities remain outside of the SPEA, tree protection measures are being followed, fencing and sediment and erosion control measures are in working order, and storm water management structures are functioning correctly and all other relevant measures to protect are followed.

Environmental monitoring is planned to protect the drainages, riparian areas, slope stability, and general condition of the proposed project area during clearing and grubbing activities and road and property construction. Monitoring is to be completed weekly, or during key construction activities or extreme weather conditions (i.e. high rainfall). A post development environmental completion report is a required part of this permit to ensure all measures to protect were followed. This report is submitted to agencies as a final signoff. All relevant document files pertaining to environmental monitoring activities are attached to this report.

There must be an R.P.Bio. present during on-site works to review and implement the environmental protection plans, sediment and erosion control plans, CIA and associated environmental reports for the proposed project. For further reference the environmental practices in the Develop with Care 2014[24] guidelines identify the standards of practice that must be followed.

This RAPR report is for the proposed development of 128 Rollie Rose Drive (Lot 12), of the Phase 1 Holland Creek Residential Development Project, which includes the construction of low density multi family residential homes. This proposed development will be established using this report as a baseline guide including the SPEA and measures to protect.

[24] Develop with Care 2014. https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices/develop-with-care

Section 6. Photos

Photo1 Viewing southeast towards east section of proposed development area and RAA/SPEA along the northwest bank of T1-R1.

Photo2 Viewing west towards 128 Rollie Rose Drive and the proposed development frontage.

Photo3	Viewing southeast towards RAA and SPEA with fencing and riparian signage along the northwest bank of T1-R1.

Photo4	Viewing northeast along RAA and SPEA towards property boundary and adjacent developed lots.

Photo5	Viewing southwest along RAA and SPEA towards the property boundary and west section of proposed development area.

Photo6	Viewing southwest upstream T1-R1 from ST06 towards representative forest structure with disturbance indicators from historical logging and previous industrial activity.

Photo7 Viewing northeast downstream T1-R1 from ST02.

Photo8 Viewing southwest upstream T1-R1 from ST01 towards reach break into Reach 2.

Photo9 Viewing northeast downstream T1-R1 from ST07.

Photo10 Viewing southwest upstream T1-R1 from ST10 towards falls at ST08.

Photo11 Viewing northeast downstream T1-R1 from ST10 towards ST11 and culvert.

Photo12 Viewing southwest upstream T1-R1 from Rollie Rose Drive towards culvert inlet.

Photo13 Viewing northeast downstream T1-R1 from Rollie Rose Drive along culvert route.

Photo14 Viewing northeast downstream T1-R1 from Rollie Rose Drive towards culvert outlet.

Section 7. Professional Opinion

Qualified Environmental Professional opinion on the development proposal's riparian assessment.

Date 2024-09-23

1. We Derek Nickel R.P.Bio., Chris Hudec P.Eng., Louis Chapdelaine P.Geo., Sean Babulic P.Eng., David Clough R.P.Bio., and Margaret Symon R.F.P.

hereby certify that:

a) I am/We are qualified environmental professional(s), as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;
b) I am/We are qualified to carry out the assessment of the proposal made by the developer Coastal Legacy Developments Ltd., which proposal is described in section 3 of this Assessment Report (the "development proposal"),
c) I have/We have carried out an assessment of the development proposal and my/our assessment is set out in this Assessment Report; and
d) In carrying out my/our assessment of the development proposal, I have/We have followed the specifications of the Riparian Areas Protection Regulation and assessment methodology set out in the minister's manual; AND

2. As qualified environmental professional(s), I/we hereby provide my/our professional opinion that:

a) [N/A] the site of the proposed development is subject to undue hardship, (**if applicable, indicate N/A otherwise**) and
b) [X] the proposed development will meet the **riparian protection standard** if the development proceeds as proposed in the report and complies with the measures, if any, recommended in the report.

[NOTE: "Qualified Environmental Professional" means an individual as described in section 21 of the Riparian Areas Protection Regulation.

May 10, 2023

Our File: 3060-21-10

Derek Nickel
Project Biologist
TerraWest Environmental Management and Consulting

Via email: dnickel@terrawest.ca

Dear Derek Nickel:

RE: Condition and Impact Assessment
Subject Property: Lot 12 District Lot 103 Oyster District Plan EPP75579 (128 Rollie Rose Drive)

Thank you for providing the "Condition and Impact Assessment" report for 128 Rollie Rose Drive, dated May 2, 2023. We have reviewed the report and concur with the findings.

We understand that there are no recommendations in the report that require immediate attention. Recommendations of the report which require future action (e.g. windowthrow management/mitigation measures, erosion control measures, etc.) will be made conditions of the Development Permit which must be issued prior to development of the property, including further land alteration or vegetation clearing.

Please contact me at (250)245-6420 or jthompson@ladysmith.ca if you have any questions.

Sincerely,

Julie Thompson
Senior Planner
Development Services Department

Mailing
PO Box 58
Cowichan Bay, BC
V0R 1N0

Regional
4176 Departure Bay Road
Nanaimo, BC
V9T 4B7

Town of Ladysmith
Development Services Department
132C Roberts Street
Ladysmith, BC
V9G 1A2

CONFIDENTIAL

May 02, 2023

Attn: Julie Thompson, *Senior Planner/Development Approvals Supervisor, Town of Ladysmith*

Re: **Condition and Impact Assessment** – Lot 12, Block 192, District Lot 103, Land District 43, Plan EPP75579

1.0 Introduction

TerraWest Environmental Inc. (TerraWest) was retained by Chris Cochrane of Coastal Legacy Developments Ltd. (the 'Client') to complete a Condition and Impact Assessment (CIA) of the property located at 128 Rollie Rose Drive, Lot 12 in Phase 1 of the Holland Creek Estates development in Ladysmith, BC, herein referred to as the 'Subject Property' and/or the 'Site'. Activities conducted within the defined Site boundaries are herein referred to as "on Site".

2.0 Background

Prior to the initiation of development activities on the Subject Property, the Client obtained a Qualified Environmental Professional (QEP) to complete a CIA as well as Riparian Area Protection Regulations (RAPR) edits as per the Ministry of Forests, Lands, Natural Resource Operations and Rural Development FLNRO request. The RAPR report (no. 7506A) was completed and notification of rejection for failure to meet the assessment and reporting criteria of the RAPR was received on August 15, 2022, from FLNRO. Once written approval of the CIA is obtained by the Town of Ladysmith, both documents will be submitted as

attachments along with the updated RAPR to the province. Once the RAPR package is approved by the province it will be used to assist in the Development Permit application and approval process through the Town of Ladysmith prior to any new development on Site.

The proposed development of 128 Rollie Rose Drive, Lot 12, of the Phase 1 Holland Creek Residential Development Project is situated on a total lot area of 0.190 ha located in the Cowichan Valley Regional District by the Town of Ladysmith. The proposed development along Tributary 1 (T1), will be adjacent to and about 40 m of riparian habitat on the northwest side of T1, which eventually discharges into Holland Creek. The proposed development includes the construction of low-density multi-family residential homes consisting of three townhouses with a total of seven units, other portions will remain as greenspace or be used as roads/right of ways. The total area covered by housing footprints, access roads and other structures is proposed to be 0.130 ha. The site plan map is available in Appendix A.

3.0 Riparian Impact Assessment

This CIA outlines the historical disturbance and alterations that have occurred on-Site inside the Town of Ladysmith's Development Permit Areas 6/8[1] which involve the Riparian Assessment Area (RAA) for T1. Aerial photos in Appendix B show the progression of historical development activities in and around the Subject Property.

The Subject Property has had site preparation activities including vegetation clearing occur inside the RAA of Tributary 1, however the SPEA component of the RAA remained intact as confirmed during the detailed 2021 RAPR field assessment and November 1st, 2022, CIA Site inspection; see November 1st, 2022 Site photos in Appendix C. The CIA Site inspection focused on assessing potential impacts to the SPEA from unauthorized historical vegetation clearing in the RAA of Tributary 1 as well as identifying mitigation measures if warranted.

RAPR reports are to be submitted and approved prior to development activities inside RAA areas. This ensures appropriate measures will be set up and in place to protect SPEAs prior to development activities. It is important to protect the biological functions of the SPEAs associated with the different Zones of Sensitivity (ZOS). The ZOS within the SPEA provides benefit to fish and fish habitat by way of Large Woody Debris/Bank Stability, Litter Fall and Insect Drop, and Shade. Each of the ZOS are determined by field measurements based on the application of current RAPR methodology. Based on the current RAPR methodology the SPEA of Tributary 1 (10m) was determined.

[1] https://www.ladysmith.ca/business-development/development-permit-areas (accessed February 22, 2023).

4.0 SPEA Protective Measures

4.1 Danger Trees and Windthrow

A windthrow and hazard tree assessment of the Site was completed by Strathcona Forestry Consulting in October 2021[2] for the commissioned RAPR. Previous clearing of vegetation in the RAA area outside of the SPEA occurred in 2017 during earlier lot and subdivision development activities along Tributary 1. Due to the time that had elapsed from the historical clearing activities the windthrow and hazard tree assessment could not directly determine what impacts the previous clearing had on the SPEA, instead it focused on current SPEA conditions, health and mitigation measures. One however could logically assume there was impact to the dripline and root zone for the remaining trees at the time of clearing, and that the clearing could have impacted windthrow and danger trees. Currently the SPEA, dripline and critical rootzone were in good stable condition upon the most recent Site visit, regeneration of vegetation would have occurred within the past five years, windthrow and danger trees were as stated in the windthrow and hazard tree assessment. Forest cover on the northwest side of Tributary 1 was assessed. Windthrow risk was rated as MODERATE. Likelihood of windthrow was rated MODERATE. The northwest portion of the RAA along Tributary 1 is leeward to prevailing winds and is less prone to wind damage; the assessed leeward segment contained hazardous trees according to the assessment.

Management and mitigation measures will be undertaken as per the windthrow and hazard tree assessment to avoid disturbance to existing trees such as hazard tree treatment, planting new vegetation, increase coarse woody debris, all of which will decrease the potential for additional hazard trees, enhance biodiversity, and help to maintain a carbon sink. Recommended prescriptions and guidelines within the windthrow and hazard tree assessment in conjunction with the RAPR measures to protect and the provincial RAR Revegetation Guidelines will yield a net environmental improvement.

4.2 Slope Stability

Based on the geotechnical assessment conducted by Lewkowich Engineering Associated Ltd. in 2021 for the Site[3], the unauthorized disturbance and clearing activities in the RAA of Tributary 1 has not resulted in impacts related to slope stability.

The slope was previously graded during the construction of Rollie Rose Drive as part of the Holland Creek Area development and had been appropriately revegetated to prevent erosion. Based on the anticipated soil conditions, and the inclination of the north slope, Lewkowich Engineering Associated Ltd. believes there is a low risk for slope instability. No indication of significant slope movement was found on Site[4].

---

[2] Strathcona Forestry Consulting 2021. 120 Rollie Rose Drive, Ladysmith, BC. Windthrow & Hazard Tree Assessment.
[3] Lewkowich Engineering Associates Ltd. 2021. Geotechnical Assessment.
[4] Lewkowich Engineering Associates Ltd. 2021. Geotechnical Assessment.

4.3 Protection of Trees

On November 1, 2022, a field assessment was conducted to assess the condition of the SPEA which appeared to be in good stable condition. Regeneration of vegetation would have occurred within the past five years, and any damage if it had occurred directly or indirectly to the SPEA during the unauthorized clearing was not identified during the Site visit.

It is important to take steps and protect trees within the SPEA as they can be damaged by construction activities taking place on adjacent land outside of the SPEA. Tree roots may extend outwards from their base to multiple times their own height, thus making them susceptible even if ground disturbance is outside the SPEA. In addition, the operation of heavy equipment close to the SPEA has the potential to cause damage to trees. Indirect impacts may also occur over the rooting zone in the form of paving or altering the ground level under trees.

Tree protection measures have been included in the RAPR report. A QEP will observe for compliance during development inspections and any other practices that may impact SPEA tree health.

4.4 Encroachment

Previous clearance of vegetation in the RAA area outside of the SPEA occurred in 2017 during earlier lot and subdivision development activities along Tributary 1. Based on the detailed RAPR Assessment Report, unauthorized encroachment occurred in the RAA but not in the SPEA. Further disturbance and development within Site will only be permitted upon approval of the detailed assessment submitted under RAPR and successfully obtaining a development permit from the Town of Ladysmith.

The developer understands that the access to SPEA needs to be restricted for residence of the proposed plans as mentioned above. There should be no encroachment into the SPEA including any dwellings, clearings, people, domestic animals or vehicles. The SPEA will be flagged and marked with signage along the lot boundaries asking that the public stay out of and respect the sensitive riparian habitat. Currently some signage already exists at the east boundary of the Site stating "Riparian Preservation Area Please Protect". Property owners will be advised about SPEA locations on bills of sale with copies of the RAPR report.

4.5 Erosion and Sediment Control (ESC)

Unauthorized clearing activities did not result in erosion and sediment control problems in the RAA or SPEA. The slope was previously graded during the construction of Rollie Rose Drive as part of the Holland Creek Area development and had been appropriately revegetated to prevent erosion.

An erosion and sediment control plan by Lewkowich Engineering Associates Ltd. was developed for the proposed project area[3]. A QEP will complete Site inspections to ensure the implementation of erosion and sediment control measure are correctly in place prior to development activities and maintained throughout the duration of the project as discussed in the RAPR.

4.6 Stormwater Management

Previous clearing activities within the RAA on Site have not caused an increase in stormwater runoff into the SPEA and subsequently T1 based on observations made during the previous Site visit. Since clearing the Site was revegetated and the slope was contoured to manage stormwater as discussed in Section 4.2 and 4.5. Future development of the proposed project area must ensure that runoff patterns and water quality are not altered. Impermeable surfaces increase stormwater runoff and could impact Tributary 1 if not managed correctly.

Site servicing and stormwater management plans were prepared by Islander Engineering Ltd. for the proposed project area in their Drainages and Servicing Plan[4].

4.7 Floodplain Concerns

There are no floodplain concerns outside the SPEA areas. The channels and active floodplains were confined within the SPEA. The proposed plans for low density multi-family residential homes are well above stream channel and should pose no concerns to flooding outside the SPEA.

5.0 Closure

The unauthorized clearing activities on Site that occurred in 2017 without an approved Development Permit from the Town of Ladysmith within DPA 6/8 and the RAA associated with T1, have not impacted the SPEA of T1 based on observations from the Site visit and from the supporting assessments, reports and plans referenced in this CIA.

It is imperative that this CIA along with the current RAPR are approved by local and provincial governments, and a development permit is obtained from the Town of Ladysmith prior to any further disturbances or works within the developable portion of the RAA on the Subject Property.

We trust this meets your requirements, and if there are any questions regarding the above, please do not hesitate to contact the undersigned below.
Kind regards,

[3] Lewkowich Engineering Associates Ltd. 2021. Erosion and Sediment Control Plan | [redacted], Ladysmith, BC
[4] Islander Engineering Ltd. 2021. Drainages and Servicing Plans

Prepared by:

COLLEGE OF APPLIED BIOLOGY
Derek Nickel
R.P. Bio
3004
CAB

2-May-2023

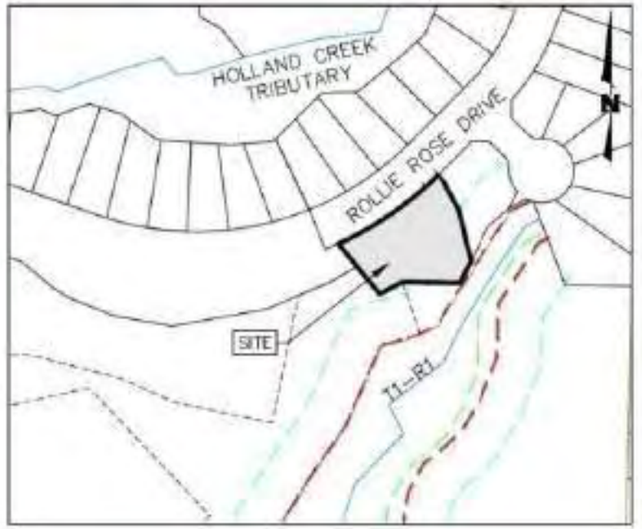
Derek Nickel, B.Sc., R.P. Bio
Project Biologist
250-216-4313

Prepared by:

Stormy Kirkland, B.Sc., R.B.Tech.(Trainee)
Environmental Technologist
778-268-0168

APPENDIX A.

SITE PLAN



LEGEND

- Site Property Boundary
- Building Footprint
- Driveway
- Large Woody Debris (LWS) ZOS
- Litter Fall and Insect Drop (LDIS) ZOS
- Tributary 1 (T1) Reach 1 (R1)
- 7.2m Shade ZOS
- 10m Streamside Protection and Enhancement Area (SPEA)
- 30m Riparian Assessment Area (RAA)

ISLANDER ENGINEERING

0 10 20 40
metres

Reference: CVRD
Projection: NAD1983 UTM Zone 10

N

Project: 2472
Address: Lot 12 Rollie Rose Dr.
Date: 2023-01-02
Drawn: MS
Version 2

Site Plan with 2022 Imagery

Figure 1

APPENDIX B.

AERIAL PHOTOGRAPHS OF SITE DEVELOPMENT

ISLANDER ENGINEERING

0 5 10 20
metres

Reference: CVRD
Projection: NAD1983 UTM Zone 10

Project: 2472
Address: Lot 12 Rollie Rose Dr.
Date: 2023-01-02
Version 2

Riparian Assessment Area (RAA) with 2020 Imagery

Figure 2

ISLANDER ENGINEERING

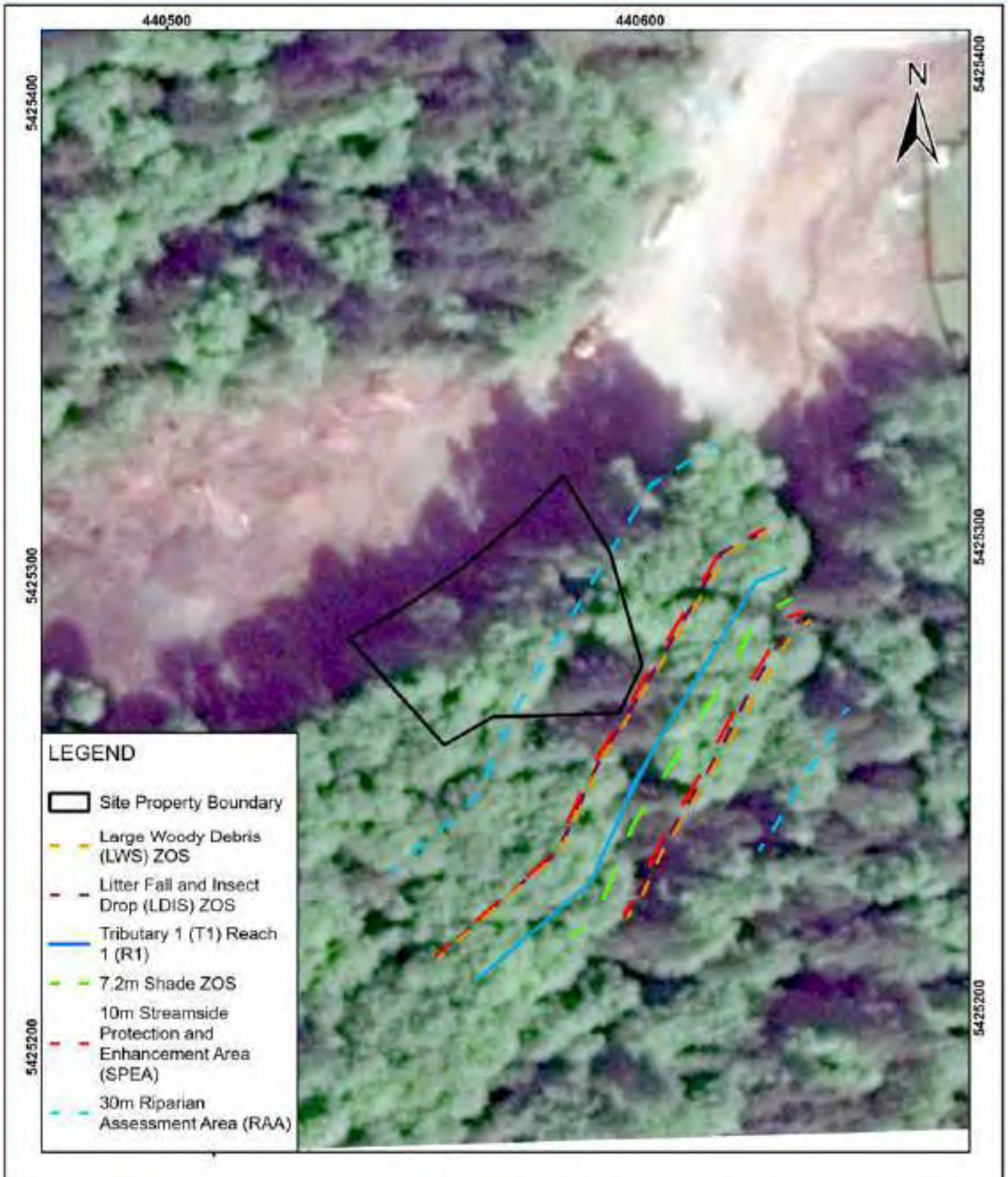
0 12.5 25 50
metres

Reference: CVRD
Projection: NAD1983 UTM Zone 10

Project: 2472
Address: Lot 12 Rollie Rose Dr.
Date: 2023-01-02
Version 2

Riparian Assessment Area (RAA) with 2019 Imagery

Figure 3



ISLANDER ENGINEERING

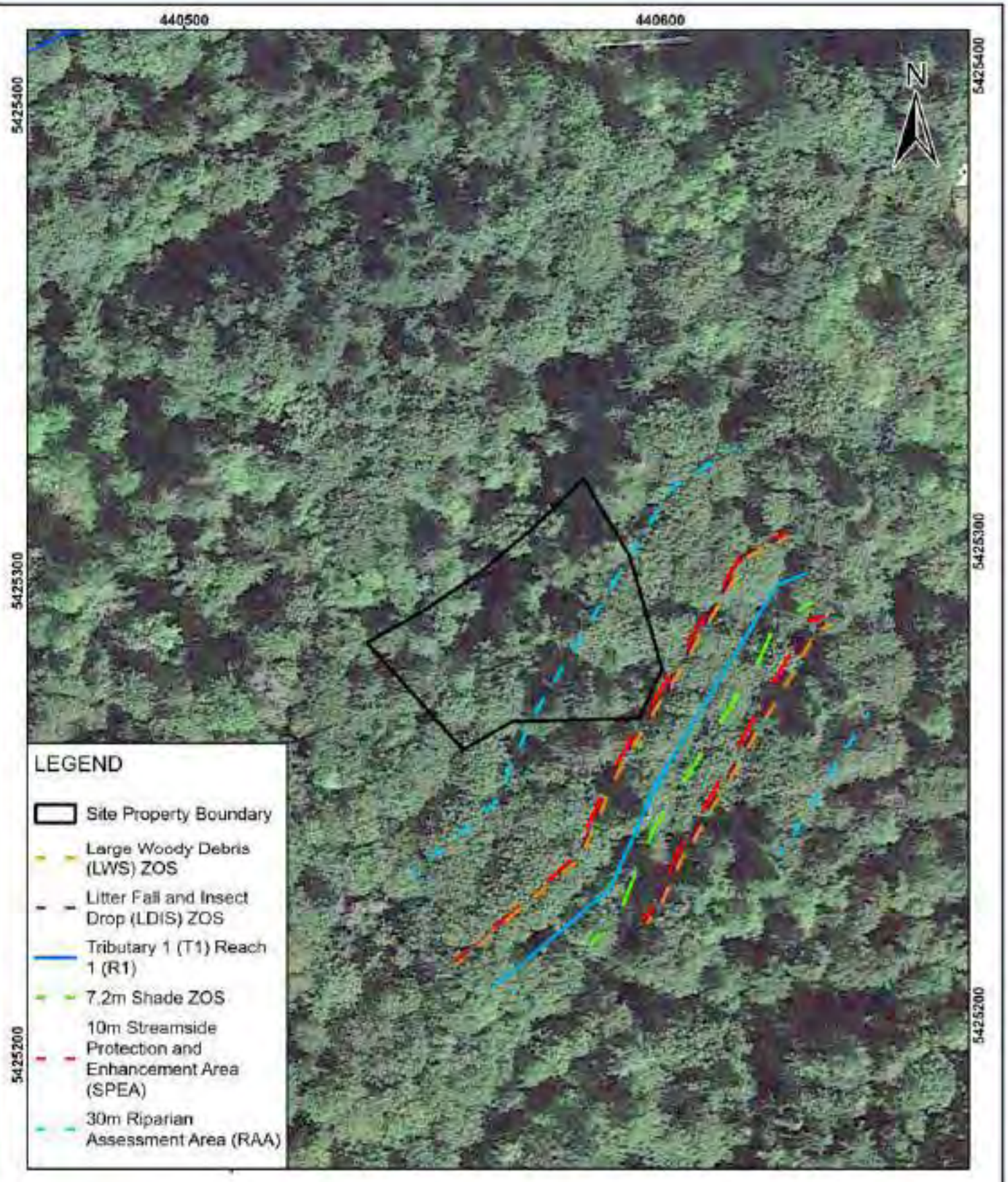
0 10 20 40
metres

Reference: CVRD
Projection: NAD1983 UTM Zone 10

Project: 2472
Address: Lot 12 Rollie Rose Dr.
Date: 2023-01-02
Version 2

Riparian Assessment Area (RAA) with 2017 Imagery

Figure 4



ISLANDER ENGINEERING

0 10 20 40
metres

Reference: CVRD
Projection: NAD1983 UTM Zone 10

Project: 2472
Address: Lot 12 Rollie Rose Dr.
Date: 2023-01-02
Version 2

Riparian Assessment Area (RAA) with 2016 Imagery

Figure 5

APPENDIX C.

SITE INSPECTION PHOTOGRAPHS

Photo 1. Viewing southeast towards east section of proposed development area and RAA/SPEA along the northwest bank of T1-R1.

Photo 2. Viewing southwest towards 128 Rollie Rose Drive and the proposed development frontage.

Photo 3. Viewing northeast towards property boundary and adjacent developed lots.

Photo 4. Viewing northeast towards 128 Rollie Rose Drive and the proposed development frontage.

Photo 5. Viewing southeast towards RAA and SPEA along the northwest bank of T1-R1.

Photo 6. Viewing northeast along RAA and SPEA towards property boundary, fence, and adjacent developed lots.

Photo 7. Viewing southwest upstream T1-R1 adjacent to 128 Rollie Rose Drive.

Photo 8. Viewing dry T1-R1 channel adjacent to 128 Rollie Rose Drive.

Photo 9. Viewing northeast downstream T1-R1 adjacent to 128 Rollie Rose Drive.

D. R. Clough Consulting
Fisheries Resource Consultants
6966 Leland Road
Lantzville B.C. V0R 2H0
Ph/Fax: 250-390-2901 Cell: 250-714-5416 email:*drclough@shaw.ca*

March 20, 2013

Attn: 0885538BC Ltd and Stzuminus First Nation
c/o Glenn Carey, Project Manager
6774 Dickinson Road
Nanaimo, BC V9V 1A2
Ph: 250-390-1475 email: *glen.car@shaw.ca*

RE: Holland Creek Watershed, Ladysmith B.C.

Environmental Assessment

Introduction:

In the proposal for the development on property on the south side of Holland Creek we were asked to provide a preliminary Biological assessment during the winter. The objectives of the assessment were to determine;

1.) Stream and drainage mapping: There are two unnamed drainages as well as Heart Creek and Holland Creek in the development area. We will identify the location in the field with flagging and GPS the location of the unnamed drainages for upload files preliminary planning maps.
2.) Stream Fish Habitat values: The streams will be assessed with a standard fish habitat assessment to determine the physical status of the channel as well as potential for fish presence and type.
3.) Inspect the proposed bridge crossing area on Heart Creek.
4.) Consultation: The importance of this watershed to Stzuminus First Nations, Ladysmith Sportsmen Club and Town of Ladysmith will result in consultation to determine their interest and input in fisheries values. There will be a site visit and meeting to explain findings and listen to concerns.

Methods

Stream mapping

Brad Remillard, RPBio and Dave Clough, RPBio undertook the stream channel assessments in January and February 2013. We began at either the top or bottom of the major drainages and flagged stations and tributaries as we inspected the channels for habitat characteristics. Hand held Garmin (450) GPS was used with a cellular GPS application (*Everytrail*) and a photo and location reference as well. GPS data was edited on Garmin *Mapsource* software and uploaded to Google Earth for display. The survey area is bounded by Holland Creek on the north east and the Hydro line on the south west.

Stream Habitat

Each stream was inspected by a biologist for fish habitat suitability. Fish habitat features such as barriers, rearing and spawning habitat as well as flow regimes were analyzed. We also referred to past fish presence information from past electroshock surveys and information from local stream stewardship groups.

Bridge Site Inspection

The general area (taken from the preliminary mapping) suggested approximately 100m of area along Heart Creek. This area was walked to determine the best site based on a narrow confined channel that would result in least impact to fish habitat values.

Consultation

The Stzuminus First Nation was consulted at their bad office on January 27, 2013 to discuss the development and the possibility of a fish hatchery. The Ladysmith Sportsmen attended on-site tour with the proponent and a follow up inspection of hatchery locations on the 27th of February.

Results

Study Area Overview;

Holland Creek is a salmon and trout stream its entire length adjacent the subject property. The salmon swim upstream under the E&N Railway culvert adjacent the island Highway Bridge then upstream approximately 400m inside the Holland Creek Park to the Dogwood Avenue Bridge. To this point the river is heavily utilized by Chum salmon spawners in October and November. The river then continues upstream past the Lot 103 tributaries in a confined valley. Salmon access lives approximately 1.8km above Dogwood Avenue at Crystal falls, a 10m bedrock barrier. The reach above Dogwood is used by Coho spawners as well as Cutthroat.

Crystal Falls is the first of many in a long (8.5 km) steep climb up to Holland Lake (670m elev.). There are resident Cutthroat trout and Rainbow Trout above the falls to Holland Lake. Holland Lake is impounded and used as part of the Town of Ladysmith water supply (Company Dam).

Holland Creek is protected by a second growth forest that is 30 to 100m in width on each side to the park boundaries and beyond. The forest was logged; the stumps show it was historically dominated by Douglas Fir with Red Cedar near the water. The forest is regenerating with those species as well as Red Alder, Broad Leaf Maple and many shrub species including Willow, Indian Plum, Ocean Spray, Salmonberry, Sword Fern and Blackberry. There are a few veteran Douglas Fir in the forest. This same forest type extends upland into Lot 103 area with the largest trees found in the Heart Creek valley. Lot 103 also has many polygons of younger stands of trees just emerging from the brush as well as a recent logging above either side of Heart Creek.

The Holland Creek foot trail encircles the creek on both sides, with a bridge over each of the Lot 103 tributaries near their entrance to Holland Creek. The Hydro line provides the southwest boundary to the property and Holland Creek/Heart Creek are on the northeast boundary of the lot.

The Holland Creek watershed has seen a concerted effort of salmon enhancement and habitat restoration over the last 20 years. There are now hundreds of pieces of wood debris placed for fish habitat. Four sidechannel areas have been dug out in the lower reaches increasing the summer wetted habitat and winter flood refuge significantly in Holland Creek. This work has been done by a partnership led by the Ladysmith Sportsmen Club working with Stzuminus First Nation Fisheries Program and Town of Ladysmith. There is a hatchery on Bush Creek that incubates approximately 15,000 coho fry and 50,000 Chum fry from this creek annually. There are plans to consider relocation of the Bush Creek hatchery to Holland Creek due to the better water quality, easier access and safety.

Assessment results are presented overleaf with a Map, and Photos for each drainage.

Stream Mapping/Fish Habitat

Streams were at medium to high flow levels during the survey allowing for identification of the mainstems as well as smaller tributaries. There are three Holland Creek tributaries that drain the proposed development area; Tributary 1, 2 and Heart Creek respectively from downstream to up (Figure 1).

Tributaries 1 and 2 are unnamed drainages that enter Holland Creek over bedrock water falls (5m) with no fish access.

Table 1) Holland Creek Lot 103 Fish Habitat Summary.

Drainage	Fish Access/Habitat
Holland Creek	Yes
Tributary 1	No
Tributary 2	No
Heart Creek	Yes

Tributary 1

The mainstem is 830 m long through the property from the hydro line to Holland Creek. It enters over a 5m bedrock falls just north of the Dogwood Avenue Bridge parking lot. The channel is approximately 2.1m wide. The lower reach to the first hydro line (200m) is relatively low gradient at 4-11%. This reach appears to have been diverted from its historic route as the channel has evidence of recent formation with no natural stream characteristics. It was likely diverted west to make way for Dogwood Avenue. Above the old Hydro right of way the channel appears natural but disturbed by historic logging lacking large woody debris. The channel gradient increases to more than 20% and is confined in a small valley with vegetated sidewalls to just below (150m) the Hydro Line where it is fed by three seasonal channels T1, T1-2, T1-3, that braid across the Hydro Line. The channel furthest north is the strongest (T1). The Hydro Line and logging roads appear to have disrupted the natural course in this area such that the historical location is difficult to determine above the split in channels. There is no fish access into this channel. An electroshock in 2010 found no fish in the 200 m along the lower reach where the gradient is less than 20%. The tributary has perennial water flow to Holland Creek.

Tributary 2

The main channel of Tributary 2 is 930m long upstream Hydro line crossing. It has two short tributaries (2B, 2C,) that enter it within the Lot 103 area. Beginning at Holland Creek there is a 4.5m bedrock falls that denies fish access. Upstream this channel was disturbed by historic logging lacking pools and large woody debris. It lies in a semi-confined channel with vegetated sidewalls. The creek channel is 1.7m wide in the lower reach on a gradient of 1-7% above the barrier. It loses its confinement at the Hydro line crossing where it is dry in summer. Water flow is perennial to Holland Creek and in summer this water accrues below the hydro line.

Heart Creek

This is the longest and largest tributary with length of 1.2 km from the Hydro line to Holland Creek. Heart Creek has a 240m long reach of salmon access, ending at a 5m bedrock water falls. Above the falls there is a confined and deep (20-50m) treed valley that creates an isolated reach of Heart Creek to the Hydro Line where the canyon ends. The average channel width was 4.1m on a 10% slope. Heart Creek goes approximately 1.0 km further upstream to its source at Heart Lake. The entire length of Heart Creek is habitat for resident Cutthroat & Rainbow Trout which occupy the lake as well as perennial pockets in the lower reach. The fish are seeded into the entire length of the stream from Heart Lake. The upper reaches above the Hydro line are more disturbed by historic logging and are seasonal while below the Hydro line, there is flow recovery in summer with perennial flow into Holland Creek.

Heart Creek Bridge Site Inspection

The mid reach of Heart Creek is the location of a proposed road location. We inspected the stream channel widths in this area and found the channel width and floodplain ranged between 5.0 and 6.3m. The cross section sites were flagged in the field as XS (see Fig.1). The valley walls in the area were 25% slope on the south and 50% slope on a 10m bank on the north side. There were no significant fish habitat features in the area, pools were shallow and the channel had little LWD. The banks were steep but

vegetated and stable. The stream substrates are Boulder/Cobble/Gravel. There were no significant veteran trees in the vicinity.

Consultation/Planning for Hatchery

Ladysmith Sportsmen Club operate the Bush Creek Hatchery. They built the hatchery with the full support of the Stzuminus First Nation in 1995 after both parties agreed there was a local need. Since then there has been a shared use of the facility. The hatchery enhances Chum and Coho stocks in five local streams; Stocking, Holland, Bush, Walker and the Chemainus River. They have 10 heath stacks and a capacity for 400,000 eggs. Over the years since the hatchery was developed the water quality in Bush Creek has declined. The gravity fed water is colder, carries more sediment and dries to a trickle in early summer. The water supply plugged this year and the eggs were all transported to Nanaimo Hatchery by the club in January. The hatchery also has no electrical power other than a generator so the alarm and fish feeders work off solar power. Its remote location 2.5 km up a logging road has resulted in vandalism and robbery constantly. The new location is next to town and walking distance from local schools allowing the education programs conducted by the Club to expand. The new building may have a classroom for workshops and school programs.

The developers of the property have offered their land for a hatchery at a time when the operators of the hatchery were considering relocation. Consultation meetings have been held this winter, the relocation was discussed by both groups, and they walked the sites. There is an opportunity to use T1 and T2 as well as Heart Creek which all have flowing water year round. An inspection this winter found the water temperatures to be 1-3C warmer than Bush Creek which has a significant effect on egg development timing. The Holland Creek hatchery idea was taken to the DFO Community Programs Community Advisor for advice and permitting. This permit will require a more detailed design to identify the flow and space requirements.

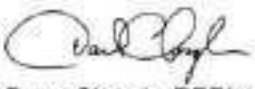
CONCLUSIONS

The assessment of the drainages was made to determine preliminary planning for a residential development. No lot or road determinations are finalized. The developer had instructed us to provide this environmental information such that they could plan around the environmental aspects.

The environmental aspects of this area show Tributary 1 and 2 to be lacking fish access but important water supplies to Holland Creek. The summer water flow contribution of these two streams is approximately 25%. Heart Creek is a fish bearing channel which has a salmon reach to the base of the falls and is populated with resident trout above. Heart Creek is protected by a deep treed ravine which provides shade and habitat to the stream. The T1 and T2 channels are confined or semi-confined in treed depressions. To determine the riparian setback of these channels a Riparian Area Assessment (RAR) will need to be done. The RAR identifies the requirement for building setbacks as well as stormwater management, construction environmental protection as well as Danger Trees, Windthrow, Floodplain, Slope Stability, and Tree Protection.

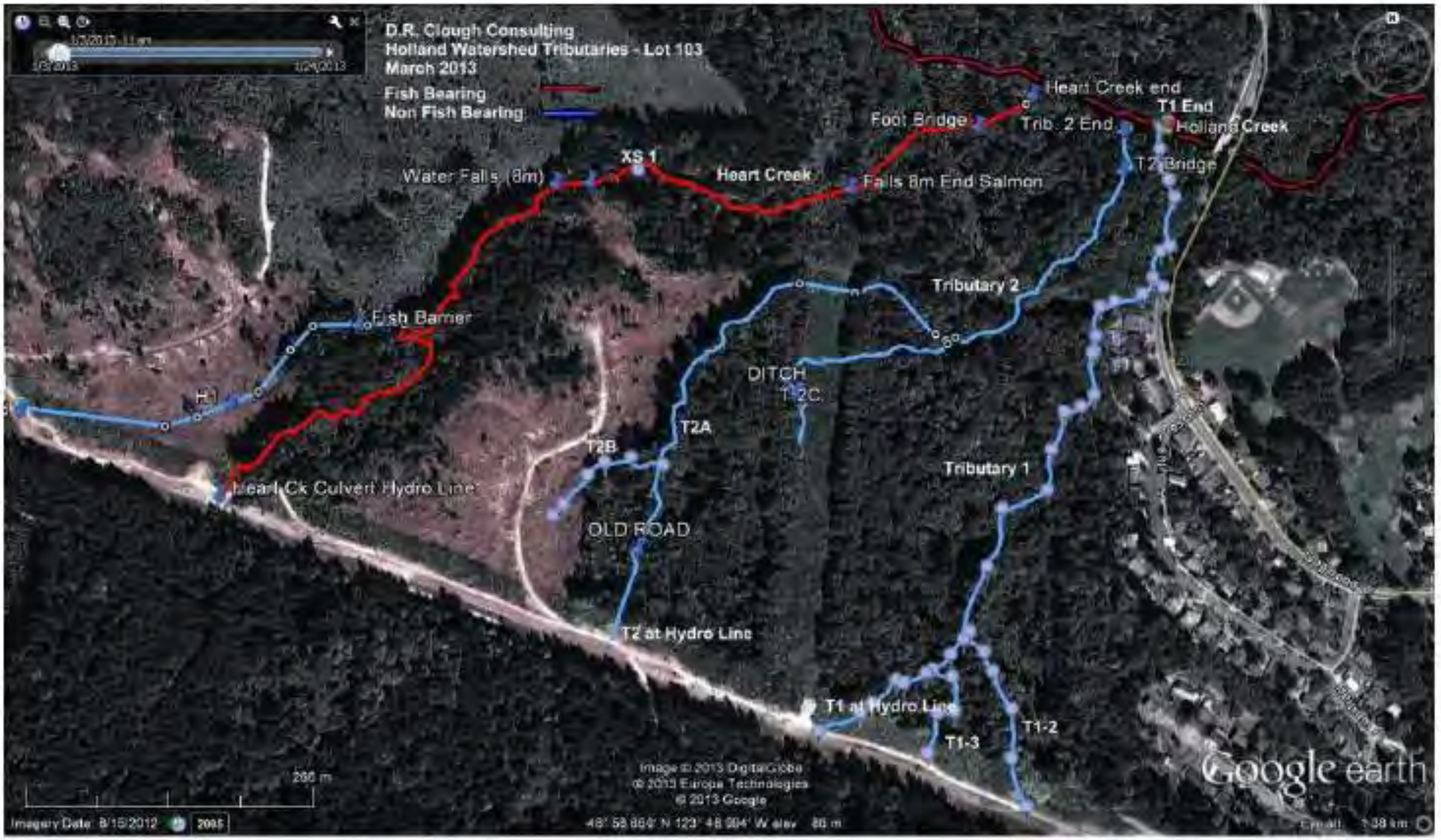
The development of the hatchery will follow a series of regulatory steps, which are out of the control of the proponents but the DFO are indicating their support (they haven't said no) and they should be able to assist in getting the approvals from their auditors and provincial agencies.

Yours Truly,



Dave Clough, RPBio

Figure 1.) Holland Creek Lot 3 Drainage Location and Fish Presence Map.



1.) Holland Chum spawners next to LWD.

4.) Holland Creek sidechannel 1.

2.) Ladysmith Club SalmonBrood capture

5.) Holland Creek mainstem June flow.

3.) Holland Creek Chum egg takes with Students

6.) Crystal falls salmon Barrier.

1.) Trib 1 enters Holland at falls.

4.) Trib 1- Mid reach - steep and confined.

2.) Trib 1 was diverted thru fill adjacent Dogwood Ave

5.) Trib 1-2 at entry to T1.

3.) Washed out culvert at oild Hydro Rd.

6.)T1 and tribs cross at 3 locations on Hydro Line road

1.) Trib. 2 Falls into Holland Creek

4.) Trib. 2C

2.) Washed out culvert at old Hydro Rd

5.) Trib 2B at end.

3.) Trib 2 -mid reach.

6.) Trib. 2 mainstem at Hydro Line

1.) Heart Creek Falls at Lower Hydro line

4.) Heart Ck - second falls in bedrock

2.) Heart Creek above falls

5.) Heart Creek Trib H1 barrier at exit.

3.) Heart Ck near proposed crossing.

6.) Heart Creek at Hydro Line culvert.

Strathcona Forestry Consulting

128 Rollie Rose Drive, Ladysmith, BC

Windthrow & Hazard Tree Assessment

Prepared for: Coastal Legacy Development Ltd.
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14 December 2021

Executive Summary

Strathcona Forestry Consulting was retained by Coastal Legacy Development Ltd. to prepare a windthrow and hazard tree assessment of the riparian area at 128 Rollie Rose Drive (Lot 12). A tributary of Holland Creek flows through the upper portion of the lot, below which the property is proposed for mixed residential development. The RARP (Riparian Areas Protection Regulation) Project lead is Derek Nickel RPBio at Terra West Environmental Inc. The intent is to maintain tree cover where safely possible in conjunction with the planned development. The Riparian Area is to be dedicated to the Town of Ladysmith as parkland.

The purpose of this report is to determine whether there are windthrow concerns within and adjacent to the SPEA as a result of the proposed development, and, where necessary, to prescribe windthrow protection measures.

Forest cover from the northern (lower) portion of the lot has been removed downslope of the stand of trees retained within and along the outer edge of the RAA. Forest cover at one edge segment of Tributary 1 was assessed. Windthrow risk was rated MODERATE. Likelihood of windthrow was rated MODERATE. Five trees (two bigleaf maples, one western hemlock, one red alder, and one western redcedar) were assessed as potentially hazardous; four trees were recommended for treatment; the remaining cedar is deemed safe to retain.

Recommended hazard mitigation includes felling (including options for high stumping and/or retention of coarse woody debris) and coppicing (maple). Coppicing maples wil reduce tree height and remove any dangerous limbs, while encouraging lateral branching. High stumping is encouraged to retain perching sites, while also providing opportunities for installing nesting boxes and bat boxes. Planting with ecologically suitable native trees and shrubs is recommended to rehabilitate previously disturbed portions of the SPEA.

Treatment to prevent windthrow should follow standard strategies to minimize disturbance to rooting layers during clearing and construction, including not creating

windthrow, and protecting trees in the SPEA. Measures to avoid disturbance to existing trees will decrease potential for additional hazard trees.

If the measures identified in this report to protect the integrity of the SPEA and surrounding riparian habitat are implemented, there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes downstream.

Mitigative actions (treatment of hazardous trees and remediation of the SPEA) will yield a net environmental improvement. Recommended strategies will enhance local biodiversity of both riparian and upland forest areas by increasing resiliency. Compliance with these recommendations will ensure risks associated with windthrow and hazard trees can be mitigated to reduce long-term maintenance, while also enhancing safety within and surrounding the riparian forest stand.

Introduction

Strathcona Forestry Consulting was retained by Coastal Legacy Development Ltd. to prepare a windthrow and hazard tree assessment of the riparian area at 128 Rollie Rose Drive (Lot 12). The lot is proposed for mixed residential development. Tributary 1 of Holland Creek flows through the upper portion of the property. The RARP Project lead is Derek Nickel RPBio at Terra West Environmental Inc. The Riparian Assessment Area (RAA) boundary is 30m; the Streamside Protection and Enhancement Area (SPEA) is 10 m for Tributary 1.

The purpose of this report is to determine whether there are windthrow concerns within and adjacent to the SPEA as a result of the proposed development, and, where necessary, to prescribe windthrow protection measures. The intent is to maintain tree cover where safely possible in conjunction with the planned development. The Riparian Area is to be dedicated to the Town of Ladysmith as parkland.

Riparian Areas Protection Regulation

The Riparian Areas Protection Regulation (RAPR) defines "stream" to encompass any watercourse – natural or human-made – that provides fish habitat, contains water on a perennial or seasonal basis, is scoured by water or contains observable deposits of mineral alluvium, and has a continuous channel bed, including a watercourse that is obscured by overhanging or bridging vegetation or soil mats. A watercourse may not itself be inhabited by fish, but may provide water, food and nutrients to streams that do support fish.

Under the Riparian Areas Regulation, a proponent must prepare a Riparian Assessment report in support of their application to local government for development approval if development is proposed within 30 m of a stream or the top of a ravine bank of a stream. The Assessment Report must be prepared by a Qualified Environmental Professional (or group of professionals) who understands the interaction of various features, functions, and conditions of riparian areas. The RAR Assessment Report prescribes the specific requirements of the SPEA (streamside protection and enhancement area) and ZOS (zone of sensitivity). The width of the SPEA, determined through appropriate methodology, outlines required measures to maintain the integrity

of the SPEA. The ZOS, determined through detailed assessment procedures under the RAR, identifies a zone of sensitivity adjacent to a waterbody within which disturbance is restricted, i.e., an undisturbed riparian buffer.

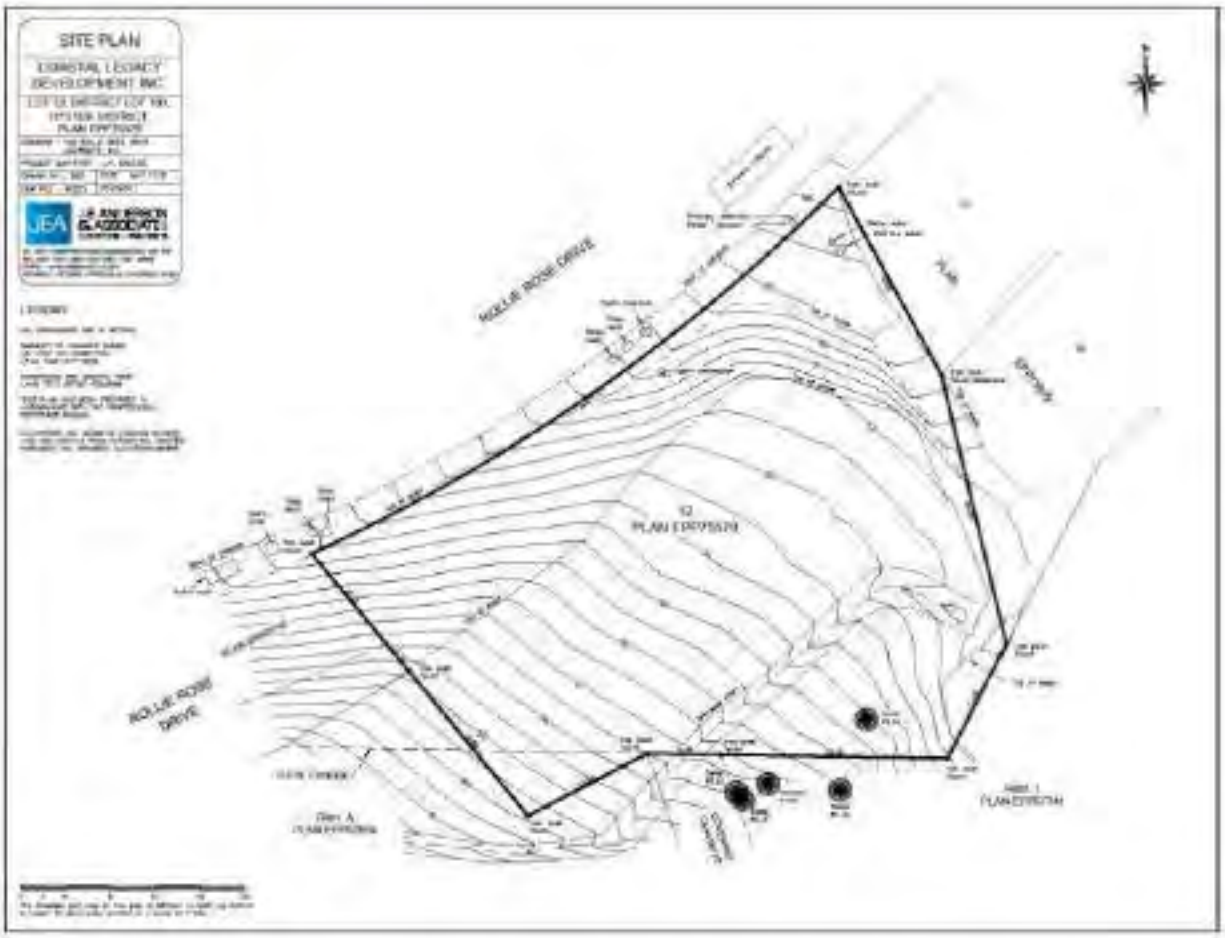
The effects of the biophysical processes through which riparian vegetation influences in stream conditions vary continuously with buffer width. Under the RAPR, a fixed buffer width is generally selected in order to maintain in stream conditions similar to those found in undisturbed forests, and/or to target specific species such as salmonid fishes.

Specific experts (i.e., geotechnical advisors, windthrow specialists) may be called on to provide their relative expertise on site characteristics that may pose specific problems or concerns.

The Riparian Assessment report for the proposal must demonstrate appropriate assessment methods have been followed, and must certify:

I. if the development is implemented as proposed there will be no harmful alteration, disruption, or destruction of natural features, functions, and conditions that support fish life processes in the riparian assessment area, or

II. if the streamside protection and enhancement areas identified in the report are protected from the development and the measures identified in the report as necessary to protect the integrity of those areas from the effects of the development are implemented by the developer, there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area



Top: Topo map. 128 Rollie Rose Drive (provided by client). Bottom: location map.

Site Description

The subject property is located on the upper (south) side of Rollie Rose Drive, a short distance west of Kinsman Place (see map and site survey pg. 6). Upslope and further to the west are cleared areas intended for future residential development, upslope to the south is forested land; new residential development extends north and east. Forest cover had been removed from the lower slope of the subject property.

Tributary 1 of Holland Creek flows northeast through the upper (southern) portion of Lot 1, and discharges into Holland Creek, which in turn discharges into Ladysmith Harbour, less than a kilometre to the northeast. The SPEA on Holland Creek Tributary 1 is dedicated to the Town of Ladysmith for parkland.

The Town of Ladysmith does not have a Tree Protection bylaw

Site Attributes

Biogeoclimatic Classification

The subject site is classified in the Coastal Douglas-fir Moist Maritime Subzone (CDFmm). The CDFmm has warm dry summers and moist mild winters. Prevailing winds in winter are generally southeasterly (to southwesterly). Ecosystems in the assessed area were classified as CDFmm_04/05/01.

Vegetation

The SPEA is forested with mature to maturing second-growth forest cover. Forest cover is "mixed" – with a moderately dense mixture of coniferous and deciduous trees. Coniferous trees dominate - mainly Douglas-fir (*Pseudotsuga heterophylla*), with lesser amounts of western redcedar (*Thuja plicata*), grand fir (*Abies grandis*), and western hemlock (*Tsuga heterophylla*). Deciduous cover includes big leaf maple (*Acer macrophyllum*), and red alder (*Alnus rubra*).

The understorey is characterized by a discontinuous shrub layer (sword fern, salal, and Oregon grape) and a discontinuous moss layer (*Hylocomium splendens, Kindbergia oregana, Rhytidiadelphus triquetus*).

Observations of historical blowdown were minimal. Downed and decaying, cut logs (not new) were observed north of, and outside the RAA, on the upper portion of the slope at the subject property.

Soils in the area developed in moderately deep, sandy gravelly fluvial, fluvioglacial and/or marine deposits. Soils are well to imperfectly drained. Very gravelly to gravelly loamy sand is the usual texture in the upper horizons; subsoils consist of very gravelly loamy and or very gravelly sand. The coarse fragment content is at least 35% and usually exceeds 50% by volume. A weak to moderate cemented layer is generally present at depths between 35 and 90 cm; relatively unweathered parent material is encountered at depths between 1.5 and 2 m. The usual taxonomic classification is Orthic Dystric Brunisol; the lesser common soil is a Duric Dystric Brunisol (MoE Technical Report 17).

Site Visit

Field work took place in December 2021 (see photos next two pgs.). At the time of the assessment, property survey pins were evident, and the SPEA was flagged.

Potentially hazardous trees were recorded but not GPS referenced due to the relatively small size of the site and relatively limited extent of forest cover.

PHOTOS – 128 Rollie Rose Drive

Sign on northern edge of SPEA; upper portion of lot.

128 Rollie Rose Drive: Left: view looking northeast. Right: view north at new homes on Rollie Rose Dr.

Remnant forest extending north from Holland Creek Tributary 1.

Holland Creek Tributary 1.

View looking north from upper portion of lot. Note woody debris.

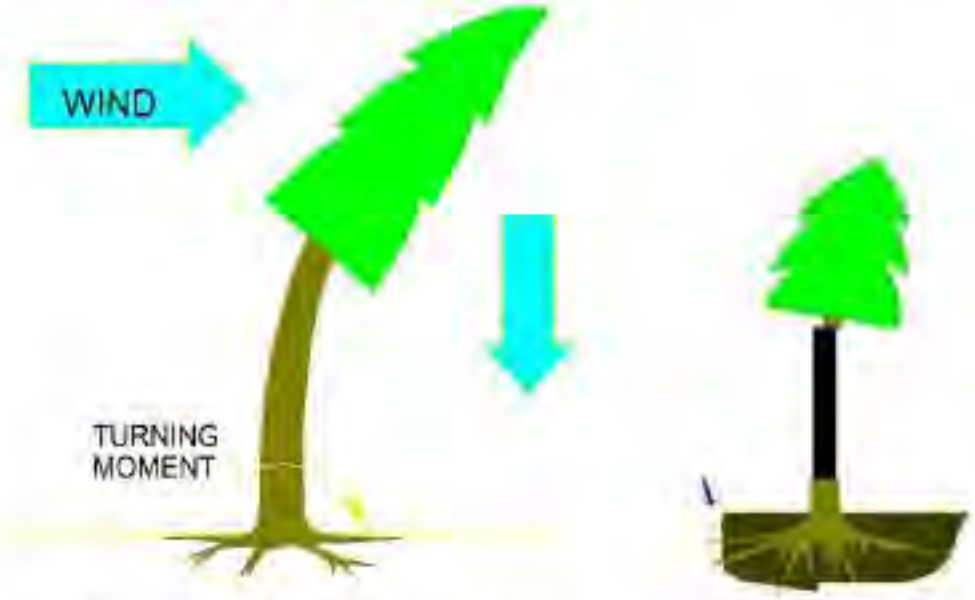
Abandoned shelter on southern side of Tributary 1.

Windthrow – Background Discussion

> Windthrow (Tree fall) – tree uprooting or stem breakage that results when wind loads exceed stem or anchorage strength.

The purpose of windthrow assessment is to determine whether there are windthrow concerns as a result of proposed development and prescribe windthrow protection measures outside of the SPEA.

In coastal BC, the most common cause of stand damaging winds is the western movement of extra-tropical low pressure systems from the Pacific Ocean. These storms produce counter-clockwise rotating regional-scale wind fields that interact with local geography and terrain. Pacific low pressure systems are strongest during the coolest months (i.e. October to April) when they are accompanied by gusty winds and high rainfall. The long duration of these storms and the high rainfall can be significant factors in windthrow risk because root-soil cohesion breaks down as trees rock back and forth in wet soil. In routine events, local geography and terrain produce predictable differences in local wind speeds. Catastrophic damage patterns during intense systems are less dependent on local terrain.



During strong Pacific low systems with wind and heavy rains, root-soil cohesion breaks down as trees rock back and forth in wet soil (left). Intense winds can cause boles to "snap" (right).

The other large scale weather systems which can cause stand damaging winds are arctic ridges of high pressure. These cold, dry systems occasionally move south over the interior of BC and outward toward the coast. Strong outflow winds through major valleys are associated with these winter systems, particularly when there is an offshore low pressure system and therefore a steep differential gradient in surface air pressure (high to low).

In the summer, local wind effects are created where strong differences in air temperature develop. On-shore winds develop in the afternoon as the land heats up relative to the ocean.

Windthrow Assessment

Windthrow hazard and likelihood assessment is conducted on those areas in the stand (edge segments) that have a risk to values or objectives as a result of windthrow.

1. A set of diagnostic questions is used to assess various hazards for windthrow.

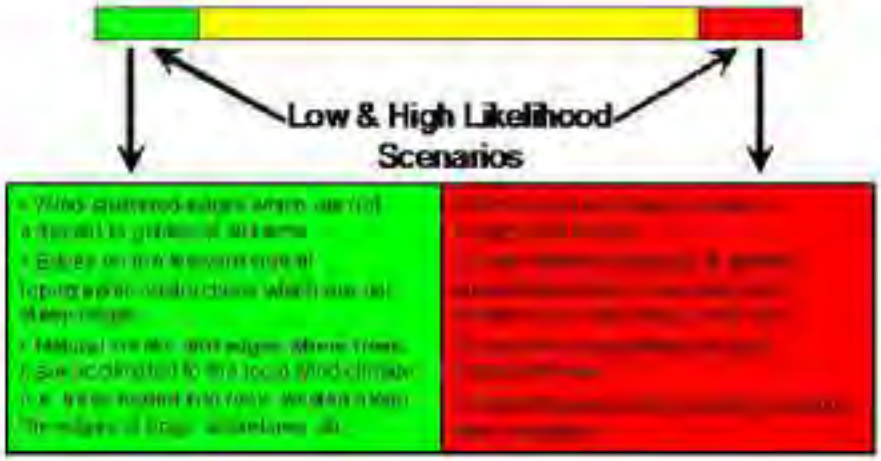
2. Three hazard components (topographic, stand and soil) are assessed and then brought together in a ranking table to provide an overall biophysical hazard for windthrow. The three components take into account location, and characteristics of the stand and soil median - all factors critical to assess the inherent hazard of the area for windthrow – i.e., the biophysical hazard.

> Biophysical Hazard – the intrinsic stability of the stand in its pre-treatment condition. The inherent ability to resist wind damage is the cumulative result of topographic, soils and stand features interacting as the stand develops with endemic windloading.

3. The biophysical hazard is then used along with an estimate of treatment hazard (activity associated with development) to rank the likelihood of windthrow occurring on the edge segment.

> Treatment Hazard – is the way in which a particular treatment increases or decreases the windloading or wind resistance of trees. A simple example of treatment hazard is the influence of land clearing to expose new edges. Treatment hazard can be reduced by further treatments such as pruning, or topping.

Treatment hazard ranges from low to high depending on how or where land clearing will be applied. The two working together give an indication of how likely windthrow will be on the edge or within a retained forest stand, (i.e., the likelihood of windthrow).



4. Once the likelihood of windthrow is determined, consequences are considered to provide an assessment of windthrow risk. Windthrow risk is the combination of the likelihood of windthrow and the potential consequences of that windthrow. Windthrow risk reflects the risk associated with the site plan, considering the likelihood of windthrow against limits (thresholds) that are set based on consequences.

Windthrow risk is not equal to the likelihood of windthrow. If considerable windthrow is expected, but there are no consequences, there is little risk.

Windthrow impact definitions

- *Windthrow Likelihood* - is the expected level of damage from endemic winds. It combines Biophysical Hazard and Treatment Hazard.
- *Windthrow Consequences* - is the probable level of impact on specific management objectives, or sensitivity of those objectives, if the expected level of windthrow occurs.
- *Windthrow Risk* - is the potential for a negative consequence from windthrow caused by endemic winds. It is the combination of Windthrow Likelihood and Consequence.

Windthrow treatment, when prescribed, is necessary to retain and/or enhance riparian habitat and reduce hazard (to workers, residents, visitors, structures).

FIELD ASSESSMENT

Forest at an edge segment on the northern slope below Tributary 1 was examined:

SPEA and surrounding tree cover at RAA were assessed.

1. **Edge segment: SPEA and surrounding forest cover (on upper, northern slope)**

Wind force Indicators:

Biophysical Hazard -

Topographic Exposure: Is this a windy area?
Midslope location. Terrain features (low hills to south and west) decrease windiness; hills are sufficiently high to deflect the general wind profile. Removal of tree cover on the lower side of the RA likely does not have a significant impact on wind disturbance.
Leeward side of prevailing winds.
Topographic Hazard Class: Moderate (intermediate)

Stand stability: Are trees acclimated to wind loading?
Trees are generally acclimated to wind loading. Edge segment incorporates natural stand edge (stream banks). Mature stand has moderate density.
Tree-level indicators of acclimatization: Dominants and codominant conifers trees with medium-sized live crowns; relatively high degree of taper. Mature deciduous trees (big leaf maple and red alder) > 25 m height, potentially unstable canopies.
Stand Hazard Class: Moderate (neutral)

Soil Anchorage: Is root anchoring restricted by an impeding layer, low strength soil, or poor drainage? Is this a closed-canopied stand? Is there evidence of blowdown?
Root anchorage restricted by an impeding layer. Well- to imperfectly-drained soils in the area have moderate soil strength.

Soil Hazard Class: Moderate (neutral)

Treatment Hazard: Will the proposed disturbance substantially increase wind loading on trees along the stand edge or retained trees?
Boundary does not face directly toward winds. Boundary not exposed to multiple wind directions.
Treatment Hazard Class: Moderate (moderate increase)

WINDTHROW LIKELIHOOD EVALUATION Biophysical Hazard = Topographic, Stand and Soil Hazards Windthrow Likelihood = Biophysical Hazard + Treatment Hazard If Treatment Risk is 'None,' then Windthrow Likelihood is 'None.'						
	Very High	**High**	**Moderate**	**Low**	**Very Low**	**None**
Topographic Hazard		3	**2**	**1**	-	-
Stand Hazard		3	**2**	**1**	-	-
Soil Hazard		2	**1**	**0**	-	-
Biophysical Hazard	8	6-7	**4-5**	**<4**	-	-
Treatment Hazard		6	**4**	**2**	-	
Windthrow Likelihood	14	12-13	**10-11**	**6-9**	<6	

Windthrow Risk Category
What will be the consequences for safety and liabilities?

VERY HIGH – very negative consequences	HIGH – negative consequences
MODERATE – slightly negative consequences	LOW – minimal to no consequences

LIKELIHOOD of EXCEEDING WINDTHROW THRESHOLDS:	
Likelihood categories	
Nil –	Both assessed likelihood for penetration and amount are not close to thresholds
Low –	Assessed likelihood does not exceed either thresholds buy may be close
Mod –	Assessed likelihood somewhat exceeds amount threshold, but does not seem to exceed penetration threshold (where applicable)
High –	Assessd likelihood considerably exceeds amount threshold, and/or seems to exceed penetration thresholds by a small amount (if applicable)
Very High –	Assessed likelihood considerably exceeds penetration threshold, as well as amount threshold (if both apply)
Estimate likelihood of exceeding windthrow thresholds: Low-Mod	

WINDTHROW RISK ASSESSMENT				
DIAGNOSTIC QUESTION: If the thresholds for windthrow are exceeded as expected, what will be the consequences for development values, safety, liabilities and riparian management concerns?				
Risk =	☐ Very High (very negative)	☐ High (negative)	☐ ✓Moderate (slightly negative)	☐ ✓Low (minimal to no consequences)

Generally, Very High, or High risk situations must be addressed to lower risk. A Moderate risk situation may also need to be addressed with mitigation measures, depending on consequences.

Hazard Tree Assessment:

Tree #	SPEA Tree	Species*	DBH	Height	Description and Recommended Treatment
1	N	Mb	15	6	Tree Class 4 (snag). Coppice (cut at 5 m). (Directional falling will result in tree falling downslope, away from RAR).
2	N	Hw	60	22	Tree Class 2. Fell. Stem damage. Fell. (Directional falling will result in tree falling downslope, away from RAR).
3	N	Cw	85	25	Mature cedar. Branches > half way down bole. Sapsucker activity. Retain. Monitor for signs of potential deterioration. Avoid damaging roots.
4	N	Mb	48&55	22	Class 2. Split trunk. Coppice. Beside "1" post and Remnant A sign. Dead limbs and minor lean to site. Coppice at 5 m.
5	N	Dr	20	9	Tree class 5. Fell. Retain CWD along RAA boundary.

*see Tree Species abbreviation list Appendix 1

BEST MANAGEMENT PRACTICES to MANAGE WINDTHROW RISK and HAZARD TREES

Treatment	Description	Recommended for Tree #
Topping	Removal of upper crown and stem	
Top pruning	Removal of branches from the upper crown	
Spiral pruning	Removal of branches throughout the crown	
Edge feathering	Intended to mimic partial damage along edges. Vulnerable trees (i.e., slender trees, codoms, low live crown ratios) are harvested at the edge before (it is assumed) they will blow down	
Coppicing	Deciduous trees are cut to reduce height and branching; live stem is retained	1,4
Remove / High stumping and/or retention of CWD may be a consideration	Tree is determined to be a hazard, and requires falling. Where safe, consider high stumping to retain value for wildlife. Where not safe, consider retaining Coarse Woody Debris to enhance biodiversity	2,5

Tree # 4. Split trunk maple.

Tree # 2. Hemlock with unstable rooting.

Tree # 3: large cedar – retain.

Assessment Results

Windthrow risk at forest cover along Holland Creek Tributary 1 SPEA at 128 Rollie Rose Drive is rated Moderate. Windthrow likelihood is Moderate. Five (5) trees along the outside northern fringe of the RAA on Tributary 1 were assessed as potentially hazard trees; four (4) are recommended for treatment. Two trees (big leaf maple) are recommended for coppicing. A large hemlock with defects poses a risk to the proposed development, and should be felled, similarly, a red alder snag is recommended for felling. Identified hazardous trees have defects which could increase susceptibility to wind damage, which poses a risk to workers and future residents.

Care must be taken during development to avoid disturbance within the drip line of trees along the edges of the RAA. Damage to "edge" trees will increase susceptibility to windthrow and disease.

The coast of British Columbia is subjected to severe storms in the fall/winter. The subject site is somewhat protected from prevailing winds by local topographic features (nearby hills, mid-slope position). Extended periods of little precipitation – as occurred in the summer of 2021 – can cause severe stress to trees. Long dry spells make trees more susceptible to fungi and insects. In a prolonged drought, studies indicate tree deaths can occur as a result of carbon starvation because trees close their stomata, blocking entry of carbon needed for photosynthesis. Drought-damaged, weakened trees are extra susceptible to damage from heavy winds and rain in severe storms.

Best management practices to manage windthrow risk and hazard trees generally involve a variety of treatments, including spiral pruning, coppicing (to remove dead/dying high branches and reduce height while encouraging lateral branching) and removal (with options for high stumping and / or retention of coarse woody debris). In this case, removal (directional falling into SPEA) is recommended. High stumping is recommended for the maples, which can be expected to coppice. Nesting boxes for bats and birds could be considered for high stumps.

Summary of Recommendations

BEST MANAGEMENT PRACTICES to MANAGE WINDTHROW RISK and HAZARD TREES at 128 Rollie Rose Drive

Treatment	Description	Recommended for Tree #
Topping	Removal of upper crown and stem	
Top pruning	Removal of branches from the upper crown	
Spiral pruning	Removal of branches in the crown to reduce heavy weight of upper tree canopy, reducing potential for windthrow; spiral pruning retains height and integrity of the tree	
Edge feathering	Intended to mimic partial damage along edges. Vulnerable trees (i.e., slender trees, codoms, low live crown ratios) are harvested at the edge before (it is assumed) they will blow down	
Coppicing	Deciduous trees are height trimmed to remove heavy windthrow-prone upper crowns and dangerous upper limbs; low lateral branching is encouraged; live stem is retained to readily re-sprout	1,4
Fell – high stumping and/or retention of CWD may be a consideration	Tree is determined to be a hazard, and requires falling. Where safe, consider high stumping to retain value for wildlife. Where not safe, consider retaining Coarse Woody Debris to enhance biodiversity	2,5

General Guidelines:

- At pre-work meeting(s), review tree list and management priorities with workers. Tree protection fencing must be in place to ensure appropriate setbacks. (See Site Plan and tree list, Appendix 1)
- Prior to commencement of clearing/construction, an ocular survey should take place to identify any additional Danger Trees that may result from conditions occurring after this assessment took place. Appropriate treatment must be implemented prior to clearing/construction in order to ensure the site is safe for the uses intended.
- During site preparation and construction, monitor clearing and construction within the RAA adjacent to the SPEA by a QEP.
- Use a qualified Arborist for the treatment work.

- Assign a qualified monitor to oversee tree retention and protection activities within the development area throughout the length of the project.
- Wherever safely possible, attempt to retain existing tree cover within the SPEA, in order to maintain bank stability.
- Minimize disturbance to roots of trees within the RAA and on the edge of the SPEA. Limit ground disturbance within the drip line (at least 3 m from boles of trees) within the RAA from the edge of the SPEA.
- Retain native ground cover in SPEA (salal, Oregon grape, salal, ferns, mosses, etc.)
- Promptly re-vegetate any areas disturbed within and surrounding the SPEA with native trees and shrub species ecologically suited to the site (as per direction from a QEP, and under direction of a qualified landscaper). Numbers of plantings may need to be adjusted pending a post-clearing survey by a QEP.
  Recommended replacement plantings:

Plantings	**Size**	**Spacing**	**Total Number*** * assess after land clearing
Red huckleberry *(Vaccinium parvifolium)*	2 or 5 gal. pots	1.5 x 1.5 m (Plant throughout)	30+
Western redcedar *(Thuja plicata)*	415 or 615 1-0 PSB	1.5 x 1.5 m (Spot plant within SPEA)	25+
Sword fern	2 or 5 gal. pots	2 x 2 m (Plant along e portion of SPEA)	20+

- Coarse woody debris (CWD) that could be added into the SPEA will use local trees treated from inside and outside the SPEA (approximately no more than 1 m of CWD per lineal m of SPEA).
- Remove invasive plant species from the RAA and surrounding area (i.e., holly, daphne).
- Retain existing "regen" (naturally seeded-in conifer seedlings

Conclusions

Implementation of mitigative actions (e.g., hazard tree treatment and remediation of the SPEA) will yield a net environmental improvement. Remediation will increase resiliency of riparian forest at Tributary 1. The majority of the identified potentially hazardous trees at the site are very likely to fall down in the near future, especially given the intensity of storms occurring through the fall of 2021 and forecast to continue into the winter. Remediation will provide a better outcome for this forest. Remediation will compensate identified deficiencies with species diversification (overstorey and understorey) and habitat diversity (increased levels of coarse woody debris). Species and habitat diversification will result in succession to a more maintenance-free and safer forest.

If the measures identified in this report to protect the integrity of the SPEA and surrounding riparian habitat are implemented by the developer, there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in (and/or downstream of) the riparian assessment area. Strategies to sustain tree cover will help enhance local biodiversity of both riparian and upland habitats. Finally, if the recommendations contained in this report are followed during planning and construction, risk associated with windthrow and hazard trees can be mitigated to ensure the safety of the intended development.

Appendix 1. Tree Species Names

Tree Species Abbreviations, Common Names & Latin Names

Bg – Grand fir (*Abies grandis*)
Cw – Western redcedar (*Thuja plicata*)
Dr – Red alder (*Alnus rubra*)
Fd – Douglas-fir (*Pseudotsuga menziesii*)
Hw – Western hemlock (*Tsuga heterophylla*)
Mb – Big leaf maple (*Acer macrophyllum*)
Dogwood = Western flowering dogwood (*Cornus nuttallii*)

LIMITATIONS

This report provides an assessment of windthrow/danger tree hazard and risk. Evaluation is based on professional judgment. The investigation involved a field observation. Recommended treatment pertains only to the particular site as disclosed at the time of inspection. The report was prepared considering site-specific circumstances and conditions. It is intended only for use by the client for the purpose for which it was commissioned and for use by local government regulating the activities to which it pertains.

Prepared by:

Margaret Symon, R.P.F. 1485 A.B.C.F.P.
Dangerous Tree Assessor Certification: W8668
Windthrow Assessor credentials: NRPCanada

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27 July 2024

To: Julia Tippett, Planner E: jtippett@ladysmith.ca
Development Services Department
Town of Ladysmith, BC

cc: Brett Carrothers E: hollywoodtreeco@gmail.com
Chris Sharpe E: Chris.Sharpe@shaw.ca

Re: 128 Rollie Rose: Tree Preservation Plan

Background: At the request of Mr. Chris Sharpe, property owner, 128 Rollie Rose Road, and in accordance with the Town of Ladysmith DPA 8 (ESA Multi-Unit Residential Development Permit Area) Guidelines, this report provides a Tree Preservation Plan for the forested riparian buffer on the southern rim of the subject property, which is proposed for multi-family residential development. The Tree Preservation Plan was prepared by Brett Carrothers, ISA Certified Arborist PN-9165A, Holly Wood Tree Co. in liaison with Margaret Symon, RPF, Strathcona Forestry Consulting.

Site Visit and Description: Accompanied by Chris Sharpe, field inspections were conducted July 18 and 19, 2024 to review site conditions. The subject property straddles a tributary of Holland Creek. In 2021, Terra West Environmental Inc. conducted the RAPR (Riparian Areas Protection Regulation) assessment to determine the Streamside Protection Enhancement Area (SPEA). Signage along the edge of the SPEA denotes the boundary between the cleared away of the lot and the SPEA, which contains mature, mixed forest cover. Outside of the SPEA, since 2021, the owner has regularly implemented brushing activities to control the infestation of invasive weed species (e.g., Scotch broom [*Cytisus scoparius*], Himalayan blackberry [*Rubus armeniacus*]) at the cleared portion of the lot. Brushing treatments have effectively reduced the vigour and spread of invasive species at the property. Inspection of the SPEA perimeter in July 2024 did not identify specific trees hazardous to the proposed development. Ongoing monitoring of the tree cover is recommended, however, as conditions can change due to various conditions (e.g. windstorms).

Recommendations: In conformance with the DPA 8 Guidelines, the following measures are recommended to maintain the integrity of the riparian buffer at the subject property:

1) Prior to construction activities, QERP* to delineate the riparian buffer with snow fencing. Additionally, flag out rooting zones (length = 6 x tree dbh) and clearly delineate rooting zones around perimeter trees along the SPEA/riparian setback.
2) Retain trees within the SPEA (unless identified as a danger/windthrow hazard)
3) Prior to commencement of land clearing and construction, a certified danger tree assessor must be retained to conduct an ocular survey to identify any hazardous trees within and along the perimeter of the SPEA that may have resulted from conditions (natural and/or manmade) occurring after inspections took place in July 2024. Should any trees be designated as hazardous, appropriate mitigation must be done to abate the hazard.
4) A qualified monitor (QERP) must oversee tree retention and protection activities within the subject area during of the project.
5) Identified Danger Trees should be treated outside the bird nesting window for the region (no felling March 15- August 15).
6) Any hazard trees identified to be felled that have trunks >40 cm dbh should be placed in forested buffer area as CWD (coarse woody debris). Any coarse woody debris (CWD) added to reserve zone will constitute no more than 1 m of CWD per lineal m of setback boundary. Inputs of coarse woody debris to the forest floor along the perimeter of the setback area will improve soil function, structure and productivity, and will increase opportunities for small animal species, such as salamanders and voles.
7) At pre-work, ensure workers are aware no disturbance within flagged riparian area and rooting zones is not permitted. Ensure workers sign off their acknowledgement.
8) Minimize disturbance to roots of trees within and on the edge of forested buffer. Minimize ground disturbance within the drip line (a distance equivalent to 6 x dbh) from boles of trees of perimeter trees.

   Tree protection barriers must be built to ensure trees are not damaged during construction. Barriers are required around any protected/retained trees that could be impacted by development. Materials: Install plastic mesh screening and stakes around retained trees; install a minimum distance of six (6) times the tree diameter.
9) Post-construction, permanent fencing (e.g., split cedar rail) is recommended to demarcate forested buffers post-construction.
10) Promptly re-vegetate any areas of soil disturbed by land clearing and construction with approved landscaping materials and/or native plant species. Re-vegetate areas of exposed soil with ecologically suitable native tree and shrub species of a size that will quickly re-establish cover when construction activities are deemed complete in order to minimize encroachment of invasive weed species (e.g. broom, Himalayan blackberry, English ivy, daphne).
11) Where forest cover has been inadvertently (or previously) reduced along edges of the forest stand, under-plant ecologically suitable, native herbs and shrubs (e.g., snowberry, Pacific

dogwood, baldhip rose, salal, sword fern. Numbers of plantings will need to be calculated pending a post-clearing survey (RPF). Suggested plantings could include:

Plantings	Size	Spacing	Total Number* * assess after land clearing
Salal (*Gaultheria shallon*)	2 or 5 gal. pots	1x1 m	TBD
Red huckleberry (*Vaccinium parviflorum*)	2 or 5 gal. pots	1x1 m	TBD
Sword fern (*Polystichum munitum*)	2 or 5 gal. pots	1.5 x 1.5 m	TBD
Dogwood (*Cornus nutalli*)	5 gal. pots	2 x 2 m	TBD

12) At pre-work, ensure workers are aware no disturbance within flagged riparian area and rooting zones is permitted.

13) Management of soil:

Minimize clearing and the amount of exposed soil.

- Identify and protect areas where existing vegetation, such as trees, will not be disturbed by construction activity.
- Protect stream and woodland buffer from any disturbance or construction activity by fencing or otherwise clearly marking these areas.

Sequence construction activities so that the soil is not exposed for long periods of time.

- Schedule or limit grading to small areas.
- Install key sediment control practices before site grading begins.
- Schedule site stabilization activities, such as landscaping, to be completed immediately after the land has been graded to its final contour.

Inspect and maintain silt fences after each storm.

- Make sure the bottom of the silt fence is buried.
- Securely attach the material to the stakes.
- Don't place silt fences in the middle of a waterway or use them as a check dam.
- Stormwater should not flow around the silt fence

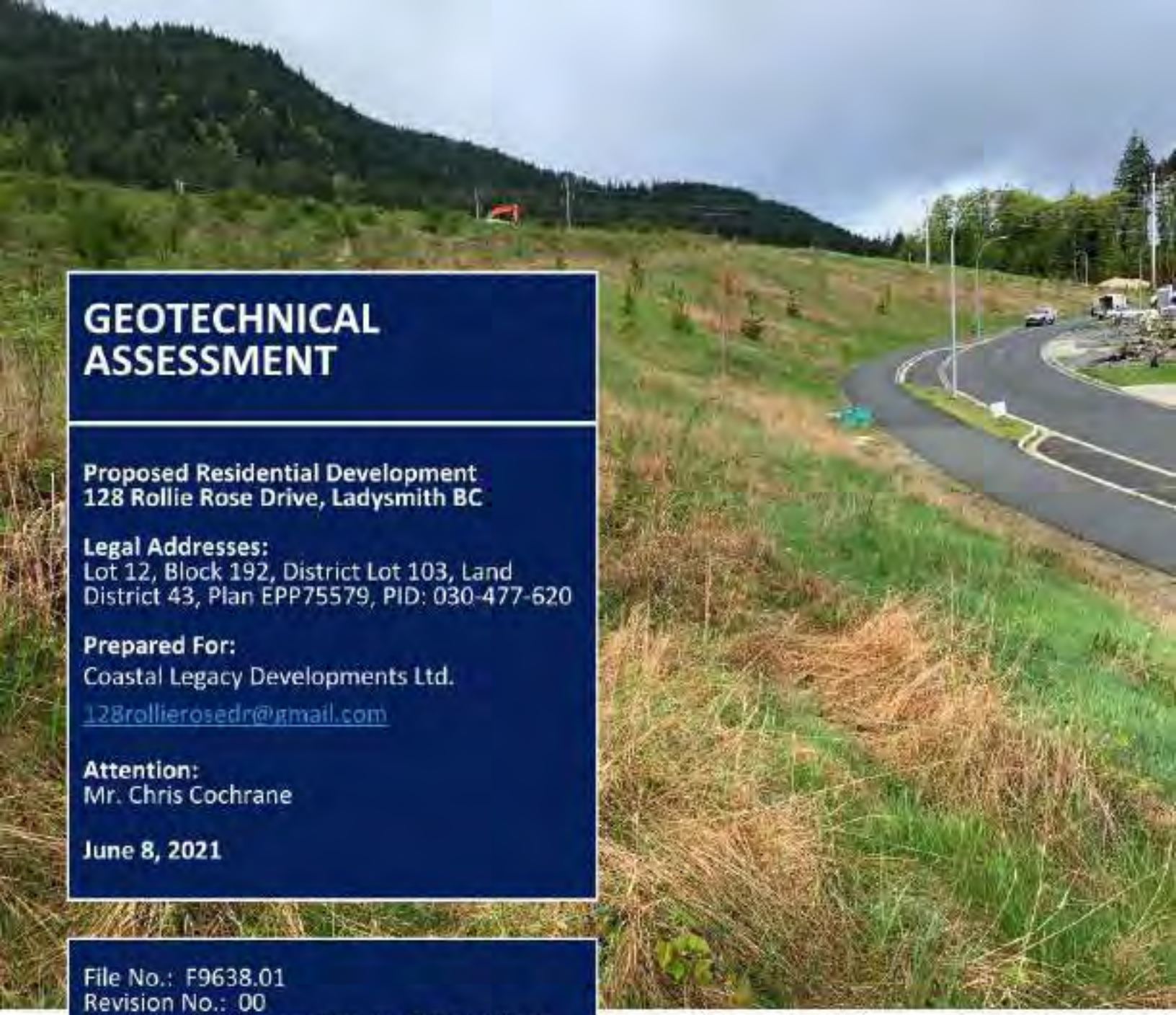
14) Discourage future residents from damaging retained trees by not loading rock fill on roots, not tying ropes or wires around tree stems, and not hammering nails into trees.

***=Qualified Environmental Registered Professional**

Prepared by:

Brett Carothers , ISA Certified Arborist PN-9165A

& Margaret Symon RPF PCP WMS WDA



GEOTECHNICAL ASSESSMENT

Proposed Residential Development
128 Rollie Rose Drive, Ladysmith BC

Legal Addresses:
Lot 12, Block 192, District Lot 103, Land District 43, Plan EPP75579, PID: 030-477-620

Prepared For:
Coastal Legacy Developments Ltd.
128rollierosedr@gmail.com

Attention:
Mr. Chris Cochrane

June 8, 2021

File No.: F9638.01
Revision No.: 00
Prepared by: Tennes Hamre, GIT and Chris Hudec, M.A.Sc., P.Eng.

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LEA Lewkowich Engineering Associates Ltd.

DISCLAIMER

1. Lewkowich Engineering Associates Ltd. (LEA) acknowledges that this report, from this point forward referred to as "the Report," may be used by the Town of Ladysmith (ToL) as a precondition to the issuance of a development and/or building permit and that this Report and any conditions contained in the Report may be included in a restrictive covenant under Section 56 of the Community Charter and registered against the title of the Property at the discretion of the ToL.
2. This report has been prepared in accordance with standard geotechnical engineering practice solely for and at the expense of Coastal Legacy Developments Ltd. We have not acted for or as an agent of the ToL in the preparation of this report.
3. The conclusions and recommendations submitted in this Report are based upon information from relevant publications, a visual site-assessment of the Property, anticipated and encountered subsurface soil conditions, current construction techniques, and generally accepted engineering practices. No other warrantee, expressed or implied, is made. If unanticipated conditions become known during construction or other information pertinent to the structure becomes available, the recommendation may be altered or modified in writing by the undersigned.
4. This Report was authored, to the best of our knowledge at the time of issuance, with considerations for local requirements specific to the Authority Having Jurisdiction (AHJ) and their standards for the preparation of such reports, the 2018 British Columbia Building Code (BCBC), and current engineering standards. Updates to municipal bylaws, policies, or requirements of the AHJ, or updates to the BCBC and/or professional practice guidelines may impact the validity of this Report.
5. This Report has been prepared by Mr. Tennes Hamre, GIT and Mr. Chris Hudec, M.A.Sc., P.Eng. Both are adequately experienced and are also members in good standing with their association, the Engineers and Geoscientists of British Columbia (EGBC).

EXECUTIVE SUMMARY

1. The following is a brief synopsis of the Property, assessment methods, and findings presented in the Report. The reader must read the Report in its entirety; the reader shall not rely solely on the information provided in this summary. This site-specific Report supersedes all previous geotechnical reports.
2. The subject Property, 128 Rollie Rose Drive, Ladysmith, BC, from this point forward referred to as "the Property," is located on the east coast of Vancouver Island within the jurisdictional boundaries of the ToL. The proposed development for the Property at the time of this Report consists of the construction of a multi-family residential development consisting of 3 townhouse buildings with a total of 7 units.
3. A site-specific hazard assessment was conducted to identify potential geotechnical hazards related to the subject Property. A steep slope hazard was the only potential hazard identified.
4. The findings confirm the development is considered safe as proposed.

List of Abbreviations Used in the Report

Abbreviation	Title
BCBC	British Columbia Building Code
EGBC	Engineers and Geoscientists of British Columbia
JEA	J.E. Anderson & Associates Ltd.
LEA	Lewkowich Engineering Associates Ltd.
ToL	Town of Ladysmith
TP	Test Pit

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 General

As requested, LEA has carried out a geotechnical assessment of site conditions at the above noted Property as they relate to the proposed multi-family townhouse development. This Report provides a summary of our findings, recommendations, and conclusions.

1.2 Background

a. We understand the development as proposed consists of 3 townhouses with a total of 7 units in the ToL.

b. We understand the development will preferably be constructed utilizing cast-in-place foundations, slab-on-grade or wood-joist flooring systems, with wood-framed superstructures.

c. We assume the proposed development will include the installation of associated on and off-site civil works and services. At the time of this Report, we understand the development as proposed does not include any below grade parking (parkade) or below grade living space (basement, or similar).

1.3 Assessment Methodology

a. A subsurface investigation was carried out on April 30, 2021, using a Zaxis 135 excavator. A total of four (4) TPs (TP 21-01 to TP 21-04) were excavated at locations within the Property. All TPs were backfilled upon completion of our investigation.

b. A desktop study and literature review of the available background information including; surficial and bedrock geology maps, seismic hazard maps, and previous geotechnical studies in the immediate area.

c. A site plan showing the location of the TPs (Drawing F9638-01) is attached, following the text of this Report.

d. The TP locations were sited to provide good general coverage of the Property given the available information regarding building locations at that time, and general access to the developed residential Property as dictated by trees, and underground servicing.

2.0 SITE CONDITIONS

2.1 Physical Setting

a. The subject Property is located near Holland Creek in a new subdivision development off Dogwood Drive in the southern portion of the ToL, within the jurisdictional limits of the ToL.

b. The Property is an irregular shaped lot which lies to the south of Rollie Rose Drive and approximately 30m to the southwest of Kinsman Place. The location of the Property is shown below in Figure 2.1.

Figure 2.1 – Location Plan of Subject Property[1]

c. The Property is located within Development Permit Area (DPA) 6 – Riparian and DPA 8 – Multi-Unit Residential ESA[1] and is subject to the requirements of the Holland Creek Local Area Plan Schedule C[3a].

2.2 Terrain and Features

a. The Property has been previously graded along the Rollie Rose Drive frontage sloping to the northwest with approximately 6.0m of vertical relief as measured from the crest of the slope. The 6.0m of vertical relief is over a horizontal distance of 15.0m, which equates to a slope of approximately 21.0 degree or 38.0 percent. The crest of the graded slope trends approximately westward across the Property before turning southwestward towards the east side of the Property. The remainder of the Property to the south slopes gradually to the east with approximately 9.0m of vertical relief. The 9.0m of vertical relief is over a horizontal distance of 52.0m, which equates to a slope of approximately 9.8 degrees or 17.2 percent. Please reference the attached Site Plan prepared by JEA for further information.

b. A drainage ditch follows the gradual slope on the south side of the Property. The ditch extends northeast across the Property before existing near the southeast side of the Property.

c. The above distances are estimates based on measurements taken in the field during our investigation, available site plans, and a review of available satellite imagery and topographical information available on Google Earth[9].

2.3 Regional Geology

a. Surficial geology for the area[5] is classified as having glaciofluvial sediments, comprised of sand and gravel deposits related to outwash from previous glaciations. Much of the low-lying coastal areas, including Ladysmith and Chemainus are draped by up to twelve metres of sandy diamicton (sdMb)[5].

b. Bedrock geology for the area[6] is classified as undivided sedimentary rocks of the Upper Cretaceous, Nanaimo Group.

2.4 Soil Conditions

a. Consistent soil strata were encountered during the TP investigation. Generally, these strata consisted of topsoil and/or surficial fills comprised of a loose, brown to black, moist, silty sand and gravel with some organics, underlain by a loose to compact, moist, brown, sand and gravel with trace to some silt and trace organics, underlain by a compact, light brown, moist, silt with some sand and gravel, underlain by a dense, grey, silt with some sand and gravel. The latter material was interpreted in the field to be an over-consolidated glacial till.

b. The main strata are discussed in general below. Detailed descriptions of the subsurface conditions are provided on the attached TP logs (TP21-01 to TP21-04).

c. Loose, brown to black, moist, silty sand and gravel with trace to some organics (roots and rootlets) was encountered in each of the excavated TPs to a mean depth of 0.3m, and to a maximum depth of 0.5m.

d. Loose to compact, brown, moist, sand and gravel with trace to some silt was encountered in each of the excavated TPs at depths from 0.3m to 1.2m.

e. Compact, moist, brown, silt with some sand and gravel was encountered in each of the excavated TPs extending to depths of 0.8m to 1.5m.

f. Dense, brown, moist, sand and silt with some gravel and cobble (glacial till) was encountered in each of the TPs at depths from 1.4m to 1.9m, and was encountered at a mean depth of 1.4m.

g. Depths are referenced to the existing ground surface at the time of our field investigation. Soil classification terminology is based on the Modified Unified classification system. The relative proportions of the major and minor soil constituents are indicated by the use of appropriate Group Names as provided in ASTM D2488-93 and/or D2487 Figures 1a, 1b, and 2. Other descriptive terms generally follow conventions of the Canadian Foundation Engineering Manual.

2.5 Groundwater Conditions

a. Groundwater seepage was not encountered during the course of our field investigations.

b. Given the encountered conditions, specifically the dense fine-grained glacial till subgrade, we expect that a

shallow "perched" groundwater table is present seasonally. We expect that the groundwater flows associated with this perched condition would be related directly to the volume and frequency of storm events.

c. Groundwater levels can be expected to fluctuate seasonally with cycles of precipitation. Groundwater conditions at other times and locations can differ from those observed within the TPs at the time of our assessment.

d. If groundwater flows or conditions are different than those encountered during the TP investigation, additional measures may be required during construction. Contact our office immediately if unanticipated conditions are encountered at any point during construction.

2.6 Covenant Review

a. As part of our assessment, we have reviewed the Property title relative to any restrictive covenants that may be registered. At the time of this assessment there were three covenants registered against the title of the Property.

b. Two covenants, Documents No. CA6043366 and No. CA6043367, speak to requirements for restrictions and preconditions on use of the development, vegetation and tree management buffers, wildfire protection, geotechnical hazards, streamside protection and enhancement areas, and fencing requirements to protect streamside areas. These covenant requirements, with the exception of the geotechnical hazards section, shall be addressed separately by a suitable qualified professional(s).

c. The third covenant, Document No. CA6857585, is a geotechnical covenant that speaks to recommendations and requirement presented in the geotechnical report prepared by LEA in 2018. Given this covenant is based on requirements set out by LEA in previous geotechnical report for Lots 1 through 20, we recommend that the covenant CA6857585 be discharged from the title of the Property, and a new covenant registered against the Property which includes this current site specific Report.

3.0 DISCUSSIONS AND RECOMMENDATIONS

3.1 Steep Slopes and Site Grading

a. This geotechnical hazard assessment includes a preliminary qualitative analysis of the stability of slopes which could impact the proposed development based on a background review and a visual site assessment.

b. A detailed slope stability analyses is typically required when a building development is proposed at the top of bedrock slopes steeper than 1 Horizontal to 1 Vertical (45°), or soil slopes steeper than (2H:1V / 27°).

excluding circumstances where indicators of global instability are present.

c. The location of two of the three townhome buildings have been proposed in the northwestern part of the Property where a portion of the structures are located into a slope inclined 21° to the north. This slope was previously graded during the construction of Rollie Rose Drive as part of the Holland Creek Area development and has been appropriately revegetated to prevent erosion. Based on the anticipated soil conditions, and the inclination of the north slope, LEA believes there is a low risk for slope instability at the building locations. No indications of significant slope movements were found on the Property.

3.2 Foundation Design and Construction

a. Prior to construction, the building area should be stripped to remove all unsuitable materials to provide an undisturbed natural subgrade for the footing support.

b. Foundation loads should be supported on natural undisturbed material approved for use as a bearing stratum by our office or structural fill and may be designed using the following values.

   i. For foundations constructed on structural fill, as outlined in Section 4.2 of this Report an SLS bearing pressure of 150 kPa, and a ULS bearing pressure of 200 kPa may be used for design purposes.

   ii. For foundations constructed on glacial till, an SLS bearing pressure of 200 kPa, and a ULS bearing pressure of 265 kPa may be used for design purposes.

c. As the elevation of the glacial till is expected to vary throughout the building area, we recommend the Structural Engineer for the project use the design values for structural fill provided above. This will prevent conflict where the glacial till soils are not present at a "practical" building elevation. The design values provided above for structural fill can be achieved through the conventional placement and compaction of engineered fill over an approved naturally deposited subgrade.

d. Exterior footings should be provided with a minimum 0.45m depth of ground cover for frost protection purposes.

e. The design values provided above for structural fill can be achieved through the conventional placement and compaction of engineered fill over an approved naturally deposited subgrade.

f. Prior to placement of concrete footings, any bearing soils that have been softened, loosened, or otherwise disturbed during the course of construction should be removed, or else compacted following our recommendations for structural fill. Compaction will only be feasible if the soil has suitable moisture content and if there is access to heavy compaction equipment. If no structural fill is placed, a smooth-bladed clean up bucket should be used to finish the excavation.

3.3 Seismic Site Classification

a. Based on the 2018 British Columbia Building Code, Division B, Part 4, Table 4.1.8.4.A, "Site Classification for Seismic Site Response," the soils and strata encountered during the test pitting investigation would be "Site Class C" (Very Dense Soil or Soft Rock).

3.4 Stormwater Management

a. The development should be in conformance with the Holland Creek Local Area Plan, Schedule C of Bylaw 1488, section 10.1.3 which states "Provide storm water management which prevents flooding and erosion, and mitigates negative impacts on the natural environment and riparian areas".

b. As part of the geotechnical investigation, field observations of the subgrade soil conditions with respect to the on-site infiltration and disposal of stormwater were carried out.

c. Based on the subgrade soil conditions encountered during the investigation, it is the opinion of LEA that site conditions (glacial till) are not conducive to the installation of an on-site stormwater infiltration medium.

d. Site conditions may be conducive to the installation of storm water detention measures. The location(s) of any proposed detention measures shall be reviewed by the Geotechnical Engineer to determine if the design method(s) and/or location(s) pose a hazard to the subject Properties or any adjacent or adjoining properties.

3.5 Erosion and Sediment Control

a. In general, coarse grained soils (cobbles, gravels, coarse sand) are susceptible to erosion but have a relatively low potential for sedimentation and/or sediment transport. Fine grained soils (fine sand, silt, and clay) are typically susceptible to both erosion and sedimentation. It is our expectation that the subject project will likely encounter both fine and coarse-grained soils.

b. Sources of erosion and sedimentation include but are not limited to soil areas exposed during clearing and grubbing, stockpiled soils created during the excavation and earthworks phase as well as any exposed soils left in place as part of the final grading and or landscaping.

c. LEA recommends the following best management practices in order to reduce erosion and sedimentation impacts on the Property:

   i. Retaining vegetated areas and buffers.
   ii. Appropriately cover all stockpiled materials on-site.
   iii. Revegetate exposed soil slopes where existing vegetation has been removed.
   iv. Ensure that construction traffic leading to and from the site are not impacting the existing

storm services.

3.6 Foundation Drainage

a. Conventional requirements of the 2018 BCBC pertaining to building drainage are considered suitable at this site.

3.7 General Excavation - Future Building Sites

a. All unsuitable overburden materials should be removed to provide a suitable base of support. Unsuitable materials include any non-mineral material such as vegetation, topsoil, peat, fill or other materials containing organic matter, as well as any soft, loose, or disturbed soils.

b. Unsuitable material, including existing fill soils, were encountered in each of the subsurface explorations from depths of 0.2m to approximately 1.2m, and to a mean depth of 1.0m.

c. Fine-grained soils and to a lesser extent glacial tills, are particularly moisture sensitive. Extended periods of saturated soil conditions can make these soils unsuitable for bearing purposes, where they could be suitable bearing surfaces when moist or damp. Exposure of these soils to water after excavation (rain or snow) can also make these soils unsuitable for bearing purposes. Therefore, weather conditions dictate whether these soils are suitable for bearing purposes at the time of construction. LEA recommends contingency plans for over excavation when weather or seasonal conditions could make these soils unsuitable for bearing at the time of construction.

d. Groundwater ingressing into any excavations should be controlled with a perimeter ditch located just outside of the building areas, connected to positive drainage.

e. The Geotechnical Engineer is to confirm the removal of unsuitable materials and approve the exposed competent inorganic subgrade.

3.8 Structural Fill

f. Where fill is required to raise areas that will support buildings, slabs, or pavements, structural fill should be used. The Geotechnical Engineer should first approve the exposed subgrade in fill areas, to confirm the removal of all unsuitable materials.

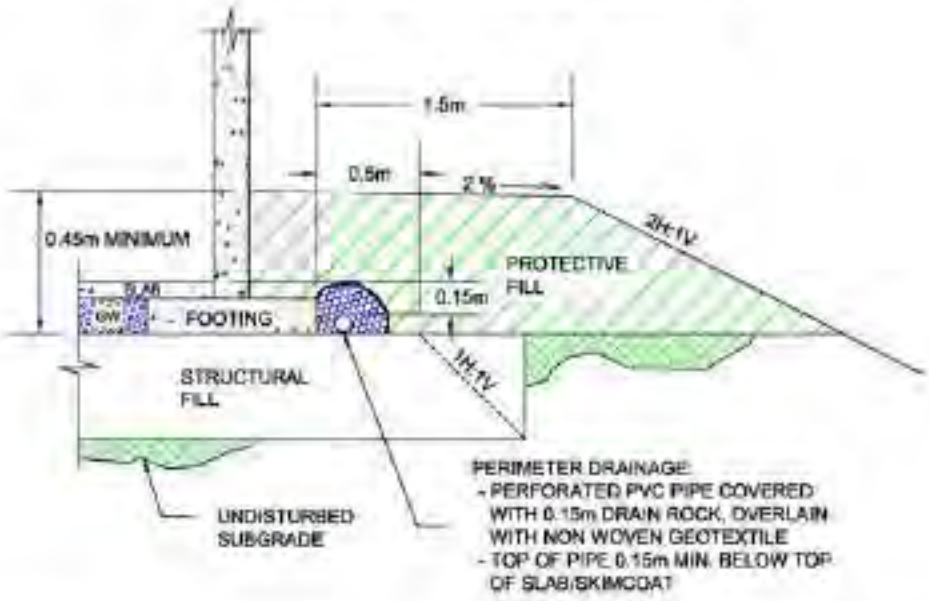
g. Structural fill should be inorganic sand and gravel. If structural fill placement is to be carried out in the wet season, material with a fines content limited to 5% passing the 75µm sieve should be used, as such a material will not be overly sensitive to moisture, allowing compaction during rainy periods of weather.

h. Structural fill should be compacted to a minimum of 95% of Modified Proctor maximum dry density (ASTM D1557) in foundation and floor slab areas, as well as in paved roadway and parking areas.

i. Structural fills under foundations, roadways, and pavements should include the zone defined by a plane

extending down and outward a minimum 0.5m from the outer edge of the foundation at an angle of 45 degrees from horizontal to ensure adequate subjacent support. Refer to Figure 4.2 below.

Figure 4.2 – Typical Section, Structural Fill



j. Compaction of fill should include moisture conditioning as needed to bring the soils to the optimum moisture content and compacted using vibratory compaction equipment in lift thicknesses appropriate for the size and type of compaction equipment used.

k. A general guideline for maximum lift thickness is no more than 100mm for light hand equipment such as a "jumping-jack," 200mm for a small roller and 300mm for a large roller or heavy (>500 kg) vibratory plate compactor or a backhoe mounted hoe-pac or a large excavator mounted hoe-pac, as measured loose.

l. It should be emphasized that the long-term performance of buildings, slabs, and pavements is highly dependent on the correct placement and compaction of underlying structural fills. Consequently, we recommend that structural fills be observed and approved by the Geotechnical Engineer. This would include approval of the proposed fill materials and performing a suitable program of compaction testing during construction.

3.9 Pavement Design – Private Works

a. Any organic or deleterious material should be removed from beneath the designated roadway, driveway, or parking areas prior to subgrade preparation. If fill is required to bring the subgrade up to the desired elevation, structural fill should be used.

b. The encountered clay stratum is within the understood limits of the future parking lot area. Assuming

design parking lot elevations are similar to existing site grades, the clay stratum can remain in place and should not impact the suitability of the area for use as a parking lot.

c. The subgrade should be proof rolled after final compaction and any areas showing visible deflections should be inspected and repaired. The Geotechnical Engineer shall review the parking lot and roadway subgrade conditions during the course of excavation.

d. The parking lot subgrade and pavement should be sloped to provide adequate drainage as per the design and direction of the civil consultant.

e. An estimated soaked California bearing ratio of 30% and a 20 year design life have been used in the calculating pavement designs. See Tables 4.4.1 and 4.4.b below.

Table 4.4.1 – Pavement Design Recommendations for Light Traffic/Low Volume Areas

Areas Subject to Cars and Small Trucks	
Estimated Equivalent Single-Axle Load: 2×10^4	
Asphaltic Concrete Pavement	50mm
19mm Well-Graded Granular Base Course	100mm
75mm Select Granular Subbase (SGSB)	250mm

Table 4.4.2 – Pavement Design Recommendations for Heavy Traffic/High Volume Areas

Areas Subject to Large Trucks	
Estimated Equivalent Single-Axle Load: 2×10^5	
Asphaltic Concrete Pavement	75mm
19mm Well-Graded Granular Base Course	150mm
75mm Select Granular Subbase (SGSB)	300mm

f. It is recommended that a reinforced concrete slab be utilized where garbage dumpsters are located. The slab should be large enough to contain the disposal unit and front tires of the garbage truck during disposal operations.

g. The above recommendations for general stripping, granular and pavement structure are in accordance with current best-practices. If the recommendations provided here prove cost-prohibitive or restrictive, alternative options may be considered through a balance of reduced preparation efforts, with a corresponding reduction in pavement design life.

4.0 CONCLUSIONS

From a geotechnical point of view, and provided the recommendations in this Report are followed, the

land is considered safe for the use intended (defined for the purposes of this Report as 3 townhouse buildings with a total of 7 units), with the probability of a geotechnical failure resulting in property damage of less than:

i. 2% in 50 years for geotechnical hazards due to seismic events, including slope stability;

ii. 10% in 50 years for all other geotechnical hazards.

4.1 ACKNOWLEDGEMENTS

Lewkowich Engineering Associates Ltd. acknowledges that the Approving Officers and Building Officials may rely on this Report when making a decision on application for development of the land. We acknowledge that this Report has been prepared solely for, and at the expense of Coastal Legacy Developments Ltd. We have not acted for or as an agent of the ToL in the preparation of this Report.

4.2 LIMITATIONS

The conclusions and recommendations submitted in this Report are based upon the information available at the time of this assessment. The recommendations given are based on the observed and anticipated subsurface conditions, current construction techniques, and generally accepted engineering practices. No other warrantee, expressed or implied, is made. If unanticipated conditions become known during construction or other information pertinent to the structures becomes available, the recommendations may be altered or modified in writing by the undersigned.

5.0 CLOSURE

Lewkowich Engineering Associates Ltd. appreciates the opportunity to be of service on this project. If you have any comments, or additional requirements at this time, please contact us at your convenience.

Respectfully Submitted,
Lewkowich Engineering Associates Ltd.

Tennes Hamre, GIT
Junior Geoscientist

Reviewed By:

2021-06-17

Chris Hudec, M.A.Sc., P.Eng.
Senior Project Engineer

6.0 ATTACHMENTS

1. J.E. Anderson & Associates Ltd. drawing titled "Site Plan", Drawing No. 90033, Dated 05/11/2021.
2. Coastal Legacy Development Ltd. drawing titled "Site Plan", Sheet No. 1.
3. Test Pit Site Plan, LEA Drawing No. F9638-01
4. Test Pit Logs, LEA Drawing No. F9638-02

7.0 REFERENCES

1. Province of BC, Interactive webmap, iMapBC.
2. Town of Ladysmith map titled "Official Community Plan, Map 2, Development Permit Areas," Dated September 18, 2018.
3. Town of Ladysmith map titled "*Official Community Plan, Map 1, Land Use*," Dated September 18, 2018.
4. Town of Ladysmith "*Holland Creek Local Area Plan*" Schedule C of the Town of Ladysmith Official Community Plan Dated September 18, 2018.
5. Ministry of Environment Mapping, Produced by R.H. Guthrie and C.R. Penner, titled "*Vancouver Island Geology*."
6. Geoscience BC map titled "Map 2013-NVI-1-1, Geology, Northern Vancouver Island Project." Dated January 2013.

SITE PLAN

COASTAL LEGACY DEVELOPMENT INC.

LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

ADDRESS : 128 ROLLIE ROSE DRIVE, LADYSMITH, B.C.	
PROJECT SURVEYOR : J.R. ENDERS	
DRAWN BY : CDB	DATE : MAY 11/21
OUR FILE : 90033	REVISION :

J.E. ANDERSON & ASSOCIATES
SURVEYORS - ENGINEERS
1A - 3411 SHENTON ROAD, NANAIMO, B.C. V9T 2H1
TEL 250 - 758 - 4631 FAX 250 - 758 - 4660
EMAIL nanaimo@jeanderson.com
NANAIMO - VICTORIA - PARKSVILLE - CAMPBELL RIVER

LEGEND

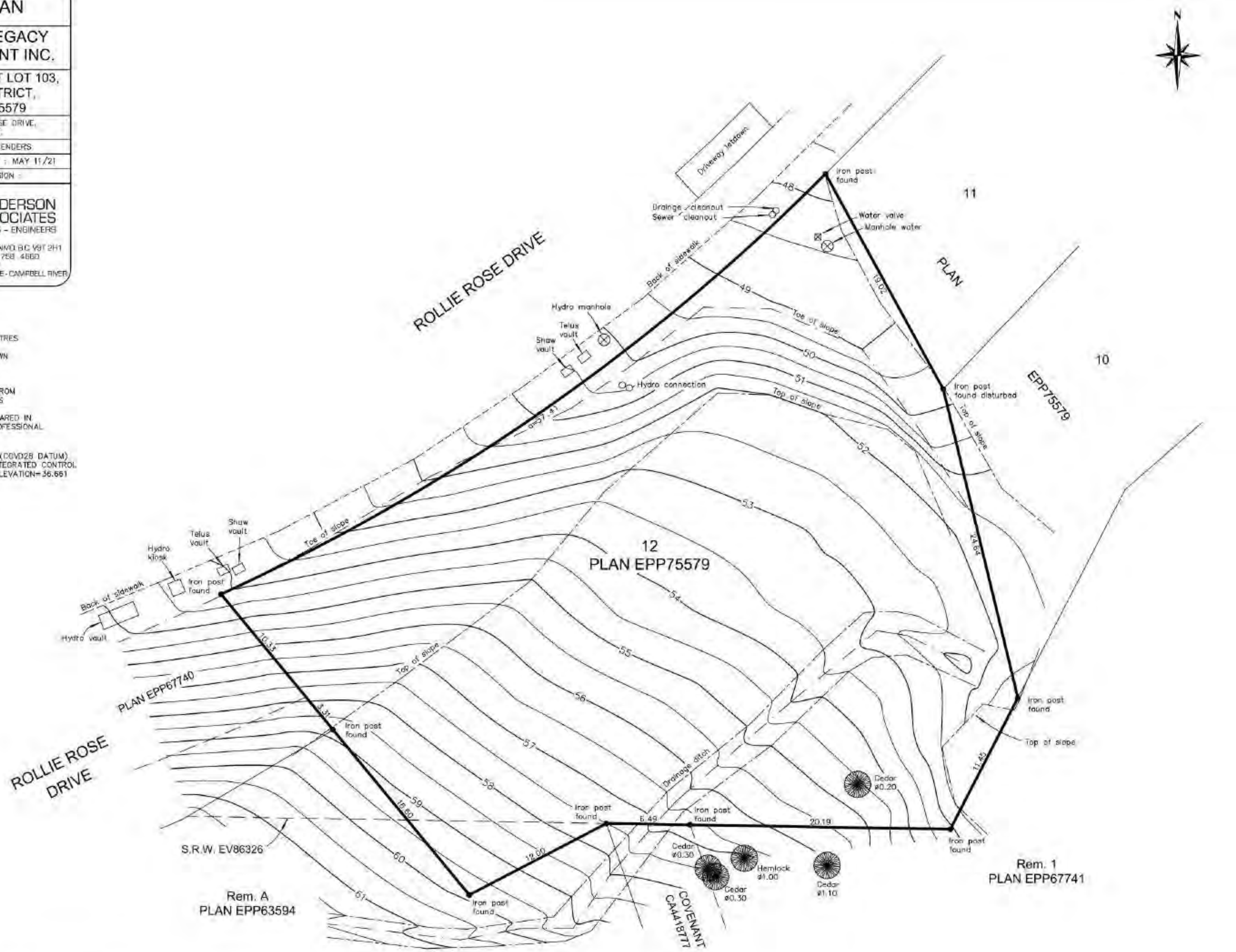
ALL DIMENSIONS ARE IN METRES

SUBJECT TO CHARGES SHOWN ON TITLE NO. CA8877327 (P.I.D. 030-477-620)

DIMENSIONS ARE DERIVED FROM LAND TITLE OFFICE RECORDS

THIS PLAN HAS BEEN PREPARED IN ACCORDANCE WITH THE PROFESSIONAL REFERENCE MANUAL

ELEVATIONS ARE GEODETIC (CGVD28 DATUM) AND ARE DERIVED FROM INTEGRATED CONTROL MONUMENT No. 87H3632, ELEVATION= 36.661



0 2 4 8 12 16 20

The intended plot size of this plan is 560mm in width by 432mm in height (C size) when plotted at a scale of 1:200.

SITE PLAN

SCALE $\frac{1}{16}$"=1'0"

COMPANY NAME:

PROJECT:

SITE PLAN

LOCATION:

SITE PLAN

SHEET NUMBER: 1

REV No.	DATE	BY	P.Eng	REVISION DESCRIPTION

DRAWING TITLE
TEST PIT LOCATION PLAN

PROJECT NAME
126 ROLLIE ROSE DRIVE,
LADYSMITH, BC

LEGAL DESCRIPTION
LOT 12, BLOCK 192, PLAN EPP75579,
DISTRICT LOT 103, LAND DISTRICT 43

ENGINEER'S SEAL

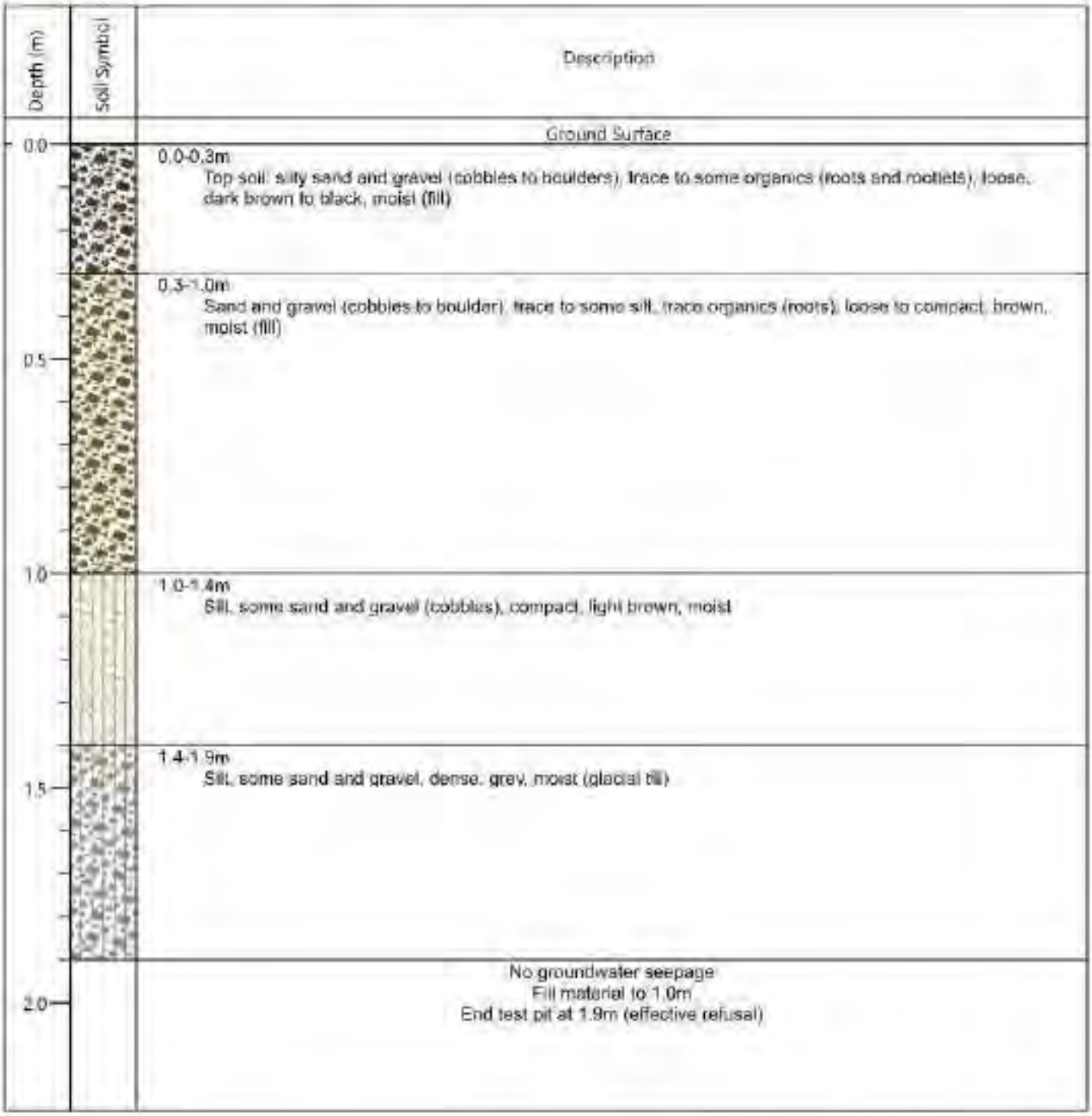
PLOT DATE	DRAWN BY
2021-05-17	NV
REVIEWED BY	SCALE
CH	NTS
PROJECT No.	DRAWING No.
F9638	F9638-01

Lewkowich Engineering Associates Ltd.

Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: F9638 TP20-01
Client: Coastal Legacy Developments Ltd
Project: 128 Rollie Rose Drive
Location: Ladysmith, BC



Logged By: Eric L'Heureux
Reviewed By: Chris M. Hudec P.Eng
Digging Method: Zaxis 135 Excavator

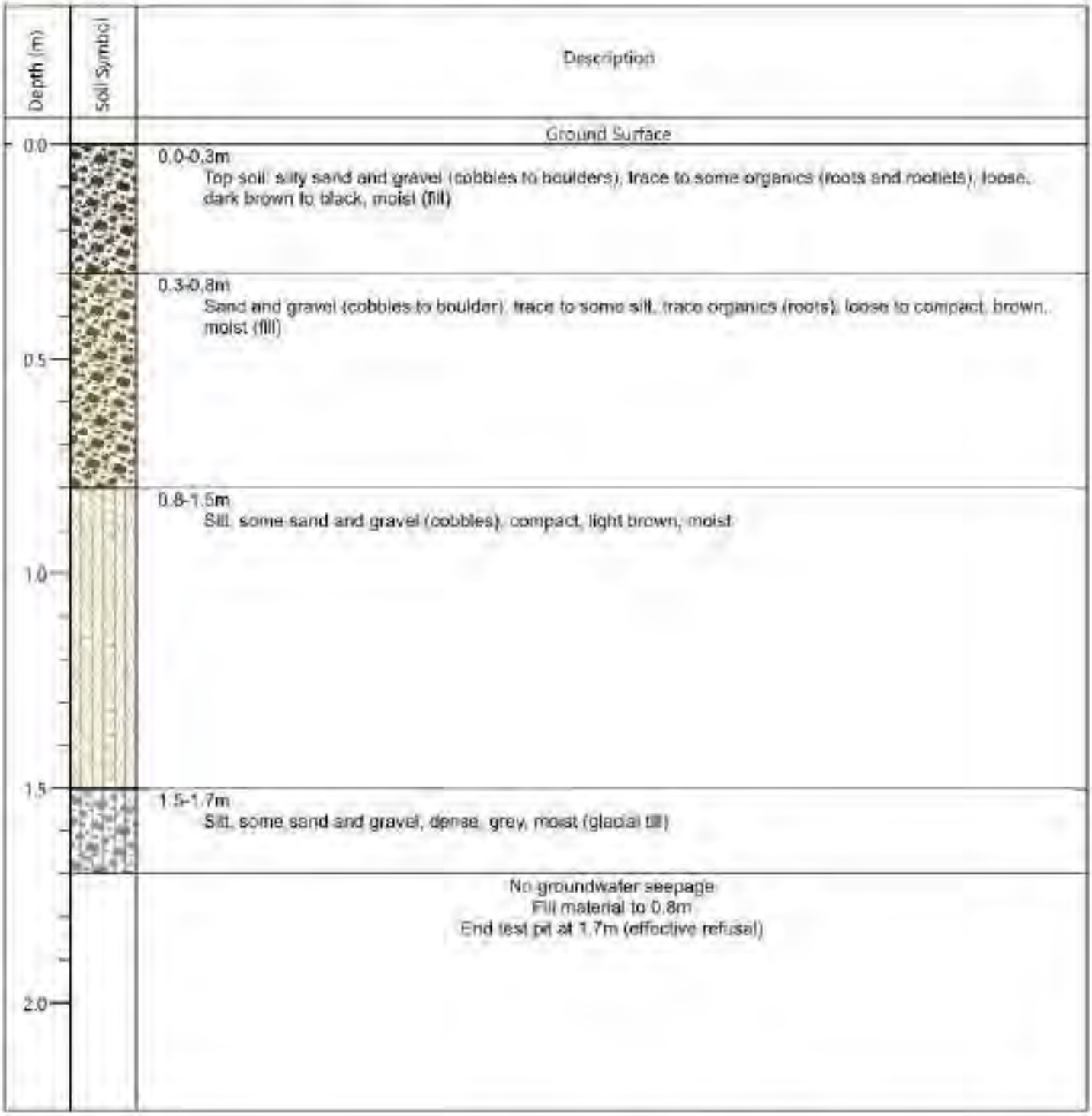
Date: April 30, 2021
Page 1 of 1

1900 Boxwood Road
Nanaimo, British Columbia, V9S 5Y2
Phone: 250-756-0355
Fax: 250-756-3831
Email: geotech@lewkowich.com

Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: F9638 TP20-02
Client: Coastal Legacy Developments Ltd
Project: 128 Rollie Rose Drive
Location: Ladysmith, BC



Logged By: Eric L'Heureux
Reviewed By: Chris M. Hudec P.Eng
Digging Method: Zaxis 135 Excavator

Date: April 30, 2021
Page 1 of 1

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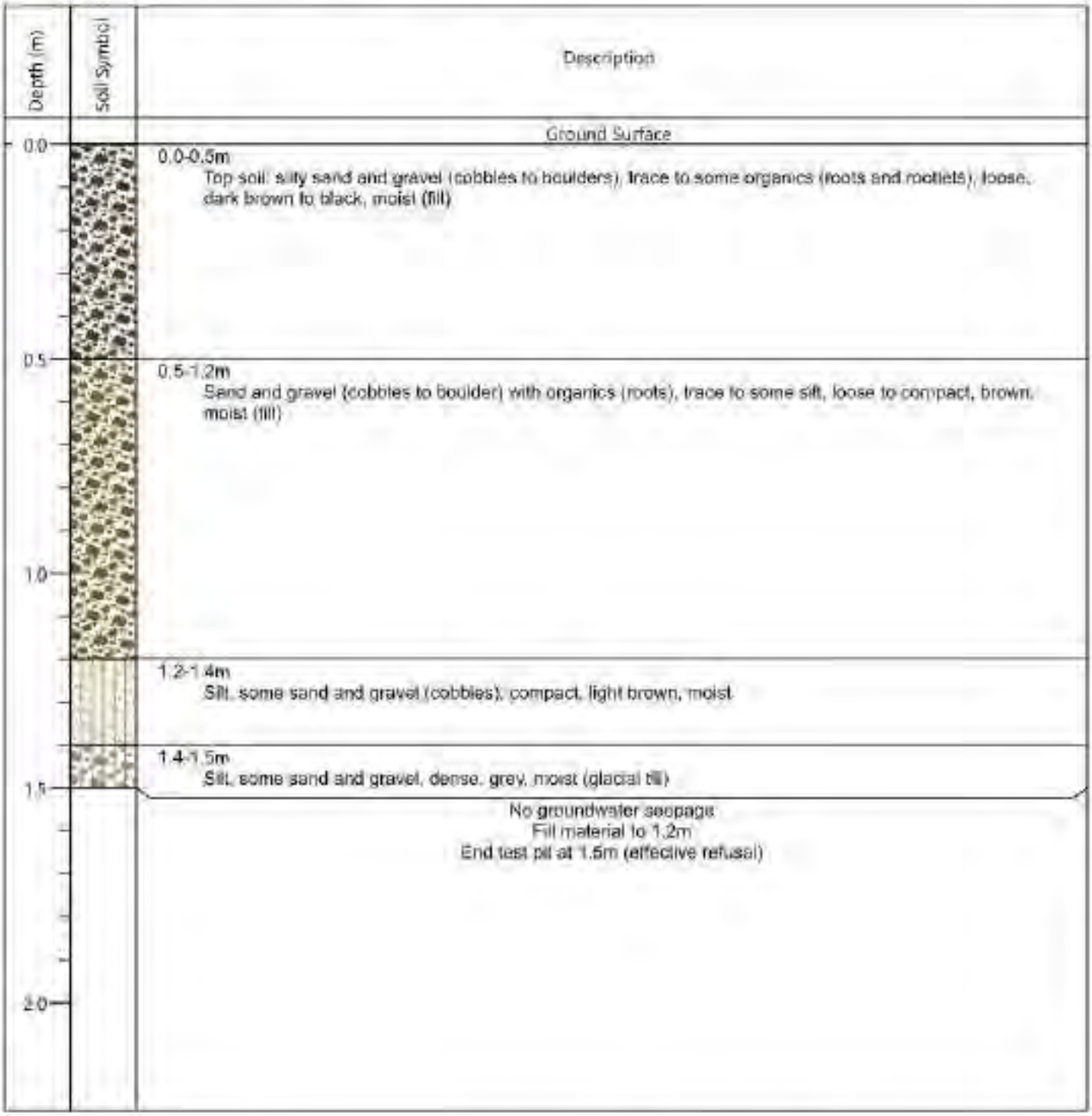
Lewkowich Engineering Associates Ltd.

TEST PIT LOG

File Number: F9638 TP20-03
Client: Coastal Legacy Developments Ltd
Project: 128 Rollie Rose Drive
Location: Ladysmith, BC



Logged By: Eric L'Heureux
Reviewed By: Chris M. Hudec P.Eng
Digging Method: Zaxis 135 Excavator

Date: April 30, 2021
Page 1 of 1

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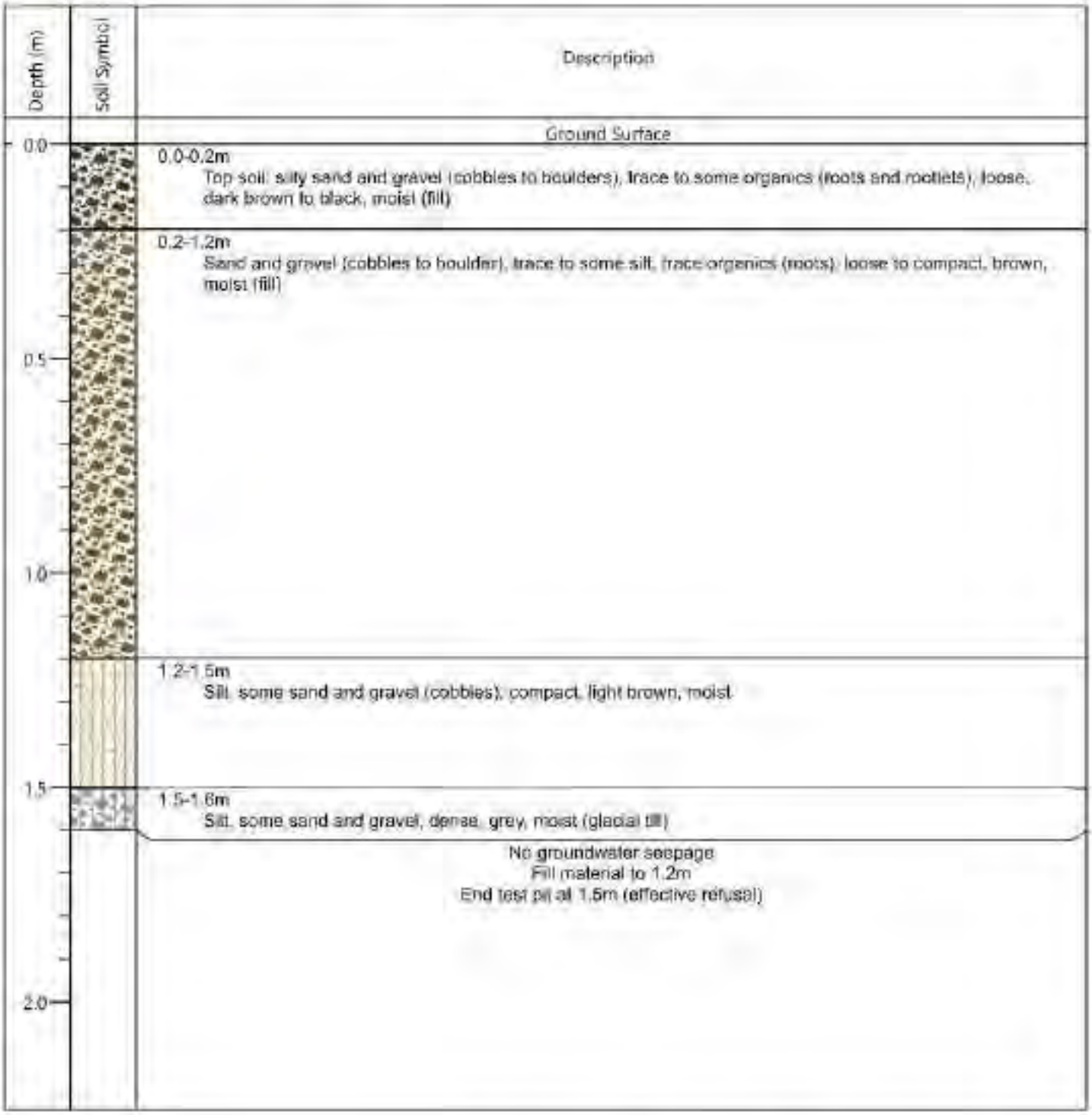
Lewkowich Engineering Associates Ltd.

TEST PIT LOG

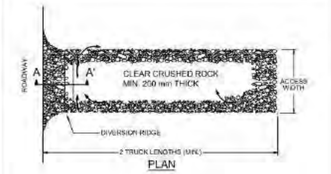
File Number: F9638 TP20-04
Client: Coastal Legacy Developments Ltd.
Project: 128 Rollie Rose Drive
Location: Ladysmith, BC



Logged By: Eric L'Heureux
Reviewed By: Chris M. Hudec P.Eng
Digging Method: Zaxis 135 Excavator

Date: April 30, 2021
Page 1 of 1

1900 Boxwood Road
Nanaimo, British Columbia, V9S 5Y2
Phone: 250-756-0355
Fax: 250-756-3831
Email: geotech@lewkowich.com

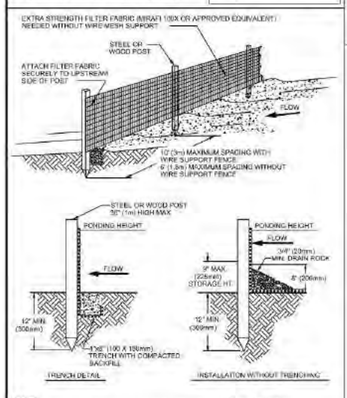


PLAN

SECTION A - A'

NOTES:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO ANY PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. IF THE ACCESS PAD ALONE IS INADEQUATE, WHEEL WASHING IS REQUIRED. THIS SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

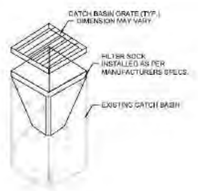
1. GRAVEL ACCESS PAD



NOT TO SCALE

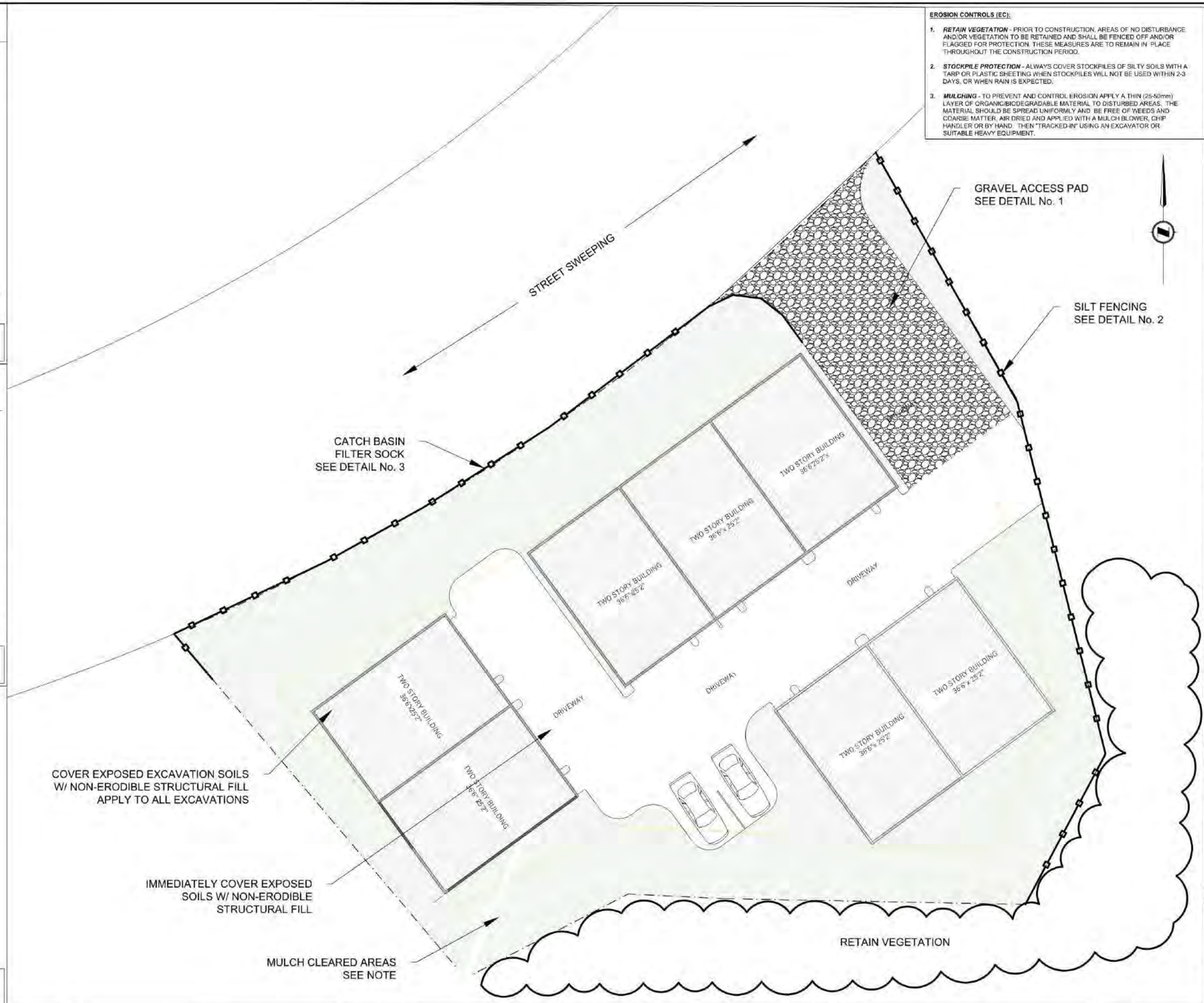
NOTES:
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY IF (225mm) MAXIMUM RECOMMENDED STORAGE HEIGHT.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

2. SILT FENCE



NOTES:
1. PLACE FILTER SOCK WITHIN CATCH BASINS WHERE WATER CAN SAFELY POND.
2. FILTER SOCK TO BE NON-WOVEN GEOTEXTILE INERT TO BIOLOGICAL DEGRADATION AND RESISTANT TO NATURALLY ENCOUNTERED CHEMICALS, ALKALIS AND ACIDS.
3. INSPECT AND REMOVE ACCUMULATED SEDIMENT FOLLOWING EACH STORM EVENT.
4. DAMAGED FILTER SOCKS TO BE REPLACED IMMEDIATELY.

3. SILT SOCK



EROSION CONTROLS (EC):

1. ***RETAIN VEGETATION*** - PRIOR TO CONSTRUCTION, AREAS OF NO DISTURBANCE AND/OR VEGETATION TO BE RETAINED AND SHALL BE FENCED OFF AND/OR FLAGGED FOR PROTECTION. THESE MEASURES ARE TO REMAIN IN PLACE THROUGHOUT THE CONSTRUCTION PERIOD.
2. ***STOCKPILE PROTECTION*** - ALWAYS COVER STOCKPILES OF SILTY SOILS WITH A TARP OR PLASTIC SHEETING WHEN STOCKPILES WILL NOT BE USED WITHIN 2-3 DAYS, OR WHEN RAIN IS EXPECTED.
3. ***MULCHING*** - TO PREVENT AND CONTROL EROSION APPLY A THIN (25-50mm) LAYER OF ORGANIC/BIODEGRADABLE MATERIAL TO DISTURBED AREAS. THE MATERIAL SHOULD BE SPREAD UNIFORMLY AND BE FREE OF WEEDS AND COARSE MATTER. AIR DRIED AND APPLIED WITH A MULCH BLOWER, CHIP HANDLER OR BY HAND. THEN "TRACKED-IN" USING AN EXCAVATOR OR SUITABLE HEAVY EQUIPMENT.

GENERAL NOTES:

1. EROSION AND SEDIMENT CONTROL FOR THIS PROJECT WILL BE AS OUTLINED IN THE FISHERIES AND OCEANS CANADA AND MINISTRY OF WATER, LANDS AND AIR PROTECTION HANDBOOK ENTITLED "LAND DEVELOPMENT GUIDELINES FOR THE PROTECTION OF AQUATIC HABITAT, MAY 1992" AND "BEST MANAGEMENT PRACTICES FOR URBAN AND RURAL LAND DEVELOPMENT IN BRITISH COLUMBIA; JUNE 2004". IT IS INCUMBENT UPON THE CONTRACTOR TO ACQUIRE THESE GUIDELINES AND FAMILIARIZE THEM SELF WITH THE REQUIREMENTS THEREIN.
2. THE CONSULTANT ASSUMES NO RESPONSIBILITY FOR DAMAGES RESULTING FROM IMPROPER EROSION AND SEDIMENT CONTROL MEASURES UNDERTAKEN BY THE CONTRACTOR.
3. ANY DIRECTION GIVEN BY THE ENGINEER TO THE CONTRACTOR FOR EROSION AND SEDIMENT CONTROL AND NOT FOLLOWED BY THE CONTRACTOR WILL BE REPORTED TO THE CITY OF NANAIMO.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT NO MUD, DIRT, SOIL, SILT OR ANY OTHER SUBSTANCES ARE SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY, OR AREAS THAT LEAD TO CATCH BASINS CONNECTED TO PUBLIC SYSTEMS. THE CONTRACTOR IS TO CLEAN UP ANY SUCH MATERIAL IMMEDIATELY. STREETS ARE TO BE SWEPT WITH A VACUUM STREET SWEEPER AFTER WORK STOPPAGE EACH DAY.
5. PRIOR TO CONSTRUCTION, INSTALL TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT TO LIMIT TRACKING OF SITE SOILS ONTO OFFSITE ROADWAYS. THE WIDTH OF THE PAD SHOULD NOT BE LESS THAN THE FULL WIDTH OF POINT INGRESS OR EGRESS AND IN ANY CASE SHOULD NOT BE LESS THAN 6 m WIDE WITH A LENGTH OF THE PAD TO BE NOT LESS THAN 20 m AND HAVING A MINIMUM THICKNESS OF 200 mm (8") OF COARSE GRANULAR MATERIAL. COARSE GRANULAR MATERIAL SUCH AS 75 mm SHOT ROCK OR FRACTURED DRAIN ROCK UNDERLAIN WITH GEO-TEXTILE FABRIC IS RECOMMENDED.
6. THE ENTRANCE SHOULD BE MAINTAINED FOR THE DURATION OF CONSTRUCTION, IN A CONDITION THAT WILL PREVENT TRACKING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, OR AREAS THAT LEAD TO CATCH BASINS CONNECTED TO PUBLIC SYSTEMS. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL MATERIAL AS CONDITIONS DEMAND. THE PAD MAY BE REMOVED ONCE PERMANENT PAVEMENTS ARE IN PLACE AT THE SITE. A WHEEL WASH MAY BE REQUIRED IF THE TEMPORARY GRAVEL PAD IS NOT WORKING.
7. PRIOR TO CONSTRUCTION, CLEARLY FLAG OR FENCE AREAS OF NO DISTURBANCE AS WELL AS ANY DESIGNATED TREES AND SHRUBS THAT ARE TO BE PRESERVED. MARKINGS SHOULD REMAIN IN PLACE THROUGHOUT CONSTRUCTION.
8. STRIP AND GRUB ONLY THOSE AREAS NECESSARY FOR THE CURRENT CONSTRUCTION. STAGE CONSTRUCTION OPERATIONS TO LIMIT DISTURBANCE AND DO NOT STRIP ANY AREA UNTIL REQUIRED.
9. GRADE WORK AREAS AWAY FROM ADJACENT PROPERTIES AND TOWARDS THE SEDIMENT POND ON THE SITE FOR DISPOSAL AND INFILTRATION.
10. IF GRADED AREAS WITHIN THE PROJECT WILL NOT BE COMPLETED OUTSIDE OF THE WET SEASON (OCTOBER TO APRIL), REVEGETATION OPERATIONS SHOULD BE CARRIED OUT WITHIN ONE WEEK OF GRADING COMPLETION OR NO LATER THAN SEPT. 15th.
11. SILT FENCING IS TO BE INSTALLED AROUND ALL STOCKSPOIL PILES, OR PILES ARE TO BE OTHERWISE COVERED TO LIMIT EROSION AND SEDIMENT GENERATION.
12. INSTALL SETTLEMENT PONDS EQUIPPED WITH EMERGENCY OVERFLOW, FOR RETENTION/INFILTRATION TREATMENT OF RUNOFF COLLECTED BY INTERCEPTOR SWALES (DITCHES) AND/OR SILT BARRIERS. THE SETTLEMENT PONDS ARE TO HAVE A MINIMUM VOLUME TO CONTAIN FLOWS FROM A 10-YEAR RETURN PERIOD, 24-HOUR RAINFALL EVENT. THE PONDS SHOULD BE USED AND MAINTAINED THROUGHOUT THE DURATION OF CONSTRUCTION.
13. ROUTINE INSPECTION AND MAINTENANCE OF THE SYSTEM COMPONENTS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHOULD DESIGNATE AN ON-SITE PERSON TO BE RESPONSIBLE FOR DAY-TO-DAY MANAGEMENT OF THE ESCP. THE CONTRACTOR IS TO SUPPLY A PHONE NUMBER WHERE THE CONTACT PERSON CAN BE REACHED 24HOURS/DAY. AT A MINIMUM, INSPECT ALL BMP'S WEEKLY TO ENSURE PROPER FUNCTION WITH INSPECTION REPORTS PROVIDED TO THE ENGINEER FOR REVIEW.
14. 48 HOURS PRIOR TO ANY SIGNIFICANT STORM EVENT, THE DESIGNATED SITE PERSON SHOULD INSPECT THE E&SC WORKS AND ENSURE THAT THE WORKS ARE ADEQUATE TO PROTECT THE SITE DURING THE STORM EVENT AND PROVIDE A WRITTEN REPORT TO THE ENGINEER AND/OR THE AUTHORITY HAVING JURISDICTION UPON REQUEST. IF THE DESIGNATED PERSON DETERMINES THAT THE E&SC WORKS ARE NOT ADEQUATE TO PROTECT THE SITE DURING THE ANTICIPATED STORM EVENT, THEN HE/SHE IS TO IMMEDIATELY INFORM THE ENGINEER AND CONTRACTOR SO THAT THE WORKS CAN BE MODIFIED TO ADEQUATELY PROTECT THE SITE DURING THE STORM EVENT AND PROVIDE A WRITTEN REPORT TO THE ENGINEER UPON REQUEST.
15. DURING AND/OR FOLLOWING EACH SIGNIFICANT STORM EVENT, THE DESIGNATED SITE PERSON SHOULD OBSERVE THE SETTLEMENT PONDS AND STORM DRAIN TO CONFIRM THAT TURBID WATERS FROM SOURCES ASSOCIATED WITH CONSTRUCTION ARE NOT ENTERING THE STORM DRAINAGE SYSTEM. TAKE IMMEDIATE CORRECTIVE ACTION IF INSPECTION INDICATES A PROBLEM. RECORD INSPECTION DATES, ANY SIGNIFICANT OBSERVATIONS, AND ACTIONS TAKEN, THEN INFORM THE ENGINEER IN CHARGE.

RUNOFF CONTROLS (RC):

1. ***TRENCHING*** - LIMIT DISTURBANCE TO 4.0 m ON EITHER SIDE OF TRENCHING. STRIP AND STOCKPILE TOPSOIL AND ROOT MATTER SEPARATELY FROM MINERAL SOIL. STOCKPILE THE ROOT MATTER AND TOPSOIL ON THE DOWN-SLOPE SIDE OF THE TRENCH AND MINERAL SOIL ON THE UP-SLOPE SIDE OF THE TRENCH TO DEFLECT ANY UP-SLOPE FLOW THAT MAY OCCUR. IF EXCAVATED SOIL WILL NOT BE RE-USED, REMOVE IMMEDIATELY. SILT FENCE SHOULD BE ERECTED BETWEEN THE TRENCHING OPERATION AND AREAS OFF-SITE. BACKFILL ALL EXCAVATIONS UP TO THE WORKING END OF THE PIPE BY THE COMPLETION OF EACH WORK DAY. FOLLOWING BACKFILL, MATCH THE EXISTING GROUND SURFACE (I.E. THE FINISHED TRENCH SHOULD NOT FORM A BERM OR SWALE THAT WOULD CONCENTRATE OVERLAND FLOWS OF SURFACE WATER).

SEDIMENT CONTROLS (SC):

1. ***ACCESS PAD*** - CONSTRUCT AN ACCESS PAD TO REDUCE OFFSITE SEDIMENTATION. INSTALL PAD PRIOR TO USE OF HEAVY EQUIPMENT OR SITE GRADING OPERATIONS, AND MAINTAIN THE PAD THROUGHOUT CONSTRUCTION OPERATIONS. THE ACCESS PAD MAY BE REMOVED DURING PREPARATION FOR PAVING.
2. ***STREET SWEEPING*** - DURING CONSTRUCTION, USE STREET SWEEPING TO CLEAN STREET FROM SEDIMENT CAUSED BY CONSTRUCTION ON AN AS-NEEDED BASIS. DO NOT USE STREET WASHING AS IT CARRIES SEDIMENT INTO THE STORM DRAINAGE SYSTEM. SUMMER STREET SWEEPING ALSO REDUCES PROBLEMS OF WINDBLOWN DUST.

Rev. No.	DATE	BY	REVISION DESCRIPTION	ENGR

LEGEND

SITE LEGAL DESCRIPTION
LOT 12, BLOCK 192, DISTRICT LOT 103
LAND DISTRICT 3
PLAN EPP75579

BENCHMARK DESCRIPTION

STAMP / SEAL

HORIZONTAL SCALE 1:125

VERTICAL SCALE

DESIGN LC
DRAWN LC
CHECKED LC
PLOT DATE 2022-02-05
PRINT DATE

CLIENT NAME
COASTAL LEGACY DEVELOPMENTS LTD.

PROJECT NAME
128 ROLLIE ROSE DRIVE
LADYSMITH, BC

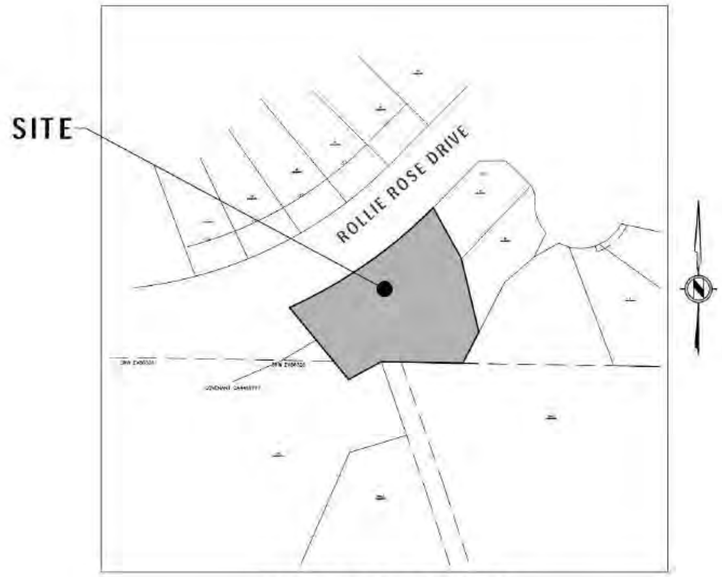
DRAWING TITLE
EROSION AND SEDIMENT CONTROL PLAN

Lewkowich Engineering Associates Ltd.

PROJECT No.	DRAWING No.	REVISION No.	CITY PLAN FILE No.
F9638	F9638-01	00	

APLIN MARTIN

EGBC Permit to Practice Number #1001018
Aplin & Martin Consultants Ltd.
#104 - 6596 Applecross Road, Nanaimo, BC, Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com



SITE LOCATION PLAN
SCALE = 1:1000

DRAWING INDEX

DRAWING No.	REV No.	DRAWING TITLE
23-8024-C000	03	23-8024 - COVER
23-8024-C010	03	23-8024 - GENERAL NOTES
23-8024-C050	03	23-8024 - KEY PLAN
23-8024-C100	03	23-8024 - GRADING PLAN
23-8024-C120	03	23-8024 - GRADING PROFILE
23-8024-C200	03	23-8024 - SERVICE PLAN
23-8024-C800	03	23-8024 - STORM MANAGMENT PLAN

NOT FOR CONSTRUCTION

DEVELOPER:
1447227 BC LTD
250-327-1617
2092 SKAHA DRIVE, NANAIMO, BC

PROJECT:
LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

MUNICIPAL PROJECT No. . & .

APLIN & MARTIN PROJECT No. 23-8024

GENERAL NOTES:

1. ALL WORK AND MATERIALS ARE TO BE AS DESCRIBED IN THE TOWN OF LADYSMITH 'ENGINEERING STANDARDS AND SPECIFICATIONS' OR AS OTHERWISE APPROVED BY THE ENGINEER.
2. A CONSTRUCTION PERMIT TO INSTALL WORKS WITHIN STREETS , LANES AND TOWN PROPERTY AREAS', WILL BE REQUIRED WHERE CONSTRUCTION IS TO BE UNDERTAKEN IN TOWN OF LADYSMITH RIGHT-OF-WAYS AND/OR ON TOWN OF LADYSMITH OWNED UTILITIES OR PROPERTIES.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. CONNECTION TO, OR ALTERNATION OF EXISTING, TOWN-OWNED UTILITIES, WILL BE UNDERTAKEN BY TOWN OF LADYSMITH FORCES ONLY, UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.
5. UPON APPROVAL OF THE PERMIT THE TOWN OF LADYSMITH ENGINEER SHALL BE NOTIFIED FORTY-EIGHT (48) HOURS PRIOR TO COMMENCEMENT OF WORK.
6. ALL ELEVATIONS ARE GEODETIC AND DERIVED FROM CONTROL MONUMENT 87H3632.
7. ALL LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND ALL STRUCTURES ARE NOT NECESSARILY SHOWN.
8. TREE PROTECTION TO BE INSTALLED AS PER TOWN OF LADYSMITH ZONING BYLAW 1904 PART 7.2.2.E
9. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM, AND SANITARY CONNECTIONS TO THE SITE. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION. EXISTING AND PROPOSED SERVICES MAY REQUIRE ADJUSTMENT WHERE A CONFLICT OCCURS.
10. ANY ALTERNATIVES TO SPECIFIED MATERIALS OR APPURTENANCES TO BE APPROVED BY THE MUNICIPAL ENGINEER PRIOR TO CONSTRUCTION.
11. CIVIL SCOPE ENDS AT 1.0m FROM THE PROPOSED BUILDING FOOTPRINT. BUILDING CONSULTANT SCOPE INCLUDES ALL WORKS 1.0m WITHIN THE BUILDING FOOTPRINT.
12. TRENCHING TO BE AS PER TOWN OF LADYSMITH DRAWING 3T-1 AND 3T-2. TRAVELED AREA BACKFILL TO BE IMPORTED GRANULAR MATERIAL COMPACTED TO MINIMUM 95% MODIFIED PROCTOR, UNLESS OTHERWISE APPROVED BY THE GEOTECHINCAL ENGINEER OF RECORD.
13. ALL ASBESTOS CEMENT ENCOUNTERED WITHIN THE TRENCH LINE SHALL BE REMOVED AND DISPOSED OF, OR ABANDONED, IN ACCORDANCE WITH WORKSAFE BC AND MUNICIPALITY REQUIREMENTS.
14. ALL PIPING AND RELATED APPURTENANCES TO BE INSPECTED AND APPROVED BY THE ENGINEER OF RECORD, OR THEIR REPRESENTATIVE, PRIOR TO BACKFILLING.
15. ASPHALT PAVEMENT RESTORATION TO BE AS PER TOWN OF LADYSMITH DRAWING 3T-3.
16. ALL SURFACE RESTORATION (ROADS, CURBS, SIDEWALKS, ETC) SHALL BE TO ORIGINAL CONDITION OR BETTER.

WATERMAIN NOTES:

1. ALL WATER PIPES TO HAVE A MINIMUM 1.2m OF COVER, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER OF RECORD.
2. ALL WATER MAINS TO BE PVC DR18, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS
3. ALL EXISTING WATER MAINS TO BE REMOVED OR ABANDONED ONLY ONCE EXISTING WATER MAIN IS DECOMMISSIONED OR AS APPROVED BY THE ENGINEER OF RECORD.
4. ALL WATER MAIN JOINTS TO BE RESTRAINED AS PER TOWN OF LADYSMITH STANDARDS AND SPECIFICATIONS SECTION 4B.8 FOR THRUST BLOCKS AND JOINT RESTRAINTS.
5. ALL WATER MAIN JOINTS WITHIN 3.0m HORIZONTAL OR 0.45m VERTICAL OF SANITARY SEWER OR STORM DRAINS TO BE PROTECTED BY SHRINK WRAP OR PETROLEUM TAPE AS PER VANCOUVER ISLAND HEALTH AUTHORITY GUIDELINES FOR APPROVAL OF WATER SUPPLY SYSTEM.
6. TESTING OF THE WATER SYSTEM TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH ENGINEERING STANDARDS AND SPECIFICATIONS:
   - 6.1. SECTION 4B.10 PRESSURE AND LEAKAGE TESTING,
   - 6.2. SECTION 4B.11 FLUSHING, CHLORINATION AND BACTERIAL SAMPLING, AND
   - 6.3. SECTION 4B.12 NOTIFICATION TO MUNICIPAL ENGINEER – SYSTEM TESTS AND FINAL CONNECTION.

SANITARY SEWER NOTES:

1. ALL SANITARY PIPES TO HAVE A MINIMUM 1.5m OF COVER IN ROAD RIGHT-OF-WAYS AND 1.0m IN UNTRAVELED AREAS, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER OF RECORD.
2. ALL SANITARY MAINS TO BE PVC DR35, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS.
3. ALL SANITARY SERVICE CONNECTIONS TO BE 150ø PVC DR28 UNLESS OTHERWISE NOTED.
4. ALL SANITARY FORCE MAINS TO BE HDPE DR12 UNLESS OTHERWISE NOTED.
5. ALL SANITARY SERVICE BOXES TO BE IN ACCORDANCE WITH TOWN OF LADYSMITH DRAWINGS S07 AND S08.
6. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SERVICE TO EXISTING USERS DURING CONSTRUCTION THROUGH BYPASS PUMPING. THE CONTRACTOR IS TO PROVIDE A BYPASS PUMPING PLAN PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR SHALL ENSURE THAT THE PUMPING EQUIPMENT IS KEPT IN GOOD WORKING CONDITION DURING THE PROJECT.
7. ALL TESTING TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH STANDARDS AND SPECIFICATIONS:
   - 7.1. SECTION 5B.8 LEAKAGE TESTING OF GRAVITY SEWERS, AND
   - 7.2. SECTION 5B.9 VIDEO INSPECTING MAINS AND SERVICE CONNECTIONS
8. THE CONTRACTOR IS TO FLUSH ALL MAINS AND PROVIDE CCTV INSPECTION TO THE ENGINEER OF RECORD PRIOR TO ASPHALT INSTALLATION OR RESTORATION.

STORM DRAINAGE NOTES:

1. ALL STORM PIPES TO HAVE A MINIMUM 1.5m OF COVER IN ROAD RIGHT-OF-WAYS AND 1.0m IN UNTRAVELED AREAS, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER.
2. ALL STORM MAINS TO BE PVC DR35, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS.
3. ALL STORM DRAINAGE SERVICE CONNECTIONS TO BE 150ø PVC DR28, UNLESS OTHERWISE NOTED.
4. ALL CATCH/LAWN BASIN LEADS TO BE 200ø PVC DR35, UNLESS OTHERWISE NOTED.
5. ALL PERFORATED DRAIN PIPES TO BE PVC DR35, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS.
6. ALL STORM DRAINAGE SERVICE BOXES TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH STANDARD DRAWINGS D06, D07, AND D08.
7. ALL CATCH BASINS WITHIN CITY RIGHT-OF-WAY TO BE TOWN OF LADYSMITH TYPE 1 AS PER STANDARD DRAWING D11AND D12, UNLESS OTHERWISE NOTED.
8. ALL LAWN BASINS WITHIN CITY RIGHT-OF-WAY TO BE TOWN OF LADYSMITH DITCH INLET TYPE AS PER STANDARD DRAWING D14 AND D14A, UNLESS OTHERWISE NOTED.
9. PROPOSED STORM DRAINAGE SERVICES ARE TO BE INSTALLED BELOW EXISTING BASEMENT ELEVATION OR AT THE SAME INVERT AS THE SANITARY SERVICES WHERE POSSIBLE, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER OF RECORD.
10. NOT ALL STORM CONNECTIONS ARE SHOWN. SOME PROPERTIES MAY HAVE MORE THAN ONE CONNECTION TO THE EXISTING DITCH OR ADJACENT CULVERT.
11. ALL EXISTING STORM DRAINS AND CULVERTS TO BE ABANDONED SHALL BE INSPECTED FOR EXISTING STORM CONNECTIONS. ALL EXISTING CONNECTIONS ARE TO BE RELOCATED TO THE NEW STORM SEWER SYSTEM. DO NOT PLUG OR ABANDON AN EXISTING STORM DRAINAGE CONNECTION WITHOUT WRITTEN APPROVAL FROM THE TOWN OF LADYSMITH CONSTRUCTION REPRESENTATIVE.
12. ALL TESTING TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH ENGINEERING STANDARDS AND SPECIFICATIONS:
    - 12.1. SECTION 6B.6 NOTIFICATION TO THE TOWN OF LADYSMITH
    - 12.2. SECTION 6B.7 CLEANING AND FLUSHING, AND
    - 12.3. SECTION 6B.8 VIDEO INSPECTING MAINS.
13. THE CONTRACTOR IS TO FLUSH ALL MAINS AND PROVIDE CCTV INSPECTION TO THE ENGINEER OF RECORD PRIOR TO ASPHALT INSTALLATION OR RESTORATION.

POWER, COMMUNICATIONS AND GAS:

7. THE CONTRACTOR SHALL CONTACT BC ONE CALL A MINIMUM OF THREE WORKING DAYS PRIOR TO START OF CONSTRUCTION. NOTE THAT BC ONE CALL WILL NOT HAVE INFORMATION ON CITY UTILITIES OR SHAW. CALL 1-800-DIG-SHAW FOR SHAW INFORMATION.
8. THE CONTRACTOR SHALL CONSTRUCT UNDERGROUND BC HYDRO, TELUS, SHAW CABLE AND FORTIS BC IN ACCORDANCE WITH THE APPLICABLE UTILITY COMPANY'S CURRENT SPECIFICATIONS.
9. THE CONTRACTOR SHALL NOTIFY ALL UTILITY OWNERS REQUIRED PRIOR TO THE START OF CONSTRUCTION TO ARRANGE INSPECTION AND APPROVALS.
10. THE CONTRACTOR SHALL CONTACT BC HYDRO AND TELUS TO INSTALL RISERS ON EXISTING JUNCTION BOXES TO BRING LID ELEVATIONS FLUSH TO GRADE.
11. CONNECTION TO, OR ALTERATION OF, EXISTING MUNICIPALITY OWNED UTILITIES REQUIRES AUTHORIZATION BY THE MUNICIPALITY'S REPRESENTATIVE.
12. ALL LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHALL BE CONFIRMED BY THE USE OF A PIPE LOCATOR AND MANUAL DIGGING. ALL OR ANY STRUCTURES NOT NECESSARILY SHOWN.
13. ALL SURFACE RESTORATION (ROADS, CURBS, SIDEWALKS, ETC) SHALL BE TO ORIGINAL CONDITION OR BETTER.
14. THE CONTRACTOR SHALL NOTIFY ALL RESIDENCES AND/OR BUSINESSES AFFECTED BY THE CONSTRUCTION FIVE DAYS PRIOR TO STARTING THE CONSTRUCTION. THE CONTRACTOR SHALL ALSO EACH DAY INDIVIDUALLY NOTIFY EACH RESIDENCE OR BUSINESS WHICH WILL BE AFFECTED BY THE NEXT DAYS' WORK.
15. THE DRAWINGS MAY NOT SHOW ALL INDIVIDUAL UNDERGROUND HOME SERVICE CONNECTIONS. THE CONTRACTOR SHALL EXPOSE ALL EXISTING UNDERGROUND FACILITIES BY HAND DIGGING BEFORE USING MECHANICAL EXCAVATING EQUIPMENT.

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEER'S DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES.

REV.	DESCRIPTION	DR.	CH.	DATE	APP.
1	ISSUED FOR COORDINATION	CIT	ABG	2023/12/22	SAL
2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4					
5					

APLIN MARTIN

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#104 - 6596 Applecross Road, Nanaimo, B.C. Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE: GENERAL NOTES

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
PROJECT NO. .
SCALE: HORZ. VERT.
DRAWING DATE: NOVEMBER, 2023
DRAWING NO. .
A & M DRAWING NO. 23-8024-C010
SHEET NO. 01 OF 06
REV. 03

KEY PLAN NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON-SITE PRE-CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS, AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM, AND SANITARY CONNECTIONS TO THE SITE. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION. EXISTING AND PROPOSED SERVICES MAY REQUIRE ADJUSTMENT WHERE A CONFLICT OCCURS.
5. CIVIL SCOPE ENDS 1.0m FROM THE BUILDING FOOTPRINT. BUILDING CONSULTANT SCOPE INCLUDES ALL WORKS WITHIN 1.0m OF THE BUILDING FOOTPRINT.
6. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO-ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
7. CONSULT FORTIS BC AND MECHANICAL DRAWINGS FOR GAS DISTRIBUTION AND DESIGN INFORMATION.
8. CONSULT BC HYDRO AND ELECTRICAL DRAWINGS FOR ELECTRICITY DISTRIBUTION AND DESIGN INFORMATION.
9. CONSULT TELE-COMMUNICATIONS AND ELECTRICAL DRAWINGS FOR TELE-COMM. DISTRIBUTION AND DESIGN INFORMATION.

LEGEND

PROP. STORM SEWER	
EX. SANITARY SEWER	
PROP. STORM SEWER	
PROP. WATERMAIN	
STREET LIGHTING	STL
STORM SERVICE CONNECTION	
SANITARY SERVICE CONNECTION	
EDGE OF PAVEMENT	
UNDERGROUND GAS – BY OTHERS	
UNDERGROUND HYDRO – BY OTHERS	H
UNDERGROUND TELEPHONE – BY OTHERS	UT
UNDERGROUND COMMUNICATION – BY OTHERS	
MANHOLE	
LAWN BASIN	
CLEANOUT	
CATCH BASIN	
EXISTING GROUND CONTOUR	
MIN. GARAGE FLOOR ELEVATION	MGE=99.99m
RETAINING WALL – BY OTHERS	
ASPHALT PAVEMENT	
PAVERS AS PER LANDSCAPE DRAWINGS	
MULTI-USE PATH	
SWALE	

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEERS DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES.

REV.	DESCRIPTION	DR	CH	DATE	APP
1	ISSUED FOR COORDINATION	CIT	ABG	2023/12/22	SAL
2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4					
5					

APLIN MARTIN
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Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE: 23-8024 - KEY PLAN

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
PROJECT NO. .
SCALE: HORZ. 1:150 VERT.
DRAWING DATE: NOVEMBER, 2023
DRAWING NO. .
A & M DRAWING NO. 23-8024-C050
SHEET NO. 02 OF 06
REV. 03

0 1.5 1:150 7.5m

SITE GRADING NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON-SITE PRE-CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO-ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
5. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS AND TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
6. ALL EXCAVATION, FILL PLACEMENT AND COMPACTION TO BE IN ACCORDANCE WITH GEOTECHNICAL CONSULTANTS REPORT.
7. ALL ON-SITE ASPHALT PAVEMENT TO BE CONSTRUCTED AS PER PAVEMENT STRUCTURE DETAIL ON THE DETAIL SHEET.
8. CHANGES TO GRADE SHALL BE FORMED BY SMOOTH CURVES.
9. ALL BUILDINGS EXIT TO GRADE FROM THE LOWER FLOOR, UNLESS OTHERWISE NOTED.
10. CONTRACTOR TO EMPLOY GEOTECHNICAL CONSULTANT FOR PERFORMANCE OF IN PLACE TESTING DURING THE PREPARATION OF THE SUBGRADE AND CONSTRUCTION OF THE PAVEMENT STRUCTURE.
11. CONTRACTOR TO REVIEW DETAILS SHEET TO CONFIRM SITE SPECIFIC DESIGN REQUIREMENTS. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION.

SITE GRADING LEGEND

EXISTING GROUND ELEVATION	
FINISHED GROUND ELEVATION	+99.99
FINISHED GROUND ELEVATION AT TOP OF WALL	+99.99 TW
FINISHED GROUND ELEVATION AT BOTTOM OF WALL	+99.99 BW
FINISHED GROUND ELEVATION TO MEET EXISTING ELEVATION	+99.99 M
GRADE	9.9%
EXISTING GROUND CONTOUR	
MINIMUM GARAGE ELEVATION	MGE=99.99m
FINISHED FLOOR ELEVATION	FFE=99.99m
CURB & GUTTER – SEE DETAIL	
EDGE OF ASPHALT PAVEMENT	
RETAINING WALL – BY OTHERS	
SWALE	
CULVERT	
CATCH BASIN	
LAWN BASIN	
RIM ELEVATION	(99.99)
ASPHALT PAVEMENT	
PROPOSED MANHOLE	
CLEANOUT	
EX. MULTI-USE PATH	
PAVERS AS PER LANDSCAPE DRAWINGS	

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

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LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES

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3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4					
5					

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CLIENT: 1447227 BC LTD
250-327-1617

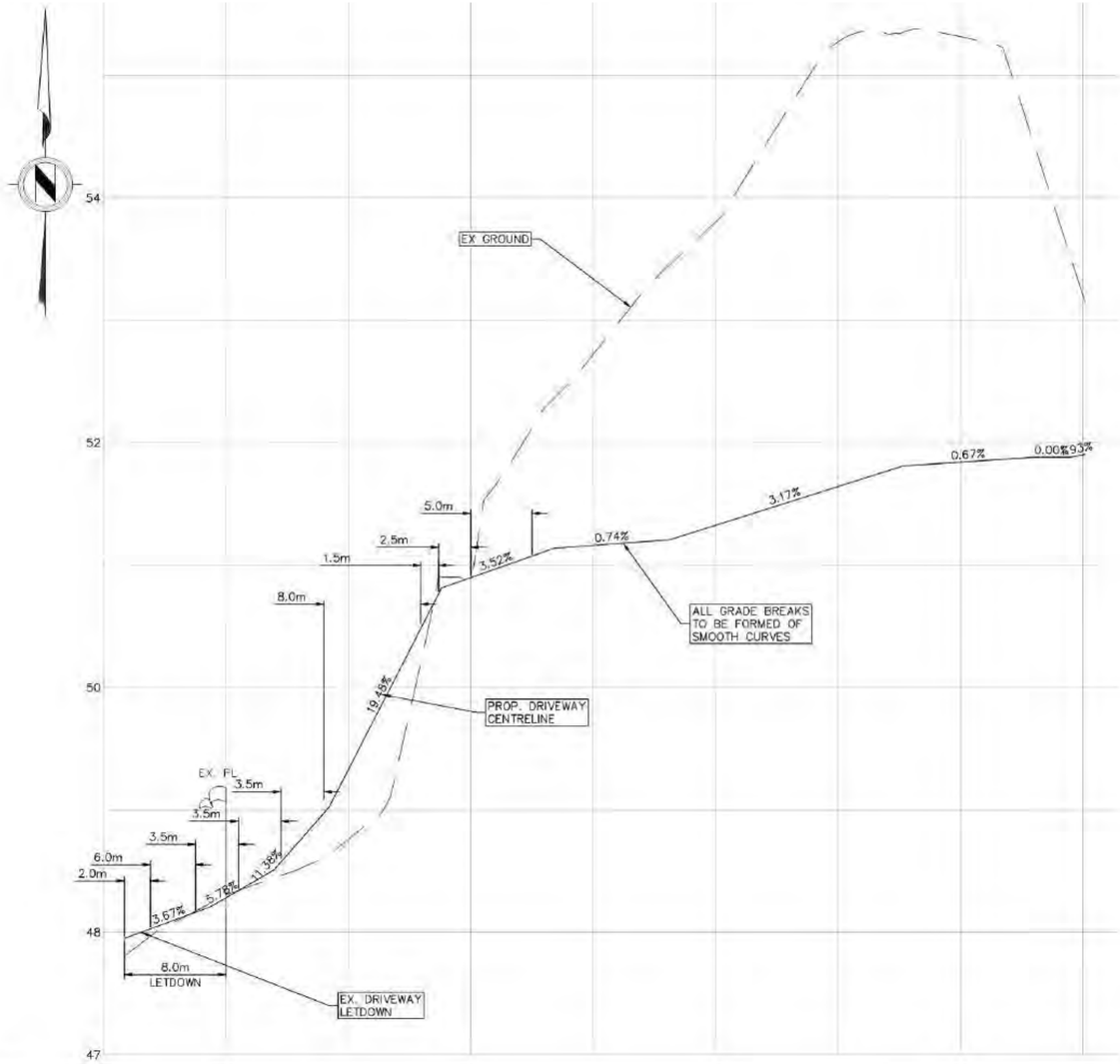
PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE: 23-8024 - GRADING PLAN

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
PROJECT NO. .
SCALE: HORZ. 1:150 VERT.
DRAWING DATE: NOVEMBER, 2023
DRAWING NO. .
A & M DRAWING NO. 23-8024-C100
SHEET NO. 03 OF 06
REV. 03

0 1.5 1:150 7.5m



CENTRELINE ROAD ELEVATIONS	EXISTING	48.21	50.94	51.32	51.82
	PROPOSED	48.21	50.94	51.32	51.82
CHAINAGE	1+080	1+100	1+120	1+140	1+160

SITE GRADING NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON-SITE PRE-CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO-ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
5. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS AND TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
6. ALL EXCAVATION, FILL PLACEMENT AND COMPACTION TO BE IN ACCORDANCE WITH GEOTECHNICAL CONSULTANTS REPORT.
7. ALL ON-SITE ASPHALT PAVEMENT TO BE CONSTRUCTED AS PER PAVEMENT STRUCTURE DETAIL ON THE DETAIL SHEET.
8. CHANGES TO GRADE SHALL BE FORMED BY SMOOTH CURVES.
9. ALL BUILDINGS EXIT TO GRADE FROM THE LOWER FLOOR, UNLESS OTHERWISE NOTED.
10. CONTRACTOR TO EMPLOY GEOTECHNICAL CONSULTANT FOR PERFORMANCE OF IN PLACE TESTING DURING THE PREPARATION OF THE SUBGRADE AND CONSTRUCTION OF THE PAVEMENT STRUCTURE.
11. CONTRACTOR TO REVIEW DETAILS SHEET TO CONFIRM SITE SPECIFIC DESIGN REQUIREMENTS. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION.

SITE GRADING LEGEND

EXISTING GROUND ELEVATION	
FINISHED GROUND ELEVATION	+99.99
FINISHED GROUND ELEVATION AT TOP OF WALL	+99.99 TW
FINISHED GROUND ELEVATION AT BOTTOM OF WALL	+99.99 BW
FINISHED GROUND ELEVATION TO MEET EXISTING ELEVATION	+99.99 M
GRADE	9.9%
EXISTING GROUND CONTOUR	
MINIMUM GARAGE ELEVATION	MGE=99.99m
FINISHED FLOOR ELEVATION	FFE=99.99m
CURB & GUTTER – SEE DETAIL	
EDGE OF ASPHALT PAVEMENT	
RETAINING WALL – BY OTHERS	
CATCH BASIN	
LAWN BASIN	
ASPHALT PAVEMENT	
PROPOSED MANHOLE	
CLEANOUT	
EX. MULTI-USE PATH	
PAVERS AS PER LANDSCAPE DRAWINGS	
FINISHED GROUND	
EXISTING GROUND	
SWALE	

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

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LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES.

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CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

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TITLE: 23-8024 - GRADING PROFILE

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL

A & M FILE: 23-8024

PROJECT NO. .

SCALE: HORZ. 1:250 VERT. 1:50

DRAWING DATE: NOVEMBER, 2023

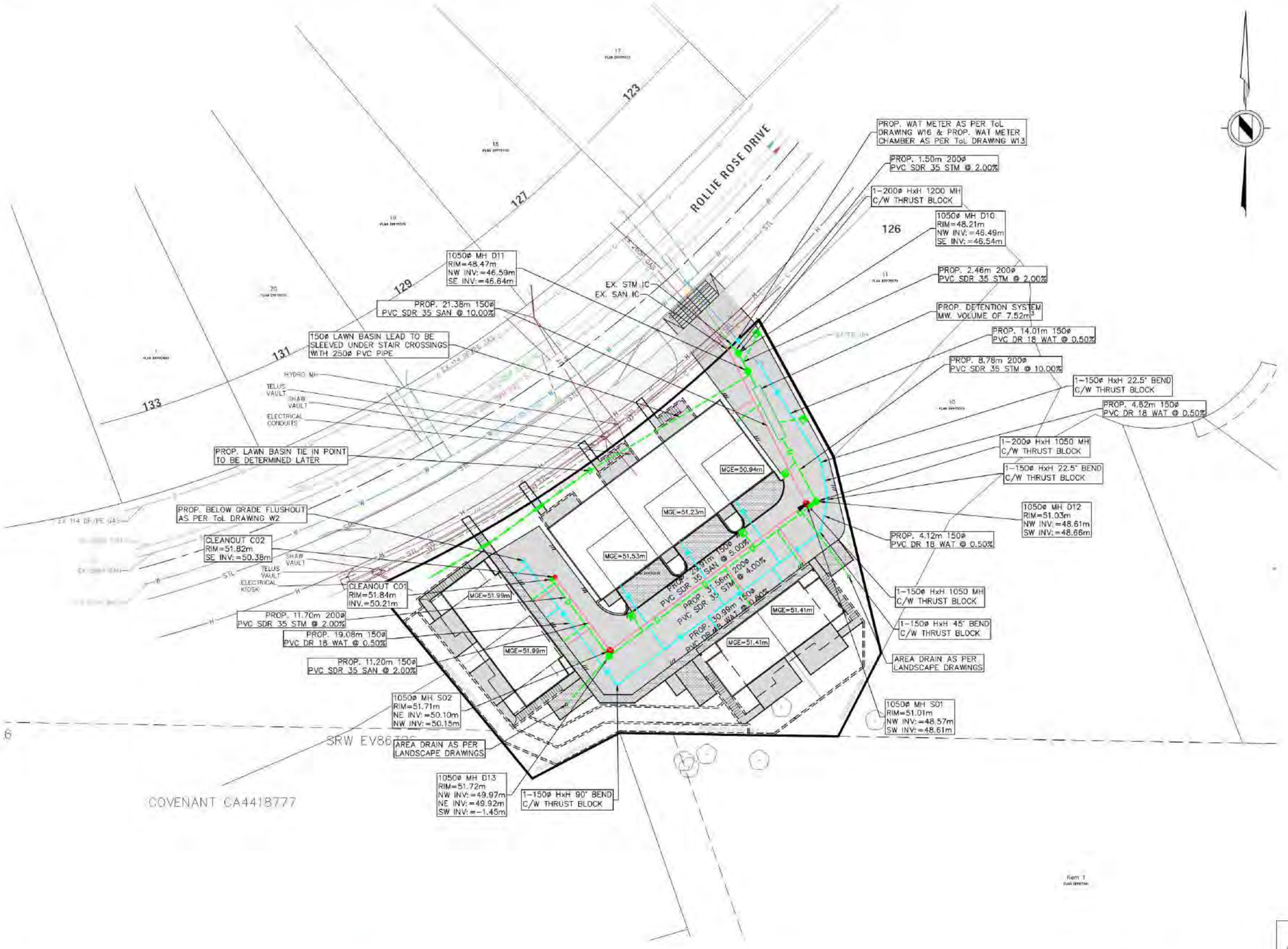
DRAWING NO. .

A & M DRAWING NO. 23-8024-C120

SHEET NO. 04 OF 06

REV. 03

0 2 1:250 12m
0 0.5 1:50 2.5m



SITE SERVICING NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON-SITE PRE-CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS, AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM, AND SANITARY CONNECTIONS TO THE SITE. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION. EXISTING AND PROPOSED SERVICES MAY REQUIRE ADJUSTMENT WHERE A CONFLICT OCCURS.
5. CIVIL SCOPE ENDS AT 1.0m FROM THE BUILDING FOOTPRINT. BUILDING CONSULTANT SCOPE INCLUDES ALL WORKS WITHIN 1.0m OF THE BUILDING FOOTPRINT.
6. BUILDING CONTRACTOR TO INSTALL STORM AND SANITARY CLEANOUTS AT BUILDING LOCATION AS PER BC PLUMBING CODE 2018 DIVISION B PART 2 SENTENCE 2.4.7.1.(6).
7. ALL ON-SITE CATCH BASINS ARE TO BE INSTALLED AS PER CATCH BASIN DETAIL ON THE DETAIL SHEET.
8. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO-ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
9. CONSULT FORTIS BC AND MECHANICAL DRAWINGS FOR GAS DISTRIBUTION AND DESIGN INFORMATION.
10. CONSULT BC HYDRO AND ELECTRICAL DRAWINGS FOR ELECTRICITY DISTRIBUTION AND DESIGN INFORMATION.
11. CONSULT TELE-COMMUNICATIONS AND ELECTRICAL DRAWINGS FOR TELE-COMM. DISTRIBUTION AND DESIGN INFORMATION.
12. CONTRACTOR TO REVIEW DETAILS SHEET TO CONFIRM SITE SPECIFIC DESIGN REQUIREMENTS. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION.

LEGEND

- PROP. STORM SEWER
- EX. SANITARY SEWER
- PROP. STORM SEWER
- PROP. WATERMAIN
- STREET LIGHTING — STL —
- STORM SERVICE CONNECTION
- SANITARY SERVICE CONNECTION
- EDGE OF PAVEMENT — EP —
- UNDERGROUND GAS - BY OTHERS — G —
- UNDERGROUND HYDRO - BY OTHERS — H —
- UNDERGROUND TELEPHONE - BY OTHERS — UT —
- UNDERGROUND COMMUNICATION - BY OTHERS
- SWALE
- CULVERT
- MANHOLE
- CLEANOUT
- LAWN BASIN
- CATCH BASIN
- EXISTING GROUND CONTOUR
- MIN. GARAGE FLOOR ELEVATION — MGE=99.99m
- RETAINING WALL - BY OTHERS — — — — —
- ASPHALT PAVEMENT
- PAVERS AS PER LANDSCAPE DRAWINGS
- MULTI-USE PATH

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEERS DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES.

REV.	DESCRIPTION	DR	CH	DATE	APP
1	ISSUED FOR COORDINATION	CIT	ABG	2023/12/22	SAL
2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4					
5					

APLIN MARTIN
EGBC Permit to Practice Number #1001018
Aplin & Martin Consultants Ltd.
#104 - 6596 Applecross Road, Nanaimo, B.C. Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE: 23-8024 - SERVICE PLAN

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
DRAWING DATE: NOVEMBER, 2023

PROJECT NO. .
SCALE: HORZ. 1:250 VERT.
DRAWING NO. .
A & M DRAWING NO. 23-8024-C200
SHEET NO. 05 OF 06
REV. 03

0 2 1:250 12m

STORMWATER MANAGEMENT NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON-SITE PRE-CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS, AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM AND SANITARY CONNECTIONS TO THE SITE. REPORT TO THE ENGINEER OF RECORD ANY DISCREPANCIES PRIOR TO START OF CONSTRUCTION.
5. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO-ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
6. CONTRACTOR TO REVIEW DETAILS SHEET TO CONFIRM SITE SPECIFIC DESIGN REQUIREMENTS. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION.

STORMWATER MANAGEMENT LEGEND

- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- 100 YEAR PIPE FLOW – IN PIPE
- MANHOLE, CLEANOUT, HEADWALL NUMBER
- CATCHMENT AREA (CATCHMENT: A1, AREA (ha): 99.99)
- CATCHMENT AREA BOUNDARY LINE
- PAVERS AS PER LANDSCAPE DRAWINGS
- HARDSCAPE BUILDING AREA
- HARDSCAPE PAVEMENT AREA
- LANDSCAPE AREA
- MANHOLE
- CATCH BASIN
- LAWN BASIN
- RIM ELEVATION (99.99)
- LOCAL OVERLAND FLOW DIRECTION
- SWALE

STORMWATER DETENTION CALCULATION

10 YEAR RELEASE RATE FLOWS

	Time T_c	Runoff Coeff.	Area A	Intensity I	Flow Q
	min	%	Ha	mm/hr	m³/s
Q_{pre}	10	0.30	0.19	46.5	0.007
Q_{post}	10	0.77	0.19	46.5	0.019

Storage Volume Required (Modified Rational Method)

Storage = $T_d \times (Q_d - Q_{rel}) + 0.5 \times T_c \times Q_{rel} \times (1/Q_{rel} - 1/Q_c)$

- T_c = Time to concentration [seconds]
- Q_c = Peak flow for storm at $T = T_c$ [m³/s]
- T_d = Time of storm duration [seconds]
- Q_d = Peak flow for storm at $T = T_d$ [m³/s]
- Q_{rel} = Maximum allowable release rate [m³/s]

Storage Required = 7.34 m³

Rainfall Duration T_d	Rainfall Intensity I	Release Rate Q_{rel}	Peak Flow Q_c	Peak Flow Q_d	Storage
min	mm/hr	m³/s	m³/s	m³/s	m³
10	46.5	0.007	0.019	0.019	6.97
15	37.5	0.007	0.019	0.015	7.34
20	32.2	0.007	0.019	0.013	7.29
25	28.6	0.007	0.019	0.012	6.97
30	25.9	0.007	0.019	0.011	6.45
35	23.9	0.007	0.019	0.010	5.79
40	22.3	0.007	0.019	0.009	5.02
45	20.9	0.007	0.019	0.009	4.16
50	19.8	0.007	0.019	0.008	3.22
55	18.8	0.007	0.019	0.008	2.21
60	17.9	0.007	0.019	0.007	1.14
70	16.5	0.007	0.019	0.007	-1.13

10 YEAR DETENTION REQUIREMENT

Table 1: Typical Runoff Coefficients

Surface Type	Runoff Coefficient	Surface Type	Runoff Coefficient
Pavement, Asphalt	0.95	Turf, Flat (0 - 1% slope)	0.25
Pavement, Concrete	0.95	Turf, Average (1 - 5% slope)	0.35
Pavement, Brick	0.85	Turf, Hilly (3 - 10% slope)	0.40
Pavement, Gravel	0.75	Turf, Steep (> 10% slope)	0.45
Roofs, Conventional	0.95	Vegetation, Flat (0 - 1% slope)	0.10
Roof, Garden Roof (< 10 cm)	0.50	Vegetation, Average (1 - 5% slope)	0.20
Roof, Garden Roof (10 - 20 cm)	0.30	Vegetation, Hilly (3 - 10% slope)	0.25
Roof, Garden Roof (21 - 50 cm)	0.20	Vegetation, Steep (> 10% slope)	0.30
Roof, Garden Roof (> 50 cm)	0.10		

LEED RUNOFF COEFFICIENTS

RUNOFF COEFFICIENT CALCULATION

Historic Conditions

	Area m²	Area %	Runoff Coeff.	Weighted Average Coeff.
Site Area	1903	100%	0.30	0.30
Forested	1903	100%		

Existing Conditions

	Area m²	Area %	Runoff Coeff.	Weighted Average Coeff.
Site Area	1903	100%	0.30	0.30
Softscape	1903	100%		
Roof	0	0%	0.95	
Hardscape	0	0%	0.95	

Proposed Conditions

	Area m²	Area %	Runoff Coeff.	Weighted Average Coeff.
Site Area	1903	100%	0.77	0.77
Softscape	500	26%	0.30	
Roof	560	29%	0.95	
Pavers	155	8%	0.85	
Hardscape	688	36%	0.95	

CALCULATED RUNOFF COEFFICIENTS

STORM FLOW ANALYSIS - CALCULATION SHEET

Municipal Project:
Project Title: Ladysmith Multi
Project Location: 128 Rollie Rose Drive

APLIN MARTIN
EGBC Permit to Practice: 1001018

Consultants: Aplin & Martin Consultants Ltd.
Engineer of Record: Scott Lewis, P.Eng

SEAL/ENGINEER'S STAMP

RETURN PERIOD: 10 Years
DATE: 29-Feb-24
A&M File: 23-8024
Design by: CIT
Check By: ABG
SHEET: 1 of 1

Mannings Formula
$V = (1/n) \times R^{2/3} \times S^{1/2}$
$Q = V \times A$
$n_{(Pipe)} = 0.013$
Mannings Formula
$Q = C \times I \times A \times 2.78$
$I = a \times T_c^{b} \times 10$

Locations		Sub-Catchments						Flow Calculations		Pipe Parameters						
FROM MH	TO MH	Area #	Area A	Runoff Coeff C	AxC	Accum. (AxC)	Time of Conc T_c	Rainfall Intensity I	Design Flow Q_5	Diameter of Pipe D	Length of Pipe L	Design Slope S	Installed Slope	Flow Capacity Q_{CAP}	Velocity V_{CAP}	Time of Flow
			(Ha)		(Ha)	(Ha)	(min)	(mm/hr)	(L/s)	(mm)	(m)	(%)	(%)	(L/s)	(m/s)	(min)
ONSITE																
CO1	D13	A	0.02	0.95	0.01	0.01	10.00	46.45	1.84	200	11.70	2.00		46.4	1.48	0.13
D13	D12	B	0.10	0.77	0.08	0.09	10.13	46.14	11.61	200	31.56	4.00		65.6	2.09	0.25
D12	D11	C	0.07	0.77	0.05	0.14	10.38	45.54	17.84	200	11.00	10.00		103.7	3.30	0.06
D11	D10	D	0.01	0.77	0.01	0.15	10.44	45.40	18.88	200	2.46	2.00		46.4	1.48	0.03
D10	IC	E	0.00	0.95	0.00	0.15	10.47	45.33	18.86	200	1.50	2.00		46.4	1.48	0.02

10 YEAR RATIONAL METHOD

STORM FLOW ANALYSIS - CALCULATION SHEET

Municipal Project:
Project Title: Ladysmith Multi
Project Location: 128 Rollie Rose Drive

APLIN MARTIN
EGBC Permit to Practice: 1001018

Consultants: Aplin & Martin Consultants Ltd.
Engineer of Record: Scott Lewis, P.Eng

SEAL/ENGINEER'S STAMP

RETURN PERIOD: 100 Years
DATE: 29-Feb-24
A&M File: 23-8024
Design by: CIT
Check By: ABG
SHEET: 1 of 1

Mannings Formula
$V = (1/n) \times R^{2/3} \times S^{1/2}$
$Q = V \times A$
$n_{(Pipe)} = 0.013$
Mannings Formula
$Q = C \times I \times A \times 2.78$
$I = a \times T_c^{b} \times 10$

Locations		Sub-Catchments						Flow Calculations		Pipe Parameters						
FROM MH	TO MH	Area #	Area A	Runoff Coeff C	AxC	Accum. (AxC)	Time of Conc T_c	Rainfall Intensity I	Design Flow Q_{100}	Diameter of Pipe D	Length of Pipe L	Design Slope S	Installed Slope	Flow Capacity Q_{CAP}	Velocity V_{CAP}	Time of Flow
			(Ha)		(Ha)	(Ha)	(min)	(mm/hr)	(L/s)	(mm)	(m)	(%)	(%)	(L/s)	(m/s)	(min)
ONSITE																
CO1	D13	A	0.02	0.95	0.01	0.01	10.00	68.71	2.72	200	11.70	2.00		46.4	1.48	0.13
D13	D12	B	0.10	0.77	0.08	0.09	10.13	68.20	17.17	200	31.56	4.00		65.6	2.09	0.25
D12	D11	C	0.07	0.77	0.05	0.14	10.38	67.25	26.35	200	11.00	10.00		103.7	3.30	0.06
D11	D10	D	0.01	0.77	0.01	0.15	10.44	67.03	27.88	200	2.46	2.00		46.4	1.48	0.03
D10	IC	E	0.00	0.95	0.00	0.15	10.47	66.92	27.83	200	1.50	2.00		46.4	1.48	0.02

100 YEAR RATIONAL METHOD

NOT FOR CONSTRUCTION

LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES.

REV.	DESCRIPTION	DR	CH	DATE	APP
1	ISSUED FOR COORDINATION	CIT	ABG	2023/12/22	SAL
2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4					
5					

APLIN MARTIN
EGBC Permit to Practice Number #1001018
Aplin & Martin Consultants Ltd.
#104 - 6596 Applecross Road, Nanaimo, B.C. Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

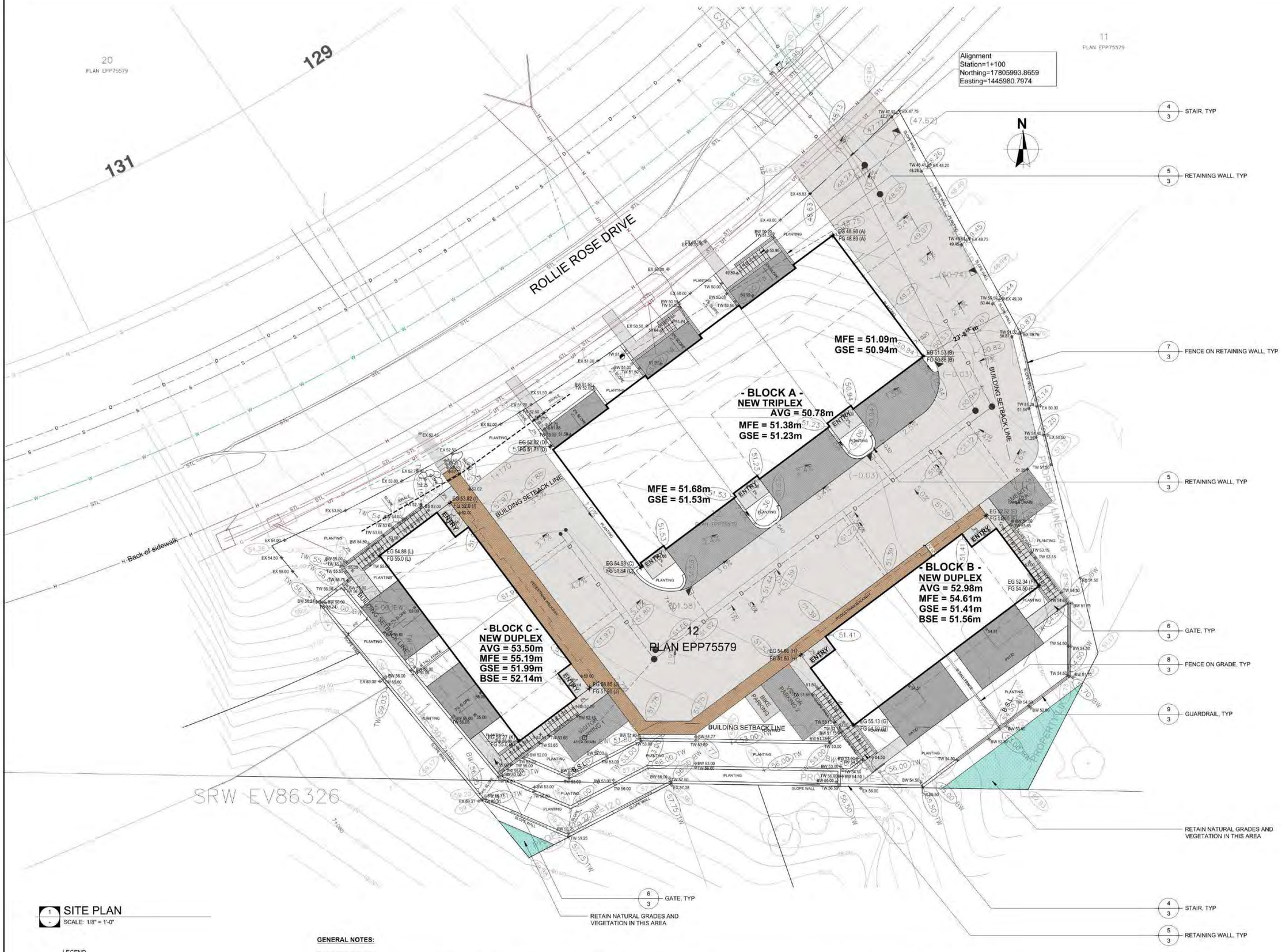
The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE: 23-8024 - STORM MANAGMENT PLAN

PROJECT NO. .
SCALE: HORZ. 1:250 VERT.
DRAWING NO. .
A & M DRAWING NO. 23-8024-C800

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
DRAWING DATE: NOVEMBER, 2023
SHEET NO. 06 OF 06
REV. 03

0 2 1:250 12m



1 - SITE PLAN
SCALE: 1/8" = 1'-0"

LEGEND

- C/P, CONCRETE PAVING SEE DETAIL 1 IN SHEET L3
- 4 1/2" x 9" X 2 1/2" CLASSIC STANDARD SERIES PAVER BY BELGARD HARVEST COLOR SEE DETAIL 2 IN SHEET L3
- 4 1/2" x 9" X 2 1/2" CLASSIC STANDARD SERIES PAVER BY BELGARD NATURAL COLOR SEE DETAIL 2 IN SHEET L3
- 24"X24", 2" THICK TEXADA HYDRAPRESSED SLAB BY BELGARD NATURAL COLOR SEE DETAIL 3 IN SHEET L3
- RETAIN NATURAL GRADES AND VEGETATION IN THIS AREA

GENERAL NOTES:

1. **Retaining Walls**
All retaining walls shall be approved by GEOTECH & STRUCTURAL ENGINEER. Refer to ARCHITECTURAL for layout & grading and retaining walls. Contractor shall insure positive drainage behind all retaining walls and throughout the site.

2. Area Drains
Refer to Civil engineer's drawings

3. Automatic Irrigation System
All planting and lawn areas shall be provided with an automatic irrigation system. Provide PVC sleeving below walkway paving as required for irrigation system. Insure good coverage for all planting and lawn areas. Contractor shall be responsible for irrigation design and construction and provision of as-built irrigation plan following completion of the work.

4. Landscape Lighting
Landscape lighting locations and power supply shall be approved by ELECTRICAL. Contractor shall supply and install recessed wall mounted stair lights

5. BCSLA/BCLNA Standards
All landscaping and plant material shall be in accordance with BCSLA/BCLNA Standards, current edition.

6. Minimum growing medium depths:

Lawn	6" (150mm)
Shrubs	24" (600mm)
Trees	36" (1000mm)

7. Mulch
Apply 3" thick pine bark mulch in all planting areas

POINT LANDSCAPE STUDIO INC.

7788682378

YYU@POINTLASTUDIO.COM

WWW.POINTLASTUDIO.COM

ISSUANCE:

No.	Date	Details	By
1	FEB 20, 2024	ISSUED FOR COORDINATION	YY
2	APR 25, 2024	ISSUED FOR DP	YY

PERMIT DRAWING ONLY, NOT FOR CONSTRUCTION

STAMP:

PROJECT NAME:
128 ROLLIE RD.
LADYSMITH

DRAWING TITLE:
SITE & GRADING PLAN

PLS PROJECT NUMBER: 23012
DATE: 2023 AUG 23

DRAWN BY: YY

SCALE: 1/8"=1'

DWG. NO.: L1

OF: 3

PLANTING PLAN
SCALE: 1/8" = 1'-0"

PLANT LIST

Code	Quantity	Scientific Name	Common Name	Size	Spacing
Trees					
AB	5	Acer palmatum 'Bloodgood'	Bloodgood Japanese Maple	Cal. 6cm	As Shown
AC	5	Acer circinatum	Vine Maple	Cal. 6cm	As Shown
AG	1	Abies grandis	Grand Fir	3m tall	As Shown
AR	7	Acer Rubrum	Red Maple	Cal. 8cm	As Shown
CD	1	Crataegus douglasii	Black Hawthorn	Cal. 6cm	As Shown
CN	3	Cornus nuttallii	Pacific Dogwood	Cal. 8cm	As Shown
MF	1	Malus fusca	Pacific Crab Apple	Cal. 8cm	As Shown
Shrubs					
As		Amelanchier alnifolia	Saskatoon Serviceberry	#3 pot	As Shown
Au	300	Arctostaphylos uva-ursi	Kinnikinnick	#1 pot	300mm O.C.
Az	50	Azalea japonica Palestrina	Azalea	#3 pot	450mm O.C.
Cs	40	Cornus stolonifera	Red-osier Dogwood	#1 pot	900mm O.C.
Gs	236	Gaultheria shallon	Salal	10cm pot	300mm O.C.
La	30	Mahonia nervosa	Oregon Grape	#1 pot	450mm O.C.
Pc	3	Physocarpus capitatus	Pacific Ninebark	#3 pot	As Shown
Pm	20	Pinus mugo	Mugo pines	#5 pot	As Shown
Rm	20	Rhododendron macrophyllum	Pacific Rhododendron	#3 pot	450mm O.C.
Rn	10	Rosa Nutkana	Nootka Rose	#3 pot	450mm O.C.
Rs	15	Ribes sanguineum	Red-Flowering Currant	#3 pot	As Shown
Sd	50	Spiraea douglasii	Rose spirea	#3 pot	450mm O.C.
Sr	6	Sambucus racemosa	Red Elderberry	#3 pot	As Shown
Sm	21	Spiraea Japonica 'Goldflame'	Goldflame Spirea	#1 pot	As Shown
Tb	12	Taxus x media H. M. Eddie	Yew	#2 pot	600mm O.C.
Vd	30	Viburnum davidii	David viburnum	#3pot	As Shown
Groundcovers and Perennials					
as	14	Astilbe chinensis 'Purple Candles'	Chinese Astilbe	#1 Pot	300mm O.C.
fc	28	Fragaria chiloensis	Coastal Strawberry	#1 pot	300mm O.C.
po	10	Polystichum munitum	Western Swordfern	#1 pot	900mm O.C.
Lawn					
Sod	814 sf				

POINT LANDSCAPE STUDIO INC.

7788682378

YYU@POINTLASTUDIO.COM

WWW.POINTLASTUDIO.COM

ISSUANCE:

No.	Date	Details	By
1	FEB 20, 2024	ISSUED FOR COORDINATION	YY
2	APR 25, 2024	ISSUED FOR DP	YY

PERMIT DRAWING ONLY, NOT FOR CONSTRUCTION

STAMP:

PROJECT NAME:
128 ROLLIE RD.
LADYSMITH

DRAWING TITLE:
PLANTING PLAN

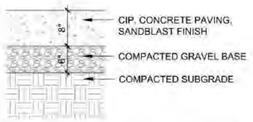
PLS PROJECT NUMBER: 23012
DATE: 2023 AUG 23

DRAWN BY: YY

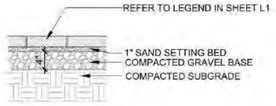
SCALE: 1/8"=1'

DWG. NO.: L1

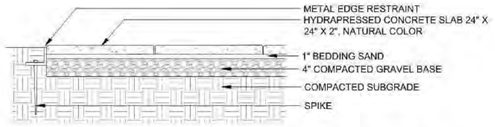
OF: 3



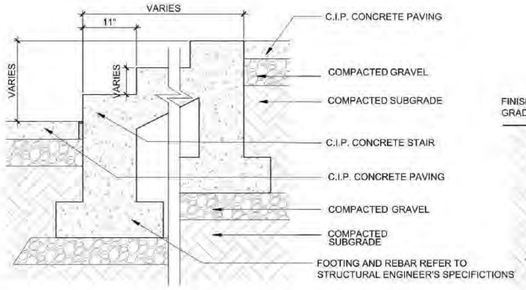
1 - CIP. CONCRETE PAVING
SCALE: 1" = 1'-0"



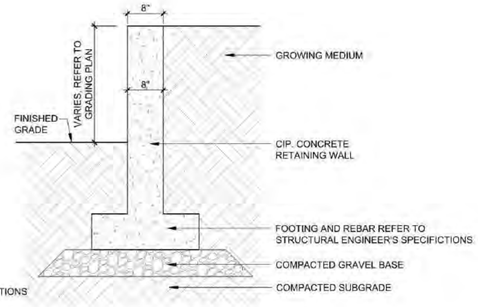
2 - CONCRETE UNIT PAVER ON GRADE
SCALE: 1" = 1'-0"



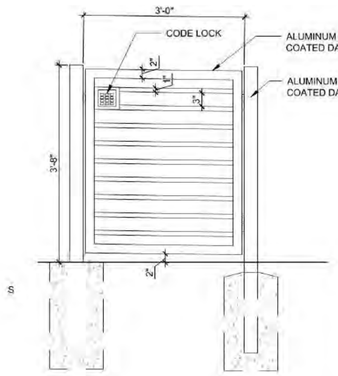
3 - HYRAPRESSED CONCRETE SLAB PAVING
SCALE: 1" = 1'-0"



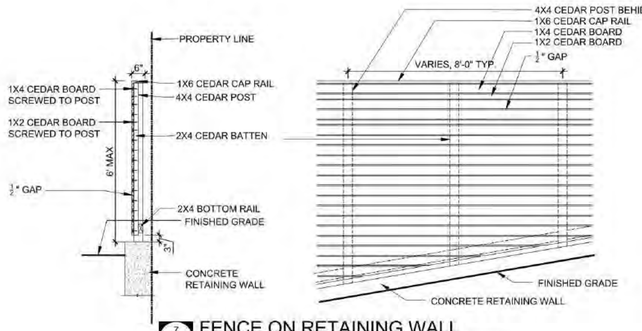
4 - C.I.P. CONCRETE STAIR
SCALE: 1" = 1'-0"



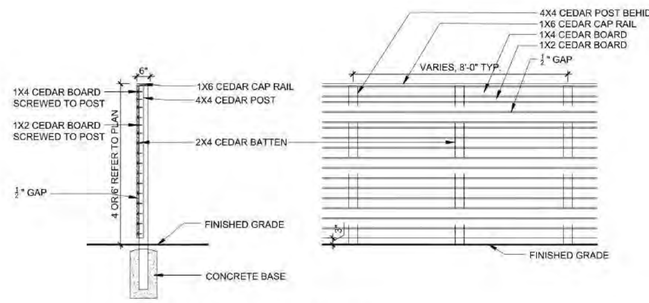
5 - CIP. CONCRETE RETAINING WALL, TYP.
SCALE: 1" = 1'-0"



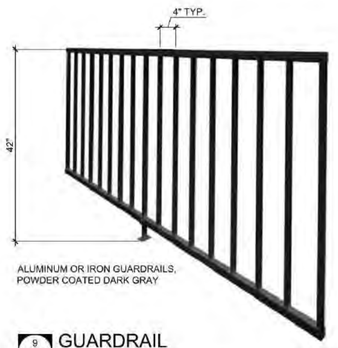
6 - GATE
SCALE: 1" = 1'-0"



7 - FENCE ON RETAINING WALL
SCALE: 1/2" = 1'-0"



8 - FENCE ON GRADE
SCALE: 1/2" = 1'-0"



9 - GUARDRAIL
SCALE: 1/2" = 1'-0"

PROTECT TREE FROM DAMAGE DURING TRANSPORTATION AND PLANTING

LOCATE AND FLAG ALL BURIED UTILITIES IN TREE PLANTING SITES PRIOR TO DIGGING.

DO NOT EXPOSE TREE ROOTS TO DIRECT SUN OR FROST.

FOR TREE STAKES, USE 50MM WIDE FABRIC BELT ATTACHED TO TREE STAKES WITH SINGLE NAILS, DO NOT DAMAGE ROOT BALL.

SET ROOT BALL TO SAME GRADE AS NURSERY, WATER AND FERTILIZER AT TIME OF PLANTING

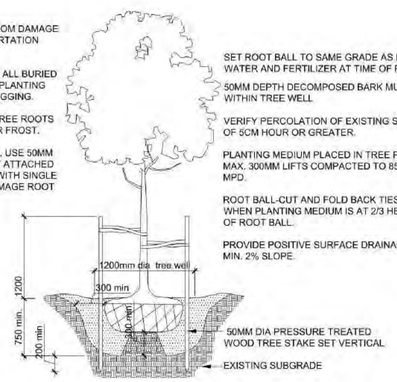
50MM DEPTH DECOMPOSED BARK MULCH WITHIN TREE WELL

VERIFY PERCOLATION OF EXISTING SOIL OF 5CM HOUR OR GREATER.

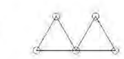
PLANTING MEDIUM PLACED IN TREE PIT IN MAX. 300MM LIFTS COMPACTED TO 85% MPD.

ROOT BALL-CUT AND FOLD BACK TIES WHEN PLANTING MEDIUM IS AT 2/3 HEIGHT OF ROOT BALL.

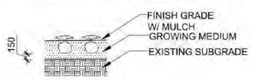
PROVIDE POSITIVE SURFACE DRAINAGE MIN. 2% SLOPE.



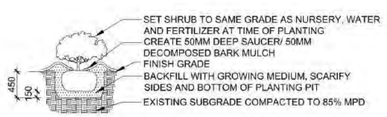
TREE PLANTING ON GRADE



TRIANGULAR SPACING (SPACING SEE PLANT LIST)



GROUNDCOVER PLANTING ON GRADE



SHRUB PLANTING ON GRADE

10 - PLANTING DETAILS - TYP.
SCALE: NTS

POINT LANDSCAPE STUDIO INC.

7788682378

YYU@POINTLASTUDIO.COM

WWW.POINTLASTUDIO.COM

ISSUANCE:

No.	Date	Details	By
1	FEB 06, 2024	ISSUED FOR COORDINATION	YY
2	APR 25, 2024	ISSUED FOR DP	YY

PERMIT DRAWING ONLY, NOT FOR CONSTRUCTION

STAMP:

PROJECT NAME:
128 ROLLIE RD.
LADYSMITH

DRAWING TITLE:
DETAILS

PLS PROJECT NUMBER: 23012
DATE: 2023 AUG 23

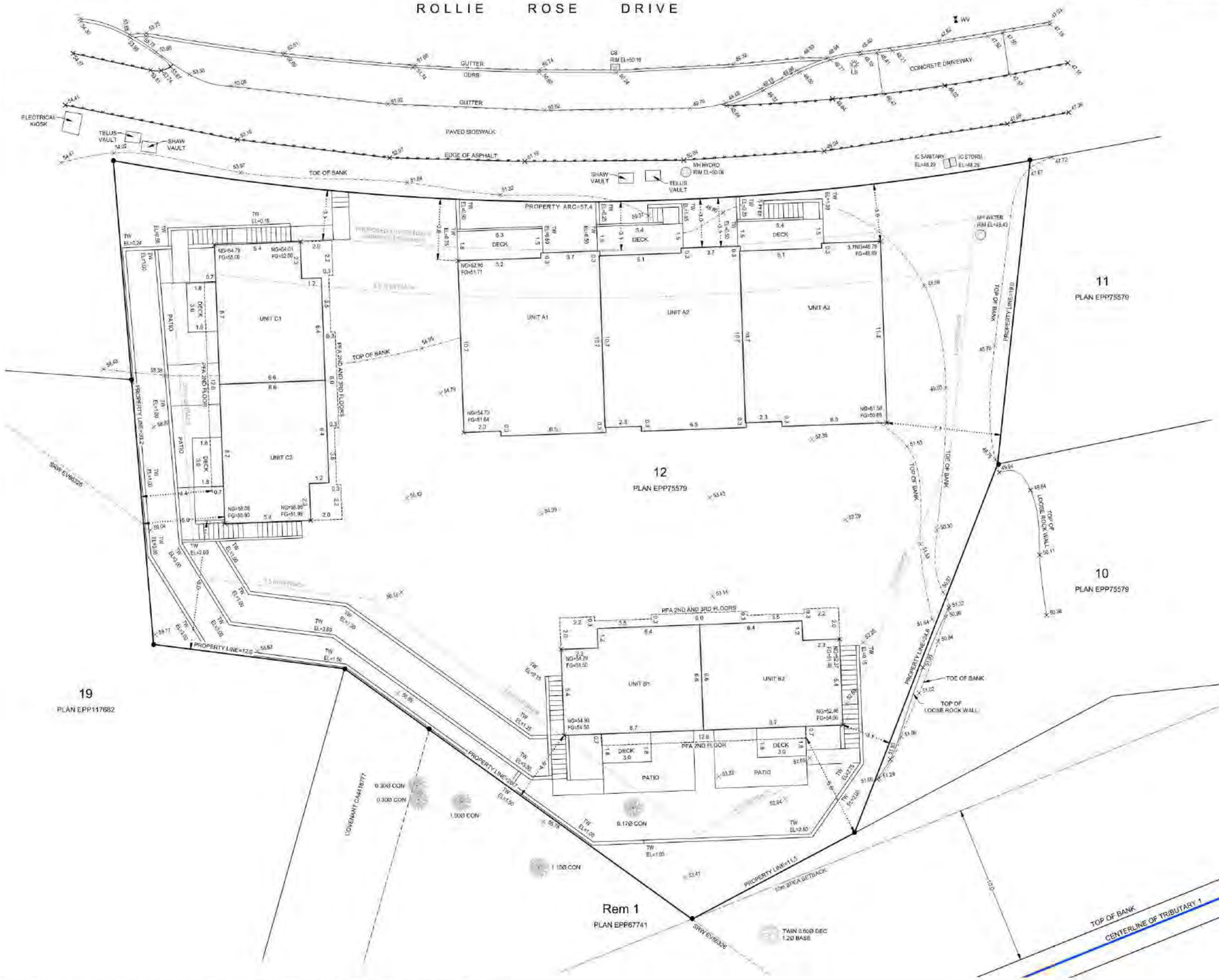
DRAWN BY: YY

SCALE: AS SHOWN

DWG. NO.: L3

OF: 3

BUILDING AND HEIGHT CALCULATIONS:	BUILDING A	BUILDING B	BUILDING C
Average Natural Grade (NG):	52.02 m	53.65 m	55.96 m
Average Finished Grade (FG):	50.78 m	52.58m	53.59 m
Maximum Permitted Building Height	10.00 m	10.00 m	10.00 m
Proposed Building Height	9.95 m	9.44 m	9.62 m
Maximum Roof Peak Elevation	60.76 m	62.86 m	63.59 m
Proposed Roof Peak Elevation	60.73 m	62.42 m	63.12 m



SITE PLAN OF LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579.

TOWN OF LADYSMITH
INTEGRATED SURVEY AREA 43
CIVIC ADDRESS: 128 ROLLIE ROSE DRIVE
PID: 030-477-820
ZONE: R-3-A

SCALE 1:125

2 1 0 1 2 5

ALL DISTANCES ARE IN METRES AND DECIMALS THEREOF.

LEGEND:

- ● - DENOTES STANDARD IRON POST FOUND
- x 47.72 - DENOTES SPOT ELEVATION OF 47.72m (TYPICAL)
- CB - DENOTES CATCH BASIN
- IC - DENOTES INSPECTION CHAMBER WITH DESCRIPTION
- LS - DENOTES LAMP STANDARD
- MH - DENOTES MANHOLE WITH DESCRIPTION
- WV - DENOTES WATER VALVE
- PFA - DENOTES PERIMETER OF FLOOR ABOVE
- TW EL = 0.15 - DENOTES ELEVATION FROM TOP OF WALL TO FINISHED GRADE (TYPICAL)
- 0.60Ø DEC - DENOTES 0.60m Ø DECIDUOUS TREE
- 1.10Ø CON - DENOTES 1.1m Ø CONIFEROUS TREE

DATUM:

ELEVATIONS ARE GEODETIC AND DERIVED FROM CONTROL MONUMENT 87H3532.

CONTOUR INTERVAL = 1 METRE

PROPERTY:

PROPERTY DIMENSIONS SHOWN ARE DERIVED FROM: PLAN EPP75579

OFFSETS TO PROPERTY LINES ARE NOT TO BE USED TO DEFINE BOUNDARIES.

REFER TO CURRENT CERTIFICATE(S) OF TITLE FOR ADDITIONAL EXISTING OR PENDING CHARGES.

GENERAL:

THIS PLAN SHOWS THE LOCATION OF VISIBLE FEATURES ONLY, AND DOES NOT INDICATE BURIED SERVICES THAT MAY EXIST ON OR AROUND THE SUBJECT SITE.

FEATURES SHOWN WITHOUT DIMENSIONS SHOULD BE CONFIRMED WITH BENNETT LAND SURVEYING LTD.

TREE SPECIES AND DIMENSIONS SHOULD BE CONFIRMED BY A QUALIFIED ARBORIST. SHADED AREA IS NOT AN INDICATION OF DRIP LINE LOCATION UNLESS SPECIFICALLY LABELLED.

NOTE:

BUILDINGS SHOWN ARE BASED ON DETAILS OR INFORMATION RECEIVED FROM ADAPT DESIGN, RECEIVED: 2024-06-13.
RETAINING WALLS SHOWN ARE BASED ON DETAILS OR INFORMATION RECEIVED FROM APLIN MARTIN DATED: 2023 AUG 23.

bennett ©
LAND SURVEYING LTD.
BC LAND SURVEYORS
2339-UNIT B DELINEA PLACE NANAIMO, BC V9T 5L9
TEL 250-754-5816 www.bennettsurveys.com

DATE:	BY:
2024-09-09	TDM
REVISION:	0

CERTIFIED CORRECT

FIELD SURVEY COMPLETED ON THE 28TH DAY OF SEPTEMBER, 2023.

THIS DOCUMENT IS NOT VALID UNLESS ORIGINALLY SIGNED AND SEALED OR DIGITALLY CERTIFIED.

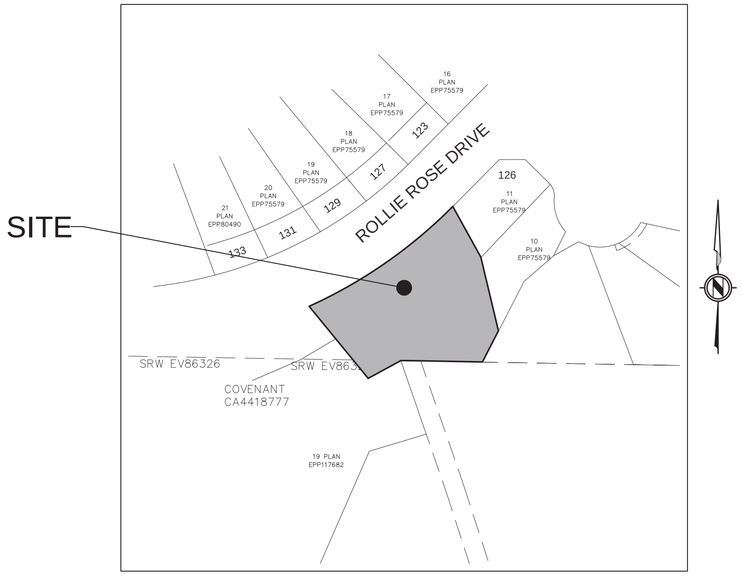
EGBC Permit to Practice Number #1001018
Aplin & Martin Consultants Ltd.
#104 - 6596 Applecross Road, Nanaimo, BC, Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

DEVELOPER:

1447227 BC LTD
250-327-1617
2092 SKAHA DRIVE, NANAIMO, BC

PROJECT:

LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC



SITE LOCATION PLAN
SCALE = 1:1000

DRAWING INDEX

DRAWING No.	REV No.	DRAWING TITLE
23-8024-C000	05	23-8024 - COVER
23-8024-C010	05	23-8024 - GENERAL NOTES
23-8024-C050	05	23-8024 - KEY PLAN
23-8024-C100	05	23-8024 - GRADING PLAN
23-8024-C120	05	23-8024 - GRADING PROFILE
23-8024-C200	05	23-8024 - SERVICE PLAN
23-8024-C800	05	23-8024 - STORM MANAGMENT PLAN

SCHEDULE E - Strom Water Management Plan
DP 3060-21-10
128 Rollie Rose Drive
7 Pages

MUNICIPAL PROJECT No. . & .

APLIN & MARTIN PROJECT No. 23-8024

NOT FOR CONSTRUCTION

Jun 27 2024 - 9:07pm M:\MAN\2023\23-8024_DWG_ONSITE PRODUCTION\23-8024 - 00 - Cover.dwg/00 23-8024 - COVER cturner

GENERAL NOTES:

1. ALL WORK AND MATERIALS ARE TO BE AS DESCRIBED IN THE TOWN OF LADYSMITH 'ENGINEERING STANDARDS AND SPECIFICATIONS' OR AS OTHERWISE APPROVED BY THE ENGINEER.
2. A CONSTRUCTION PERMIT TO INSTALL WORKS WITHIN STREETS , LANES AND TOWN PROPERTY AREAS', WILL BE REQUIRED WHERE CONSTRUCTION IS TO BE UNDERTAKEN IN TOWN OF LADYSMITH RIGHT-OF-WAYS AND/OR ON TOWN OF LADYSMITH OWNED UTILITIES OR PROPERTIES.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. CONNECTION TO, OR ALTERNATION OF EXISTING, TOWN-OWNED UTILITIES, WILL BE UNDERTAKEN BY TOWN OF LADYSMITH FORCES ONLY, UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.
5. UPON APPROVAL OF THE PERMIT THE TOWN OF LADYSMITH ENGINEER SHALL BE NOTIFIED FORTY-EIGHT (48) HOURS PRIOR TO COMMENCEMENT OF WORK.
6. ALL ELEVATIONS ARE GEODETIC AND DERIVED FROM CONTROL MONUMENT 87H3632.
7. ALL LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND ALL STRUCTURES ARE NOT NECESSARILY SHOWN.
8. TREE PROTECTION TO BE INSTALLED AS PER TOWN OF LADYSMITH ZONING BYLAW 1904 PART 7.2.2.E
9. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM, AND SANITARY CONNECTIONS TO THE SITE. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION. EXISTING AND PROPOSED SERVICES MAY REQUIRE ADJUSTMENT WHERE A CONFLICT OCCURS.
10. ANY ALTERNATIVES TO SPECIFIED MATERIALS OR APPURTENANCES TO BE APPROVED BY THE MUNICIPAL ENGINEER PRIOR TO CONSTRUCTION.
11. CIVIL SCOPE ENDS AT 1.0m FROM THE PROPOSED BUILDING FOOTPRINT. BUILDING CONSULTANT SCOPE INCLUDES ALL WORKS 1.0m WITHIN THE BUILDING FOOTPRINT.
12. TRENCHING TO BE AS PER TOWN OF LADYSMITH DRAWING 3T-1 AND 3T-2. TRAVELED AREA BACKFILL TO BE IMPORTED GRANULAR MATERIAL COMPACTED TO MINIMUM 95% MODIFIED PROCTOR, UNLESS OTHERWISE APPROVED BY THE GEOTECHINCAL ENGINEER OF RECORD.
13. ALL ASBESTOS CEMENT ENCOUNTERED WITHIN THE TRENCH LINE SHALL BE REMOVED AND DISPOSED OF, OR ABANDONED, IN ACCORDANCE WITH WORKSAFE BC AND MUNICIPALITY REQUIREMENTS.
14. ALL PIPING AND RELATED APPURTENANCES TO BE INSPECTED AND APPROVED BY THE ENGINEER OF RECORD, OR THEIR REPRESENTATIVE, PRIOR TO BACKFILLING.
15. ASPHALT PAVEMENT RESTORATION TO BE AS PER TOWN OF LADYSMITH DRAWING 3T-3.
16. ALL SURFACE RESTORATION (ROADS, CURBS, SIDEWALKS, ETC) SHALL BE TO ORIGINAL CONDITION OR BETTER.

WATERMAIN NOTES:

1. ALL WATER PIPES TO HAVE A MINIMUM 1.2m OF COVER, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER OF RECORD.
2. ALL WATER MAINS TO BE PVC DR18, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS
3. ALL EXISTING WATER MAINS TO BE REMOVED OR ABANDONED ONLY ONCE EXISTING WATER MAIN IS DECOMMISSIONED OR AS APPROVED BY THE ENGINEER OF RECORD.
4. ALL WATER MAIN JOINTS TO BE RESTRAINED AS PER TOWN OF LADYSMITH STANDARDS AND SPECIFICATIONS SECTION 4B.8 FOR THRUST BLOCKS AND JOINT RESTRAINTS.
5. ALL WATER MAIN JOINTS WITHIN 3.0m HORIZONTAL OR 0.45m VERTICAL OF SANITARY SEWER OR STORM DRAINS TO BE PROTECTED BY SHRINK WRAP OR PETROLEUM TAPE AS PER VANCOUVER ISLAND HEALTH AUTHORITY GUIDELINES FOR APPROVAL OF WATER SUPPLY SYSTEM.
6. TESTING OF THE WATER SYSTEM TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH ENGINEERING STANDARDS AND SPECIFICATIONS:
   - 6.1. SECTION 4B.10 PRESSURE AND LEAKAGE TESTING,
   - 6.2. SECTION 4B.11 FLUSHING, CHLORINATION AND BACTERIAL SAMPLING, AND
   - 6.3. SECTION 4B.12 NOTIFICATION TO MUNICIPAL ENGINEER - SYSTEM TESTS AND FINAL CONNECTION.

SANITARY SEWER NOTES:

1. ALL SANITARY PIPES TO HAVE A MINIMUM 1.5m OF COVER IN ROAD RIGHT-OF-WAYS AND 1.0m IN UNTRAVELED AREAS, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER OF RECORD.
2. ALL SANITARY MAINS TO BE PVC DR35, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS.
3. ALL SANITARY SERVICE CONNECTIONS TO BE 150ø PVC DR28 UNLESS OTHERWISE NOTED.
4. ALL SANITARY FORCE MAINS TO BE HDPE DR12 UNLESS OTHERWISE NOTED.
5. ALL SANITARY SERVICE BOXES TO BE IN ACCORDANCE WITH TOWN OF LADYSMITH DRAWINGS S07 AND S08.
6. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SERVICE TO EXISTING USERS DURING CONSTRUCTION THROUGH BYPASS PUMPING. THE CONTRACTOR IS TO PROVIDE A BYPASS PUMPING PLAN PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR SHALL ENSURE THAT THE PUMPING EQUIPMENT IS KEPT IN GOOD WORKING CONDITION DURING THE PROJECT.
7. ALL TESTING TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH STANDARDS AND SPECIFICATIONS:
   - 7.1. SECTION 5B.8 LEAKAGE TESTING OF GRAVITY SEWERS, AND
   - 7.2. SECTION 5B.9 VIDEO INSPECTING MAINS AND SERVICE CONNECTIONS
8. THE CONTRACTOR IS TO FLUSH ALL MAINS AND PROVIDE CCTV INSPECTION TO THE ENGINEER OF RECORD PRIOR TO ASPHALT INSTALLATION OR RESTORATION.

STORM DRAINAGE NOTES:

1. ALL STORM PIPES TO HAVE A MINIMUM 1.5m OF COVER IN ROAD RIGHT-OF-WAYS AND 1.0m IN UNTRAVELED AREAS, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER.
2. ALL STORM MAINS TO BE PVC DR35, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS.
3. ALL STORM DRAINAGE SERVICE CONNECTIONS TO BE 150ø PVC DR28, UNLESS OTHERWISE NOTED.
4. ALL CATCH/LAWN BASIN LEADS TO BE 200ø PVC DR35, UNLESS OTHERWISE NOTED.
5. ALL PERFORATED DRAIN PIPES TO BE PVC DR35, UNLESS OTHERWISE NOTED. SIZE NOTED ON DRAWINGS.
6. ALL STORM DRAINAGE SERVICE BOXES TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH STANDARD DRAWINGS D06, D07, AND D08.
7. ALL CATCH BASINS WITHIN CITY RIGHT-OF-WAY TO BE TOWN OF LADYSMITH TYPE 1 AS PER STANDARD DRAWING D11AND D12, UNLESS OTHERWISE NOTED.
8. ALL LAWN BASINS WITHIN CITY RIGHT-OF-WAY TO BE TOWN OF LADYSMITH DITCH INLET TYPE AS PER STANDARD DRAWING D14 AND D14A, UNLESS OTHERWISE NOTED.
9. PROPOSED STORM DRAINAGE SERVICES ARE TO BE INSTALLED BELOW EXISTING BASEMENT ELEVATION OR AT THE SAME INVERT AS THE SANITARY SERVICES WHERE POSSIBLE, UNLESS OTHERWISE NOTED OR APPROVED BY THE ENGINEER OF RECORD.
10. NOT ALL STORM CONNECTIONS ARE SHOWN. SOME PROPERTIES MAY HAVE MORE THAN ONE CONNECTION TO THE EXISTING DITCH OR ADJACENT CULVERT.
11. ALL EXISTING STORM DRAINS AND CULVERTS TO BE ABANDONED SHALL BE INSPECTED FOR EXISTING STORM CONNECTIONS. ALL EXISTING CONNECTIONS ARE TO BE RELOCATED TO THE NEW STORM SEWER SYSTEM. DO NOT PLUG OR ABANDON AN EXISTING STORM DRAINAGE CONNECTION WITHOUT WRITTEN APPROVAL FROM THE TOWN OF LADYSMITH CONSTRUCTION REPRESENTATIVE.
12. ALL TESTING TO BE IN ACCORDANCE WITH THE TOWN OF LADYSMITH ENGINEERING STANDARDS AND SPECIFICATIONS:
   - 12.1. SECTION 6B.6 NOTIFICATION TO THE TOWN OF LADYSMITH
   - 12.2. SECTION 6B.7 CLEANING AND FLUSHING, AND
   - 12.3. SECTION 6B.8 VIDEO INSPECTING MAINS
13. THE CONTRACTOR IS TO FLUSH ALL MAINS AND PROVIDE CCTV INSPECTION TO THE ENGINEER OF RECORD PRIOR TO ASPHALT INSTALLATION OR RESTORATION.

POWER, COMMUNICATIONS AND GAS:

7. THE CONTRACTOR SHALL CONTACT BC ONE CALL A MINIMUM OF THREE WORKING DAYS PRIOR TO START OF CONSTRUCTION. NOTE THAT BC ONE CALL WILL NOT HAVE INFORMATION ON CITY UTILITIES OR SHAW. CALL 1-800-DIG-SHAW FOR SHAW INFORMATION.
8. THE CONTRACTOR SHALL CONSTRUCT UNDERGROUND BC HYDRO, TELUS, SHAW CABLE AND FORTIS BC IN ACCORDANCE WITH THE APPLICABLE UTILITY COMPANY'S CURRENT SPECIFICATIONS.
9. THE CONTRACTOR SHALL NOTIFY ALL UTILITY OWNERS REQUIRED PRIOR TO THE START OF CONSTRUCTION TO ARRANGE INSPECTION AND APPROVALS.
10. THE CONTRACTOR SHALL CONTACT BC HYDRO AND TELUS TO INSTALL RISERS ON EXISTING JUNCTION BOXES TO BRING LID ELEVATIONS FLUSH TO GRADE.
11. CONNECTION TO, OR ALTERATION OF, EXISTING MUNICIPALITY OWNED UTILITIES REQUIRES AUTHORIZATION BY THE MUNICIPALITY'S REPRESENTATIVE.
12. ALL LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHALL BE CONFIRMED BY THE USE OF A PIPE LOCATOR AND MANUAL DIGGING. ALL OR ANY STRUCTURES NOT NECESSARILY SHOWN.
13. ALL SURFACE RESTORATION (ROADS, CURBS, SIDEWALKS, ETC) SHALL BE TO ORIGINAL CONDITION OR BETTER.
14. THE CONTRACTOR SHALL NOTIFY ALL RESIDENCES AND/OR BUSINESSES AFFECTED BY THE CONSTRUCTION FIVE DAYS PRIOR TO STARTING THE CONSTRUCTION. THE CONTRACTOR SHALL ALSO EACH DAY INDIVIDUALLY NOTIFY EACH RESIDENCE OR BUSINESS WHICH WILL BE AFFECTED BY THE NEXT DAYS' WORK.
15. THE DRAWINGS MAY NOT SHOW ALL INDIVIDUAL UNDERGROUND HOME SERVICE CONNECTIONS. THE CONTRACTOR SHALL EXPOSE ALL EXISTING UNDERGROUND FACILITIES BY HAND DIGGING BEFORE USING MECHANICAL EXCAVATING EQUIPMENT.

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEERS DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES

REV.	DESCRIPTION	DR	CH	DATE	APP
1	ISSUED FOR COORDINATION	CIT	ABG	2023/12/22	SAL
2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4	ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/05/21	SAL
5	RE-ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/06/26	SAL

APLIN MARTIN

EGBC Permit to Practice Number #1001018

Aplin & Martin Consultants Ltd.
#104 - 6596 Applecross Road, Nanaimo, B.C. Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — S. A. LEWIS #23811
Permit to Practice #1001018
2024-06-27

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE: GENERAL NOTES

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL

A & M FILE: 23-8024

PROJECT NO. .

SCALE: HORZ. VERT.

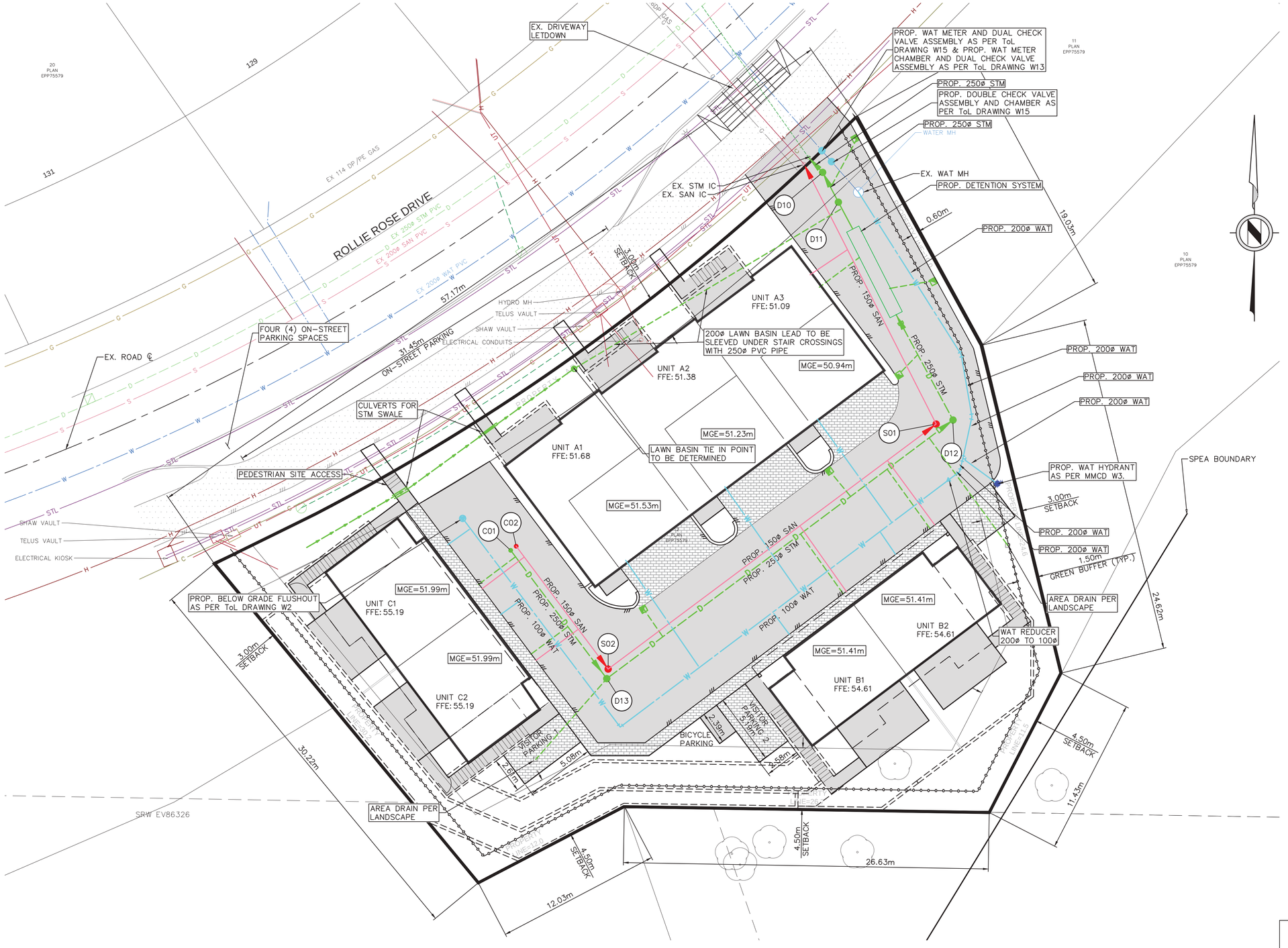
DRAWING DATE: NOVEMBER, 2023

DRAWING NO. .

A & M DRAWING NO. 23-8024-C010

SHEET NO. 01 OF 06

REV. 05



KEY PLAN NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON-SITE PRE-CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS, AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM, AND SANITARY CONNECTIONS TO THE SITE. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION. EXISTING AND PROPOSED SERVICES MAY REQUIRE ADJUSTMENT WHERE A CONFLICT OCCURS.
5. CIVIL SCOPE ENDS 1.0m FROM THE BUILDING FOOTPRINT. BUILDING CONSULTANT SCOPE INCLUDES ALL WORKS WITHIN 1.0m OF THE BUILDING FOOTPRINT.
6. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO-ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
7. CONSULT FORTIS BC AND MECHANICAL DRAWINGS FOR GAS DISTRIBUTION AND DESIGN INFORMATION.
8. CONSULT BC HYDRO AND ELECTRICAL DRAWINGS FOR ELECTRICITY DISTRIBUTION AND DESIGN INFORMATION.
9. CONSULT TELE-COMMUNICATIONS AND ELECTRICAL DRAWINGS FOR TELE-COMM. DISTRIBUTION AND DESIGN INFORMATION.

LEGEND

- PROP. STORM SEWER
- EX. SANITARY SEWER
- PROP. STORM SEWER
- PROP. WATERMAIN
- STREET LIGHTING
- STORM SERVICE CONNECTION
- SANITARY SERVICE CONNECTION
- EDGE OF PAVEMENT
- UNDERGROUND GAS – BY OTHERS
- UNDERGROUND HYDRO – BY OTHERS
- UNDERGROUND TELEPHONE – BY OTHERS
- UNDERGROUND COMMUNICATION – BY OTHERS
- MANHOLE
- WAT METER/DVCA
- WAT FLUSHOUT
- WAT REDUCER
- LAWN BASIN
- CLEANOUT
- CATCH BASIN
- FIRE HYDRANT
- EXISTING GROUND CONTOUR
- MIN. GARAGE FLOOR ELEVATION (MGE=99.99m)
- RETAINING WALL – BY OTHERS
- ASPHALT PAVEMENT
- PAVERS AS PER LANDSCAPE DRAWINGS
- MULTI-USE PATH
- SWALE

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

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LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES

REV.	DESCRIPTION	DR	CH	DATE	APP
1	ISSUED FOR COORDINATION	CIT	ABG	2023/12/22	SAL
2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4	ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/05/21	SAL
5	RE-ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/06/26	SAL

APLIN MARTIN

EGBC Permit to Practice Number #1001018

Aplin & Martin Consultants Ltd.
#104 - 6596 Applecross Road, Nanaimo, B.C. Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA S. A. LEWIS #23611 Scott Lewis

Permit to Practice #1001018
2024-06-27

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TITLE: 23-8024 - KEY PLAN

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
DRAWING DATE: NOVEMBER, 2023

PROJECT NO.: .
SCALE: HORZ. 1:150 VERT.
DRAWING NO.: .
A & M DRAWING NO.: 23-8024-C050
SHEET NO.: 02 OF 06
REV.: 05

0 1.5 1:150 7.5m

SITE GRADING NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON-SITE PRE-CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
3. ALL CONSTRUCTION WITHIN PRIVATE PROPERTY IS TO BE IN ACCORDANCE WITH BRITISH COLUMBIA BUILDING CODE 2024, BRITISH COLUMBIA PLUMBING CODE 2024, 2019 MASTER MUNICIPAL CONSTRUCTION DOCUMENTS AND IS TO BE ACCEPTABLE TO THE TOWN OF LADYSMITH BUILDING AND PERMITS DEPARTMENT.
4. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO-ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
5. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS AND TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
6. ALL EXCAVATION, FILL PLACEMENT AND COMPACTION TO BE IN ACCORDANCE WITH GEOTECHNICAL CONSULTANTS REPORT.
7. ALL ON-SITE ASPHALT PAVEMENT TO BE CONSTRUCTED AS PER PAVEMENT STRUCTURE DETAIL ON THE DETAIL SHEET.
8. CHANGES TO GRADE SHALL BE FORMED BY SMOOTH CURVES.
9. ALL BUILDINGS EXIT TO GRADE FROM THE LOWER FLOOR, UNLESS OTHERWISE NOTED.
10. CONTRACTOR TO EMPLOY GEOTECHNICAL CONSULTANT FOR PERFORMANCE OF IN PLACE TESTING DURING THE PREPARATION OF THE SUBGRADE AND CONSTRUCTION OF THE PAVEMENT STRUCTURE.
11. CONTRACTOR TO REVIEW DETAILS SHEET TO CONFIRM SITE SPECIFIC DESIGN REQUIREMENTS. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION.

SITE GRADING LEGEND

EXISTING GROUND ELEVATION	+99.99
FINISHED GROUND ELEVATION	+99.99
FINISHED GROUND ELEVATION AT TOP OF WALL	+99.99 TW
FINISHED GROUND ELEVATION AT BOTTOM OF WALL	+99.99 BW
FINISHED GROUND ELEVATION TO MEET EXISTING ELEVATION	+99.99 M
GRADE	9.9%
EXISTING GROUND CONTOUR	99.5
MINIMUM GARAGE ELEVATION	MGE=95.99m
FINISHED FLOOR ELEVATION	FFE=99.99m
CURB & GUTTER – SEE DETAIL	
EDGE OF ASPHALT PAVEMENT	
RETAINING WALL – BY OTHERS	
WAT FLUSHOUT	
CATCH BASIN	
LAWN BASIN	
RIM ELEVATION	(99.99)
ASPHALT PAVEMENT	
PROPOSED MANHOLE	
WAT METER/DVCA	
CLEANOUT	
FIRE HYDRANT	
EX. MULTI-USE PATH	
PAVERS AS PER LANDSCAPE DRAWINGS	

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

IT IS THE RESPONSIBILITY OF THE CONTRACTOR'S SURVEYOR TO VERIFY THAT ALL LEGAL SURVEY DIMENSIONS SHOWN ON THE ENGINEERS DRAWINGS AGREE WITH THOSE ON THE REGISTERED LEGAL SURVEY PLAN. SHOULD THERE BE ANY DISCREPANCIES, THEN IMMEDIATELY NOTIFY THE ENGINEER OF RECORD

LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES

REV.	DESCRIPTION	DR	CH	DATE	APP
1	ISSUED FOR COORDINATION	CIT	ABG	2023/12/22	SAL
2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
3	ISSUED FOR COORDINATION	CIT	ABG	2024/02/28	SAL
4	ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/05/21	SAL
5	RE-ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/06/26	SAL

APLIN MARTIN
EGBC Permit to Practice Number #1001018
Aplin & Martin Consultants Ltd.
#104 - 6596 Applecross Road, Nanaimo, B.C. Canada V9V 0A4
Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

PROFESSIONAL ENGINEER S. A. LEWIS #23811 Province of British Columbia
Permit to Practice #1001018
2024-06-27

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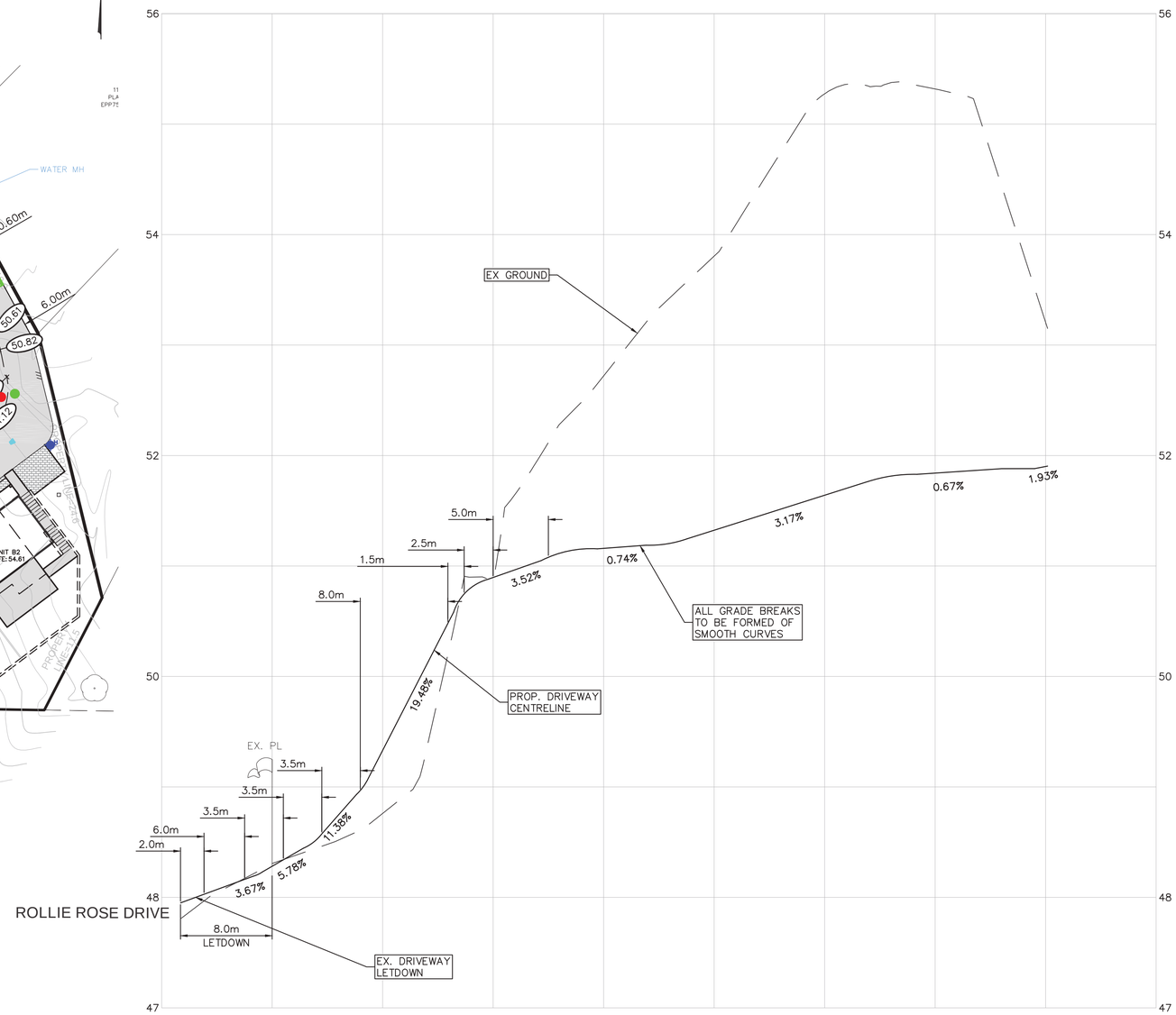
TITLE: 23-8024 - GRADING PLAN

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
PROJECT NO. .
SCALE: HORZ. 1:150 VERT.
DRAWING DATE: NOVEMBER, 2023
DRAWING NO. .
A & M DRAWING NO. 23-8024-C100
SHEET NO. 03 OF 06
REV. 05

0 1.5 1:150 7.5m



CENTRELINE ROAD ELEVATIONS	EXISTING									
	PROPOSED		48.21		50.94		51.32		51.82	
CHAINAGE	1+090	1+100		1+120		1+140		1+160		1+180

SITE GRADING NOTES:

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GRADE	9.9%
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FINISHED FLOOR ELEVATION	FFE=99.99m
CURB & GUTTER – SEE DETAIL	
EDGE OF ASPHALT PAVEMENT	
RETAINING WALL – BY OTHERS	
CATCH BASIN	
LAWN BASIN	
ASPHALT PAVEMENT	
PROPOSED MANHOLE	
WAT METER/DVCA	
WAT FLUSHOUT	
CLEANOUT	
FIRE HYDRANT	
EX. MULTI-USE PATH	
PAVERS AS PER LANDSCAPE DRAWINGS	
FINISHED GROUND	
EXISTING GROUND	
SWALE	

NOT FOR CONSTRUCTION

NOTICE TO CONTRACTOR

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LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579

BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES

REV.	DESCRIPTION	DR	CH	DATE	APP
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2	ISSUED FOR COORDINATION	CIT	ABG	2024/01/18	SAL
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Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

PROFESSIONAL ENGINEER S. A. LEWIS #23811 PROVINCE OF BRITISH COLUMBIA
Permit to Practice #1001018
2024-06-27

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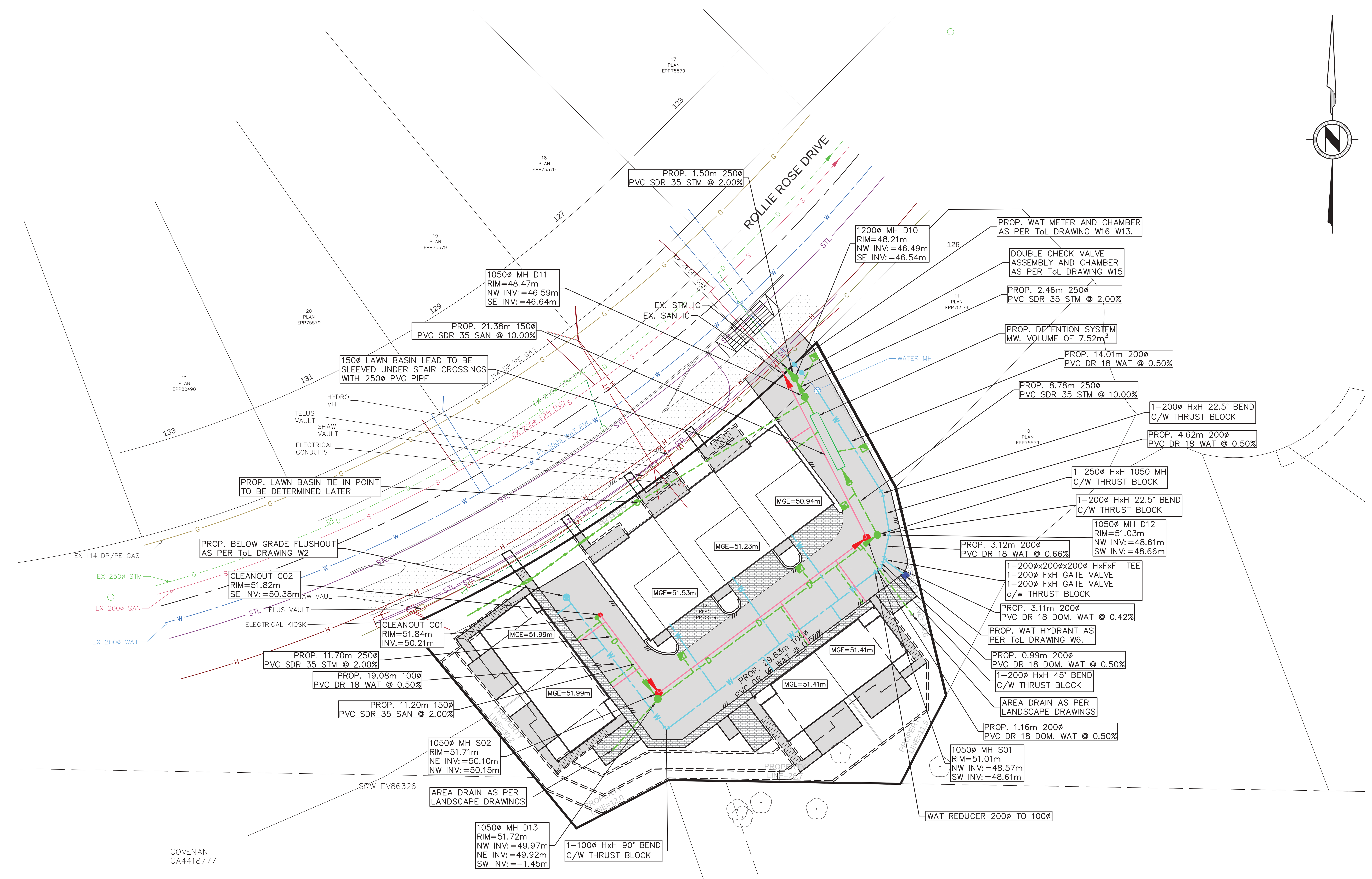
TITLE: 23-8024 - GRADING PROFILE

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
DRAWING DATE: NOVEMBER, 2023
PROJECT NO. .
SCALE: HORZ. 1:250 VERT. 1:50
DRAWING NO. .
A & M DRAWING NO. 23-8024-C120
SHEET NO. 04 OF 06
REV. 05

0 2 1:250 12m
0 0.5 1:50 2.5m



SITE SERVICING NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON–SITE PRE–CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
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4. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM, AND SANITARY CONNECTIONS TO THE SITE. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION. EXISTING AND PROPOSED SERVICES MAY REQUIRE ADJUSTMENT WHERE A CONFLICT OCCURS.
5. CIVIL SCOPE ENDS AT 1.0m FROM THE BUILDING FOOTPRINT. BUILDING CONSULTANT SCOPE INCLUDES ALL WORKS WITHIN 1.0m OF THE BUILDING FOOTPRINT.
6. BUILDING CONTRACTOR TO INSTALL STORM AND SANITARY CLEANOUTS AT BUILDING LOCATION AS PER BC PLUMBING CODE 2018 DIVISION B PART 2 SENTENCE 2.4.7.1.(6)
7. ALL ON–SITE CATCH BASINS ARE TO BE INSTALLED AS PER CATCH BASIN DETAIL ON THE DETAIL SHEET.
8. ALL BUILDINGS AND ROADS ARE TO BE LOCATED BY CO–ORDINATES AS CALCULATED BY A B.C. LAND SURVEYOR.
9. CONSULT FORTIS BC AND MECHANICAL DRAWINGS FOR GAS DISTRIBUTION AND DESIGN INFORMATION.
10. CONSULT BC HYDRO AND ELECTRICAL DRAWINGS FOR ELECTRICITY DISTRIBUTION AND DESIGN INFORMATION.
11. CONSULT TELE–COMMUNICATIONS AND ELECTRICAL DRAWINGS FOR TELE–COMM. DISTRIBUTION AND DESIGN INFORMATION.
12. CONTRACTOR TO REVIEW DETAILS SHEET TO CONFIRM SITE SPECIFIC DESIGN REQUIREMENTS. REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD PRIOR TO THE START OF CONSTRUCTION.

LEGEND

PROP. STORM SEWER	—D— — —
EX. SANITARY SEWER	—S—
PROP. STORM SEWER	——
PROP. WATERMAIN	—W— – —
STREET LIGHTING	— STL —
STORM SERVICE CONNECTION	- - - - - -
SANITARY SERVICE CONNECTION	——
EDGE OF PAVEMENT	——///——
UNDERGROUND GAS – BY OTHERS	— G —
UNDERGROUND HYDRO – BY OTHERS	— H —
UNDERGROUND TELEPHONE – BY OTHERS	— UT —
UNDERGROUND COMMUNICATION – BY OTHERS	— C —
SWALE	
CULVERT	— — — —
MANHOLE	
WAT METER/DVCA	
WAT REDUCER	
WAT FLUSHOUT	
CLEANOUT	
LAWN BASIN	
CATCH BASIN	
FIRE HYDRANT	H
EXISTING GROUND CONTOUR	99.5
MIN. GARAGE FLOOR ELEVATION	MGE=99.99m
RETAINING WALL – BY OTHERS	======
ASPHALT PAVEMENT	
PAVERS AS PER LANDSCAPE DRAWINGS	
MULTI–USE PATH	

NOT FOR CONSTRUCTION

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BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES

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4	ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/05/21	SAL
5	RE–ISSUED FOR DEVELOPMENT PERMIT	CIT	ABG	2024/06/26	SAL

APLIN MARTIN

EGBC Permit to Practice Number #1001018

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Tel: (778) 841-0484, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT: 1447227 BC LTD
250-327-1617

PROJECT: LADYSMITH MULTI-FAMILY DEVELOPMENT
128 ROLLIE ROSE DRIVE, LADYSMITH, BC

PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, S. A. LEWIS #23811
Permit to Practice #1001018
2024-06-27

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TITLE: 23-8024 - SERVICE PLAN

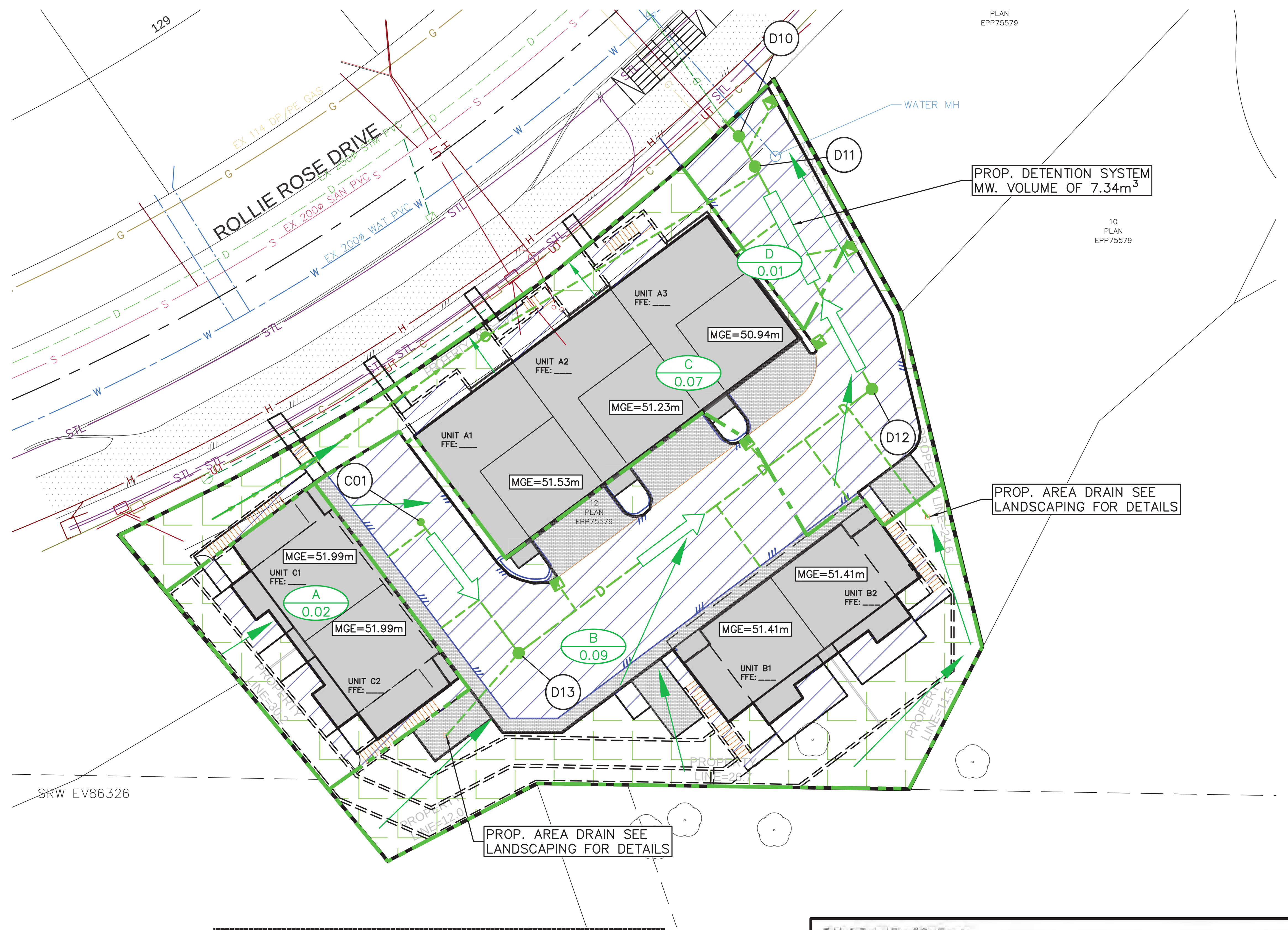
DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024

PROJECT NO. .
SCALE: HORZ. 1:250 VERT.
DRAWING DATE: NOVEMBER, 2023

DRAWING NO. .
A & M DRAWING NO. 23-8024-C200
SHEET NO. 05 OF 06
REV. 05

0 2 1:250 12m

Jun 27 2024 – 9:08am M:\NAN\2023\23-8024_DWG_ONSITE PRODUCTION\23-8024 – 200 – Service Plan.dwg/05 23-8024 – Service Plan cturner



STORMWATER MANAGEMENT NOTES:

1. REFER TO GENERAL NOTES SHEET FOR MINIMUM PIPE COVER, PIPE MATERIALS, AND TESTING PROCEDURES.
2. THE CONTRACTOR MUST CONTACT THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO SCHEDULE AN ON–SITE PRE–CONSTRUCTION MEETING DURING WHICH CONSTRUCTION METHODS, TIMING, AND INSPECTION WILL BE DISCUSSED.
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4. CONTRACTOR TO VERIFY THE LOCATION AND INVERTS OF EXISTING WATER, STORM AND SANITARY CONNECTIONS TO THE SITE. REPORT TO THE ENGINEER OF RECORD ANY DISCREPANCIES PRIOR TO START OF CONSTRUCTION.
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STORMWATER MANAGEMENT LEGEND

- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- 100 YEAR PIPE FLOW – IN PIPE
- MANHOLE, CLEANOUT, HEADWALL NUMBER
- CATCHMENT AREA (CATCHMENT A1, AREA (ha) 99.99)
- CATCHMENT AREA BOUNDARY LINE
- PAVERS AS PER LANDSCAPE DRAWINGS
- HARDSCAPE BUILDING AREA
- HARDSCAPE PAVEMENT AREA
- LANDSCAPE AREA
- MANHOLE
- CATCH BASIN
- LAWN BASIN
- RIM ELEVATION (99.99)
- LOCAL OVERLAND FLOW DIRECTION
- SWALE

[redacted]

10 YEAR DETENTION REQUIREMENT

Table 1: Typical Runoff Coefficients

Surface Type	Runoff Coefficient	Surface Type	Runoff Coefficient
Pavement, Asphalt	0.95	Turf, Flat (0 - 1% slope)	0.25
Pavement, Concrete	0.95	Turf, Average (1 - 3% slope)	0.35
Pavement, Brick	0.85	Turf, Hilly (3 - 10% slope)	0.40
Pavement, Gravel	0.75	Turf, Steep (> 10% slope)	0.45
Roofs, Conventional	0.95	Vegetation, Flat (0 - 1% slope)	0.10
Roof, Garden Roof (< 10 cm)	0.50	Vegetation, Average (1 - 3% slope)	0.20
Roof, Garden Roof (10 - 20 cm)	0.30	Vegetation, Hilly (3 - 10% slope)	0.25
Roof, Garden Roof (21 - 50 cm)	0.20	Vegetation, Steep (> 10% slope)	0.30
Roof, Garden Roof (> 50 in)	0.10		

LEED RUNOFF COEFFICIENTS

[redacted]

CALCULATED RUNOFF COEFFICIENTS

[redacted]

10 YEAR RATIONAL METHOD

[redacted]

100 YEAR RATIONAL METHOD

NOT FOR CONSTRUCTION

LEGAL DESCRIPTION: LOT 12, DISTRICT LOT 103, OYSTER DISTRICT, PLAN EPP75579					
BENCHMARK: MONUMENT: 87H3632, ELEVATION: 36.661m, DATUM: LOCATED AT: INTERSECTION OF WEST EDGE DOGWOOD DR. AND ARBUTUS CRES					
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128 ROLLIE ROSE DRIVE, LADYSMITH, BC

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2024-06-27

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TITLE: 23-8024 - STORM MANAGMENT PLAN

PROJECT NO. .
DRAWING NO. .
SCALE: HORZ. 1:250 VERT.
A & M DRAWING NO. 23-8024-C800

DESIGN: ABG CHECK: ABG
DRAWN: CIT APPR: SAL
A & M FILE: 23-8024
DRAWING DATE: NOVEMBER, 2023
SHEET NO. 06 OF 06
REV. 05

0 2 1:250 12m

SCHEDULE F - Tree Preservation Plan
DP 3060-21-10
128 Rollie Rose Drive
3 Pages

Margaret Symon, RPF PCP
Strathcona Forestry Consulting
PO Box 387 Stn. Mn.
Duncan BC V9L 3X5
strathcona.fc@shaw.ca
250 715-6983 (c/text)

27 July 2024

To: Julia Tippett, Planner E: jtippett@ladysmith.ca
Development Services Department
Town of Ladysmith, BC

cc: Brett Carrothers E: hollywoodtreeco@gmail.com
Chris Sharpe E: Chris.Sharpe@shaw.ca

Re: 128 Rollie Rose: Tree Preservation Plan

Background: At the request of Mr. Chris Sharpe, property owner, 128 Rollie Rose Road, and in accordance with the Town of Ladysmith DPA 8 (ESA Multi-Unit Residential Development Permit Area) Guidelines, this report provides a Tree Preservation Plan for the forested riparian buffer on the southern rim of the subject property, which is proposed for multi-family residential development. The Tree Preservation Plan was prepared by Brett Carrothers, ISA Certified Arborist PN-9165A, Holly Wood Tree Co. in liaison with Margaret Symon, RPF, Strathcona Forestry Consulting.

Site Visit and Description: Accompanied by Chris Sharpe, field inspections were conducted July 18 and 19, 2024 to review site conditions. The subject property straddles a tributary of Holland Creek. In 2021, Terra West Environmental Inc. conducted the RAPR (Riparian Areas Protection Regulation) assessment to determine the Streamside Protection Enhancement Area (SPEA). Signage along the edge of the SPEA denotes the boundary between the cleared away of the lot and the SPEA, which contains mature, mixed forest cover. Outside of the SPEA, since 2021, the owner has regularly implemented brushing activities to control the infestation of invasive weed species (e.g., Scotch broom [*Cytisus scopa*rius], Himalayan blackberry [*Rubus armeniacus*]) at the cleared portion of the lot. Brushing treatments have effectively reduced the vigour and spread of invasive species at the property. Inspection of the SPEA perimeter in July 2024 did not identify specific trees hazardous to the proposed development. Ongoing monitoring of the tree cover is recommended, however, as conditions can change due to various conditions (e.g. windstorms).

Recommendations: In conformance with the DPA 8 Guidelines, the following measures are recommended to maintain the integrity of the riparian buffer at the subject property:

1) Prior to construction activities, QERP* to delineate the riparian buffer with snow fencing. Additionally, flag out rooting zones (length = 6 x tree dbh) and clearly delineate rooting zones around perimeter trees along the SPEA/riparian setback.
2) Retain trees within the SPEA (unless identified as a danger/windthrow hazard)
3) Prior to commencement of land clearing and construction, a certified danger tree assessor must be retained to conduct an ocular survey to identify any hazardous trees within and along the perimeter of the SPEA that may have resulted from conditions (natural and/or manmade) occurring after inspections took place in July 2024. Should any trees be designated as hazardous, appropriate mitigation must be done to abate the hazard.
4) A qualified monitor (QERP) must oversee tree retention and protection activities within the subject area during of the project.
5) Identified Danger Trees should be treated outside the bird nesting window for the region (no felling March 15- August 15).
6) Any hazard trees identified to be felled that have trunks > 40 cm dbh should be placed in forested buffer area as CWD (coarse woody debris). Any coarse woody debris (CWD) added to reserve zone will constitute no more than 1 m of CWD per lineal m of setback boundary. Inputs of coarse woody debris to the forest floor along the perimeter of the setback area will improve soil function, structure and productivity, and will increase opportunities for small animal species, such as salamanders and voles.
7) At pre-work, ensure workers are aware no disturbance within flagged riparian area and rooting zones is not permitted. Ensure workers sign off their acknowledgement.
8) Minimize disturbance to roots of trees within and on the edge of forested buffer. Minimize ground disturbance within the drip line (a distance equivalent to 6 x dbh) from boles of trees of perimeter trees.

   Tree protection barriers must be built to ensure trees are not damaged during construction. Barriers are required around any protected/retained trees that could be impacted by development. Materials: Install plastic mesh screening and stakes around retained trees; install a minimum distance of six (6) times the tree diameter.
9) Post-construction, permanent fencing (e.g., split cedar rail) is recommended to demarcate forested buffers post-construction.
10) Promptly re-vegetate any areas of soil disturbed by land clearing and construction with approved landscaping materials and/or native plant species. Re-vegetate areas of exposed soil with ecologically suitable native tree and shrub species of a size that will quickly re-establish cover when construction activities are deemed complete in order to minimize encroachment of invasive weed species (e.g. broom, Himalayan blackberry, English ivy, daphne).
11) Where forest cover has been inadvertently (or previously) reduced along edges of the forest stand, under-plant ecologically suitable, native herbs and shrubs (e.g., snowberry, Pacific

dogwood, baldhip rose, salal, sword fern. Numbers of plantings will need to be calculated pending a post-clearing survey (RPF). Suggested plantings could include:

Plantings	**Size**	**Spacing**	**Total Number*** * assess after land clearing
Salal (*Gaultheria shallon*)	2 or 5 gal. pots	1x1 m	TBD
Red huckleberry (*Vaccinium parviflorum*)	2 or 5 gal. pots	1x1 m	TBD
Sword fern (*Polystichum munitum*)	2 or 5 gal. pots	1.5 x 1.5 m	TBD
Dogwood (*Cornus nutallii*)	5 gal. pots	2 x 2 m	TBD

12) At pre-work, ensure workers are aware no disturbance within flagged riparian area and rooting zones is permitted.

13) Management of soil:

Minimize clearing and the amount of exposed soil.

• Identify and protect areas where existing vegetation, such as trees, will not be disturbed by construction activity.

• Protect stream and woodland buffer from any disturbance or construction activity by fencing or otherwise clearly marking these areas.

Sequence construction activities so that the soil is not exposed for long periods of time.

• Schedule or limit grading to small areas.

• Install key sediment control practices before site grading begins.

• Schedule site stabilization activities, such as landscaping, to be completed immediately after the land has been graded to its final contour.

Inspect and maintain silt fences after each storm.

• Make sure the bottom of the silt fence is buried.

• Securely attach the material to the stakes.

• Don't place silt fences in the middle of a waterway or use them as a check dam.

• Stormwater should not flow around the silt fence.

14) Discourage future residents from damaging retained trees by not loading rock fill on roots, not tying ropes or wires around tree stems, and not hammering nails into trees.

***=Qualified Environmental Registered Professional**

Prepared by:

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SCHEDULE G - Construction
Environmental Management Plan
DP 3060-21-10
128 Rollie Rose Drive
170 Pages

ENVIRONMENTAL MANAGEMENT
& CONSULTING

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN
128 Rollie Rose Drive, Ladysmith, BC

Prepared For:

Sharp Sites Inc.

Prepared By:

TerraWest Environmental Inc.

Project File: CSHC24-02

Version 1
July 12, 2024

This plan is intended to be a "Living Document" and may be subject to changes as prescribed by the Town of Ladysmith and/or Sharpe Sites Inc.

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REVISION LOG

Construction Environmental Management Plan		
Version #	Date issued	Comments
1	July 12, 2024	Initial submission to client.

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE

Sharp Sites Inc. (the 'Owner' and 'Contractor') has commissioned TerraWest Environmental Inc. (TerraWest) to develop this Construction Environmental Management Plan (CEMP) with an embedded Erosion and Sediment Control Plan (ESCP) for the proposed multi-family development (the 'Project') at 128 Rollie Rose Drive, in Ladysmith, BC (the 'Site').

The primary objectives of this CEMP are as follows:

- Serve as a reference for the Owner and Contractor with respect to relevant best management practices (BMPs), guidelines, and procedures with the interest of protecting the environment;
- Ensure the protection of wildlife and habitat features on and near the Site;
- Provide a plan for the implementation and monitoring of erosion and sediment control measures at the Site; and
- Provide guidance with regards to spill response, handling of hazardous materials, waste disposal, storage and laydown area management, vegetation and invasive species management, archeological and streamside protection and enhancement area management (SPEA) management.

This CEMP adheres to and is consistent with, the requirements in the following:

- The Riparian Areas Protection Regulation: Assessment Report, TerraWest Environmental Inc., March 2023; and
- Official Community Plan Bylaw No. 2200, Town of Ladysmith, 2022[1].

1.2 DESCRIPTIONS OF PROJECT WORKS

The Project construction works will involve but are not limited to the following activities required for the outlined development in the Project documents:

- Addition of storm sewer, sanitary sewer, watermain, electrical, concrete curb, gutter, sidewalk, stairs, asphalt roadway, landscaping and soil disposal, include the following activities:
    - Site preparation;
    - Clearing and grubbing;
    - Tench excavation, bedding and backfill;
    - Common excavation;
    - Concrete and asphalt works;
    - Surface works restoration, landscaping; and
    - Tree and riparian protection.

[1] Town of Ladysmith (2022). Official Community Plan. Available at: https://www.ladysmith.ca/business-development/development-resources/ocp

1.3 SITE LOCATION

The Site is located at 128 Rollie Rose Drive, Ladysmith, BC. The Site location and project work area is outlined below in Figure 1, and on Figure 5.

Figure 1. Project work area located at 128 Rollie Rose Drive, Ladysmith, BC. (Source: iMap BC).

1.4 POTENTIAL PROJECT ENVIRONMENTAL EFFECTS

This CEMP aims to identify and provide mitigation measures for potential risks to valued environmental components in and around the Site. Associated potential environmental risks from Project activities include but are not limited to the following:

- Increased erosion and destabilization of soil;
- Introduction of sediments, alkaline or contaminated water to surrounding aquatic habitat/storm sewer systems;
- Disturbance to wildlife and vegetation; and
- Accidental releases of fuel/oil or other deleterious substances.

The mitigation measures for the listed Project environmental risks are included within this CEMP.

2.0 ROLES AND RESPONSIBILITES

2.1 THE OWNER

The Owner and their responsibilities for the Project are summarized below:

- Implement and monitor the measures and requirements found in this CEMP to ensure the protection of the environment during Project construction and in the post-construction period;
- Comply with all regulatory authorizations, permits, Acts and bylaws associated with the Project;
- Ensure the Project meets its goal of conserving and protecting the surrounding environment;
- Ensure that the CEMP is made available to all Project personnel as a paper copy or electronically as required;
- Ensure all Project personnel are aware of the mitigation measures and best management practices outlined in this CEMP;
- Communicate environmental concerns to the Town of Ladysmith;
- Retain the services of a Qualified Environmental Professional (QEP) as Environmental Monitor (EM) for the duration of the Project;
- Coordinated with the EM monitoring Site visits, and when required emergency Site visits; and
- Environmental incident prevention and response in conjunction with the EM as outline below in Section 2.2.

2.2 ENVIRONMENTAL MONITOR

The Owner (henceforth referred to as the Contractor), has retained the services of TerraWest who will act as the QEP and EM for the duration of the Project. The QEP may appoint suitably experienced designates as required, under their supervision, for the execution of their responsibilities.

The EM's responsibilities as per this CEMP are summarized as follows:

- Ensure the Project meets its goal of conserving and protecting the surrounding environment.
- Reporting on the Contractor's conformance and compliance with regards to measures in the CEMP.
- Conducting water quality monitoring as needed as a means of evaluating the effectiveness of erosion and sediment control measures as required (Section 6.3).
- Attending construction meetings, as necessary, that relate to the protection of the environment and erosion and sediment control.

- Ensure all Project personnel are aware of the mitigation measures and best management practices outlined in this CEMP. The EM will conduct an environmental orientation and training session for the Contractor prior to the start of construction. If new subcontractors or Project personnel begin work on the Site, the Contractor and EM will ensure they are informed of all relevant environmental requirements. All Project personnel will be required to acknowledge and sign off on the orientation.
- Ensure that the CEMP is made available to all Project personnel as a paper copy or electronically as required.
- Monitoring as necessary of the Site and works to ensure the Project is meeting the requirements of the CEMP, environmental legislation, and applicable regulations.
- Submitting monitoring reports after Site inspections. The monitoring report will include the following:
    - Reporting period
    - Project name/geographic location
    - Prime contractor firm name/contact
    - Environmental monitor name/contact
    - Summary of construction activities during the reporting period
    - Summary of environmental issues encountered during the reporting period
    - Summary of mitigation measures implemented during the reporting period
    - Summary of planned corrective measures to address site deficiencies that arose during the reporting period
    - Summary of any incident reports during the reporting period
    - Representative site photographs taken during the reporting period
- Conducting additional monitoring visits during and/or following periods of inclement weather, see Section 5.8.2.
- The EM has the authority to temporarily stop or slow construction activities. The EM will issue an order to stop work if it is determined that construction activities immediately pose a risk to surrounding environmental resources or are not in compliance with regulations. In the event of an order to stop work the EM will immediately notify the Town of Ladysmith.
- Conducting additional Site visits as applicable during and following incidents that occur on Site.
- Complete and submit an Environmental Incident Report (EIR) to the Town of Ladysmith, and the Contractor within 24 to 48 hrs following an instance of non-compliance to the CEMP that poses significant risk to the surrounding environment, a reportable spill as outlined in Section 11.0 or other environmental incidents as identified by the Town of Ladysmith, EM or Contractor. The EIR template is included in Appendix C and a generic Spill Response Plan is included as Appendix D.
- The QEP will be prepared to respond to any requests for support with respect to environmental concerns and/or requests from the Town of Ladysmith in matters as they relate to the protection of the environment.

3.0 REFERENCE LEGISLATION, GUIDELINES, AND STANDARDS

The following documents, legislation, guidelines, and standards were used in the review and development of this CEMP and will be respected and adhered to by the Contractor.

Federal:

- Federal *Species at Risk Act* (SARA)[2]
    - SARA Schedule 1 protects and provides for wildlife species that are listed as extirpated, endangered, or threatened. The intention is to promote the recovery of species that have been impacted as a result of human activities.
    - Section 32 and 33 of the *Act* states that a person is prohibited to kill, harm, harass, capture, or take in any way extirpated, endangered or threatened species and that no person shall damage or destroy their residence.
    - Section 34 of the *Act* outlines if Section 32 and 33 do or do not apply to certain species in provinces and if deemed applicable Section 36 outlines the prohibitions.
- Canada *Fisheries Act*[3]
    - The *Fisheries Act* sets out to protect fish and fish habitat. The Act states that "No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat."
    - The *Act* also prohibits, under Section 36(3), the deposit of deleterious substances "No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water."
- Federal *Migratory Birds Convention Act*[4]
    - The destruction of eggs and active nests of migratory birds is prohibited.
- Measures to Protect Fish and Fish Habitat[5]
- National Guide to Erosion and Sediment Control on Roadway Projects, 2005 TACATC[6]
- Canadian Council of Ministers of the Environment Guidelines for the Protection of Aquatic Life[7]
- Canadian *Environmental Protection Act*[8]

[2] Government of Canada. 2002. Species at Risk Act [S.C. 2002 c. 29]. Available at: https://laws.justice.gc.ca/eng/acts/S-15.3/page-1.html. [Accessed: July 2024].
[3] Government of Canada. 1985. Fisheries Act [R.S.C., 1985, c. F-14]. Available at: https://laws-lois.justice.gc.ca/eng/acts/f-14/page-1.htmll. [Accessed: July 2024].
[4] Government of Canada. 1994. Migratory Birds Convention Act [S.C., 1994, c. 22]. Available at: https://laws-lois.justice.gc.ca/eng/acts/m-7.01/page-1.html. [Accessed: July 2024].
[5] Measures to Protect Fish and Fish Habitat. Available at: https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html. [Accessed: March 2024].
[6] Transportation Association of Canada. 2005. National Guide to Erosion and Sediment Control on Roadways Projects. https://www.tac-atc.ca/en/publications/ptg-erosion.
[7] Canadian Council of Ministers of the Environment. Guidelines for the Protection of Aquatic Life. Available at: https://ccme.ca/en/resources/water-aquatic-life. [Accessed: April 2024].
[8] Government of Canada. 1999. Canadian Environmental Protection Act [S.C., 1999, c. 33]. Available at: https://laws-lois.justice.gc.ca/eng/acts/c-15.31/page-1.html. [Accessed: July 2024].

- Canadian *Environmental Assessment Act*[9]
- Federal *Transportation of Dangerous Goods Act*[10]

Provincial:

- BC *Water Sustainability Act*[11]
    - The *BC Water Sustainability* Act sets out to protect fish, fish habitat and water quality in the province of BC. Section 11 of the Act states that changes in or around a stream require submission of a notification or application.
    - The BC Water Sustainability Regulation[12].
- BC *Wildlife Act*[13]
    - As per Section 34 of the *Act* it is an offence for a person to possess, take, injure, molest or destroy a bird or its egg; the nest of an eagle *spp.*, peregrine falcon (*Falco peregrinus*), gyrfalcon (*Falco rusticolus*), osprey (*Pandian haliaetus*), heron (*Ardeidae spp.*) or burrowing owl (*Athene cunicalaria*); or the nest of a bird when the nest is occupied by a bird or its egg.
- *BC Weed Control Act*[14]
    - The BC Weed Control Act designates a list of invasive plants as 'noxious weeds' at the regional and provincial level. Private property owners and government agencies are mandated by law to control these species that occur on their property or jurisdiction.
- BC Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures) Version 1.0, 2014 (Ministry of Environment)
- BC Develop with Care 2014 Environmental Guidelines for Urban and Rural Land Development in British Columbia
- BC Environmental Best Management Practices for Urban and Rural Land Development in British Columbia (Ministry of Water, Land and Air Protection 2004)
- A Compendium of Working Water Quality Guidelines for BC (Ministry of Environment)
- BC Working and Approved Water Quality Guidelines (Ministry of Environment and Climate Change Strategy)
- Joint Professional Practice Guidelines Erosion and Sediment Control[15]

[9] Government of Canada. 2012. Canadian Environmental Assessment Act [S.C., 2012, c. 19, s. 52]. Available at: https://laws-lois.justice.gc.ca/eng/acts/c-15.21/. [Accessed: July 2024].
[10] Government of Canada. 1992. Transportation of Dangerous Goods Act [S.C., 1992, c. 34]. Available at: https://laws-lois.justice.gc.ca/eng/acts/t-19.01/page-1.html. [Accessed: July 2024].
[11] Province of British Columbia. 2014. Water Sustainability Act [SBC 2014] Chapter 15. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14015. [Accessed: July 2024].
[12] Province of British Columbia. 2016. Water Sustainability Regulation. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/36_2016. [Accessed: July 2024].
[13] Province of British Columbia. 1996. Wildlife Act [RSBC 1996] Chapter 488. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96488_01. [Accessed: July 2024].
[14] Province of British Columbia. 1996. Weed Control Act. [RSBC 1996] Chapter 487. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_96487_01. [Accessed: July 2024].
[15] Engineers and Geoscientists British Columbia, The College of Applied Biologists, and The BC Institute of Agrologists. Version 1, February 5, 2024. Joint Professional Practice Guidelines Erosion and Sediment Control. Available at: https://cab-bc.org/wp-content/uploads/PP-Guidelines%E2%80%94Erosion-and-Sediment-Control.pdf

- A Field Guide to Fuel Handling, Transportation and Storage (Ministry of Water, Land and Air Protection and Ministry of Forests)
- BC *Environmental Management Act*[16]
    - BC Contaminated Sites Regulation[17]
    - BC Hazardous Waste Regulation[18]
- BC *Environmental Assessment Act*[19]
- BC Ground Water Protection Regulation[20]
- BC Spill Reporting Regulation[21]
- BC *Transportation of Dangerous Goods Act*[22]
- BC Heritage Conservation Act[23]
- BC *Wildfire Act*[24]
    - BC Wildfire Regulation[25]
- BC Workers Compensation Act[26]
    - Occupational Health and Safety Regulation[27]

Municipal:

- Town of Ladysmith (2023). Official Community Plan Bylaw 2022, No. 2200.

4.0 HABITAT PROTECTION AND ECOSYSTEM MANAGEMENT

The following sections outline measures for the protection of habitat on and near the Site.

4.1 AQUATIC AND RIPARIAN ECOSYSTEMS

The following sections outline measures for the protection of aquatic habitat near the Site.

4.1.1 Background

The Site is located adjacent to 40 meters of riparian habitat, including Tributary 1 (T1) and is part of DPA 6 – Riparian and 8 - Multi-Unit Residential Environmentally Sensitive Area[28].

[16] Province of British Columbia. 2003. Environmental Management Act. [SBC 2003] Chapter 53. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/03053_01. [Accessed: July 2024].
[17] Province of British Columbia. 1996. Contaminated Sites Regulation. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/375_96_00_multi. [Accessed: July 2024].
[18] Province of British Columbia. 1988. Hazardous Waste Regulation. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/63_88_00. [Accessed: July 2024].
[19] Province of British Columbia. 2018. Environmental Assessment Act. [SBC 2018] Chapter 51 Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/18051. [Accessed: July 2024].
[20] Province of British Columbia. 2016. Groundwater Protection Regulation. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/39_2016. [Accessed: July 2024].
[21] Province of British Columbia. 2017. Spill Reporting Regulation. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/187_2017. [Accessed: July 2024].
[22] Province of British Columbia. 1996. Transport of Dangerous Goods Act. [RSBC 1996] Chapter 458 Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_96458_01. [Accessed: July 2024].
[23] Province of British Columbia. 1996. Heritage Conservation Act. [RSBC 1996] Chapter 187 Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96187_01. [Accessed: July 2024].
[24] Province of British Columbia. 2004. Wildfire Act. [SBC 2004] Chapter 31 Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/04031_01. [Accessed: July 2024].
[25] Province of British Columbia. 2005. Wildfire Regulation. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/11_38_2005. [Accessed: July 2024].
[26] Province of British Columbia. 2019. Workers Compensation Act. [RSBC 2019] Chapter 1 Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/19001_00. [Accessed: July 2024].
[27] Province of British Columbia. 1997. Occupational Health and Safety Regulation. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/296_97_00. [Accessed: July 2024].
[28] Town of Ladysmith (2023). Official Community Plan. Available at: https://www.ladysmith.ca/docs/default-source/bylaws-2021/official-community-

The Riparian Areas Protection Regulation (RAPR) Assessment Report and appended documents [29] provide a detailed assessment of the Site's aquatic and riparian habitat values. Key findings of the reports are as follows:

- The proposed development is located near a non-fish bearing tributary (Tributary 1 and/or T1) which eventually discharges to Holland Creek (fish-bearing) approximately, 390 m north of Site.
- Holland Creek has perennial flow and anadromous fish access from its' lower reaches to water falls upstream which act as a fish barrier.
- Holland Creek supports a diverse mix of anadromous and resident fish species including cutthroat and rainbow trout along with chum and coho salmon[30].
- During a previous study of Holland Creek Watershed, Coastal Cutthroat Trout and Red Legged Frogs, two BC blue listed species were observed around the lower fish bearing drainages (off-Site)[31].
- While Tributary 1 is non-fish bearing, it provides important water supplies to Holland Creek[32].
- The streamside protection and enhancement area (SPEA) width was determined to be 10 m from the northwest bank.
- A Condition and Impact Assessment was completed by TerraWest in 2023 as part of the RAPR which addressed previous Site preparation activities including vegetation clearing inside the riparian assessment area (RAA) of T1; however, it was noted that the SPEA within the RAA remained intact as confirmed during the detailed RAPR field assessment and CIA Site inspection.
- The proposed development is within the Coastal Douglas-Fir Biogeoclimatic zone (CDFmm) and grand fir/dull Oregon-grape ecological community (BC Red Listed) [33].

4.1.2 General Measures for the Protection of Aquatic and Riparian Habitat

The following are general measures for the protection of the aquatic and riparian habitat near the Project:

- The Contractor will adhere to the Erosion and Sediment Control (ESC) Measures outlined in Section 5.0 for protection of the aquatic environment to limit the amount of sediment-laden surface water and other deleterious substances from entering stormwater systems adjacent to sensitive aquatic ecosystems.
- Primary ESC measures for works near aquatic habitat include but is not limited to: catch basin protection measures (Section 5.4) see Figure 2, reduction of dirt tracking from vehicles, sweeping of work areas, retaining vegetation buffers.

plan-2023_dpa.pdf?sfvrsn=217df7db_2. Accessed July 2024.
[29] TerraWest Environmental Inc. (2023). Riparian Areas Protection Regulation: Assessment Report.
[30] HabitatWizard. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/ecosystems/habitatwizard. Accessed July 2024.
[31] D.R. Clough Consulting. 2014. Holland Creek Watershed, Ladysmith B.C. Environmental Assessment.
[32] D.R. Clough Consulting. 2014. Holland Creek Watershed, Ladysmith B.C. Environmental Assessment.
[33] British Columbia (2024). Habitat Wizard. Available at: https://maps.gov.bc.ca/ess/hm/habwiz/

- The EM will conduct water quality sampling at their discretion to assess impacts to aquatic habitat. Details of the sampling program are included in the Water Quality Monitoring Program outlined in Section 6.3.
- The EM will be present during clearing and grubbing activities adjacent to stormwater systems, as well as culvert installations if present, to monitor water quality during activities if wetted.
- Do not work in weather conditions that are likely to contribute sediment production and cause increased turbidity in aquatic habitat.
- Spoil materials must be placed in a location which prevents sediment or debris from entering aquatic habitat and stormwater systems.
- The Contractor will adhere to the measures to protect outlined in the 2023 RAPR Assessment Report to protect and maintain the SPEA.

4.1 Protection of Amphibians

Red Legged Frogs have previously been observed near the lower drainages of Holland Creek. While Holland Creek is located off-Site, T1 could provide habitat for amphibians. The following are measures for the protection of amphibians:

- The EM will conduct amphibian sweeps prior to any clearing or other construction activities in and around the Site prior to construction.
- Isolation fencing along suitable habitat areas and construction boundaries on Site may be used, such as sediment fencing or fine wire mesh, to separate construction areas and protect amphibians, reducing or negating the need for salvage activities.
- If salvage activities are required the EM will obtain the necessary permits from the provincial government to conduct salvages prior to work in the identified area.
- The requirements of the General Wildlife Permit/scientific collection permit will apply to all salvage activities.
- If amphibian salvage activities are required, they will be completed in the spring, summer and fall to avoid the winter hibernation period.

4.1.1 Amphibian Salvage Plan

The following are measures for the protection of amphibians if salvage is required:

- Where amphibians are encountered, they will be captured using fine-meshed dip nets or by gloved hand.
    - The EM will avoid using chemicals on their hands (e.g. sunscreen or insect repellent), as they can cause harm to amphibians, and will wear nitrile gloves whenever possible.

  - When possible, the EM will rinse their hands in surface water from a nearby source prior to handling amphibians.
  - The EM will minimize the handling of amphibians to the extent possible.
- Upon capture, amphibians will be placed in a bucket for relocation.
  - The bucket will contain moss or leaf litter from the surrounding environment and be kept dark and well ventilated while awaiting relocation.
  - The containment period will be minimized and captured individuals will be relocated and released in as short a period as practical.
  - Tadpoles will be kept separate from adult to avoid predation during containment.
- Captured individuals will be relocated a safe distance from the Site and placed into a similar or higher value habitat.
  - Relocation areas will be connected to the capture site.
  - The EM will avoid selecting release sites on the other side of potential barriers (e.g. roads).
  - No amphibians are to be transported outside of the Project area.
- If amphibian egg strings or masses are encountered, construction activities will be halted in the area until the egg strings or masses have hatched. Once hatched tadpoles will be carefully removed and relocated outside the construction disturbance area. As a last resort based on Project disturbance, egg string or masses themselves may be carefully removed and relocated, however this has the potential to damage or reduce the viability of the eggs and is not recommended. The tadpoles or eggs will be moved to an area of similar habitat and water quality (pH and temperature).

4.2 PROTECTION OF BIRDS

The following are general measures for the protection of birds on the Site:

- If clearing is proposed within the migratory bird nesting window of March 15 to August 15, bird nest surveys will be conducted by the contracted EM in the proposed clearing area. The surveys will follow the protocol as described in Section 4.2.1 below and the MOTI Breeding Bird Survey Protocol included as Appendix A.
- Mature tree clearing is not anticipated during the Project works, however if clearing or construction activities are planned in areas of mature forest the following apply:
  - The Bald Eagle breeding period is from January to late August[34], while the Pacific Great Blue Heron breeding period is from January 15th to September 15th [35, 36]. The EM will conduct pre-clearing/pre-construction eagle and

[34] Blood, D.A., and G.G. Anweiler (1994). Status of The Bald Eagle in British Columbia. Wildlife Branch Ministry of Environment, Lands & Parks, Victoria, B.C. Wildlife Working Report No. WR-62
[35] Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2014. Develop with Care. Avaliable at https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/develop-with-care/fact-sheet-11-herons.pdf
[36] Vennesland, R.G. 2000. The effects of disturbance from humans and predators on the breeding decisions and productivity of the Great Blue Heron

heron surveys during this period. Any identified active nests will be protected according to the best management practices outlined in the BC Ministry of Environment's Guidelines for Raptor Conservation During Urban and Rural Land Development in British Columbia[37]

- The *BC Wildlife Act* under Section 34 protects any active nest occupied by an indigenous bird species as well as active or inactive nests of a Bald Eagle, Peregrine Falcon, Gyrfalcon, Osprey, Great Blue Heron or Burrowing Owl. Accordingly, in areas of mature forest, the EM will conduct stick-nest surveys prior to any clearing. In the event that a nest is found, the EM will develop and implement a site-specific nest management plan. Prior to the plan being implemented it will be submitted to the Town of Ladysmith and for review and approval.

- Outside of the bird nesting window of March 15th to August 15th the contracted EM will conduct cavity nest and stick nest surveys where required in areas of mature forest prior to clearing to satisfy the requirements to protect Pileated Woodpecker nesting cavities, Bald Eagles, Peregrine Falcons, Gyrfalcons, Osprey, and Great Blue Heron nests year-round.

4.2.1 Bird Nest Survey Protocol

The contracted EM will conduct bird nest surveys and management planning, as needed, according to the MOTI Breeding Bird Nest Survey Protocol included as Appendix A. The following are protocols the EM will follow when conducting bird nest surveys on the Site:

- Bird nest surveys will be conducted within the first 3-4 hours after sunrise.
- Surveys should not be undertaken during period of inclement weather or heavy wind in order to maximize the surveyor ability to detect nesting birds.
- Survey duration will be a minimum of 1 hour, with longer surveys according to habitat complexity.
- Surveys will be conducted within the clearing and grubbing limits, and up to 30 meters beyond these limits where feasible.
- If an active nest is identified in a proposed clearing area, a no-clearing buffer will be established by the EM with an appropriate set-back distance marked out with flagging tape in a radial buffer.
    - The buffer distance will be based on bird species, location of nest etc. Table 1. below includes recommended minimum buffer distances.
- Clearing may only proceed after the EM has determined the nesting and fledging is complete and/or the nest is no longer active.

in south-coastal British Columbia. M.Sc. thesis. Simon Fraser Univ., Burnaby, B.C.
[37] BC Ministry of Environment (2014) Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia. Available from:
http://www.env.gov.bc.ca/wld/documents/bmp/raptor conservation guidelines 2013.pdf

Table 1. Recommended minimum bird nest buffer size according to species of identified nesting bird. Buffer size will be determined by the EM and may be greater than the minimum buffer size is deemed necessary.

Bird species or Category	Recommended Minimum Buffer Size
Songbirds	30 m radius
Ground Nesters, Cavity Nesters (raptors and woodpeckers/sapsuckers), Waterfowl and Shorebirds	30 m radius
Pileated Woodpecker	50 m radius
Raptors (stick nesters/non-cavity nesters)	100 m radius
Bald Eagle, Golden Eagle, Osprey, Peregrine Falcon, Northern Goshawk, Trumpeter Swan, Sandhill Crane	200 m radius
Great Blue Heron	300 m radius

4.3 Protection for Trees

Precautions should be taken to prevent damage to any trees or tree roots systems which are within or adjacent to the work area. The following are general measures for the protection of trees on the Site:

- Flagging/marking of trees for cutting vs protection should be clearly identified and communicated to all parties;
- The Contractor and all workers will review the Windthrow & Hazard Tree Assessment prepared by Strathcona Forestry Consulting prior to clearing/construction. In addition, an ocular survey should be conducted prior to the start of works to identify any additional Danger Trees not originally identified in the Windthrow & Hazard Tree Assessment[38].
- All efforts will be made to protect mature trees from unnecessary cutting;
- Prepare traffic routes in such a way to minimize damage to tree roots and vegetation;
- Tree root drip zone protection areas and setbacks must be determined and marked out prior to Project activities by a QEP;
    - If the default drip zone of 7.5 m from the SPEA as discussed below in Section 4.3.1 is determined not necessary upon further study by a QEP and a new distance is proposed, the latter measurement shall apply.
- Delineate tree drip lines for trees that are to be retained and identify those lines by marker tape or other means and avoid or limit works in these zones;

[38] Strathcona Forestry Consulting. 2021. 128 Rollie Rose Drive, Ladysmith, BC, Windthrow & Hazard Tree Assessment.

- Trees and tree roots are to be protected to prevent disturbance or damage; physical protection measures such as blankets may be necessary for high impact or hot work activities such as blasting, torching, or placement of rip rap;
- Hand digging is required when roots greater than 50mm in diameter are encountered; and
- A planting plan for the Site with planting locations must be completed at the time of development by a QEP.

4.3.1 Protection for Trees within the SPEA

As discussed in Section 4.0 of this report, a RAPR Assessment was conducted in 2023 by TerraWest which outlines measures to protect and maintain trees within the SPEA:

- The trees within the SPEA must not be disturbed;
- Activities that must not take place near SPEA trees includes moving equipment, parking or storing construction equipment, significant changes to ground level and release of pollutants;
- A drip zone beyond the marked SPEA is to be implemented to protect trees and their roots from harm; a default 7.5 m drip zone will be adhered to, unless the calculated drip zone based off tree height is greater than 7.5 m, of which the latter measurement shall apply;
- Implementation of mitigative actions will be overseen by a QEP (e.g., hazard tree treatment and remediation of the SPEA) as discussed in the windthrow and hazard tree assessment with recommended guidelines in conjunction with the provincial RAR Revegetation Guidelines will yield a net environmental improvement; and
- As per the Windthrow & Hazard Tree Assessment prepared by Strathcona Forestry Consulting, native ground cover such as salal, ferns, mosses, must be retained in the SPEA and only local trees treated from inside and outside the SPEA may be added as coarse woody debris (CWD) [39];

5.0 EROSION AND SEDIMENT CONTROL MEASURES

A key Project objective is to reduce erosion and the mobilization of sediment due to Project-related activities and minimize the transport of sediment to the surrounding environment. This section will outline erosion and sediment control measures as well as BMPs. Specific erosion and sediment control structure installation procedures can be found in the BMP documents included as Appendix B[40]. Proposed erosion and sediment control components for the Site are outlined in Figure 2.

[39] Strathcona Forestry Consulting. 2021. 128 Rollie Rose Drive, Ladysmith, BC, Windthrow & Hazard Tree Assessment.
[40] Transportation Association of Canada, National Guide to Erosion and Sediment Control of Roadway Projects (2005)

5.1 General Erosion & Sediment Control Measures

The Contractor will implement ESC measures listed below and in the 2021 Geotechnical Assessment as well as the 2022 Erosion and Sediment Control Plan prepared by Lewkowich Engineering Associates Ltd. (LEA) to prevent the mobilization of sediment to the surrounding environment[41,42].

To minimize erosion and sediment transport, the following measures shall be implemented:

- Placement locations of erosion and sediment control structures will be determined by the EM in conjunction with the Contractor prior to the onset of Project works;
- Contractor and all staff must review the report prior to the start of Project works.
- The Contractor will limit the area of disturbance to the immediate area of construction. ESC measures will be in place prior to any clearing and grubbing or other soil disturbance activities;
- Maintain all Project site access locations with a focus on preventing the tracking of sediment by construction and pedestrian vehicles, see Appendix B, BMP11;
- Natural drainage patterns and current drainage structures should be maintained to the largest extent possible. Storm water catch basin inlets should be protected with catch basin weirs (donuts), catch basin socks, filter cloth inserts, or other stormwater catch basin protection inserts prior to the onset of Project works;
- Where natural drainage patterns and current drainage infrastructure are required to change, the following should take place:
    - Do not discharge surface or trench water containing suspended materials into the surrounding stormwater drainage systems unless conditions are met in Section 6.0;
    - Provide temporary drainage and pumping of surface and trench water as required to keep excavations and other Site areas free from water. If the pumping of surface water is required, the Contractor will use the following to minimize environmental impacts for sedimentation:
        - Surface water will be pumped to nearby areas of vegetation where approved and regularly monitored by the EM to allow for the infiltration of water into the ground;
        - Surface water will be pumped through a filter bag to reduce the velocity of the water and allow for filtration of suspended materials prior to discharging to the surrounding stormwater drainage system;
        - Surface water may be pumped into a settling basin to manage and reduce turbidity prior to discharge; or
        - A vac truck may be used to manage surface water where necessary for relocation to appropriate areas on Site for discharge or settling.

[41] Lewkowich Engineering Associates Ltd. 2021. Geotechnical Assessment.
[42] Lewkowich Engineering Associates Ltd. 2022. Erosion and Sediment Control Plan, 128 Rollie Rose Drive, Ladysmith, BC.

  - Protect all catch basins, silt traps, and lawn basin inlet castings that have the potential to receive runoff from the work area by using and continually maintaining filter cloth inserts or other stormwater catch basin protection inserts; and
  - Manage the runoff of turbid water or other deleterious substances in accordance with Federal and Provincial requirements.
- Minimize surface water runoff on the Project site. Potential sources include excavation, trenching, stockpiling activities, and precipitation events. Receptors are the stormwater systems along the Site boundaries and within the work area. Application of other materials and structures may be required at the discretion of the Contractor;
- Ensure that erosion and sediment control materials are available to be installed on-Site as required. The Contractor will maintain a supply of the following materials and make them readily available:
  - Sediment fencing
  - Geotextile fabric including non- woven filter fabric
  - Pumps and hoses
  - Catch basin inserts, donuts, and sediment logs
  - Straw bales (free of invasive plants)
  - Polyethylene sheeting
  - Sand bags
  - Filter bag system
- Install sediment fencing, as necessary, at the perimeter of the disturbed work areas and up-gradient ditch areas, at or close to right angles, in a manner to prevent the mobilization of sediment to surrounding environmentally sensitive areas. Sediment fencing may be necessary in areas where excavation or stockpiling occurs in close proximity to watercourses. Sediment fencing installation is detailed in the BMP23 document included in Appendix B;
- Take a phased approach so as to limit the area of exposed erodible soils to a small footprint at any given time and retain previous vegetated cover to the greatest extent possible;
- Stockpile stripped and/or imported topsoil away from active Project work areas, in a manner to prevent potential surface water from transporting fine sediments into the storm water drainage system or to the surrounding environment;
- Temporarily apply straw or mulch, if necessary, to erodible surfaces, and/or to compacted material stockpiles, to prevent the mobilization of sediment to the receiving environment. Polyethylene sheeting or tarps can also be used to protect erodible surfaces and temporary material stockpiles;
- Replanting on slopes less than 2H:1V shall include growing medium placed atop scarified or roughened underlying material as well as slope breaks, see Appendix B, BMP1 through 6;
- Remove, maintain, repair, and/or replace erosion and sediment control structures when deemed inefficient, exhausted, or no longer necessary. Take care to ensure that no accumulated sediment enters into the stormwater drainage system during

the maintenance, replacement, or removal of any established erosion and sediment control structures; and

- During periods of significant rain, the site may be shut down to prevent erosion and the mobilization of sediment, as well as immediate efforts to contain runoff and erosion.

5.2 Stockpile Management

The following are measures and information regarding the management of stockpiled material on Site and soil movement off-Site as needed:

- Stockpile materials will be properly drained, spread and trimmed to a stable slope not exceeding 2 to 1;
- Topsoil from the Site will be stockpiled in areas free of invasive plants. If topsoil is to be stored for more than one month, the piles should be covered or seeded to prevent erosion and invasive plant establishment;
- Soil stockpiles will be compacted and/or protected from rain and wind with poly sheeting or tarps;
- Stockpiles will be placed in areas that reduce the risk of overland stormwater runoff encountering the stored material. Stockpiles will be placed on areas that are not steeply sloped;
- Stockpiles must not be placed within 30 m of any drainage feature, watercourse or waterbody;
- Roads must be kept clean of any soil, sweeping will occur when soil tracking is identified by the EM or Contractor;
- The Contractor will regularly monitor any stockpiling area to assess drainage, monitor the effectiveness of erosion and sediment measures;
- If deemed necessary by the EM, sediment fencing, or sediment logs will be installed at the perimeter of stockpiles; and
- The EM will monitor laydown and disposal areas when established to assess drainage, monitor the effectiveness of erosion and sediment measures and to conduct water sampling.

5.3 Sediment Fencing

The following section contains information and measures for the use of sediment fencing as a perimeter control on the Site.

- Under the direction of the EM, sediment fencing will be installed at the perimeter of the work area to prevent surface runoff from discharging off Site and/or to direct surface water to drainage/perimeter ditches or structures;
- Sediment fencing will be installed around stockpiles as needed. The EM and the Contractor will assess the stockpiling location and type of material to determine if

sediment fencing is required. If it is determined that sediment fencing is required for a stockpile location, it will be installed prior to periods of precipitation;

- Sediment fencing installation is detailed in the BMP23 document included in Appendix B. The EM and Contractor will inspect all installed fencing to ensure proper installation;
- The EM and Contractor will inspect and maintain sediment fencing on Site from initial installation and throughout the duration of the Project:
    - Ensure that it is intact and that there are no gaps where the fence meets the ground or tears along the length of the fence;
    - Inspect sediment fencing immediately after each rainfall, and maintain the integrity of the silt fencing if required;
    - Reassess the location of installed sediment fencing as site conditions and general site topography changes to ensure adequate effectiveness;
    - Remove sediment deposits when sediment has accumulated to ~1/3 the height of the sediment fencing; and
    - Sediment fencing should be removed within 30 days of the final site stabilization, or upon approval from the Project Engineer.
- Sediment fencing minimum requirements (values are "Minimum Average Roll Values"):

Grab Tensile	500 N
Mullen Burst	1900 kPa
Elongation at Break	25% maximum
Opening	600 µm maximum
U.V. Rating @ 500 hrs	90% retained
Efficiency	>75% minimum
Construction	Woven (tape)
Texture	Smooth, shiny
Posts	4 x 4 cm treated, 1.0 m in length
Post Spacing (centres)	2 metre maximum
Permittivity	10 L/c/m^2

5.4 Catch Basin Protection

Catch basins near the Site that receive run off from the Project Area should be protected to prevent the transport of sediment to the stormwater system and to the nearby aquatic environment. The following measures will be taken to protect catch basins.

- The Contractor will install and maintain protection measures at catch basins where applicable on the Site. Methods include catch basin inserts, catch basin donuts, sediment logs, and sandbag barriers. The catch basin inserts can be preferable because they minimize flooding/pooling of water around the inlet. Figure 3 below shows examples of a catch basin insert, donut and sediment log and Appendix B

includes the BMP25 document outlining the installation of inlet protection measures.

Figure 3. Catch basin inlet protection examples. From left to right: catch basin insert, donut and sediment log.

5.5 Check Dams

The following are requirements regarding the installation and maintenance of check dams if applicable:

- Check dams will be installed in the following locations:
  - Where it observed that surface water flow velocity is causing erosion to a ditch or swale bottom;
  - Where it is determined a check dam will allow for settling of sediment within a ditch or swale; and
  - As directed by the EM.
- The maximum spacing of the dams should be so that the toe of the upstream dam is at the same elevation as the top of the downstream dam;
- Check dams should be constructed out of rock or gravel, sandbags filled with unerodable material or by using a straw wattle or equivalent ESC product. All rock or gravel used for check dams will be free of fines. Check dam installation is detailed in the BMP20 document included as Appendix B; and
- The rock must be placed purposefully to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges. The rock used must be large enough to stay in place given the expected flow through the channel.
- Periodic maintenance of check dams, such as removal of accumulated sediment, will be completed as necessary as determined by the EM.

5.6 Sediment-Laden Water Treatment

The following measures if applicable will be employed to treat sediment-laden water if generated on Site:

- The EM will assess Site areas for potential locations to discharge sediment-laden water for bio-infiltration. If a low-lying vegetated area is identified, the EM will notify

the Contractor that sediment-laden water can be discharged to the area. The outlet of the hose and discharge location will include water energy dissipation measures, to reduce the potential for erosion in the discharge area. If used, the EM will monitor the area during discharge to ensure all water infiltrates to ground, erosion is not occurring, and no sediment-laden surface water leaves the work area. The Contractor will not pump water off-Site without prior landowner permission.

- Sediment-laden water may also be moved into a settling basins/ponds or into on Site storage tanks to manage and reduce turbidity to an acceptable level, as described in Section 6.0, prior to discharge;
- A vac truck may be used to manage surface water where necessary for relocation to appropriate areas on Site for settling or discharge;
- A flocculant injection tube and dewatering bag can be used to treat sediment-laden water for discharge off-Site. The water will be pumped through a flocculant injection tube and into the dewatering bag and then directed or pumped to the discharge location. Please see Figure 4 below for a diagram of treatment system. The EM will monitor and sample the discharge from the dewatering bag to ensure it meets applicable water quality standards. The MSDS for the flocculant used in the system will be available for distribution and made available on Site.

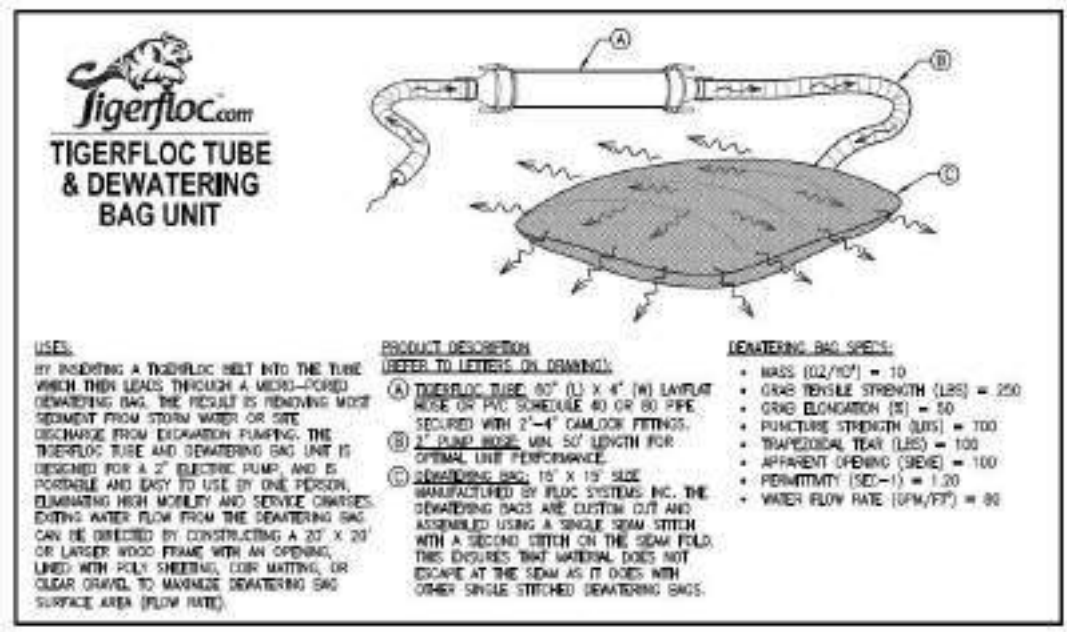

Figure 4. Flocculant injection system and dewatering bag.

5.7 Clearing and Grubbing

As clearing and grubbing directly impacts sediment and erosion controls and their placement the following measures will be followed for these activities:

- The Contractor will ensure that vegetative boundaries will be flagged and established. All flagged work area boundaries will be maintained throughout the duration of the Project;
- The Contractor must flag and mark the SPEA with signage along the lot boundaries asking that the public stay out of and respect the sensitive riparian habitat.
- Clearing and grubbing should occur outside the bird nesting season, or the EM will need to complete a bird nesting survey. If an active nest or protected inactive nest is encountered by the EM or Contractor on or near the Site, bird and bird nest survey protection and protocols will be followed as per Section 4.2.

The following Best Management Practices will help limit the impact of any excavation operations deemed necessary for this Project:

- Prepare traffic routes in such a way to minimize damage to tree roots and vegetation;
- Clearing and grubbing should be scheduled during dry weather;
- If excavation operations are necessary on hillsides or slopes, schedule the operations into a timing window of minimal precipitation to avoid or minimize erosion, sedimentation, and slope failures; and
- Avoid and or limit excavations in environmentally sensitive areas.

5.8 Maintenance & Monitoring of Erosion and Sediment Control measures

5.8.1 Contractor Responsibilities

The following outline the Contractor's erosion and sediment control responsibilities:

- The erosion and sediment control measures and practices outlined in this section are to be implemented by the Contractor prior to the commencement of construction activities.
- The Contractor is responsible for the installation of erosion and sediment control measures and for their maintenance for the duration of the Project. Throughout the Project duration, the Contractor will inspect the Project site to ensure that the controls are installed correctly, are functioning, and identify the need for erosion sediment control amendments and/or additional measures.
- The Contractor shall regularly maintain erosion and sediment control measures, such that they function as designed. Immediate action shall be taken by the Contractor to correct any deficiency observed in the operation of erosion and sediment control measures. In the event that a deficiency of any sediment or drainage control measures is directly or indirectly creating an adverse environmental impact, the Contractor shall initiate the necessary action to correct the problem as soon as possible after observing or being informed of the situation.

5.8.2 Environmental Monitor Responsibilities

The EM is responsible for the monitoring and reporting for all Project related activities that concern the protection of the environment. This includes the monitoring of the erosion and sediment control measures included in this plan.

The EM is responsible for the following activities related to the erosion and sediment control measures:

- Assessing sediment and erosion control measures on-Site for the duration of the Project for correct placement/installation, functionality, maintenance, and if amendments or additional measures are needed.
- Communicating erosion and sediment control concerns to the Contractor.
- Reporting on the Contractor's conformance and compliance with regards to erosion and sediment control measures.
- Conducting monitoring visits during and/or following periods of inclement weather/significant rain event (SRE). For the purpose of the Project, a SRE will be considered >24mm of precipitation in a 24-hour period. To measure precipitation, a rain gauge will be established on the Site to measure rainfall or data will be retrieved from a weather station representative of the Site location such as the Nanaimo Airport station of the Government of Canada[43].
- Conducting water quality monitoring as means of evaluating the effectiveness of erosion and sediment control measures as required, see Section 6.3.

6.0 SURFACE AND GROUNDWATER WATER MANAGEMENT

Sediment-laden surface water and other deleterious substances generated during construction must be prevented from entering sensitive aquatic environments. All stormwater systems, surface water bodies, and surrounding ditches will be protected from water impacted by construction activities.

During periods of heavy precipitation, there is the potential for the accumulation of water in the Project excavations. The Contractor and the EM will regularly check the forecast for heavy rainfall and schedule work accordingly to reduce the need for dewatering of excavations. Groundwater may seep into excavations depending on their depth and the water table in the area.

Previous reporting from LEA indicated the potential for a seasonal perched water table given the dense fine-grained glacial till subgrade encountered during investigation[44].

The EM will work to evaluate the effectiveness of on-Site water management and will maintain and/or improve water management measures as needed.

[43] Government of Canada (2024). Nanaimo, BC. Available at: https://weather.gc.ca/city/pages/bc-20_metric_e.html
[44] Lewkowich Engineering Associates Ltd. 2021. Geotechnical Assessment.

6.1 Water Quality Protection

To ensure the protection of surface water quality the following measures will be implemented.

- Erosion and sediment control and site drainage measures will reduce the risk of sediment-laden water from entering sensitive aquatic environments.
- Drainage structures will be regularly inspected, maintained, and periodically cleaned to ensure they are free draining.
- Prior to discharge of water generated and collected on the Site, sampling and characterization must occur and meet applicable federal, provincial, regional district and municipal standards and guidelines.
- If determined suitable by the EM, sediment laden water may be discharged to low-lying vegetated areas to promote bio-infiltration with the permission of the QEP as per Section 5.6.
- Surface water will be prevented from entering active work zones and excavations by diverting flows on paved surfaces. Swales, sandbags, ditching, pumps, hoses, sumps are options which may be used to protect active work zones and divert surface water around.
- Cover excavation trenches with steel plating or appropriate alternatives to reduce surface water from accumulating, or stop work in heavy precipitation when water management will be difficult.
- Keep excavations to a minimum size in order to reduce the likelihood of groundwater seepage and potential for surface water to accumulate.
- If rainwater or groundwater accumulates to a level that inhibits work, the Contractor will discuss the situation with the EM. The EM will perform water quality monitoring as per Section 6.3.
- Construction activities will be stopped in areas of erodible soils during heavy precipitation if increased turbidity of discharge water cannot be mitigated.

6.2 Concrete Works and Surface Water

Cast-in-place concrete works are anticipated during Project works. The following measures should be taken to ensure uncured concrete and deleterious water does not contact surface water:

- All concrete should remain isolated from flowing water for a minimum of 72 hours to ensure water pH is not affected. During periods of rain, uncured concrete will be protected with poly sheeting or tarps to prevent alkaline run-off;
- If surface water comes in contact with uncured concrete, it should be contained and prevented from entering the surrounding stormwater drainage structures and/or the surrounding environment;
- Concrete works should be avoided during heavy rain events if possible;

- Concrete wash-water from concrete trucks should be contained, collected via a recapture system or vacuum truck, and disposed of at an approved off-Site facility or treatment center. For specific disposal requirements contact Concrete BC at 604-626-4141;
- Excess concrete is to be retuned to the batch plant for re-use or recycling;
- Trucks, equipment, chutes, and tools are not permitted to be washed on Site and must be washed at the proper facilities at the batch plant;
- Spill of concrete and/or wash water must be contained with berms or sandbags and cleaned up immediately via vacuum truck to prevent migration to drainage systems, sewers, and waterways; and
- If concrete wash-water is suspected to have been generated and accidently released into the environment, the EM will sample surrounding surface water as per the Water Quality Monitoring Program outlined in the section below.

6.3 Water Quality Monitoring Program

The EM will monitor activities related to erosion and sediment control measures and at their discretion perform in-situ water quality testing if required.

The following measures will guide the EM in conducting a water quality monitoring program, if applicable:

- In-situ monitoring of turbidity and pH will be the primary water quality indicators.
- The EM will regularly review the construction schedule to determine in what segments upcoming construction activity will occur.
- The EM will visit the upcoming active Site segments and establish water quality monitoring stations if applicable.
- The EM will increase frequency of monitoring and water quality sampling during inclement weather.
- If elevated turbidity levels are measured leaving Site during water quality monitoring activities, the EM has the authority to temporarily slow or stop the works causing the elevated levels. The Contractor and EM will work together to find a solution to complete the works while maintaining the appropriate water quality levels leaving Site.
- Water quality station locations and sampling results will be provided by the EM in the environmental monitoring reports.

6.3.1 Water Quality Parameters

For the purposes of monitoring the potential impacts of construction activities on surface water quality, in-situ monitoring of turbidity and pH will be the primary indicators.

The following table outlines the criteria that will be met prior to the discharge of surface or ground water to the surrounding environment.

Table 2. Water Quality Parameters.

Parameter	Criteria[45,46]
Turbidity (NTU*)	Change from background of 8 NTU at any one time for a duration of 24 h in all waters during clear flows Change from background of 2 NTU at any one time for a duration of 30 days in all waters during clear flows Change from background of 5 NTU at any time when background is 8–50 NTU during high flows or in turbid waters Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters.
pH	6.5 – 9.0

*NTU = *Nephelometric Turbidity Units*

7.0 INVASIVE PLANT MANAGEMENT

This section of the CEMP details management practices to prevent the introduction and/or spread of invasive plant species.

7.1 INVASIVE PLANT SPECIES

Known noxious weeds and invasive species may be encountered during the project. The Province of BC requires the control of designated noxious and invasive species under the BC *Weed Control Act*. Due care should be taken to protect the Site and surrounding area from the introduction of invasive plants during Project activities. The latest version of BC's Guide to A GUIDE TO NOXIOUS WEEDS AND OTHER SELECTED INVASIVE PLANTS OF BRITISH COLUMBIA, 11TH EDITION should be reviewed for on-Site identification.

7.2 MITIGATION MEASURES FOR THE PREVENTION OF INVASIVE PLANT INTRODUCTION

The potential for introduction and/or spreading of noxious weeds from proposed Project works is considered to be low. The following list includes work activities considered to have the potential invasive plant introduction or spreading:

[45] Canadian Council of Ministers of the Environment (CCME). Water Quality Guidelines for the Protection of Aquatic Life Freshwater, Marine. https://ccme.ca/en/chemical/219#_aql_marine_concentration. [Accessed: June 2024].
[46] Canadian Council of Ministers of the Environment (CCME). Water Quality Guidelines for the Protection of Aquatic Life Freshwater, Marine. https://ccme.ca/en/chemical/162#_aql_marine_concentration. [Accessed: June 2024].

- Mobilization of machinery contaminated with plant material from previous work locations to the work area;
- Import of contaminated organic or organic mix soils (if required);
- Restorative seeding works with contaminated seed mix;

The following measures will be implemented to reduce risk of introduction and spread of invasive plants:

- The work area should be inspected for invasive plants prior to construction activities.
- To minimize disturbance, native vegetation and trees should be retained and clearing of vegetation should be only conducted when required to complete works.
- Remove invasive species immediately upon discovery. Chemical removal methods are not recommended.
- Removal of invasive species should be conducted during the correct time of year.
- Machinery utilized for invasive plant and associated soil removal will have points of contact cleaned at the site of removal before remobilization to other sites.
- Ditches, shoulders, and other roadside areas may contain invasive plants. All stripping materials from roadside areas and any other material suspected to contain invasive plant material will be disposed of at approved on-Site disposal areas or off Site at approved landfills as outlined by the Coastal Invasive Species Committee[47].
- The EM will monitor the disposal areas on Site to ensure that stripping soil and invasive plant material are disposed of appropriately. Invasive plant material shall be removed from Site for proper disposal, unless other disposal methods are previously approved by the Town of Ladysmith.
- Where required from disposal facility as outlined by the Coastal Invasive Species Committee[48], removed invasive species for disposal off Site must be double bagged (3-4 mm poly), goose tied with zap straps, and labeled "Invasive Species".
- Off-Site disposal is the preferred method by the QEP, but where approved by the QEP and the Town of Ladysmith the Contractor may deep bury invasive plant species on Site.
    - Deep burying on Site must occur at least 1 m below grade, in an area that is unlikely to be disturbed, covered with backfill above grade (equivalent to the depth of organic plant material) to account for organic plant material breakdown over time. Records of the quantity of material, location map of the burial pits, and the depths must be recorded. Signs must be used to mark the burial location and keep heavy machinery from disturbing the area. Depending on the species buried and if with seed, disturbance of the area may not be advisable for an extended period of time, this can

[47] Coastal Invasive Species Committee (2024). Disposal Information. https://www.coastalisc.com/disposal-information/. [Accessed: July 2024].
[48] Coastal Invasive Species Committee (2024). Disposal Information. https://www.coastalisc.com/disposal-information/. [Accessed: July 2024].

be determined by the QEP when the invasive plant species to be buried are identified.

- Positive effects for on Site burial on private land include[49]:
  - The minimization of the movement of plant material;
  - Keeping invasives isolated to their current location limits the potential for spreading plant and seed materials during transport; and
  - Easy, cost effective and quick.

- The Contractor will clean all earthworks machinery prior to mobilization to site, including caked soils and vegetation fragments.
- If disturbed, bare, or eroded soil surfaces are present, the Contractor will cover with a native seed mix as soon as possible to prevent the establishment of invasive weeds.
- Seeds used on the Site will be free of noxious plants as defined under the *BC Weed Control Act & Regulation* and any other prohibited species in BC.

8.0 CONSTRUCTION WASTE MANAGEMENT

Hazardous materials, Dangerous Goods, Controlled Products, and wastes generated during the completion of the Project shall be stored, used, transported, and disposed of according to applicable laws and regulations, including the BC Hazardous Waste Regulation, Transportation of Dangerous Goods, and the Occupational Health and Safety Regulation. The proper handling and storage of hazardous materials will minimize accidental loss and allow for adequate spill containment and recovery should a spill occur during site works.

8.1 HAZARDOUS MATERIALS INVENTORY

The following hazardous materials are anticipated to be on-site during the project:

- Flammable and/or combustible fuels (i.e. gasoline and diesel); and
- Waste oils that might be generated during emergency equipment servicing.

8.2 HYDROCARBON AND HAZARDOUS MATERIALS HANDLING PROCEDURES

The following procedures should be adhered to for the duration of the project:

- Fuel products will be transported and distributed via double walled "tidy-tanks", equipped on contractor vehicles, or in jerry cans/tanks with suitable secondary containment; no additional fuel products from the contractor should be stored on-site.

[49] Invasive Species Council of BC. 2021. Dispose with Care Invasive Plant Disposal in BC. Accessed at: https://bcinvasives.ca/wp-content/uploads/2022/03/Dispose-with-Care-FS-1221_20211210.pdf.

- The Contractor will maintain records for all hazardous waste/materials including records on quantity, removal, stored, generated, manifests, and certification documents.
- Contractor shall ensure that Project personnel are adequately trained in the handling and transportation of dangerous goods and controlled products and have the appropriate Personal Protective Equipment (PPE) to carry out such activities.
- All machinery used on-Site should be in good working condition with spill kits either on board or easily accessible nearby.
- A major spill kit shall be stored at the Site office for the duration of the Project, and will be maintained as appropriate.
- Refuelling and equipment maintenance will occur on stable ground, preferably on impermeable surfaces and at least 30 m from water or from storm sewer inlets.
- Absorbent pads or drip trays shall be used to catch leaks and drips from fuelling operations; fill nozzles shall remain inverted during transfer from storage tank to fill spout to minimize spillage; a spill kit will be accessible during fuelling operations.
- Waste oils generated from emergency equipment maintenance shall be stored in sealable steel drums meeting *Transportation and Dangerous Goods Act* requirements, for immediate pick-up and disposal; disposal drums shall be adequately labelled as per WHMIS requirements.
- Waste oils shall be disposed of by a qualified transporter.
- Regular equipment maintenance shall not be conducted on-site. On-site maintenance shall only be conducted on an emergency or absolute requirement basis and if conducted on-site it shall be conducted on stable ground with a spill tray is below the repairs, and at a minimum of 30 m from water.
- Vehicles and equipment shall be inspected daily to ensure they are free of leaks and in good working order. The inspections will be provided to the EM upon their request.
- If equipment is found to be leaking, a spill tray will be placed underneath, and the equipment will be placed out of service until it is repaired. Contaminated ground material will be excavated the same day it is observed and disposed of properly. If contaminated material excavation is not possible until the following day, the leak will be delineated with spray paint. If there is potential for precipitation the contaminated material will be covered in polyethylene sheeting held in place by heavy materials such as large rocks until it is disposed of.
- Material Safety Data Sheets (MSDS) shall be available on-site for all hazardous materials.

8.3 Recyclable Waste

Recyclable waste such as cardboard, wood, and approved plastic will be sorted out and stored in appropriate, clearly identified containers. The contractor will dispose of recyclable waste at an appropriate facility.

8.4 NON-RECYCLABLE WASTE

Non-recyclable solid wastes generated during the Project including general refuse, replacement air filters, construction debris, and surplus oil requiring disposal off-site will be disposed of at appropriate facilities or landfills. Only facilities/landfills authorized to accept the specific products requiring disposal shall be used. A solid waste bin will also be stored on the Site and regularly maintained and emptied.

8.5 ANIMAL ATTRACTANTS

The contractor will place all animal attractant wastes such as food scraps in animal-proof containers and will ensure that these wastes are removed on a regular basis from the Project site.

8.6 PORTABLE TOILETS

If used for the Project, portable toilets will be maintained regularly and placed in a flat location away from any water. Effluent from toilets will be removed from the site and disposed of at an appropriate treatment facility on a regular basis. Portable toilets will be tied down or anchored, such that they cannot be blown or tipped over, under reasonable conditions.

9.0 AIR QUALITY AND DUST CONTROL

9.1 DUST CONTROL

Construction works on the Project have the potential to produce dust and affect air quality. The following measures should be followed to ensure air quality is not adversely affected and to mitigate wind erosion during Project works:

- Minimize stockpile handling during dry periods and cover stockpiles in advance of high winds;
- Utilize water trucks to minimize the availability of fine erodible sediments during dry periods;
- Unfinished road surfaces should be sprayed with water when dry conditions and high traffic is expected;
- Implement sweeping procedures to keep erodible sediments from entering high traffic areas during dry periods. Sediment will be removed on the same day that track-out occurs. No flushing (applying water to remove the sediment) and no sweeping sediment into ditches will occur;
- The EM will monitor the construction area for any dust issues and report any deficiencies to the Contractor;
- Implement erosion and sediment controls outlined in Section 5.0;

- Establish a staging zone for trucks that are waiting to load/unload that is away from sensitive receptors to reduce and control emissions; and
- Trucks sourced to haul excavated and stockpiled soils from the site will be equipped with moveable fabric bed covers that are to be utilized to keep the wind off loads.

9.2 Vehicle and Equipment Idling Control Plan

The following idling time restriction are to be implemented to control air quality as a result of unnecessary equipment exhaust:

- Utilize idle reduction technologies where appropriate and applicable;
- Minimize idle times during period of inactivity and while stopped within a queue formed under the direction of a traffic control person or device as outlined below in Table 3;
- Locate combustion engines away from sensitive receptors (e.g. fresh air intakes, air conditions, and windows); and,
- Establish a staging zone for trucks waiting to load or unload material away from sensitive receptors listed above.

Follow the idling time restrictions as set out in this CEMP. The restrictions are as follows:

Table 3. Vehicle and equipment idle timing.

Vehicle Type	Maximum Idling Time
Motor vehicles and light diesel trucks	1 minute
Heavy duty diesel vehicles	5 minutes
Diesel vehicles involved in construction site passenger transportation	10 minutes
Construction equipment	Exempt when actually employed at the Site for work intended

- Idling for time exceeding those listed in the table above is permitted when:
  - Vehicles or equipment are affected by traffic or mechanical conditions;
  - Bringing up operating temperature;
  - The outdoor temperature is below 0º C or above 30º C;
  - It is necessary to operate auxiliary equipment (e.g. cranes, cement mixers, etc.);
  - A vehicle is unloading/loading a trailer;
  - Idling is required for vehicle repair or inspection;
  - Required for emergency response; and

- Defrosting or defogging windows.

- The Contractor should utilize idle reduction technologies where appropriate and applicable.

10.0 AMBIENT NOISE

Construction works on the Project using equipment and machinery have the potential to produce noise and vibration which may affect nearby residents and wildlife. The following measures should be followed to help mitigate ambient noise and vibration during Project works:

- The EM will monitor the construction area for any noise or vibration concerns during Sie visits, and report any concerns or deficiencies to the Contractor;
- The Contractor will be notified and the EM will monitor and inspect when community and input driven noise complaints are reported;
- All applicable noise by-laws or best management practices for the surrounding Town of Ladysmith community which dictate acceptable hours of construction work will be followed;
- All equipment will be kept in good working order, if deficiencies are noted the Em will report to the Contractor so maintenance can be completed;
- Mufflers shall be installed on all equipment where appropriate; and
- Site generators and light plants are only to be used when electricity in not available.

11.0 SPILL PREVENTION AND RESPONSE

It is the contractor's responsibility to minimize the potential of a hydrocarbon spill or release of other hazardous materials to the surrounding receiving environment. This section will outline best management practices for spill prevention and spill response.

11.1 ANTICIPATED CAUSES OF SPILLS

The following conditions/activities have the potential to lead to spills on the Project site:

- Poor condition of fuel storage tanks;
- Diesel/gasoline spillage from refuelling of machinery;
- Hydrocarbon lubricant, hydraulic fluid, and/or glycol coolant spillage from onsite machinery maintenance;
- Hydraulic line rupture from active machine works;
- Coolant spillage from overheating;
- Vehicle/machinery accidents, tipping, roll-over, and/or collision; and
- Vehicle/machinery collisions with fuel/lubricant storage facilities, rupturing tanks, drums, pails, etc.

11.2 Spill Prevention Best Management Practices

The followings BMPs should be followed by Project personnel to reduce the risk of spills:

- The Contractor should follow the hydrocarbon handling procedures outlined in Section 8.2 of this report;
- All fuel storage tanks will be inspected and leaking tanks or tanks in poor condition will not be permitted for use;
- The Contractor will conduct daily visual inspections on all equipment such as containment receptacles, pumps, hoses and staging gear. Identified problems corrected immediately;
- All machinery and/or passenger vehicles mobilized to the Project work area will be in sound working condition and good repair;
- Drip trays will be deployed under inactive machinery and equipment. Inactive will be defined as any stored machinery and equipment on Site not being used for project components for longer than one week;
- No onsite fuel storage tanks and/or fuel, hydraulic fluid, hydrocarbon lubricant, and glycol coolant storage on-Site;
- Portable fuel canisters and generators on-Site will be stored in portable containment berms while in use;
- All large machinery, service trucks, fuel trucks, and any passenger vehicles fitted with portable fuel tanks ("tidy tanks") will be fitted with a portable spill kit;
- A portable spill kit must be kept in all heavy machinery;
- Large, mobile spill kits (yellow garbage bin) containing booms (as well as other spill materials) must also be available onsite in all areas of active work with additional spill kits located in stockpile and laydown areas as well as storage and office/meeting areas;
- Spill kits will be capable of dealing with 110% of the largest potential spill onsite;
- Site spill kits will be routinely inspected to ensure depleted stocks are replenished;
- If soil contamination from a spill occurs, the soil will be contained, protected from precipitation, removed from site as soon as possible and taken to an appropriate disposal facility; and
- Site staff shall be informed of the location of the spill response kits and be trained in their use.

11.3 Spill Response and Reporting

In the event of a spill the Contractor and Project personnel will immediately take the necessary steps to respond to and appropriately report on the event to the EM and the Town of Ladysmith, and appropriate agencies.

11.3.1 Spill Response Plan

A Spill Response Plan is included as Appendix D of this report. In the event of a spill the Spill Response Plan will be followed.

11.3.2 Spill Notification and Reporting

The following measures will be taken to appropriately notify and report on a spill if one occurs:

- The spill observer will contact the site superintendent or representative immediately. If the situation merits, Ladysmith Fire Hall is located approximately 2.2 km away from the Site and would be the nearest first responder/emergency response assets in the area.
- All spills of any quantity will be reported to the Town of Ladysmith and the EM.
- A spill exceeding Emergency Management BC's (EMBC) reportable quantities or a spill of any amount to an aquatic receiving environment will be immediately reported to the EMBC's hotline (1-800-663-3456), and the EM. The incident will be reported in an Environmental Incident Report (Appendix E). Please see table below for reportable quantities.

Table 4. Reportable spill quantities.

REPORTABLE SPILL QUANTITIES	
Class 2.1 Flammable Gas (e.g. propane, acetylene, hydrogen)	10 kg
Class 2.2 Non-Flammable or Non-Toxic Gas (e.g. SF6, CO2, halon, refrigerants)	10 kg
Class 2.3 Toxic Gas (e.g. ammonia, chlorine)	5 kg
Class 3 Flammable Liquids (e.g. diesel, solvent, gasoline)	100 L
Class 8 Corrosive Liquids (e.g. acids, caustics, mercury)	5 kg
Pesticides and Herbicides	5 kg or L
Oil and Waste Oil	100 L
Leachable toxic waste (e.g. antifreeze)	25 kg
PCBs	Any amount
Asbestos	25 kg
Other Substances	Contact EM
☼ ALL SPILLS TO A WATERCOURSE ARE REPORTABLE TO PEP ☼	

12.0 ARCHEOLOGICAL MANAGEMENT

The following mitigation and management measures shall be implemented on Site as a course of due diligence in case of a chance find. All archeological sites are protected under the *Heritage Conservation Act* (HCA)[50]. All measures included in MOTI Chance Find Management Guidelines (Appendix E) will be followed by all Project personnel.

- All archaeological sites, regardless of condition, are protected by the HCA, HCA-protected archaeological sites or objects cannot be disturbed or altered without a permit issued by the BC Archaeology Branch of Ministry of Forests (MoF).
- If suspected or confirmed archaeological materials or human remains are encountered during the work, the Contractor must stop work in the immediate area of the find, vacate the immediate vicinity, and contact the Town of Ladysmith.
    - EM and the Town of Ladysmith will be immediately notified.
    - The Contractor will immediately flag off a 30m radius around the discovery site and prevent any work within this zone.
- Ground disturbances for site access will be kept to minimal levels; and ground disturbance outside of the primary work areas shall be avoided.

13.0 WILDFIRE MANAGEMENT

The Contractor will comply with all measures for wildfire mitigation and management included with the provincial Wildfire Act and Regulations[51]:

- In the Wildfire Regulation, high risk activities are defined as:
    - Mechanical brushing;
    - Disk trenching;
    - Preparation or use of explosives;
    - Using fire-or spark-producing tools, including cutting tools;
    - Using or preparing fireworks or pyrotechnics;
    - Grinding, including rail grinding;
    - Mechanical land clearing;
    - Clearing and maintaining rights of way, including grass mowing; and
    - Any of the following activities carried out in a cutblock excluding a road, landing, roadside work area or log sort area in the cutblock:
        - operating a power saw;
        - mechanical tree felling, woody debris piling or tree processing, including de-limbing;
        - welding;
        - portable wood chipping, milling, processing or manufacturing;

[50] British Columbia (2023). Heritage Conservation Act [RSBC 1996] Chapter 187. Assessable at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96187_01
[51] Province of British Columbia 2023. Wildfire Legislation and Regulations. Available at: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/governance/legislation-regulations. [Accessed: July 2024].

- skidding logs or log forwarding unless it is improbable that the skidding or forwarding will result in the equipment contacting rock; and
- yarding logs using cable systems;

- During Extreme or High Fire Danger Rating:
  - If High Risk Activities are undertaken after 1:00 PM during periods of High DGR, or anytime during Extreme DGR, the work areas and surrounding vegetation will be wetted prior to and after completion of the activities by the Contractor. High pressure fire pumps and associated equipment will be utilized to wet the work areas. A supply of 2,000 litres of water and a high pressure pump must be stored on site throughout the duration of the project. All vehicles and industrial equipment must be equipped with a shovel, Pulaski and a full and functional 18 litre backpack water pump or approved fire extinguisher.
  - No person shall light, fuel or make use of an open fire within the work zone.
- It is the Contractors responsibility to ensure fire equipment and water delivery requirements are met, remain on Site and are functional at all times.

14.0 PROJECT EMERGENCY CONTACT LIST

The following list can be used in the event of an environmental emergency. Additional Project contacts will be updated within this CEMP as they change or become available.

Project Role and Organization or Company	Position	Name	Phone Number	Email
Owner/Contractor's QEP and Environmental Monitor TerraWest Environmental Inc.	Project Manager/ Environmental Monitor	Derek Nickel (R.P. Bio)	250-216-4313	dnickel@terrawest.ca
	Environmental Monitor	Stormy Kirkland	778-268-0168	skirkland@terrawest.ca
Owner/Contractor Sharp Sites Inc.	Owner and Project Manager	Chris Sharpe	250-327-1617	chris.sharpe@shaw.ca
Local Municipality Town of Ladysmith	Director of Development Services	Jake Belobaba	250-245-6405	jbelobaba@ladysmith.ca
	Planner	Julia Tippett	250-245-6410	jtippett@ladysmith.ca

BC Environmental Emergency Program	-	-	800-663-3456	-
Department of Fisheries and Oceans	Spill Reporting Line	-	604-666-3500	-
Wild Animal Rehabilitation Centre/ BC SPCA Provincial Call Centre	-	-	855-622-7722	-
Environment Canada	-	-	604-666-6100	-

15.0 DISTRIBUTIONS AND REVISIONS

The Contractor is responsible to dispatch copies of this CEMP to the Project team and ensure they are kept appraised of any amendments. It is the responsibility of the Contractor to ensure that all persons engaged in this Project are aware of the Project's environmental issues, responsibilities, and liabilities. A copy shall be kept on the Project site at all times for reference and produced upon request. It is the responsibility of the Contractor that project work will be carried out in accordance with specifications and attachments in this CEMP and all referenced and relevant documents. The CEMP shall be treated as a 'living' document and may be amended as needed throughout the duration of the Project. Revised copies of the CEMP shall be distributed to the appropriate parties if changes are made.

Prepared by:

Stormy Kirkland, B.Sc., BA, AFAg
Environmental Technologist

Reviewed by:

COLLEGE OF APPLIED BIOLOGISTS
Derek Nickel
RPBio 3004
CAB

12-July-2024

Derek Nickel, B.Sc., R.P.Bio
Project Biologist

FIGURES

FIGURE 2. EROSION AND SEDIMENT CONTROLS AND STORMWATER MANAGEMENT

CLIENT: SHARPE SITES INC.

LOCATION: 128 ROLLIE ROSE DRIVE, LADYSMITH, BC

PROJECT: CSHC24-02

DATE: JULY 2024

CREATED BY: SK

LEGEND

- APPROXIMATE SITE BOUNDARY
- STREAMSIDE PROTECTION AND ENHANCEMENT AREA (SPEA) - 10 m
- TRIBUTARY 1 (T1)
- OBSERVED STORM SEWER INLET
- PROPOSED ESC MEASURES - FILTER SOCK
- PROPOSED ESC MEASURES - SILT FENCING
- PROPOSED SITE ACCESS/PAD

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 11"x17" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH

FIGURE 5. SITE LOCATION AND PROJECT WORK AREA

CLIENT: SHARPE SITES INC.

LOCATION: 128 ROLLIE ROSE DRIVE, LADYSMITH, BC

PROJECT: CSHC24-02

DATE: JULY 2024

CREATED BY: SK

LEGEND

— — — SITE BOUNDARY

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 8 1/2"X11" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH

APPENDIX A.

MOTI BREEDING BIRD SURVEY PROTOCOL

1. Survey Requirements for Areas to be Cleared and Grubbed

Both vegetated habitats and non-vegetated habitats (i.e. rock outcrops) have the potential to support nesting birds, although bird abundance is generally greater in heavily vegetated areas. In addition, many man-made structures such as retention ponds, bridges, utility towers and larger culverts have the potential for nesting bird activity.

2. Survey Timing

Bird nest surveys should be conducted during the appropriate seasonal timing window. In general this window occurs between March 15th and August 15th, however, the Contractor's Appropriately Qualified Professional (AQP) may use the guidance of the General Nesting Periods of Migratory Birds in Canada (https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.) to refine the window.

Bird nest surveys should be carried out within the first 3 to 4 hours after sunrise. Surveys should not be undertaken during periods of inclement weather (e.g. heavy rain, fog or snow) or under windy conditions (i.e., >2 on the Beaufort scale[1]).

**Note: Non-passerine species such as raptors or owls may have different seasonal nesting windows and are active at different times of the day. If environmental assessments have identified the potential for non-passerine bird species then alternate survey timing may be required.*

3. Team Member Qualifications

All nest surveys must be conducted by, or be completed under the direction of, an Appropriately Qualified Professional (AQP) who will be responsible for sign-off on all surveys. All survey team members must have sufficient experience with bird identification and biology.

4. Survey Effort

Survey duration must be a minimum of 1 hr/ha and may be longer if searches are occurring in complex habitats. The AQP will be responsible for determining the effort required within these parameters.

Survey team members will walk transects through the area to be cleared to search for bird nests and nesting activity. Where appropriate, surveyors should also use additional survey techniques to increase the likelihood of finding nests such as behavioural cues and bird song identification.

Surveys should be conducted both within the clearing and grubbing limits and, where feasible and appropriate, up to 30 meters beyond these limits.

5. Determining Nest Activity

Each nest observed during the survey must be mapped and designated as either **active** or **inactive**. If the contents of the nest are easily observed from a distance, indicators such as new nesting material and/or eggs can be used to determine activity. Other means of determining nest activity can include observations of adult birds exhibiting nesting or territorial behaviour.

Observed nests that are in good condition but do not appear to be occupied at the time of the survey, must still be considered "active" until additional observation periods have been undertaken. Observation periods must include 2 separate one hour duration survey efforts conducted on consecutive days. To avoid unnecessary disturbance, a nest should be observed from a distance if it is considered active.

6. Active Nest Buffers

A No Work Zone buffer must be applied to any active nests identified. The Contractor's AQP is responsible for developing and implementing a nest management plan including an appropriate buffer width, buffer marking, and mitigation measures for the duration of the nest occupancy. Buffer zones may be determined based on factors such as surrounding vegetative cover,

topography, species sensitivity to disturbance, existing disturbance in the area, or proposed construction activities in the vicinity of the nest.

7. Survey Cycles

a. New Surveys

Unless otherwise approved by the Ministry Representative, areas to be cleared must be surveyed a minimum of 3 times over a 5 day period with no more than 1 survey in any given day. Consecutive days are preferred. Vegetation clearing must begin within 48 hours of the end of the survey cycle. Clearing and grubbing can be undertaken for up to 10 days after the end of the survey cycle, if the AQP determines that ongoing construction activities will preclude additional nesting activity.

b. Survey Extensions

If vegetation clearing does not begin within 48 hours of the end of the survey cycle, or cannot be completed within the 10 day clearing window, then additional survey work will be required.

i) If vegetation clearing is delayed for 2-5 days following the last survey, 1 replicate survey (1 nest survey in 1 day) will be required within this 2-5 day period.
ii) If vegetation clearing is delayed for 6-9 days following the last survey, 2 replicate surveys (2 nest surveys over 2 consecutive days) will be required within this 6-9 day period.

If the above procedures are not implemented (i.e. the survey is not extended), a new survey cycle must be initiated before vegetation clearing can commence.

c. Reassessment of Active Nests

A minimum of 14 days after a nest is designated as active, the nest can be reassessed.

Reassessment will consist of a minimum 1 hour nest observation period on 2 separate days, with the timing for these reassessments based on the likelihood of observing birds at the nest. Potential disturbance of birds must be minimized during the observation period.

If watches have been conducted and no bird presence and/or breeding activity is noted, nest status can change from active to inactive. As a final verification of inactivity, the nest may be approached and inspected. The ESA buffer can also be removed.

If at any time the nest is found to be active, the AQP will determine the appropriate ESA buffer and the same procedure for an active nest will be followed.

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[1]. http://www.spc.noaa.gov/faq/tornado/beaufort.html

APPENDIX B.

NATIONAL GUIDE TO EROSION AND SEDIMENT CONTROL (BMP EXCERPTS)

APPENDIX F
FACTSHEETS: BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL

APPENDIX F -FACTSHEETS: BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL

The following factsheets describe selected Best Management Practices (BMPs) for Erosion and Sediment Control. This does not represent an exhaustive list of available BMPs and users are encouraged to consider other BMPs that are endorsed by their local roadway authorities.

Table F1 – Summary of Erosion Control and Sediment Control BMPs

BMP	Description	Erosion Control		Sediment Control	BMP	Description	Erosion Control		Sediment Control
		Exposed Surface Protection	Runoff Control				Exposed Surface Protection	Runoff Control	
1	Topsoiling	✓			16	Slope Drains		✓	
2	Seeding	✓			17	Groundwater Control		✓	
3	Mulching	✓			18	Synthetic Permeable Barrier		✓	✓
4	Hydroseeding-Hydromulching	✓			19	Fibre Rolls and Wattles		✓	✓
5	Sodding	✓		✓	20	Check Dam		✓	✓
6	Planting Trees and Shrubs	✓			21	Diversion Ditch		✓	
7	Riparian Zone Preservation	✓		✓	22	Energy Dissipators		✓	
8	Riprap Armouring	✓			23	Silt Fence			✓
9	Gabions	✓			24	Brush or Rock Berm			✓
10	Aggregate Cover	✓			25	Drain Inlet Sediment Barrier			✓
11	Stabilized Worksite Entrance	✓			26	Continuous Berm			✓
12	Rolled Erosion Control Products (RECP)	✓			27	Earth Dyke Barrier			✓
13	Cellular Confinement System	✓			28	Sediment Traps and Basins			✓
14	Chemical Stabilization	✓			29	Storm Sewer Protection			✓
15	Slope Texturing/Grading		✓		30	Pumped Silt Control Systems			✓

These BMP factsheets are adapted from those presented in the Alberta Transportation *Design Guidelines for Erosion and Sediment Control for Highways* (2003) and permission for their use is gratefully acknowledged.

Topsoiling

Erosion Control:
Exposed Surface Protection – Vegetated

BMP1

Description and Purpose

- The covering of exposed mineral soils with soils of high organic content to minimize raindrop erosion potential
- Provides a medium for vegetation to grow

Applications

- Permanent measure
- May be used to provide a bedding medium for seed germination and a cover to exposed soil that is not suitable to promote vegetation growth
- May be used on slopes with a maximum gradient of 2H:1V
- Normally topsoil is placed prior to seeding, mulching, hydroseeding-hydromulching, seeding and installing rolled erosion control products (RECP), or planting of trees/shrubs

Advantages

- Placing topsoil provides enriched organic medium for vegetation root structure to grow
- Topsoil organic content provides nutrients to promote plant growth
- Absorbs raindrop energy to reduce erosion

Limitations

- Not appropriate for slopes steeper than 2H:1V
- Dry topsoil may be removed by blowing wind
- Topsoil may not be readily available in some areas

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Prepare ground surface to final grade by removing large rocks or other deleterious materials
- Apply topsoil with dozer or light track equipment to design thickness
- Track walk upslope or downslope (do not overcompact topsoil by heavy equipment; only track walk one pass) to provide a contour of roughness of topsoil to further minimize erosion

Topsoiling

Erosion Control:
Exposed Surface Protection – Vegetated

BMP1

Construction Considerations

- Topsoil should be free of weeds which may inhibit re-vegetation of desirable plants
- Subgrade should be roughened by track walking up/down the slope prior to topsoiling to promote adhering of topsoil to subgrade (surface roughening of subgrade is especially required if topsoiling is not scheduled immediately after completion of the grade)
- Topsoil should be moistened regularly during periods of hot dry weather to minimize wind erosion
- Hydroseeding-hydromulching topsoil will minimize wind erosion of topsoil
- All available topsoil stripped for construction should be stockpiled and reused
- Seeding should follow as soon as possible after the topsoil has been placed, to reduce the possibility of it being eroded away by water or wind

Inspection and Maintenance

- Inspect topsoiled areas at least once per month after initial application or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- Areas damaged by washout or rilling should be regraded and re-topsoiled immediately

Similar Measures

- Hydroseeding-hydromulching
- Mulching
- Rolled erosion control products (RECP)

Seeding

Erosion Control:
Exposed Surface Protection – Vegetated

BMP2

Description and Purpose

- The planting or placing seed into soils of cut slope or fill embankment slopes after a layer of organic topsoil is spread over the slope
- Provides erosion protection through development of a shallow root structure from seed germination and plant growth

Applications

- Permanent or temporary measure
- Temporary seeding with rapidly growing plants may be applied to stockpile or excavation areas which will be exposed for more than 30 days
- Permanent seeding may be applied to exposed bare soil areas which have been graded to final contours
- Permanent seeding may be applied to landscape corridors, slopes and channels by broadcasting, furrowing or spraying on with mulch tackifier
- Provides habitat for wildlife after vegetation establishment
- Can be enhanced with a protective layer of mulches or rolled erosion control products (RECP) to improve growth environment

Advantages

- Enhances terrestrial and aquatic habitat with vegetation growth re-establishment
- Aesthetically pleasing with vegetation cover
- Grows stronger with time as root structure develops
- Generates vegetation to enhance infiltration of runoff and evapotranspiration
- Seeding with a mixture of grasses and herbaceous legumes in disturbed areas is an inexpensive method of stabilizing soil, particularly if the area is flat or gently sloping
- Cost of seeding disturbed areas is relatively low and its effectiveness on a long-term basis is relatively high

Limitations

- Grasses may require regular maintenance (mowing) along ditches
- Uncut dry grass may present a fire hazard and site distance obstruction adverse to highway safety
- Seeding of steep slopes may be difficult without using measures such as RECP's or hydroseeding-hydromulching methods
- Seasonal windows on planting (early spring or fall) may not coincide favourably with construction schedule
- Areas that have been covered with seeded topsoil are susceptible to erosion until vegetation is established if RECP are not used.

  - Use of topsoil and mulch can reduce rain drop erosion potential during germination and until vegetation is established
  - Additional erosion control measures, such as RECP, may be required for steep slopes and channels
- Reseeding will be required in areas of limited plant growth
- Time to establish root structure may be unacceptable for some high risk areas; sodding should be considered for these areas

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- The site to be seeded should be prepared prior to seeding
  - Surface should be graded to design grades and then topsoiled
  - Topsoil should be roughened, harrowed, or grooved
  - Seedbed should be 75 to 150 mm deep, with the top 75 mm consisting of topsoil free of large clods or stones
- Seed should be applied immediately after seedbed preparation using broadcast seed spreaders, cyclone (broadcast) spreaders, or seed drills to ensure uniformity of application
- Seedbed should be harrowed, raked, or chain-dragged to ensure proper seed-soil contact
- If soil tests indicate that fertilization is necessary, an appropriate soil amendment should be selected and applied with care; fertilizer use should be carefully controlled as this may increase nutrient loading to receiving streams if runoff is not controlled properly

Construction Considerations

- Selection of proper vegetation seed mix depends on soil conditions, climate conditions, topography, land use, and site location
  - Selected seed mixes must be appropriate for site specific conditions
  - Some jurisdictions have developed recommended seed mixes for specific regions based on historic performance results
  - Qualified agronomists or agrologists should be consulted if a suitable seed mix is not identified
- Seeding rate should be specified according to the type of grass being sown. Natural grasses and high quality tame mixes may require lower rates of application
- Fall rye or oats may be added as a companion crop to provide early growth and protection from soil erosion

- Planting of seeds by hydraulic seeding and mulching techniques should be considered for slopes steeper than 3H:1V, or where application of seed, mulch, and fertilizer in one continuous operation is desirable
- Sod may be installed for faster results, however it is very costly but essential for high risk sensitive areas
- If mulch is placed as a germination medium for seeds, the mulch layer may be further protected with a biodegradable matting to prevent mulch from being washed or blown away

Inspection and Maintenance

- Inspect seeded areas one year after initial seeding or after significant storm events to evaluate germination and seedling density results
- Freshly seeded areas should be inspected frequently to ensure growth is progressing
- Additional erosion control measures should be considered for areas damaged by runoff
- Reseedings may be required within 1 to 5 year intervals after initial seeding
- Small bare spots may need to be reseeded several times at subsequent years after initial application; larger areas may need to be completely retreated
- Cutting or mowing grasses will encourage the establishment and spread of the grass
- If a proper window for seeding is not available, then temporary seeding with fall rye or oats can take place; the area can be overseeded with a permanent mix when a proper seeding window is open

Similar Measures

- Hydraulic seeding and mulching
- Sodding

Design Considerations

- Seeding rate should be specified based on the mix and type of grasses; native seeds should be applied on a pure live seed (PLS) basis
- When using a seed drill or brillion seeder, grasses and legumes should not be planted deeper than 1 cm
- Bacterial inoculants must be used when seeding with legumes
- Seeding should occur during periods when germination can be successful and plants have sufficient time to become established before the end of the growing season
- If seeding occurs after the 50% frost probability date for the site, a dormant seeding method should be used; the seed should be applied late in the season when there is

no chance of germination, and applied with a seed drill so cold temperatures do not damage the seed

- Mulch is required when broadcast seeding or if seeding is carried out after the date specified in which fall seeding should not be carried out
- For specific needs of local growth environment, specific design and advice from local seed supplier or professional agrologist may be required
- Soil testing should be performed to determine an appropriate fertilizer, if any, and rate of application

Mulching

Erosion Control:
Exposed Surface Protection – Vegetated

BMP3

Description and Purpose

- Application of organic material or other normally biodegradable substances as a protection layer to the soil surface to:
  - minimize raindrop/runoff erosion and conserve a desirable soil moisture property for plant growth; and
  - promote seed germination and plant growth
- Mulches conserve soil moisture, reduce runoff velocities and surface erosion, control weeds, help establish plant cover, and protect seeds from predators, raindrop impact, and wind/water erosion

Applications

- Can be used to provide temporary and permanent erosion control
- Can be used as an organic cover or growth medium for seeds where topsoil is not readily available
- May be used with or without seeding in areas that are rough graded or final graded
- May be applied in conjunction with seeding to promote plant growth
- May comprise organic mulches (such as straw, wood fibres, peat moss, wood chips, pine needles, compost) or chemical mulches (such as vinyl compounds, asphalt, rubber, or other water-mixed substances)
- Chemical mulches may be used to bind other mulches in a hydroseeding-hydromulching application

Advantages

- Relatively cheap method of promoting plant growth and slope protection

Limitations

- Application of mulch may be difficult on steep slopes
- May require spray-on method to apply mulch with tackifier to provide adhesion to steep slopes

Installation

- Prepare soil surface by removing large rocks or other deleterious materials
- Apply topsoil and seed, if required, subject to topsoil availability
- Apply mulch as per supplier's recommendations
- Certain mulches may require additional anchoring to minimize loss of mulch due to wind or water erosion

Mulching

Erosion Control:
Exposed Surface Protection – Vegetated

BMP3

Construction Considerations

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Install mulches as per manufacturer or supplier recommendations
- Mulches may be crimped into the ground using a disk or tracking method to prevent movement by blowing wind or water
- Organic Mulches
  - Straw
    - Refers to stalks or stems of small grain (primarily wheat) after drying and threshing
    - Straw should be free of weeds
    - Loose straw is very susceptible to movement by blowing wind and water runoff and should be anchored either with chemical tackifier or some form of netting
    - When properly secured to surface, straw is highly suitable for promoting good grass cover quickly, however, it may be a fire hazard in dry conditions
  - Raw Wood Fibre
    - Mixture of cellulose fibres a minimum of 4 mm in length extracted from wood
    - Wood fibres usually require a soil binder and should not be used as erosion control during periods of hot dry weather in the summer or for late fall seeding unless it is used in conjunction with another suitable mulch as it is prone to removal by blowing wind or water runoff
    - Wood fibre is primarily used in hydroseeding-hydromulching operations where it is applied as part of a slurry and when used in conjunction with a tackifier, it is well suited for tacking straw mulch on steep slopes
  - Peat Moss
    - Comprises partly decomposed mosses and organic matter under conditions of excessive moisture
    - Usually available in dried and compressed bundles
    - Should be free of coarse material
    - Useful soil conditioner to improve organic content of soil promoting plant growth
    - Highly susceptible to removal by blowing wind and water runoff if dry and spread on top of soil
    - Should be tested for pH prior to use; may require a soil amendment to prevent acidity from inhibiting vegetation growth
  - Wood Chips
    - By-products of timber processing comprised of small, thin pieces of wood
    - Decompose slowly
    - Suitable for placing around individual plants (shrubs and trees) and for areas that will not be closely mowed

  - Highly resistant to removal by blowing wind and water runoff
- Bark Chips (Shredded Bark)
  - By-products of timber processing comprised of small, thin pieces of tree bark
  - Suitable for areas that will not be closely mowed
  - Have good moisture retention properties and are resistant to removal by blowing wind and water runoff
- Pine Needles
  - Comprise needles from coniferous trees (pine, spruce)
  - Needles should be air dried and free of coarse material
  - Decompose slowly
  - Suitable for use with plants that require acidic soils
  - Resistant to removal by blowing wind and water runoff
  - Pine needles may inhibit growth of other vegetation
- Compost (Straw Manure)
  - Comprised of organic residues and straw that have undergone biological decomposition until stable
  - Should be well shredded, free from coarse material, and not wet
  - Has good moisture retention properties and is suitable as a soil conditioner promoting plant growth
  - Relatively resistant to removal by blowing wind and water runoff if not dried out completely

- Chemical Mulches
  - Comprised of acrylic co-polymers, vinyl compounds, asphalt, rubber, or other substances mixed with water
  - Usually used in hydroseeding-hydromulching applications
  - Should be applied in accordance with supplier's recommendations

Inspection and Maintenance

- Inspect mulched areas at least once per year or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- Areas damaged by washout or rilling should be regraded if necessary and recovered with mulch immediately
- Additional stormwater control measures should be considered for areas of severe rilling erosion damaged by runoff
- Small bare spots may need to be reseeding and recovered with mulch

Similar Measures

- Topsoiling
- Hydraulic seeding and mulching (hydroseeding, hydromulching)
- Rolled erosion control products (RECP)

Hydroseeding-Hydromulching

Erosion Control:
Exposed Surface Protection – Vegetated

BMP4

Description and Purpose

- The spraying-on of a slurry to a slope or channel surface to provide a layer of seed and growth bedding medium
- The slurry consists of seed, fertilizer, mulch, tackifiers, and water which are mixed together in a tank
- Enables quick re-vegetation of very steep or rocky/gravelly slopes where re-vegetation by any other method would be very difficult or unsafe; frequent re-seeding and special mix design may be required
- When sprayed on the soil, the slurry forms a continuous blanket with seeds and protects the soil from wind and water erosion and raindrop impact by aggregating (or adhering) them in place
- The slurry conserves moisture, reduces soil moisture evaporation, and decreases soil surface crusting due to evaporation/drying of soil

Applications

- Can be used to provide temporary erosion control prior to establishment of permanent vegetation
- Slurry is held in suspension through consistent agitation and is sprayed onto disturbed areas using high pressure pumps
- Can be used for spray-on seeding covering large areas efficiently after placement of topsoil
- May be used to provide soil stabilization for seeding disturbed soil areas
- Can also be used with higher efficiency and large area coverage with advantages over conventional methods (broadcast seeders, drill seeders)
- Can be used in areas where little topsoil is available

Advantages

- Relatively cheap and efficient spraying method of seeding and promoting plant growth as well as erosion protection
- Allows spray-on re-vegetation of steep slopes where conventional re-vegetation methods are very difficult
- Minimizes effort required to re-vegetate disturbed areas as hydroseeding-hydromulching usually only requires one spray-on operation in comparison with planting and farrow method
- Relatively efficient operation with high coverage rates
- Provides dust control and protection from wind erosion

Hydroseeding-Hydromulching

Erosion Control:
Exposed Surface Protection – Vegetated

BMP4

Limitations

- Site must be accessible to hydroseeding-hydromulching equipment
  - Usually mounted on trucks
  - Maximum hose range of approximately 150 m
- May require subsequent spraying to reseed bare spots or areas with low growth

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Prepare soil surface by removing large rocks or other deleterious materials
- Apply topsoil if available
- Spray on hydroseed-hydromulch as per supplier's recommendations

Construction Considerations

- Seed
  - Selected seed mixes must be appropriate for site specific conditions
  - Some jurisdictions have developed recommended seed mixes for specific regions based on historic performance results
  - Qualified agronomists or agrologists should be consulted if a suitable seed mix is not identified

- Hydraulic Mulches
  - Cellulose
    - Comprised of recycled paper from newspapers, magazines, or other paper sources
    - Rapid method for applying seed, fertilizer, mulch, and water in almost any disturbed areas
    - Usually installed without tackifier in slurry
    - Short fibre lengths and lack of tackifier limits erosion control effectiveness and does little to moderate moisture content and temperature within the soil
    - Residual inks within the recycled paper may leach into soil, which may present a problem in environmentally sensitive areas
    - Longevity significantly shorter than for wood fibre mulches or bonded fibre matrices (BFM)
    - Cheaper than wood fibre mulches and BFM
  - Wood Fibre
    - Comprised of whole wood chips
    - Industry standard, provides quick and uniform method and medium for re-vegetating large areas quickly and economically

  - Longer fibre lengths than for cellulose mulches
  - Longer lasting and has better wet-dry characteristics than cellulose mulches
  - Provides limited erosion control even when sprayed on with tackifiers
  - Provides limited moderation of soil moisture content and temperature when applied at higher rates
  - Cheaper, but less effective than, BFM
  - More expensive, and more effective than, cellulose mulches
- Bonded Fibre Matrices (BFM)
  - Slurry comprised of either cellulose mulch, wood fibre mulch, or a combination of the two
  - Mulches are bound together using chemical bond, mechanical bond, or a combination of the two
  - All fibres and binding agents are premixed by the manufacturer, ensuring uniformity and consistency throughout the application
  - Well suited for sites with existing desirable vegetation and where worker safety and minimal ground disturbance are desired
  - Degree of protection is similar to that obtained from rolled erosion control products (RECP)
  - Quicker installation than for RECP
  - Chemically bonded BFM may require a ‘set-up’ or curing/drying period
    - Application must be limited to periods where there is no threat of rain during curing period
    - Mechanically bonded BFM have no curing time and are effective immediately after application
  - Application on dry soils is not recommended
  - More expensive, and more effective, than cellulose and wood fibre mulches
- Tackifiers
  - May include vinyl compounds, asphalt, rubber, or other water-mixed substances

Inspection and Maintenance

- Inspect hydroseeded-hydromulched areas at least once per year after initial application or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- dyes in the mulch can be used for control of the coverage of the mulch; also important in inspection
- Areas damaged by runoff may need to be repaired and protected
- Small bare spots may need to be reseeded

Similar Measures

- Seeding
- Mulching
- Rolled erosion control products (RECP)

Sodding

Erosion Control:
Exposed Surface Protection – Vegetated

Sediment Control:
Infiltration – Trapping

BMP5

Description and Purpose

- Use of grass sod to cover and stabilize disturbed areas of bare soil
- Rapidly establishes vegetative cover in environmentally sensitive areas where complete cover of the disturbed soil surface is essential and conventional or hydroseeding and mulching may not be effective
- Acts as a vegetative buffer
- Sod may be nursery or field sod composed of one or more species/cultivars of grasses and may contain associated plants such as legumes

Applications

- Permanent measure
- Irrigation (watering) required after placement
- May be used to protect soil surface from water and wind erosion where adequate topsoil and fertilizer can be provided
- Best used for areas that have steep grades or require immediate protection, or at locations where aesthetic appearance is a priority

Advantages

- Immediate protection for sensitive area from water and wind erosion
- Aesthetically pleasing
- Sod can be maintained or left unmanaged

Limitations

- Expensive
- Labour intensive to install
- Sod may not be readily available in all areas
- Field sod is not specifically produced for sale as turf and is generally not certified as to its composition or degree of weed infestation
- Sod cannot be stored for long periods of time

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Prepare smooth ground surface by removing large rocks or other deleterious materials
- Apply approximately 0.1 to 0.15 m of topsoil and fertilizer (if required)

Sodding

Erosion Control:
Exposed Surface Protection – Vegetated

Sediment Control:
Infiltration – Trapping

BMP5

- Lay sod strips on prepared surface with long axis perpendicular to direction of slope (or in channels, perpendicular to anticipated direction of flow)
  - Butt-joint ends of adjacent sod strips tightly together
  - Roll or tamp each sod strip to ensure continuous contact between topsoil and underside of sod strip
  - Secure each strip of sod with an anchor embedded a minimum of 0.15 m into underlying soil
  - Anchors should be spaced a maximum distance of 0.6 m apart
- Adjacent rows of sod strips should have staggered joints

Construction Considerations

- Sod must not be placed on frozen ground
- During hot and dry periods, topsoil should be cool and wetted by irrigation prior to placing sod strips
- Freshly installed sod should be irrigated (watered) to moisten the topsoil to minimum depth of 0.1 m
  - Irrigation aids in the development of root matrix within the topsoil
- Successful installation requires the use of freshly cut, healthy sod; storage time of cut sod on-site prior to installation should be kept to as short a time period as possible
- Installation on slopes may require staking to prevent sod movement

Inspection and Maintenance

- Inspect sodded areas at least once per week for the first two months after placement or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- Areas damaged by washout or rilling should be regraded and resodded immediately
- Additional erosion control measures should be considered for rilled or gullied areas
- Small bare spots may need to be resodded
- Sodded areas should be maintained by periodically fertilizing, irrigating (watering), mowing, and weed control, depending on location and maintenance plan
- Sod that is to be mowed periodically as part of its maintenance plan should not be mowed within one month of installation
- Grass clipping from mowing operations should be left on the sod unless they accumulate to a depth greater than 1 cm

Similar Measures

- Mulching
- Hydroseeding-hydromulching
- Rolled erosion control products (RECP)

Tree and Shrub Planting

Erosion Control:
Exposed Surface Protection – Vegetated

BMP6

Description and Purpose

- Consists of installing woody plantings (trees and shrubs) to develop a root matrix within the soil, increasing subsurface soil strength and stabilizing slopes with deeper root systems than grasses
- Reduces erosion potential of slopes and channel banks

Applications

- Permanent measure
- May be used on slopes stable enough to support vegetation; however, there is a low success rate for steep slopes and channel banks with gradients greater than 1H:1V
- May be used on slopes and channel banks with adequate sunlight, moisture, and wind protection to support vegetation
- May be used as bio-engineering stabilization of historical shallow slope instability soil movements on eroded slopes and gullies
- May be used along channels to provide higher channel roughness to reduce flow velocity

Advantages

- Promotes development of organic mat
- Dense leaves and large diameter plant stalks increase channel roughness and reduce flow velocities in channel thus decreasing erosion potential
- Traps sediment laden runoff and stabilizes soil
- Aesthetically pleasing once developed
- Grows stronger with time as root structure develops
- Usually has deeper root penetration than grass with greater depth of stabilization
- Manual planting may be attempted on steep slopes that are sensitive to machinery disturbance or represent an area of high erosion potential

Limitations

- Can be labour intensive to install
- Some level of uncertainty related to success of plant growth
- Revegetated areas are susceptible to erosion until vegetation develops; trees and shrubs should be planted in conjunction with hydroseeding and/or mulching
- Plants may be damaged by wildlife
- Potential for low success rate

Tree and Shrub Planting

Erosion Control:
Exposed Surface Protection – Vegetated

BMP6

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Live Staking
  - Used on cut or fill slopes or in ditches/channels
  - Comprised of willow or poplar stakes inserted into the ground; other indigenous plants may be acceptable
  - Individual dormant willow or poplar stakes should be cut to a minimum length of 0.5 m using pruning shears
    - Cuts should be made at a 45° angle a minimum of 5 cm below a leaf bud
    - All side shoots should be trimmed to within 5 cm of the main stem
  - Install live stakes in a 1 m by 1 m grid
  - Make a pilot hole a minimum of 0.3 m in depth to insert live stake into
    - Use iron bar, broom handle or other tool to make pilot hole
  - Insert live stake into pilot hole and lightly tamp soil around live stake
  - A minimum of two leaf buds should remain above grade
- Brush Layers
  - Used on cut or fill slopes or on channel/ditch walls susceptible to erosion
  - Comprised of layers of live branches placed on terraces on slopes
  - Excavate terraces perpendicular to direction of slope spaced approximately 1 m apart across entire width of slope to be protected
    - Slope terraces at an angle of 10° upwards from the back of the terrace towards the slope face
  - Place layers of branches on the terrace
    - Use individual dormant willow or poplar branches a minimum length of 1 m and a minimum diameter of 2.5 cm
    - Place brush layer approximately 0.075 to 0.2 m thick
    - Ensure a minimum length of 0.1 to 0.2 m of the branch is protruding from face of slope
  - Backfill and tamp soil over brush layer

Construction Considerations

- Successful installation requires the use of freshly cut branches or stakes
- Storage time of cut branches/stakes on-site prior to installation should be kept to as short a time period as possible
- Successful growth dependant on soil moisture and rainfall conditions
- Consultation with agrologist, greenhouse growers, local expertise can be beneficial in selecting and procuring appropriate species for planting

Inspection and Maintenance

- Inspect planted areas at least twice per year or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- Areas damaged by washout or erosion rilling should be replanted immediately
- Additional erosion control measures should be considered for severe rilling areas damaged by runoff
- Watering is required for first one to two months after planting

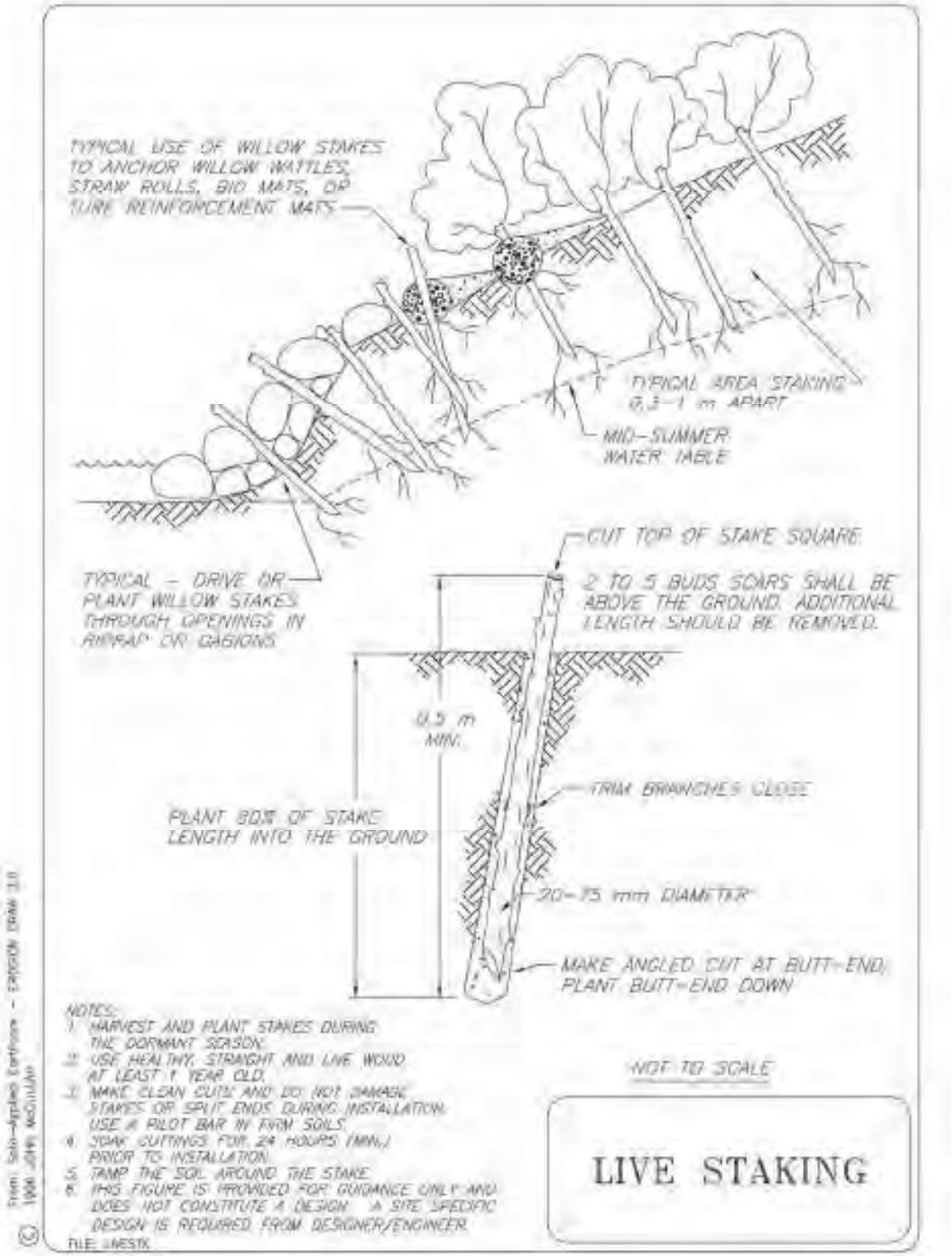
Similar Measures

- Seeding
- Mulching
- Hydroseeding-hydromulching
- Rolled erosion control products (RECP)

Tree and Shrub Planting

Erosion Control:
Exposed Surface Protection – Vegetated

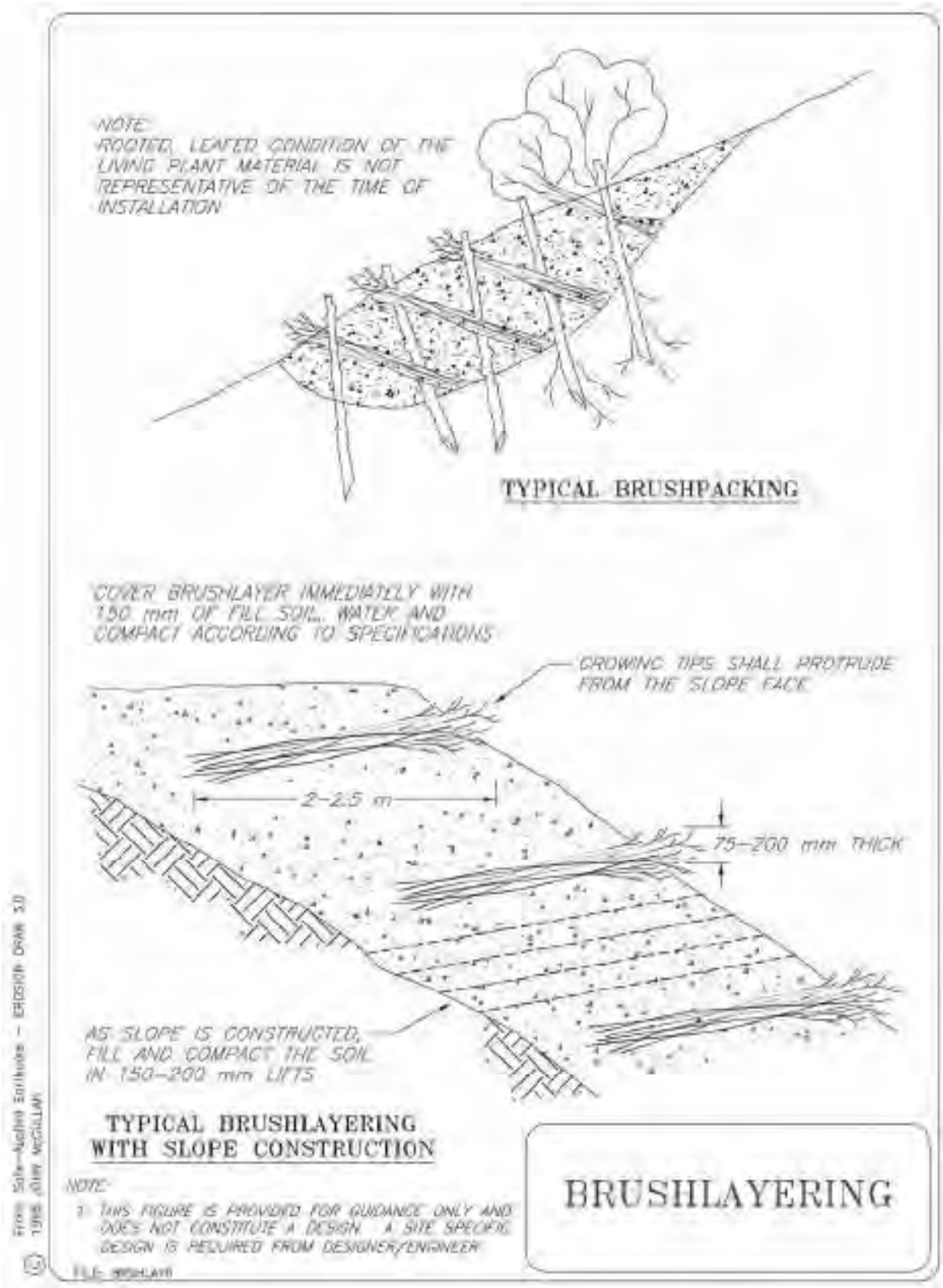
BMP6



Tree and Shrub Planting

Erosion Control:
Exposed Surface Protection – Vegetated

BMP6



Riparian Zone Preservation

Erosion Control:
Exposed Surface Protection – Vegetated

Sediment Control:
Infiltration – Trapping

BMP7

Description and Purpose

- Protection of existing plants and trees adjacent to all natural water bodies (riparian zones) adjacent to construction areas
- Existing vegetation acts as an effective vegetative buffer strip as a form of erosion and sediment control measure

Applications

- Permanent measure
- Existing established vegetation acts as an effective erosion control buffer strip barrier to slow down flows and allow infiltration and sediment trapping to occur

Advantages

- Existing dense vegetation is more effective than any man-made structures or devices for sediment or erosion control, however, other forms of sediment and erosion control measures may be required on construction sites in addition to preserved riparian zones
- Any denuding of vegetation along steep valley slopes with erodible soil will be detrimental and increase long-term sedimentation yield; it is important only to strip necessary areas along the footprint of construction. Preservation of riparian zones is generally mandatory along river valley slopes and along the edges of waterbodies

Limitations

- Preservation of riparian zones may interfere with construction efficiency
- Careful planning is required to work around preserved riparian zones

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- It is highly important to preserve an established vegetative buffer as freshly planted vegetation generally require substantial growth periods before they are as effective as established riparian zones
- Wherever possible, as much existing vegetation as possible should be retained between construction areas and sensitive zones (wetlands, marshes, streams, floodplains, etc.) to entrap sediment and to minimize off site sediment transport

Riparian Zone Preservation

Erosion Control:
Exposed Surface Protection – Vegetated

Sediment Control:
Infiltration – Trapping

BMP7

- Define and delineate riparian zones to be preserved in the Erosion and Sediment Control Plan prior to commencement of construction
- Clearly mark riparian zones to be preserved in the field so all personnel involved with construction operations can identify areas to be preserved

Construction Considerations

- Riparian zones must be fenced off immediately to minimize trespassing and to ensure effectiveness of riparian zone is maintained
- Do not allow equipment to enter areas not necessary to construction

Inspection and Maintenance

- Maintain fences protecting riparian zones from traffic

Riprap Armouring

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP8

Description and Purpose

- Large, loosely placed cobbles or boulders placed along channel banks or slopes to protect underlying soil from erosion due to flowing water
- Can protect slopes and channel banks against erosion

Applications

- Permanent measure
- May be used on channel banks and slopes with flow velocities ranging from 2 m/s to 5 m/s (dependent on rock size and thickness); appropriate for slopes that do not exceed 2H:1V
- May be used for protection at culvert inlets and outlets
- Riprap only needs to be placed at lower portion of channel section to the anticipated flow height (mean annual peak flow) plus freeboard; other forms of soft armouring (RECP blankets, seeding) can be used to promote vegetation to protect soil at upper portion of channel slopes, above riprap
- Must be used in conjunction with a non-woven geotextile or filter gravel underlay acting as a filtration separator with basal soil
- For fluctuating high flow channel, the riprap should be underlain by a layer of granular filter material for cyclic drawdown long-term performance with/without an extra layer of non-woven geotextile as underlay

Advantages

- Easy to install and easy to repair
- Very durable, long lasting, and virtually maintenance free
- Flexible

Limitations

- Expensive form of channel lining and stabilization
- Requires heavy equipment and transport of rock to site
- May not be feasible in areas where suitable rock is not available
- Riprap may have to be placed by hand
- Normally 2 to 3 times riprap thickness is required in comparison with gabion mattress thickness for equivalent protection performance under identical hydraulic conditions

Riprap Armouring

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP8

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Grade the slope or channel to final design grade
- Place filter (underlay) layer on prepared slope; filter layer can consist of non-woven geotextile underlay and/or well graded granular material dependent on hydraulic conditions
- Place riprap layer
- The following riprap sizes may be used as a guide to specifying gradation and mass:

		Riprap Size			
Nominal Mass Nominal Diameter	**Kg mm**	**7 175**	**40 300**	**200 500**	**700 800**
None heavier than:	kg or mm	40 300	130 450	700 800	1800 1100
No less than 20% or more than 50% heavier than:	kg or mm	10 200	70 350	300 600	1100 900
No less than 50% or more than 80% heavier than:	kg or mm	7 175	40 300	200 500	700 800
100% heavier than:	kg or mm	3 125	10 200	40 300	200 500

Percentages quoted are by mass.
Sizes quoted are equivalent spherical diameters, and are for guidance only.
Source: Alberta Transportation Bridge Specification (2001)

- Non-woven geotextile fabric underlay below riprap should meet typical specifications and physical properties as illustrated below:

Non-Woven Geotextile Filter Fabric Specifications and Physical Properties

Specified Parameter	**Riprap Nominal Diameter**	
	500 mm and Smaller	**Greater than 500 mm**
Grab Strength	650 N	875 N
Elongation (Failure)	50%	50%
Puncture Strength	275 N	550 N
Burst Strength	2.1 MPa	2.7 MPa
Trapezoidal Tear	250 N	350 N
Minimum Fabric Overlap to be 300 mm		

Source: Alberta Transportation Bridge Specification (2001)

Riprap Armouring

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP8

Construction Considerations

- Riprap should be placed in a uniform thickness across the channel so as not to constrict channel width
- Blasted rock is preferred (if available)
- Riprap layer should be 1.5 to 2 times the thickness of the largest rocks used, 1.5 to 3 times the thickness of the d_{50} material, and not less than 300 mm in thickness
- On channel banks, the riprap blanket should be keyed in to a depth equal to the anticipated scour depth; alternatively, a self-launching apron of extra rock can be provided

Inspection and Maintenance

- Little maintenance is required
- Periodic inspections to check for erosion of protected material or movement of riprap

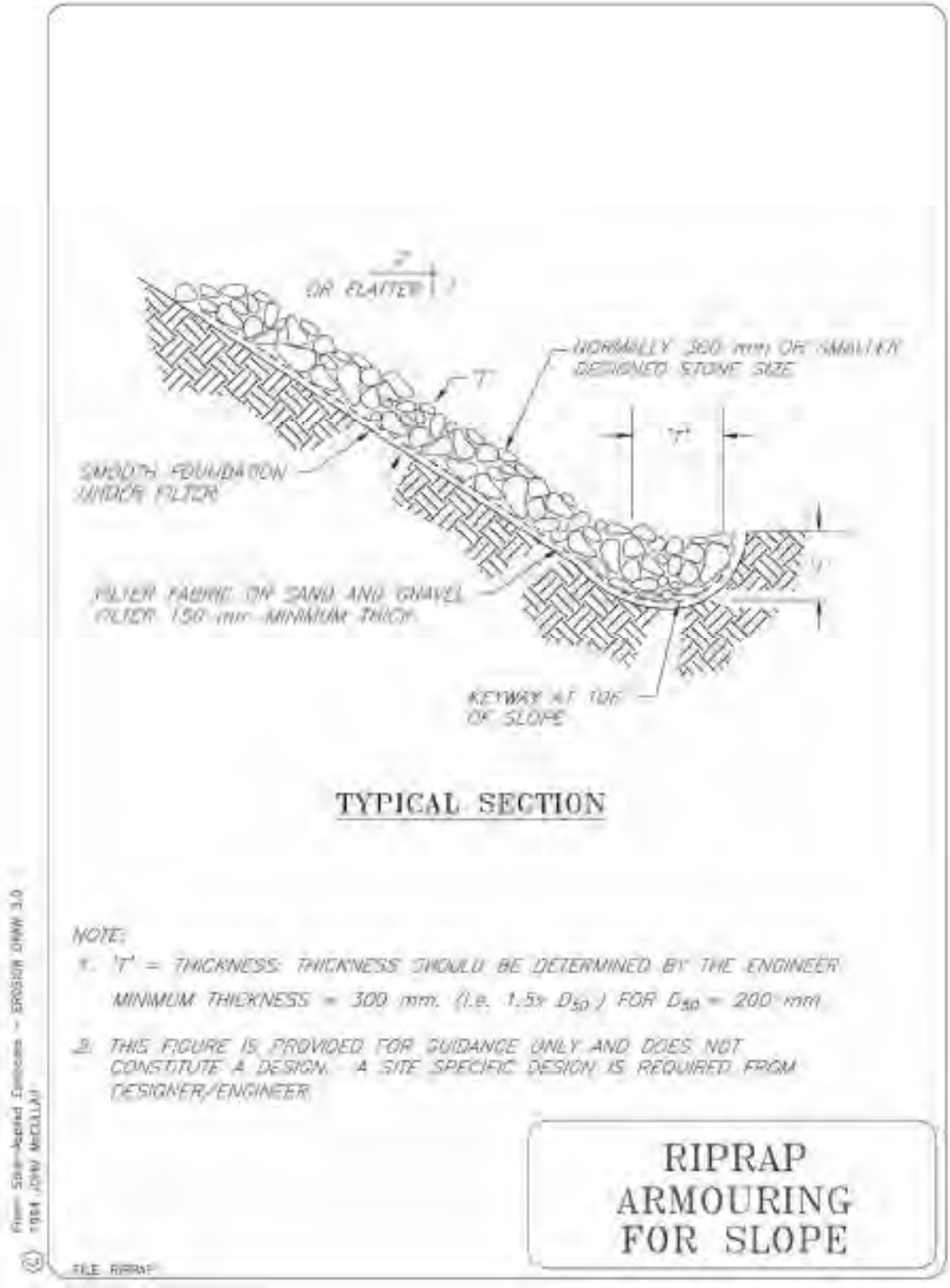
Similar Measures

- Rolled erosion control products (RECP) well vegetated; not for use at severe flow and high velocity areas
- Gabion mattresses

Riprap Armouring

Erosion Control:
Exposed Surface Protection – Non-Vegetated

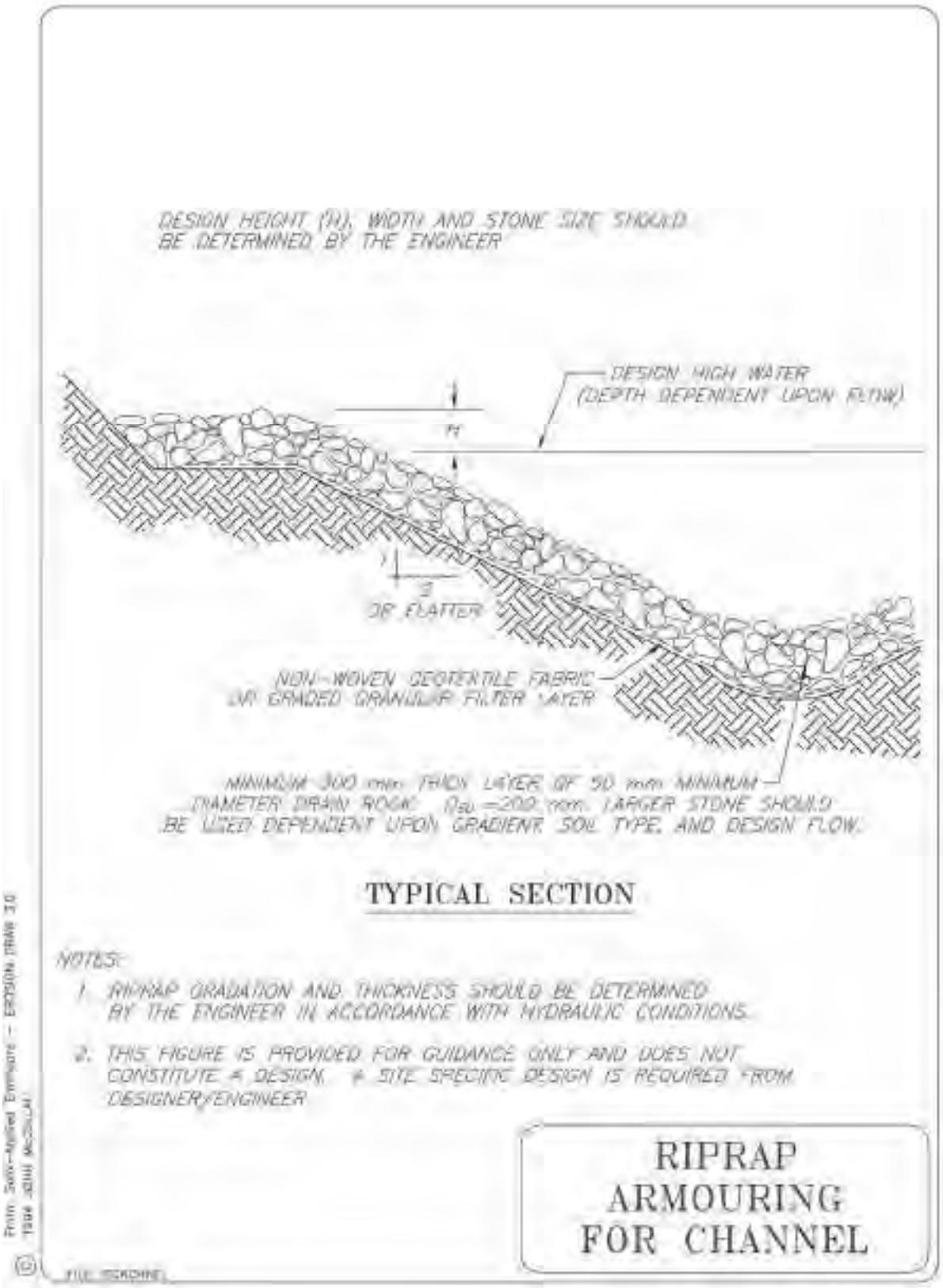
BMP8



Riprap Armouring

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP8



Gabions

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP9

Description and Purpose

- Consist of rock placed inside wire baskets to protect steep or erodible slopes from sheet flow erosion
- Protects erodible stream channel banks from potentially high erosive concentrated flow velocities or high tractive forces
- Can be applied to:
  - Slope and banks
  - Single gabion drop structure for ditch channel
  - Double gabion "energy dissipator" drop structure for ditch channel

Applications

- Permanent measure
- May be used on stream bank aprons and blankets where flow velocities do not exceed 6 m/s
- May be constructed to 0.5H:1V as a low height toe protection structure of slope
- May be used on slopes up to 1.5H:1V as slope protection, a grade break and sediment barrier
- Gabion mattresses are an alternative to riprap armouring of channels
- May be used to construct dikes or weirs
- Used as a drop structure (check structure) to reduce grade between structures and as sediment barrier in channels
- Used as a splash pad to reduce flow velocity and dissipate flow energy

Advantages

- Relatively maintenance free
- Long lasting and sturdy structure
- Lower thickness requirement for gabion (can be 1/2 to 1/3 riprap thickness) compared with riprap thickness for identical severe hydraulic conditions.
- Allows smaller diameter rock material to be used where it would normally be erodible with riprap placement
- Gabions are porous, free-draining and flexible so they are less affected by frost heaving and hydrostatic pressures
- Trap sediment and support plant growth to effect higher channel resistance to flow

Limitations

- Construction is labour intensive
- Extra costs associated with wire for mesh cages and rock fill plus geotextile fabric or sand filter layer

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Prepare subgrade on mineral soil at designated gabion location
- Subexcavate trench a minimum of 0.15 m deep to 'key-in' gabion structure
- Construct gabion basket as per manufacturers recommendations
- Line interior of basket with non-woven geotextile OR a gravely sand filter layer (if required by design) along areas where the basket is in contact with soil
- Backfill basket with rock with wire bracing at 1/3 points (or 0.3 m spacings)
- Install gabion basket top
- Backfill trench and compact soil around edges of completed basket

Construction Considerations

- Gabions should be placed on a properly graded surface
- Non-woven geotextile should be used to prevent loss of underlying material and infiltration of fine grained particles into the gabion structure
- Rock in the baskets may be placed by hand to enhance dense packing of stones and decrease void spaces
- Construct gabions with internal wire diaphragms to maintain structural stability (shape)

Inspection and Maintenance

- Should be inspected after major storm events, especially where undermining at the toe of the basket is a concern
- Repairs should be performed immediately when required; repairs may include hand grading and/or infilling undermined area with rocky material

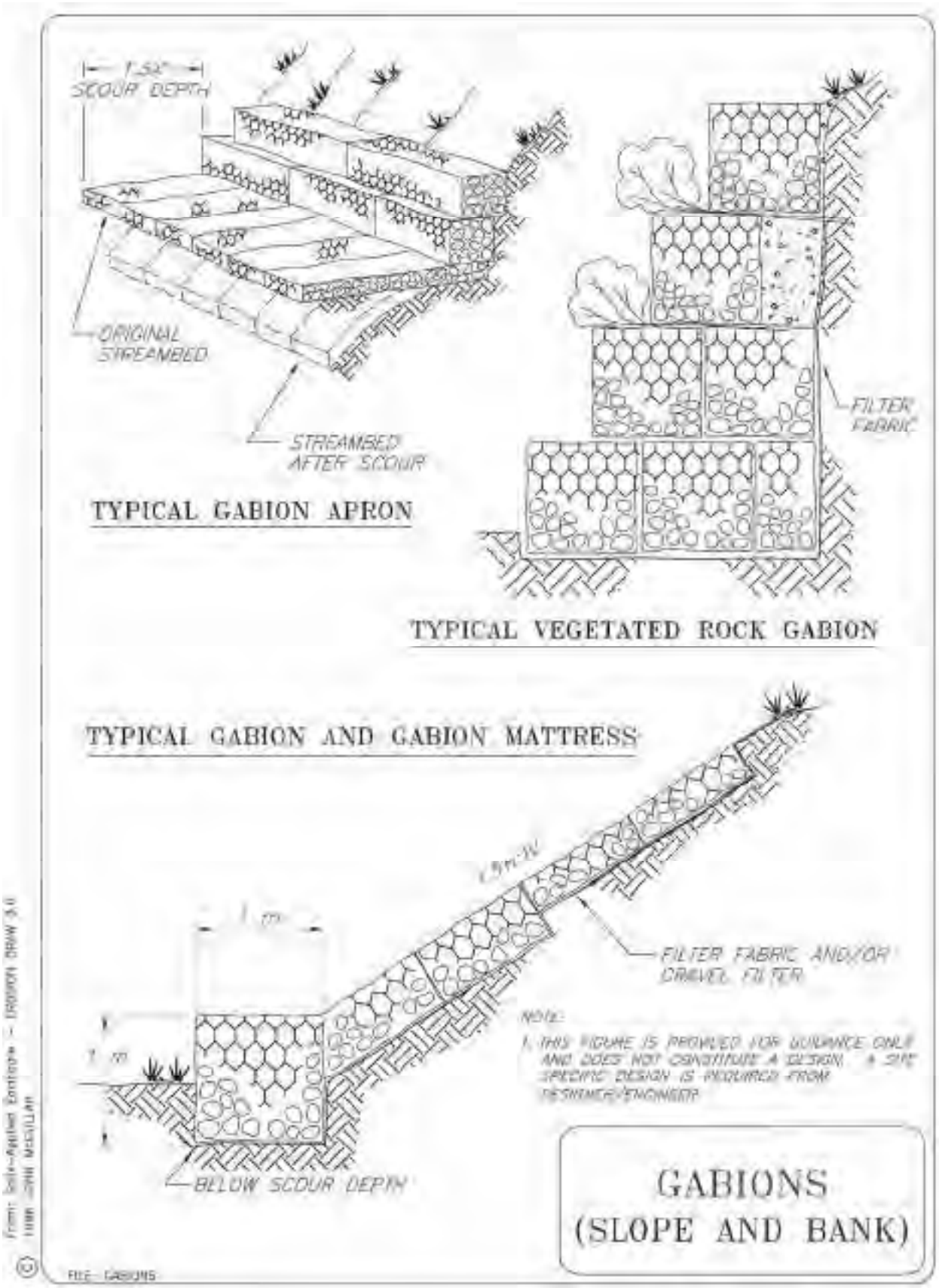
Similar Measures

- Berms/barriers
- Check dams
- Permeable/synthetic barriers
- Rock/brush barriers
- Sand/gravel bag barriers

Gabions

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP9



GABIONS
SINGLE GABION
DROP STRUCTURE FOR
DITCH CHANNEL
TYPICAL BARRIER SPACING
N.T.S.
SPACING (d) = 1 unit rise in (other) units
SLOPE S%
DITCH BED PROFILE (S)
TABLE 1
SUGGESTED SPACING (d)
S (%)
(m)
REMARKS
5-7
30
OPTION TO INSTALL A GRADE BREAK (e.g. WEAVE BARRIER) BETWEEN STRUCTURES
7-8
25
A DOUBLE GABION FOLLOWS EVERY 2 SINGLE GABIONS.
>8%
≤15
DESIGN BY ENGINEER REQUIRED
NOTES:
1. SUITABLE FOR MEDIUM TO STEEP GRADES AND CHANNELS LEADING TO WATER COURSE 4% < S < 10%
2. i) SPACING TO BE DETERMINED BY ENGINEER BASED ON HYDRAULIC CONDITIONS. — or —
ii) USE #1 CONJUNCTION WITH DOUBLE GABIONS OR OTHER BARRIER STRUCTURES.
3. SOIL COVERING BETWEEN STRUCTURES SUGGESTED FOR STEEP GRADE SOIL DITCH.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.
FRONT VIEW FROM DOWNSTREAM
TYPICAL DITCH CROSS-SECTION
GABION BASKET DITCH BARRIER
N.T.S.
GABION BASKET DITCH BARRIER
GABION MAT SPLASH PAD
DITCH
DITCH GABION MAT SPLASH PAD
SLOPE
CROSS-SECTION VIEW
"SINGLE GABION" BASKET DITCH BARRIER
& GABION MAT SPLASH PAD
N.T.S.
GABION BASKET
DITCH PROFILE
DITCH LINE
NON-WOVEN GEOTEXTILE
TIE MAT TO GABION BASKET
GABION MAT SPLASH PAD
LIP (MAX. 50mm)

Gabions

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP9

Aggregate Cover

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP10

Description and Purpose

- Crushed stone or gravel layer/blanket placed directly on erodible slopes susceptible to surface water erosion and groundwater seepage piping erosion
- To secure the soil, reduce erosion, and provide continuous all-weather protection
- For remediation of unstable slopes caused by piping loss of soil resulting from strong groundwater exit gradients and subsurface erosion.
- Protects against piping erosion of underlying soil as well as surface erosion from raindrop impact, and sheet flow
- Prevents transport of soil from areas subject to groundwater seepage
- Acts as a filter to minimize seepage erosion of soil from areas subject to groundwater seepage
- Provides hard armour protection for slopes

Applications

- Permanent measure
- May be used on highly erodible slopes (silt and sand) that cannot be effectively stabilized by vegetative methods
- May be used when cover must be placed immediately as a toe filter to minimize seepage erosion due to strong groundwater seepage exit on cut slopes
- For areas of high groundwater seepage gradients, must be used in conjunction with a non-woven geotextile fabric underlay
- In most situations, aggregate covers are installed in conjunction with subsurface drains

Advantages

- Easily constructed and implemented

Limitations

- Must be designed by qualified geotechnical personnel
- Requires equipment and transport of gravel to site
- May not be feasible in areas where suitable aggregate is not readily available
- Areas of high groundwater seepage may require other subsurface drainage measures

Aggregate Cover

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP10

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Place non-woven geotextile as underlay, as a general good practice to provide filtration separator with subgrade soils
- Place aggregate
- Grade aggregate blanket to design thickness

Construction Considerations

- Aggregate must be placed evenly over slope
- On slopes of highly erodible materials (silt and sand) aggregate blanket thickness should be 0.4 m minimum thickness and should be assessed by a qualified geotechnical engineer
- Generally for slope protection for subground piping erosion, the blanket can be constructed of clean pit run gravel (as specified in the following table) to 0.4 m thickness

Metric Sieve Size (μm)	Percent Passing
125,000	100
50,000	5-100
25,000	38-100
16,000	32-85
5,000	20-65
315	6-30
80	2-10

Inspection and Maintenance

- Inspect gravel blanket after significant storm events and repair any damaged or wash out sections immediately
- Sections washed out may need to be regraded prior to replacing gravel and geotextile

Similar Measures

- Subdrain systems

Stabilized Worksite Entrance

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP11

Description and Purpose

- Comprised of a gravel pad located at site access points (entrances) that are used to reduce the amount of sediment carried off construction sites by vehicles
- Collects sediment from vehicle washing and retains sediment on construction site
- Should include water supply to wash off excess soil from vehicles prior to exiting the construction site

Applications

- Temporary measure
- For use anywhere vehicles enter or exit a construction site

Advantages

- Retains sediment on the construction site
- Reduces deposition of sediments on public roads which may be carried by runoff into natural watercourses or drains

Limitations

- Sediment control measures should be installed to collect sediment laden runoff from gravel pad
- Installation of gravel pads may be limited by space constraints
- A supply of water is required for washing

Implementation

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Install gravel pad at planned entrances to worksite
  - Gravel pad (minimum of 15 m in length) should be of sufficient length to accommodate longest anticipated vehicle entering or exiting the site
  - Width of pad should be sufficient to accommodate the widest anticipated vehicle entering or exiting the site (minimum of 3.6 m in width)
  - Thickness of gravel pad should be a minimum of 0.30 m thick and should comprise 50 to 150 mm diameter coarse aggregate placed on top of woven geotextile filter fabric
- Water supply with pump system should be incorporated to wash vehicle undercarriages and wheels
- Install temporary sediment control measures (such as straw bale barriers or silt fences) to collect washed off sediment from gravel pad

Stabilized Worksite Entrance

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP11

Construction Considerations

- Should be constructed at all access points to construction sites
- If impractical to construct at all access points, limit vehicle access traffic to stabilized worksite entrances only
- Entrances located with steep grades or at curves on public roads should be avoided
- Woven geotextile filter fabric should be used as underlay below gravel pad as strength requirement
- Install an elevated ridge adjacent to roadway if gradient of the gravel pad is steeper than 2%, sloped towards the roadway

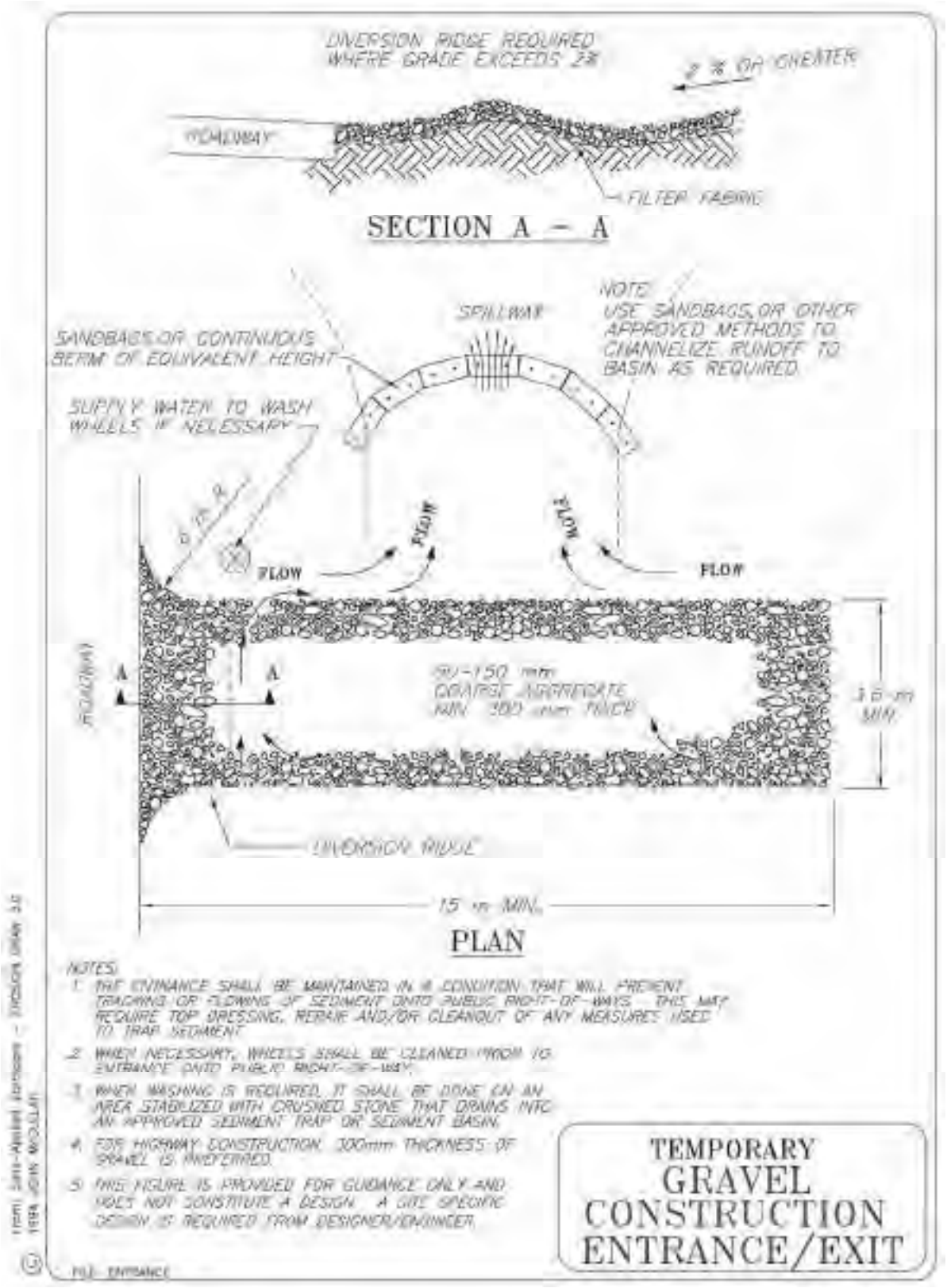
Inspection and Maintenance

- Granular material should be regraded when required
- Material may need to be added to fill large voids to maintain a minimum pad thickness of 0.30 m
- Inspect and clean out downstream sediment control measures at least once per week and after periods of significant rainfall
- Material accidentally deposited onto public roads should be cleaned as soon as possible

Stabilized Worksite Entrance

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP11



Rolled Erosion Control Products (RECP)

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP12

Description and Purpose

- Biodegradable or synthetic soil coverings used for temporary or permanent protection of disturbed soils at slopes and channels
- Categories of Rolled Erosion Control Products (RECP) can be:
  - Erosion control blankets (ECB) (generally biodegradable and temporary)
  - Turf reinforcement mats (TRM)
  - Composite turf reinforcement mats (C-TRM)
- RECP may be manufactured of organic material, synthetic material, or as a composite of organic and synthetic materials
- Protect disturbed soils from raindrop impact and surface runoff erosion, increase water infiltration into soil, retains soil moisture and decreases evaporation loss
- Protect seeds from raindrop impact, runoff, and predators
- Stabilize soil temperature to promote germination and enhance vegetation growth

Applications

- Temporary or permanent measure
- May be used to protect disturbed, exposed soils for cut or fill slopes at gradients of 2.5H:1V or steeper
- May be used on slopes where erosion potential is high
- May be used on slopes where vegetation is likely to develop slowly
- May be used to protect disturbed exposed soils in ditches and channels by providing additional tractive resistance cover in conjunction with high density vegetative growth

Advantages

- Degree of erosion protection is higher, more uniform, and longer lasting than for sprayed-on products (e.g. mulches)
- Wide range of available temporary (biodegradable) or permanent products

Limitations

- Non-performance of RECP may result from the following:
  - Low density vegetation growth (beneath RECP) due to non-favorable weather and growth conditions (i.e. soil type, moisture, storm events at critical times). The effectiveness of RECP, especially along channels, is dependent on successful vegetation growth. It is important that the designer assess the effectiveness of RECP for site-specific soil, terrain and vegetation growth conditions.
  - Hydraulic uplift of RECP and erosion of underlying soils can occur under rapid snow melt conditions when dammed melt water generates a hydraulic head and high flow velocity in a constricted snow melt channel. This situation can occur along steep channels interlaced with drop structures and with RECP lining installed in between the drop structures. Ponding of melt water and non-anchored

RECP joint areas allow flow entry beneath the RECP and generate hydraulic heads to uplift the RECP. This can occur along un-anchored edges of RECP at upper edges of ditch when snow melt occurs at tops of ditch and flow beneath the RECP. This is especially critical when underlying soil is easily erodible. It is important to trench-in and anchor the edges of the RECP installations and installed anchor pin (staples) at sufficient frequent intervals.
  - Ice buildup from groundwater seepage can uplift and dislocate the RECP and cause flow beneath the RECP to erode the substrate soils. Winter ice accumulation may be related to groundwater regime and investigative design on subsurface drainage by a geotechnical engineer is required.
- Can be labour intensive to install
- Must be installed on unfrozen ground
- Temporary blankets may require removal before permanent measures are installed
- Rolled erosion control products (RECP) are not suitable for rocky sites
- Proper surface preparation is required for intimate contact between blanket and soil
- Plastic sheeting can be used at sensitive slopes with precautions:
  - Plastic sheeting RECP product can be easily torn, ripped, non-biodegradable, and should be disposed of in a landfill
  - Plastic sheeting product, if used, results in 100% runoff, thus increasing erosion potential in downslope areas receiving the increased flow volumes
  - Plastic sheeting should be limited to temporary covering of sensitive soil stockpiles or temporary covering of small critical unstable slope areas

Construction (Slopes)

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- RECP should be installed in accordance with manufacturers directions
- The following is a general installation method:
  - Prepare surface and place topsoil and seed
  - Surface should be smooth and free of rocks, debris, or other deleterious materials
  - Blanket should be anchored at top of slope in a minimum 0.15 m by 0.15 m trench for the entire width of the blanket
  - The blanket should be rolled out downslope
    - Where the blanket roll is not long enough to cover the entire length of the slope, a minimum 0.15 m by 0.15 m check slot should be excavated at the location of the lap, and the downslope segment of blanket anchored in the check slot, similar to the method used for the top of the slope, or (2) when blankets, must be spliced down the slope, place blanket end over end (shingle style) with approximately 0.10 m overlap. Staple through overlapped area at 0.3 m intervals.

- The upslope portion of blanket should overlap the downslope portion of blanket, shingle style, at least 0.15 m with staple anchors placed a maximum 0.3 m apart
- Adjacent rolls of blanket should overlap a minimum 0.1 m
- Anchors should be placed along central portion of blanket spaced at $4/m^2$ minimum (0.5 m spacing) for slopes steeper than 2H:1V and $1/m^2$ (1 m spacing) for slopes flatter than 2H:1V
- Anchors along splices between adjacent rolls should be placed 0.9 m apart

Construction (Channels)

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- A blanket should be installed in accordance with manufacturers directions
- The following is a general installation method:
  - Prepare surface and place topsoil and seed
    - Surface should be smooth and free of large rocks, debris, or other deleterious materials
  - Begin by excavating a minimum 0.15 m deep and 0.15 m wide trench at the upstream end of channel and place end of RECP into trench
    - Use a double row of staggered anchors approximately 0.1 m apart (i.e. 0.2 m linear spacing) to secure RECP to soil in base of trench
    - Backfill and compact soil over RECP in trench
  - Roll centre RECP in direction of water flow on base of channel
  - Place RECP end over end (shingle style) with a minimum 0.15 m overlap downgrade
    - Use a double row of staggered anchors approximately 0.1 m apart to secure RECP to soil
  - Full length edge of RECP at top of sideslopes must be anchored in a minimum 0.15 m deep and 0.15 m wide trench
    - Use a double row of staggered staple anchors a maximum of 0.1 m apart (i.e. 0.2 m linear spacing) to secure RECP to soil in base of trench
    - Backfill and compact soil over RECP in trench
  - Overlap RECP on sideslopes (shingle style down channel) a minimum of 0.1 m over the centre RECP and secure RECP to soil with anchors spaced a maximum of 0.2 m apart
  - In high flow channels, a check slot across the width of the channel is recommended at a maximum spacing of 10 m to anchor the ends of the RECP to the underlying soil
    - Use a double row of staggered staple anchors a maximum of 0.1 m apart (0.2 m linear spacing) to secure RECP to soil in base of check slot

  - Backfill and compact soil over RECP in check slot
- Anchor terminal ends of RECP in a minimum 0.15 m deep and 0.15 m wide trench
  - Use a double row of staggered anchors a maximum of 0.1 m apart (i.e. 0.2 m linear spacing) to secure RECP to soil in base of trench
  - Backfill and compact soil over RECP in trench

Construction Considerations

- Slopes should be topsoiled and seeded prior to placing RECP
- Ensure blanket is in intimate contact with the soil by properly grading soil, removing rocks or deleterious materials, prior to placing blanket
- In channels, blankets should extend above the anticipated flow height, with a minimum 0.5 m of free board
- For turf reinforcement mat (TRM), blanket should be placed immediately after topsoiling
- Blanket should be anchored by using wire staples, metal geotextile stake pins, or triangular wooden stakes
  - All anchors should be a minimum of 0.15 to 0.20 m in length
  - For loose soils, use longer anchors
- Blankets should be placed longitudinal to direction of flow, with fabric not stretched but maintaining contact with underlying soil
- It is essential to understand product specifications and follow manufacturers instructions on installation methods

Product Quality Assurance/Quality Control (QA/QC) Certification

RECPs should be certified by the supplier/manufacturer to ensure product performance and compliance with specified property requirements. A certificate for QA/QC testing of manufactured products is required. The performance and QA/QC testing should be carried out by reputable laboratories (e.g. TxDoT – Hydraulic and Erosion Control Laboratory or equivalent laboratory) to ensure a commonly acceptable QA/QC standard. Depending on product type and intended performance, the product information certificate should be provided by the product supplier/manufacturer and include the following:

- Performance specification:
  - Permissible Tractive Resistance (include testing methods and vegetative growth conditions)
  - Permissible Flow Velocity (if available)
  - Longevity (for biodegradable or non-biodegradable products)
- Minimum Average Roll Values (MARVs) along with specified testing methods for:
  - Physical properties
    - Mass per unit area
    - Thickness

  - Tensile strength
  - UV Resistance
- Other physical properties (for non-woven below Erosion Mat (if specified)
  - Grab tensile strength
  - Grab elongation
  - Puncture strength
  - Trapezoidal tear
  - UV Resistance

Inspection and Maintenance

- Area covered with blankets should be regularly inspected/repaired, especially after periods of severe rainfall or storm events, to check for blanket separation or breakage
- Any damaged or poorly performing areas should be repaired immediately. Regrading of the slope by hand methods may be required in the event of rill or gully erosion.
- Inspection and maintenance should continue until dense vegetation is established
- Areas with low vegetation density should be reseeded
- After approximately one year, a top dressing of fertilizer may be applied to improve vegetation cover and assist degradation of temporary blankets

Similar Measures

- Mulching (for slopes only)
- Chemical stabilization (for slopes only, e.g. tackifiers)
- Rip rap (primarily in channels)
- Gabion mattresses (primarily in channels)

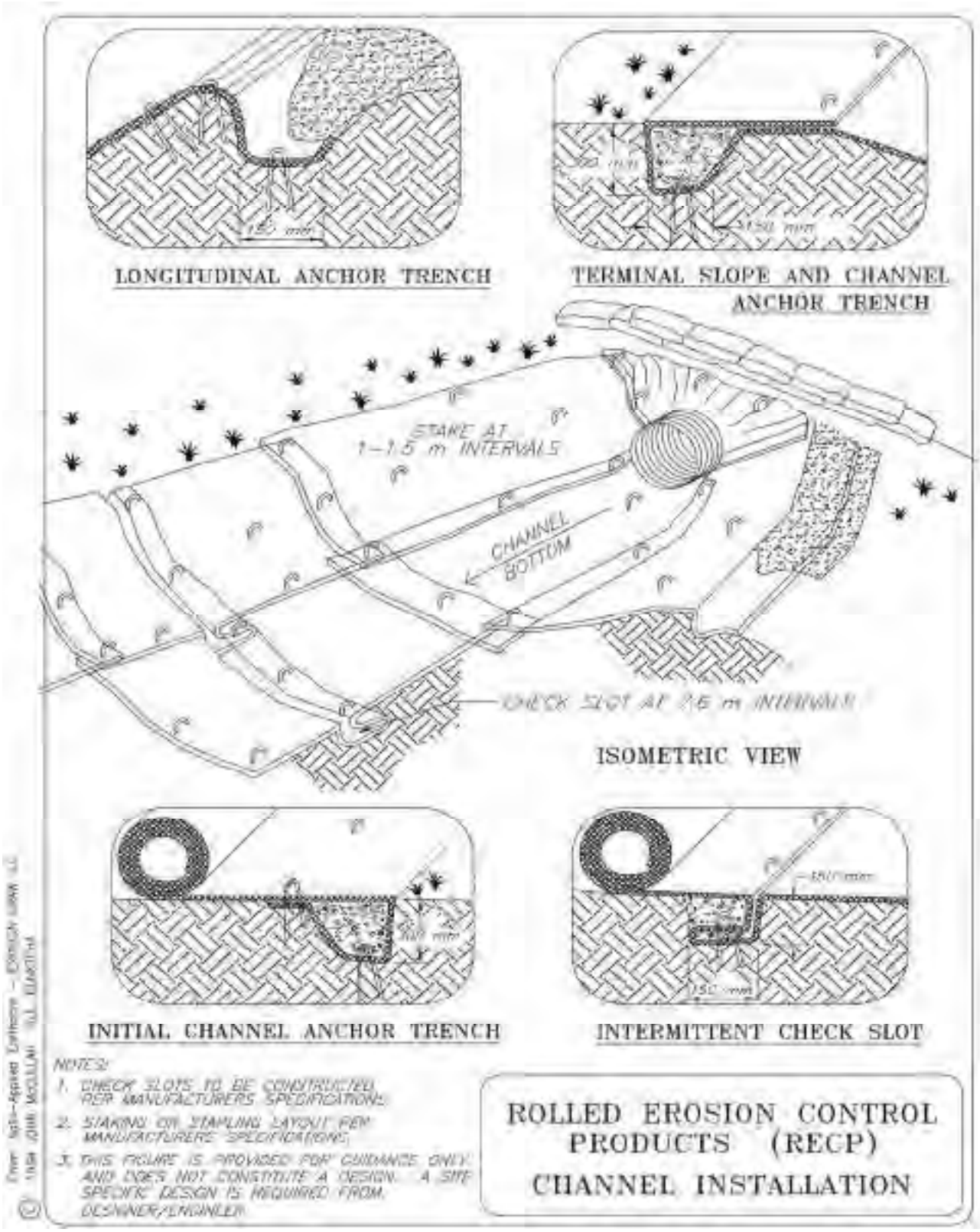
Design Considerations

- Assess hydraulic flow conditions and tractive stress on channel
- Assess local soil, weather and growth conditions (favourable/non-favourable) for revegetation (within 3 to 12 months) to allow a determination on use or non-use of RECP as a protective measure. If the revegetation conditions are assessed favourable, the use of RECP can be considered
- Assess suitability of a RECP product using tractive resistance data tested for (i) bare soil, and (ii) vegetated (a specified duration of growth period) condition
- It is noted that tractive resistance data are adopted as selection criteria of RECP and permissible velocity data can be provided for reference.

Rolled Erosion Control Products (RECP)

Erosion Control:
Exposed Surface Protection – Non-Vegetated

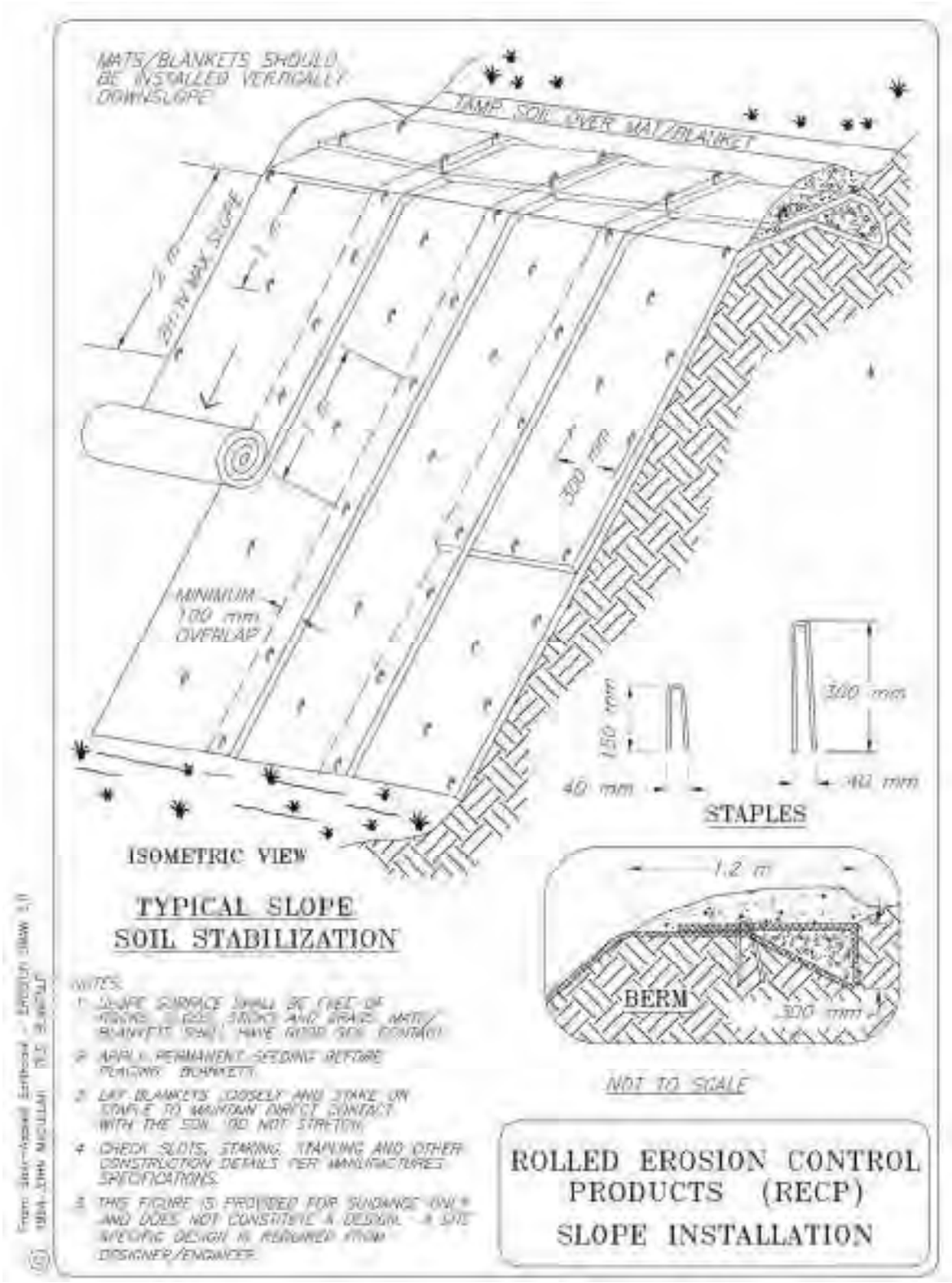
BMP12



Rolled Erosion Control Products (RECP)

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP12



Cellular Confinement System

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP13

Description and Purpose

- 3-dimensional, plastic matting with open cells filled with topsoil or aggregate
- 3-dimensional structure stabilizes cut or fill slopes
- Cells confine infilled topsoil or aggregate and protect root zone while permitting surface drainage

Applications

- Permanent measure
- May be used with granular infill on cut or fill slopes up to a slope of 1H:1V
- May be used with granular infill on slopes and in ditches where flow velocities are 3 m/s or less
- May be used as a flexible channel lining
- May be used in low-water stream crossings as granular pad for stream fording
- Matting is light, expandable, and easy to transport and place
- Use of native fill materials reduces costs; local granular fill is preferred

Limitations

- Availability can be limited, therefore expensive in some areas
- Installation can be labour intensive
- Not to be used on slopes steeper than 1H:1V
- Slopes of 1H:1V can be hazardous to work on

Construction

(Note: The following construction method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Cellular Confinement System should be installed in accordance with manufacturer's directions
- The following is a general installation method
  - Slope should be graded to design elevations and grades
  - Rocks or other deleterious debris should be removed from matting location
  - Matting should be installed in a trench as deep as the matting is thick, extending 0.6 to 1.2 m beyond crest of slope, and matting should be installed so that the top of the matting is flush with surrounding soil
    - Every other cell along crest of slope should be anchored to soil using ‘J’ pins or other suitable sturdy anchoring device
  - The matting should be rolled out downslope

  - Where the blanket roll is not long enough to cover the entire length of the slope, the downslope section of matting should be butt-jointed to the upslope section and secured using staples, hog rings, or other suitable fasteners
  - Adjacent rolls of matting should be butt-jointed and secured using staples, hog rings, or other suitable fasteners
  - Anchors should be placed at 1.2 m intervals down the slope
    - Additional anchors may be required to ensure matting is in intimate contact with soil
    - Additional anchors may be required along edges of matting
  - Backfilling should start at the crest of the slope and proceed downslope
    - For topsoil, overfill cells approximately 25 to 50 mm and lightly compact so that top of topsoil is flush with matting
    - For granular fill, overfill cells approximately 25 mm and tamp compact so that top of fill is flush with matting
  - Seeding should be applied after fill placement

Construction Considerations

- Properly grade soil surface and remove rocks and deleterious materials prior to placing matting to ensure matting is in intimate contact with the soil
- Matting should be placed longitudinal to direction of flow or downslope
- Use only a single layer of matting
- Matting elevation should be subexcavated to thickness of matting so that the top of the matting is flush with the adjacent terrain
- Infill from top of slope ensuring placement height of fill into cellular mat is <1 m

Inspection and Maintenance

- Area covered with matting should be regularly inspected, especially after periods of heavy rainfall storms to check for damage or loss of material
- Any damaged areas should be repaired immediately
- Temporary inspection should continue until vegetation is established
- Areas where vegetation fails to grow should be reseeded immediately
- If matting is broken or damaged and washout of the underlying soil occurs, the matting should be repaired or replaced after regrading the slope

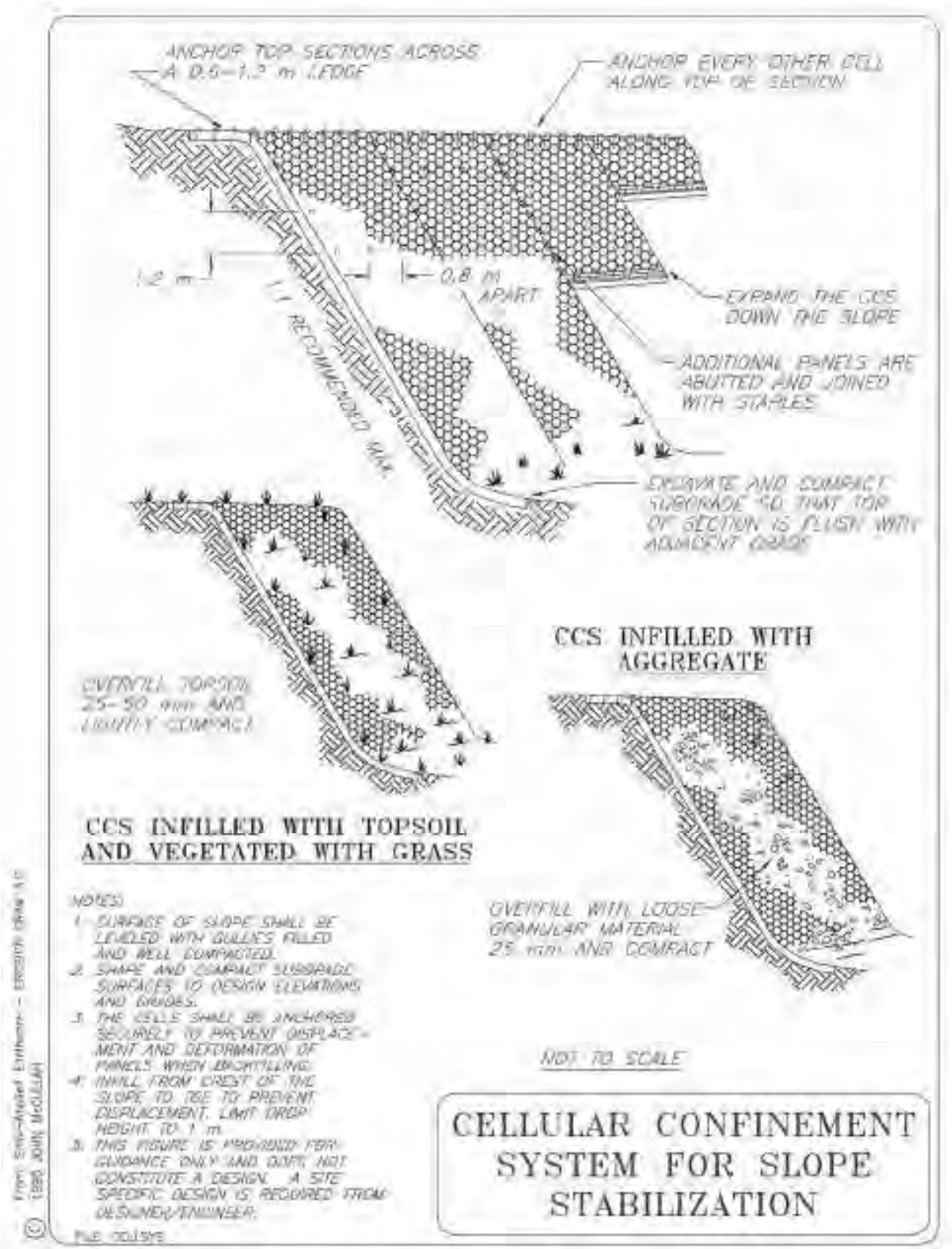
Similar Measures

- Rolled erosion control products (RECP)
- Rip rap armouring

Cellular Confinement System

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP13



Chemical Stabilization

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP14

Description and Purpose

- Chemical substances that are sprayed onto disturbed soils to effect a change of soil properties, generally by aggregating finer soil particles
- Aggregated finer soil particles are less susceptible to erosion and reduce erosion potential of exposed slopes

Applications

- Temporary measure
- May be used in place of, or in conjunction with, mulch materials to act as both a soil stabilizer and mulch binding agent
- May be used for exposed soils not subject to traffic during the temporary establishment of a seedbed
- May be used to provide temporary erosion protection before revegetation is started
- May be used in areas where success of vegetation as a soil stabilizer is very difficult
- Primarily used on dry, highly permeable soils or in soils already in place which are subject to sheet flow rather than concentrated flows
- May be used to provide temporary protection in wind erosion prone areas

Advantages

- Chemical stabilizers increase cohesion of the soil surface, which helps develop a permanent vegetative cover by reducing erosion and evaporation of soil moisture
- Can be efficiently sprayed over large areas of exposed soils

Limitations

- Site must be accessible to hydroseeding-hydromulching equipment
  - Usually mounted on trucks
  - Maximum hose range of approximately 150 m
- May require additional specialized equipment not commonly used during construction activities
- Increased longevity if chemical stabilizer application rate is increased, however, increased application rates may prevent seeds from germinating
- Crust-forming chemical stabilizers (such as bitumen) may crack during freeze-thaw cycles
- Asphalt sprays and bitumen emulsions may be prohibited in some jurisdictions, and in any case should be used with care due to environmental considerations

Chemical Stabilization

Erosion Control:
Exposed Surface Protection – Non-Vegetated

BMP14

Construction

- Prepare slope face and remove large rocks or other deleterious materials
- Place topsoil and seed (if required)
- Spray on chemical stabilization according to suppliers recommended application rate

Construction Considerations

(Note: The following list of available chemical soil stabilizers is provided for guidance only. A site-specific design by a qualified designer is required.)

Chemical Soil Stabilizers

Type	Characteristics
Alginate	Paste-like emulsion or granulate produced from sea algae and consisting largely of natural carbohydrates with associated minerals added
Aquatain	Water dispersible, non-toxic
Asphalt Sprays	Available as an asphalt emulsion or as a liquid asphalt
Bitumen	Thick-flowing undilutable emulsion or a cold emulsion, 50% dilutable with water
DCA – 70	Water dispersible, non-toxic, non-phytotoxic
Hydrosilicates Methylcellulose	Gel-like elastic film in a powder form or as a water based emulsion
Plastic Emulsion	Usually a liquid which can be diluted with water producing a thin film to cover the soil surface
Polyvinyl Alcohol	An emulsion with water

Inspection and Maintenance

- Inspect treated areas at biweekly intervals or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- Additional erosion control measures should be considered for severe rilling areas damaged by runoff
- Period of effectiveness lasts from a few weeks to a few months, depending on application rate. Repetitive applications will prolong effectiveness

Similar Measures

- Hydroseeding-hydromulching
- Rolled erosion control products (RECP)

Slope Texturing / Grading

Erosion Control:
Runoff Control

BMP15

Description and Purpose

- Texturing of slopes, either by roughening the surface, tracking the surface, or installing grooves or serrations
- Texturing reduces the runoff velocity, traps sediment, and increases the infiltration of water into the soil

Applications

- Temporary or permanent measure
- May be used to roughen the exposed soils on the slope surface in the direction of water flow to minimize erosion and to entrap some sediments
- May be used on fresh cut or fill slopes (8 m length or longer practical travel reach of a dozer) with gradients of generally 3H:1V or steeper (2H:1V as general steepness limit) constructed in cohesive soils
- May be used on slope subgrade that will not be immediately topsoiled, vegetated or otherwise stabilized
- May be applied to topsoiled slope to provide track serration to further reduce erosion potential
- May be used in graded areas with smooth and hard surfaces
- Benching of slopes is discouraged for a number of reasons. Benches increase local slope gradients over those which can be achieved without benches. Ponding and discharge from benched areas can concentrate flows and result in gully erosion. If benches must be installed for equipment access, it is important that positive downslope gradients are constructed in all areas.

Advantages

- Reduces erosion potential of a slope
- Texturing will create protrusions to increase surface roughness to reduce overland flow velocities and erosion energy
- Texturing will create minor spaces to entrap a portion of the coarse sediment and reduces amount of sediment transported downslope
- Texturing of slopes will benefit development of vegetation
- Texturing of slopes aids in performance of mulches and hydroseeding
- Texturing with track-walking up/downstream may effect a 10% reduction of sediment yield compared with untracked slope

Limitations

- Surface roughening and tracking may increase grading costs
- Surface roughening and tracking may cause sloughing in certain soil types (i.e. sandy silt) and seepage areas; geotechnical advice is recommended

- Texturing provides limited erosion and sediment control and should be used as a temporary measure prior to topsoiling
- Texturing should be used in conjunction with other erosion and sediment control measures (i.e. offtake ditches) to limit the downslope sheet flow

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Surface Roughening
  - Leave soil in rough grade condition, do not smooth grade soil
  - Large lumps of soil will aid in decreasing runoff velocities, trap sediment, and increase infiltration of water
- Surface Tracking
  - Using tracked construction equipment to move up and down the slope, leaving depressions perpendicular to the slope direction; limit passes to prevent overcompaction of the surface
  - Depressions in the soil will aid in decreasing runoff velocities, trap sediment, and increase infiltration of water
- Grooving
  - Excavating shallow furrows across the width of the slope, perpendicular to the direction of the slope
  - If used, contour grooves should be approximately 0.1 to 0.2 m in depth
- Grooves can be made by using equipment or hand

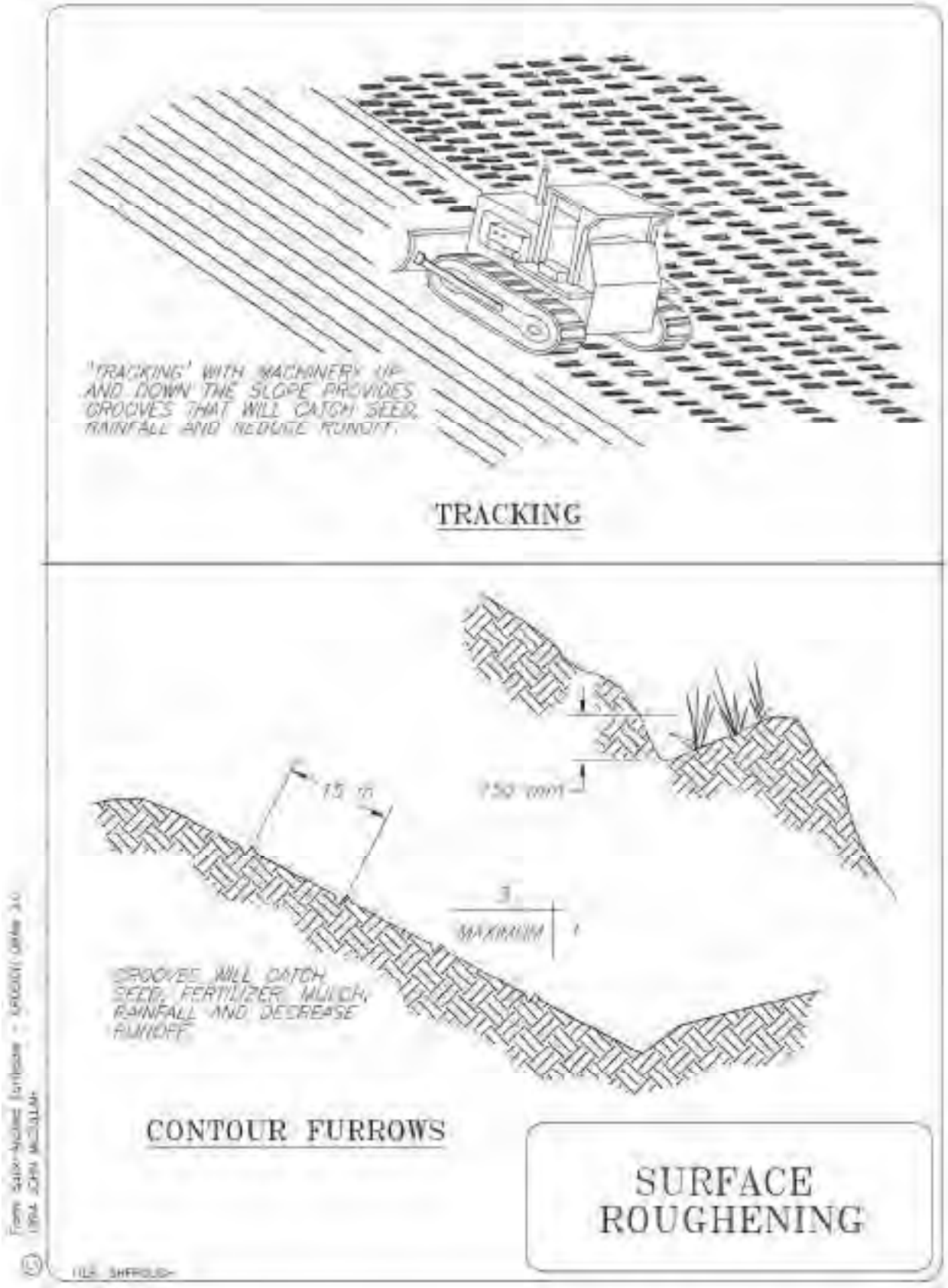
Construction Considerations

- During tracking operations, care must be taken to minimize disturbance to the soil where the equipment turns or changes direction
- Minimize the number of tracking passes to 1 to 2 times to avoid overcompaction, which can negatively impact the vegetation growth
- It is practical to track roughen a slope length of greater than 8 m by up- and down-slope operation of a small bulldozer. It is important to minimize the loosening of soil caused by turning movement of the bulldozer at the end of each pass. As the erosion potential is lower for slopes of low vertical height (<3 m height and 3H:1V slope), the tracking of low height slopes is not required and not practical for a bulldozer tracking operation.

Slope Texturing / Grading

Erosion Control:
Runoff Control

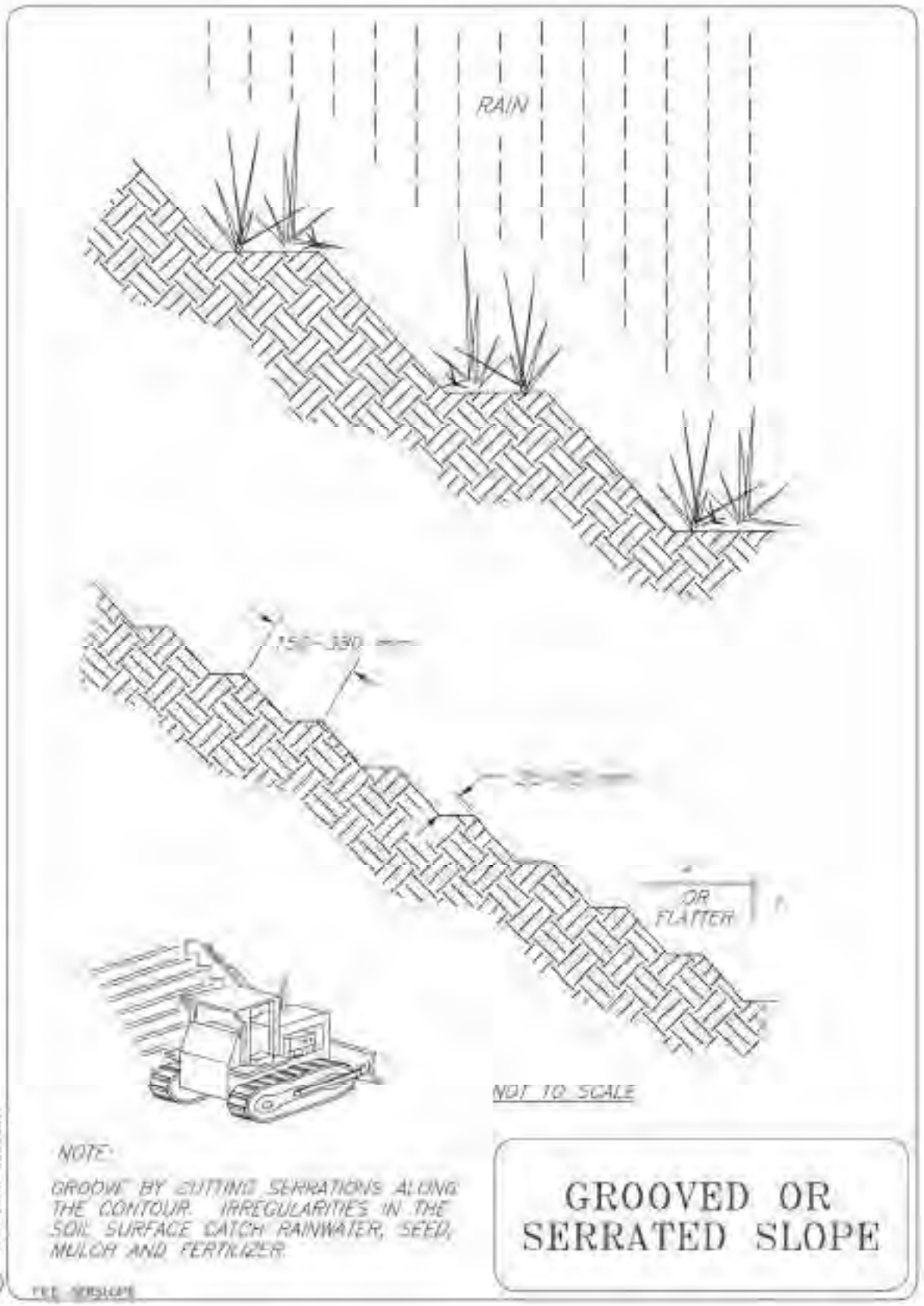
BMP15



Slope Texturing / Grading

Erosion Control:
Runoff Control

BMP15



Slope Drains

Erosion Control:
Runoff Control

BMP16

Description and Purpose

- Heavy duty, flexible pipe that carries water from top to bottom of fill or cut slope to prevent concentrated water flowing downslope and eroding face of slope

Applications

- Temporary or permanent measure
- Used on cut or fill slopes where there is a high potential for upslope runoff waters to flow over the face of the slope causing erosion, especially at areas where runoff converges resulting in concentrated runoff flows
- Used in conjunction with some form of water containment or diversion structures, such as diversion channels, berms, or barriers, to convey upslope runoff water and direct water towards slope drain

Limitations

- Pipes must be sized correctly to accommodate anticipated flow volumes
- Water can erode around inlet if inlet protection is not properly constructed
- Erosion can occur at base if outlet protection or energy dissipator is not constructed
- Slope drain must be anchored securely to face of slope

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Construct diversion or intercept channel, ditch block, barrier, or other inflow apron structure at crest of slope to channel flow toward the slope drain inlet
- Install slope drain through inlet berm or barrier with a minimum of 0.45 m of soil cover above top of drain pipe to secure the inlet
- Install scour inlet protection (such as rip rap, sand bags)
- Install energy dissipator (such as rip rap, gravel, concrete) at downslope outlet end of slope drain; the outlet must not discharge directly onto unprotected soil
- Secure the pipe from movement by tying to steel anchor stakes, hold-down grommets, or other approved anchor method
- Space anchors on each side of drain pipe at maximum 3 m intervals along entire length of drain pipe

Construction Considerations (For guidance only)

- Use coiled drain pipe for low flows only
- If constructing inflow apron at crest of slope out of sandbags, only fill each sandbag ¾ full, this will allow sandbag to be flexible enough to mould around drain pipe and remain in continuous contact with the ground
- Several slope drains may be required if upslope drainage areas are too large for one drain pipe

Inspection and Maintenance

- Inspect slope drains at least once per week, or after significant storm events (1:2 year storm and/or 40 mm precipitation in 24 hours)
- Repair any damaged section of pipe immediately
- If evidence exists of pipe movement, install additional anchor stakes to secure and anchor at zones of movement
- Remove sediment from upslope inflow apron area after each storm event otherwise either downslope sediment transport will occur or cause the drainpipe to be plugged which could result in overtopping of inflow apron structure and sheet flow over slope face

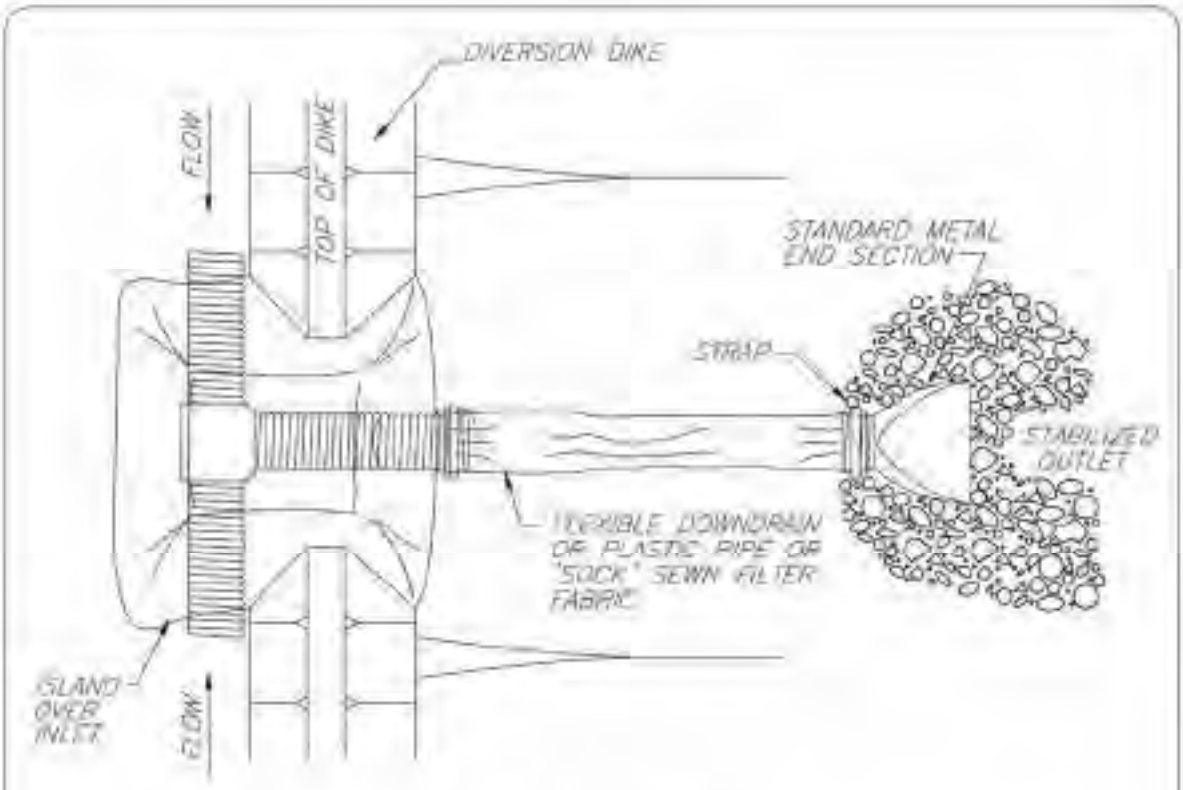
Similar Measures

- Rock lined channel
- Storm sewer

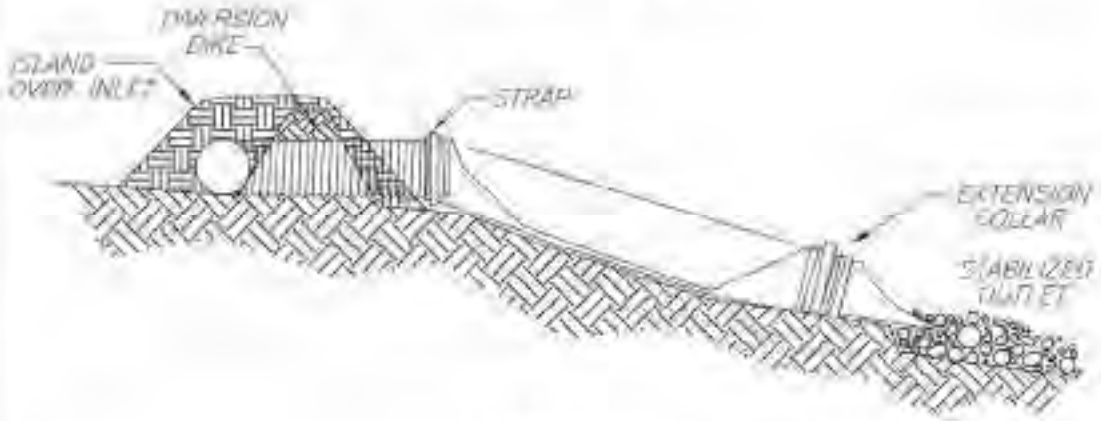
Slope Drains

Erosion Control:
Runoff Control

BMP16



PLAN VIEW



SECTION

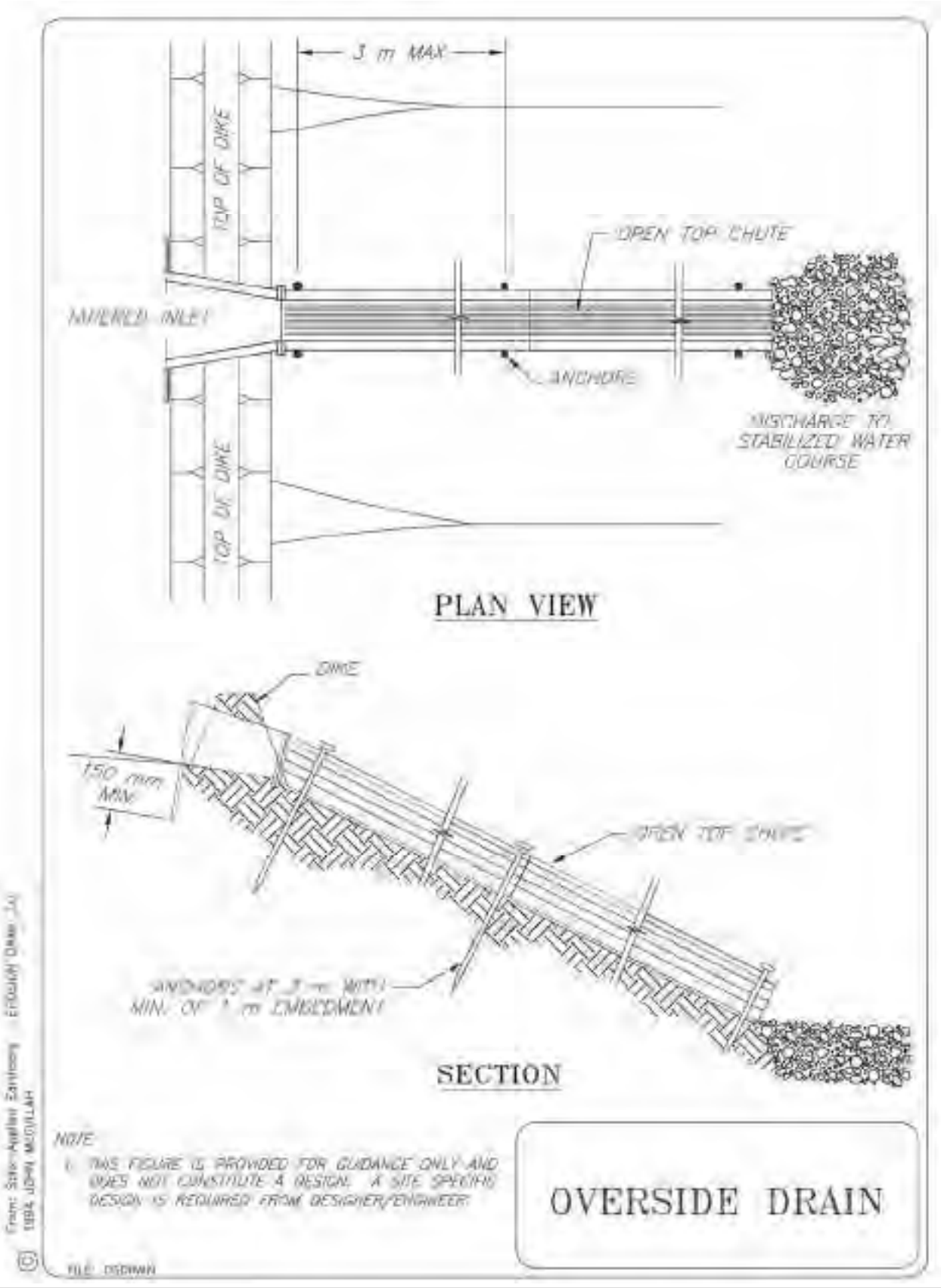
NOTE:
1. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

SLOPE DRAIN

Slope Drains

Erosion Control:
Runoff Control

BMP16



Groundwater Control

Erosion Control:
Runoff Control

BMP17

Description and Purpose

- Drains that intercept and collect subsurface flow and divert it from slope, thus lowering the groundwater table to minimize piping erosion, reduce seepage flow on slopes and increase slope stability
- Relief drains (perforated finger-drains or French drains) to mitigate high groundwater table to minimize piping erosion

Applications

- Permanent measure
- Used on cutslopes where groundwater seepage exits on slope face

Limitations

- Must be designed by a professional engineer
- Can be expensive to install
- Plugging of drainage outlet can cause build-up of pore pressure; the drain outlet must be protected to ensure a free-draining condition

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Excavate trench at subsurface drain location
- Install drain pipe
- Backfill with clean, coarse drainage gravel and/or non-woven geotextile fabric to provide filtration separation with adjacent soils

Construction Considerations

- Slopes with high water tables are susceptible to seepage and unstable excavation slopes; trench protection measures (i.e. trench box) may be required
- Carry out work as soon as possible to mitigate seepage damage, soil loss and deterioration of unstable slopes
- Excavate and install drains to the grade and spacings as designed by the geotechnical engineer
- Protect the drain outlet with sturdy pipe to ensure free draining condition

Inspection and Maintenance

- Drains installed below grade will require manholes at frequent intervals (100 m maximum) to facilitate inspection and maintenance
- Flushing and maintenance clean out of drains can be carried out through manhole locations

Synthetic Permeable Barrier

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP18

Description and Purpose

- Double panel, low profile, uni-body porous synthetic barriers used to dissipate flow energy and reduce velocity
- Barriers of patented design constructed of lightweight and durable synthetic materials
- May be used to create a grade break to reduce flow energy and velocities allowing some sediment to settle out at the upstream barrier panel of the barrier structure
- Can be used to dissipate flow energy and trap sediment during the period of revegetation; should be removed at successful re-establishment of vegetation

Applications

- Temporary structure
- May be placed across trapezoidal ditch to dissipate flow energy and reduce flow velocities
- Can be used to supplement as grade breaks along ditch interval between permanent drop structures along steep ditch grades
- May be used as midslope grade breaks along contours of midslope or at toe of disturbed slopes
- Usually used as grade breaks along ditch (3 to 7% grade) in conjunction with erosion control matting or non-woven geotextile as soil covering mattings; usually used in conjunction with permanent gabion structure at steep grade (>6%) areas
- Designed to be reusable

Advantages

- Prefabricated
- Reusable/moveable
- More appropriate for installing at transition areas of changing grades of channels so that hydraulic jumps (or change of flow regime from supercritical to subcritical) may be triggered to dissipate flow energy, thus minimizing erosion potential
- Provide portable drainage control for construction sites, ditches, channels, roads and slopes
- The double panel porous barrier may cause significant energy loss as the flow of water undergoes from supercritical flow to subcritical flow from the upstream panel to the downstream panel with a more laminar flow evolving downstream and roughly parallel to the stream bed. Less turbulence and erosion energy may be created when compared with cascading, over-topping and tumbling flow from drop structures (i.e. gabions or check structures)
- Barriers constructed of UV resistant material may be left in place for final channel stabilization as UV degradation is low

- Observed to enhance aggregation of silt material and to function as a sediment barrier with the formation of an earth block behind the upstream barrier panel area; the downstream flow exiting at the downstream barrier panel may be less erosive

Limitations

- More appropriate for use as a grade break and may be installed between permanent drop structures
- Partially effective in retaining some sediment and reducing flow velocities
- Less sturdy as drop structures in resisting high flow impact
- Not to be designed as drop structures
- Must be hand installed
- Become brittle in winter and may be easily damaged by highway maintenance activities or by public
- At the time of deactivation of the structure after vegetation establishment, metallic anchor pins, if not biodegradable, may require removal at time of completed revegetation
- Stick-up of metallic anchor pin above ground may be a nuisance and, may present a hazard to human safety and maintenance equipment
- The use of biodegradable anchor pins may be advisable

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Install as per manufacturers recommended installation instructions
- Normally installed in conjunction with erosion control matting in ditches and channels
- Prepare soil surface
- Install basal layer of erosion mat or geotextile fabric; key-in basal mat/fabric at upstream end
- Place and anchor barrier panels with adequate pin anchors to basal soils

Construction Considerations

- Maintain intimate contact between base of barrier and soil with laying of basal matting/fabric intimate to ground surface
- Ensure side panel of barrier is extended to outer edges of channel to sufficient height to provide freeboard of channel flow

Inspection and Maintenance

- Inspect barriers at bi-weekly intervals and after each significant rainfall event

- Remove sediment build-up before it reaches one-half the check structure height
- Do not damage barrier panel during removal of sediment
- Partial or non-removal of sediment build-up will create a non-permeable barrier and low level earth mini-drop structure which will force water flow over-topping the barrier. The option of non-removal of sediments may be open to converting the sediment build-up into a "vegetated earth mini-drop structure" along the ditch with the non-removal of synthetic permeable barrier in-place. This will require topsoil and seeding (or intensive mulch seeding) to promote vegetation growth.
- If erosion is noted at the toe or upslope edges of the structure, hand regrading or suitable repairs should be made immediately to prevent failure of the structure
- Remove and deactivate one year after vegetation is established

Similar Measures

- Silt fences are equally effective at retaining sediment
- Brush or rock filter berms

Design Considerations

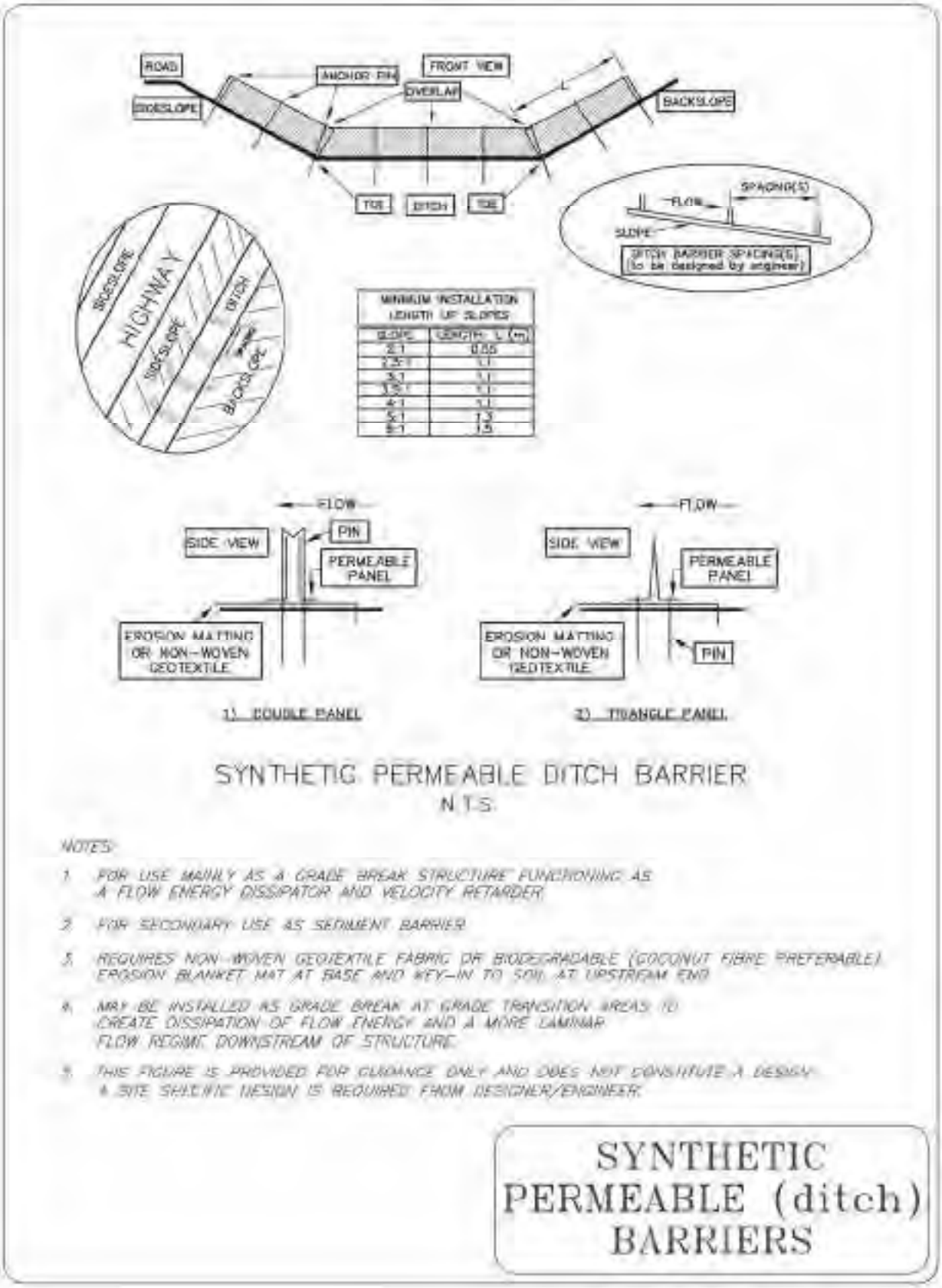
- Install synthetic permeable barrier along ditch interval between permanent drop structures (i.e. gabion); can be economic alternative and supplemental to total hard armouring of complete channel length, or high frequency of gabion installation required for high flow applications in steep ditch grade

Synthetic Permeable Barrier

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP18



SYNTHETIC PERMEABLE DITCH BARRIER

N.T.S.

NOTES:

1. FOR USE MAINLY AS A GRADE BREAK STRUCTURE FUNCTIONING AS A FLOW ENERGY DISSIPATOR AND VELOCITY RETARDER.
2. FOR SECONDARY USE AS SEDIMENT BARRIER.
3. REQUIRES NON-WOVEN GEOTEXTILE FABRIC OR BIODEGRADABLE (COCONUT FIBRE PREFERABLE) EROSION BLANKET MAT AT BASE AND "KEY-IN" TO SOIL AT UPSTREAM END.
4. MAY BE INSTALLED AS GRADE BREAK AT GRADE TRANSITION AREAS TO CREATE DISSIPATION OF FLOW ENERGY AND A MORE LAMINAR FLOW REGIME DOWNSTREAM OF STRUCTURE.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

SYNTHETIC PERMEABLE (ditch) BARRIERS

Fibre Rolls and Wattles

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP19

Description and Purpose

- Straw rolls consist of bundled straw or natural fibre, wrapped in photo-degradable open-weave plastic netting, and staked into the soil along slope contours as a grade break to reduce erosion potential
- Wattles consist of bundled live fascines, staked into the soil along slope contours
- Fibre rolls are installed across slope contours as a grade break to reduce erosion potential by reducing overland flow velocities and encouraging ponding and sediment deposition
- Live stakes can be installed to anchor the fibre rolls and wattles to provide deep root vegetation with potential favourable moisture retention provided by the fibre roll
- Fibre rolls and wattles capture sediment, organic matter and seeds carried by runoff

Applications

- Temporary measure
- May be used on slopes stable enough to support vegetation (steep, confined, slopes and channel banks with gradients greater than 1H:1V may have low success)
- May be used on slopes and channel banks with adequate sunlight, moisture, and wind protection to support vegetation
- May be used along long slopes as a grade break to shorten slope length between lines of fibre rolls at different contour elevations
- May be used as grade breaks, where slopes transition from flatter to steep gradients
- May be used on lake shores as wave breaks to assist in revegetation and stabilization of banks
- Can be used in conjunction with live staking as bioengineering measure

Advantages

- Function as a grade break measure to lower sheet and rill erosion potential
- Can be used on slopes too steep for silt fences
- In time, plastic netting will degrade due to the sunlight and straw will degrade and be incorporated into the soil
- Primary purpose is erosion control, but fibre rolls also provide some sediment control

Limitations

- Designed for low sheet flow velocities
- Designed for short slopes with a maximum gradient of 1H:1V
- May be labour intensive to install
- Straw rolls have short life span due to natural degradation; usually only functional for two seasons
- Susceptible to undermining and failure if not properly keyed into the soil

- Labour intensive maintenance may be required to ensure rolls are in continuous contact with the soil, especially when used on steep slopes or sandy soils

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Prepare slope face and remove large rocks or other deleterious materials
- Excavate small trenches approximately one-half roll diameter deep and wide across the width of the slope, perpendicular to slope direction, starting at the toe of the slope and working upwards towards crest of slope
- Space trenches a maximum of 3 to 8 m apart along the slope incline, with steeper slopes having trenches spaced closer together
- Place fibre rolls into trench, ensuring continuous contact with soil surface
- Butt-joint adjacent fibre roll segments tightly against one another
- Use a metal bar to make pilot hole through middle of the fibre roll a minimum depth of 0.3 m into underlying soil
- Pilot holes should be spaced a maximum of 1.2 m apart
- Secure fibre roll to soil using wooden stake or other appropriate anchor; live stake may be used as alternate anchor
- Place soil excavated from trench on upslope side of fibre roll and compact to minimize undermining of fibre roll by runoff
- Seed the soil along the upslope and downslope sides of the fibre roll

Construction Considerations

- Use live stakes instead of wooden stakes
- If the slope soil is loose and uncompacted, excavate trench to a minimum depth of 2/3 of the diameter of the fibre roll
- On steep slopes, anchors may be required on the downslope side of the fibre roll

Inspection and Maintenance

- Inspect structures at biweekly intervals or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- Areas damaged by washout or rutting should be repaired immediately
- Additional erosion control measures should be considered for rilling areas damaged by runoff

Similar Measures

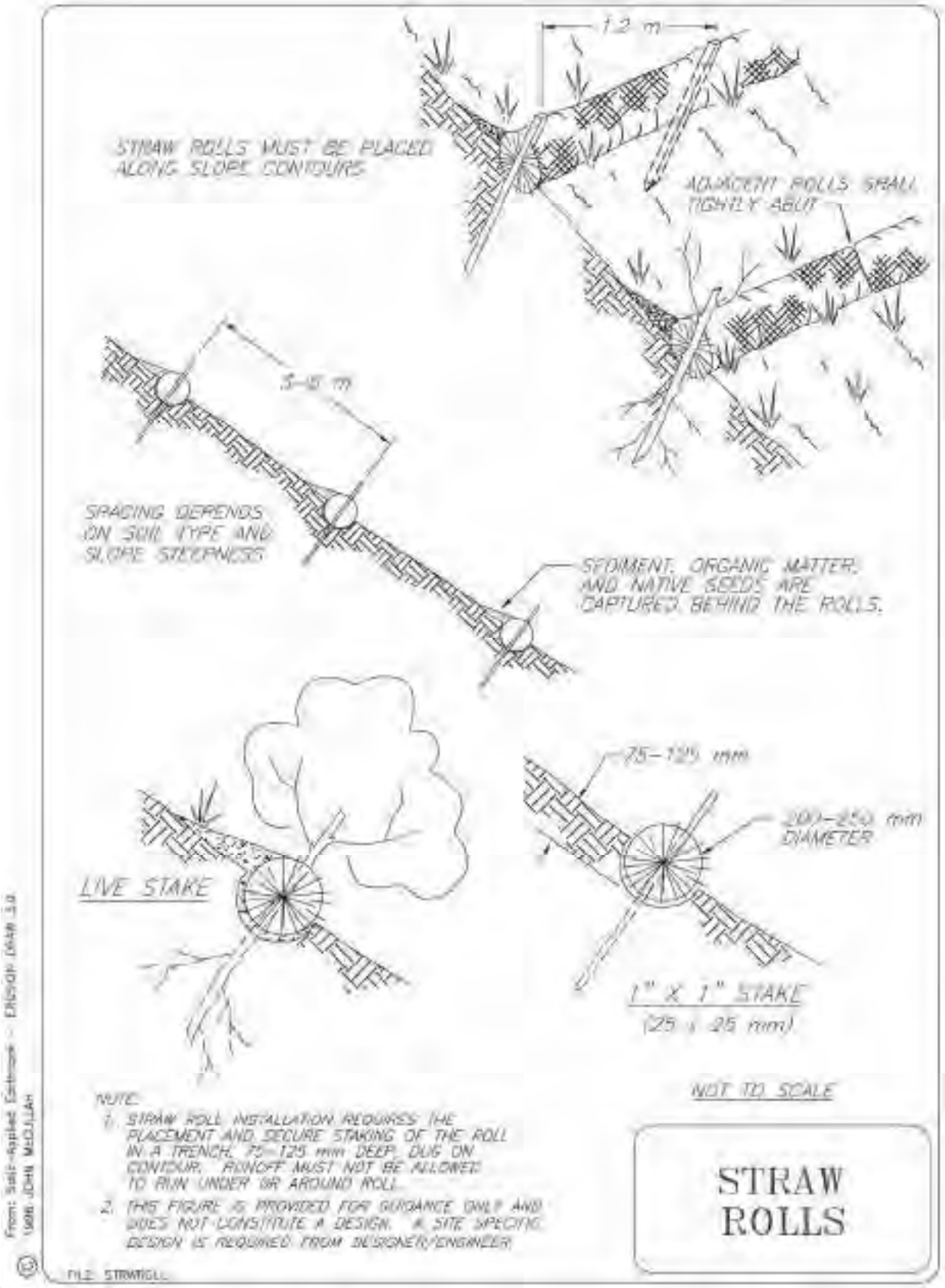
- Synthetic permeable barriers

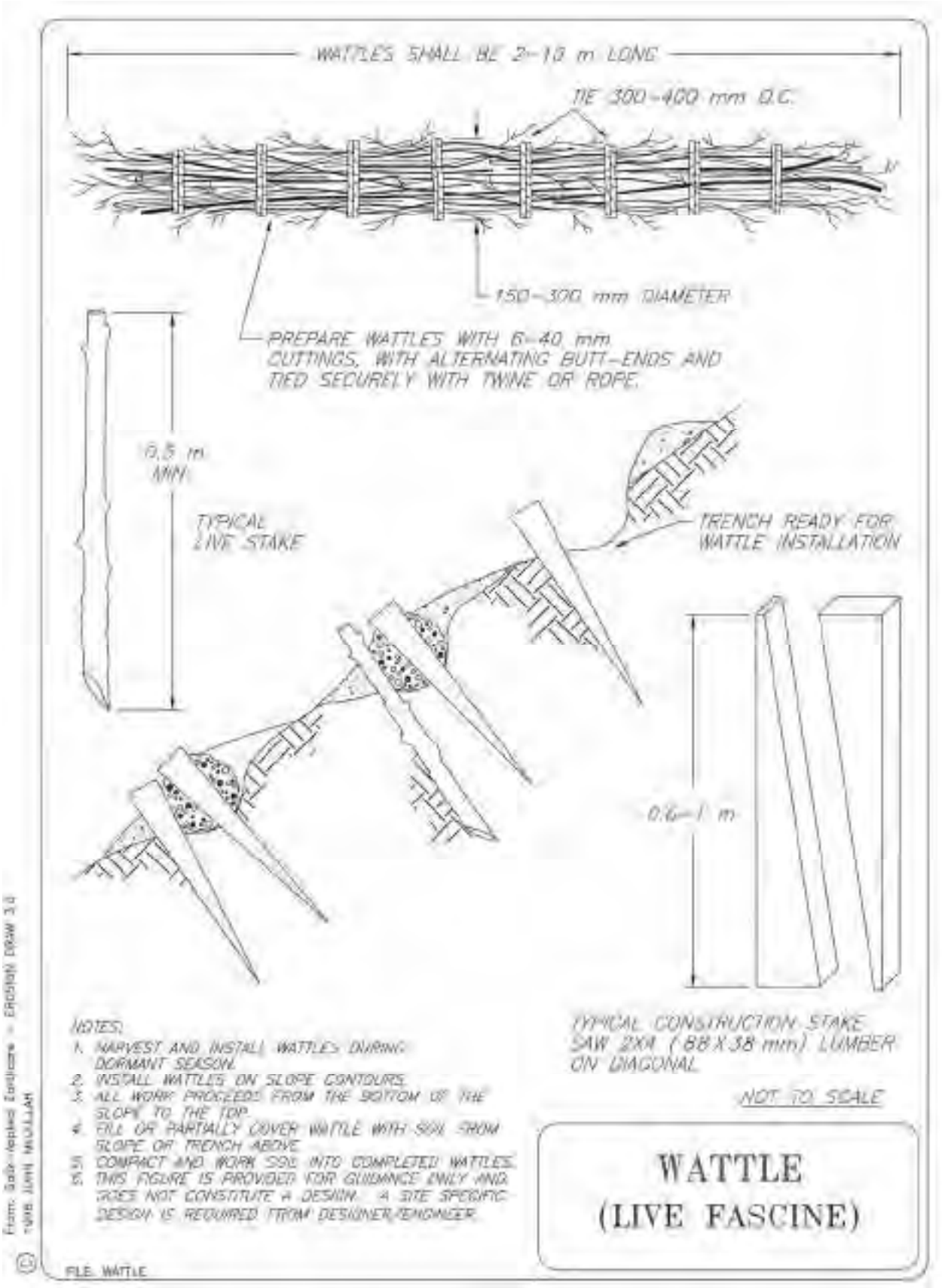
Fibre Rolls and Wattles

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP19




WATTLES SHALL BE 2–10 m LONG
TIE 300–400 mm O.C.
150–300 mm DIAMETER
PREPARE WATTLES WITH 6–40 mm CUTTINGS, WITH ALTERNATING BUTT-ENDS AND TIED SECURELY WITH TWINE OR ROPE.
0.5 m MIN.
TYPICAL LIVE STAKE
TRENCH READY FOR WATTLE INSTALLATION
0.6–1 m
NOTES:
1. HARVEST AND INSTALL WATTLES DURING DORMANT SEASON.
2. INSTALL WATTLES ON SLOPE CONTOURS.
3. ALL WORK PROCEEDS FROM THE BOTTOM OF THE SLOPE TO THE TOP.
4. FILL OR PARTIALLY COVER WATTLE WITH SOIL FROM SLOPE OR TRENCH ABOVE.
5. COMPACT AND WORK SOIL INTO COMPLETED WATTLES.
6. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.
TYPICAL CONSTRUCTION STAKE SAW 2X4 (88 X 38 mm) LUMBER ON DIAGONAL
NOT TO SCALE
WATTLE
(LIVE FASCINE)
FILE: WATTLE
From: Soil-Applied Solutions - Erosion DRW 3.0
1998 John McLean

Check Dams

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP20

Description and Purpose

- Small dam constructed across a drainage channel
- May be constructed of rock, aggregate-filled sandbags, straw bales or logs
- Ponded water decreases flow velocities to reduce erosion caused by storm runoff
- Sediment laden runoff is retained, allowing sediment to settle out

Applications

- Temporary or permanent measure
- Reduces long steep grade to intervals of gentle grades between structures
- Reduces flow velocities to decrease erosion potential caused by runoff
- Sediment laden runoff is retained behind structure allowing sediment to settle out
- May be used in channels that drain 4 ha or less (2ha or less for straw bales)
- May be used in steep channels where runoff velocity is less than 1.5 m/s (limited to 0.3 m/s for straw bales)

Advantages

- Cheaper than using riprap armouring or gabion structures in a ditch
- Rock, sandbag and straw bale structures are relatively easy to construct
- Cement can be incorporated into sandbag aggregates for a permanent application
- Timber structures are suited to areas where timber can be salvaged from clearing operations and other materials are in short supply

Limitations

- Not appropriate for flow velocities greater than 1.5 m/s (0.3 m/s for straw bales)
- Not appropriate for channels draining areas larger than 4 ha (2 ha for straw bales)
- Not appropriate for grass lined channels unless erosion is anticipated
- Susceptible to failure if water undermines or outflanks structure
- Timber structures are labour intensive to construct, gaps between logs may render them ineffective and they will decay and rot with time
- Straw bales should only be used as a temporary measure and have a short service life (1-2 years); they are susceptible to failure if bales are not properly trenched and anchored

Construction (Rock Check Dam)

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Excavate a trench key a minimum of 0.15 m in depth at the rock check structure location
- Place non-woven geotextile fabric over footprint area of rock check structure
- Construct structure by machine or hand
- Structure should extend from one side of the ditch or channel to the other
- Structure should be constructed so that centre of the crest is depressed to form a centre flow width which is a minimum of 0.30 m lower than the outer edges
- Height of structures should be less than 0.8 m in height to avoid impounding large volumes of runoff
- Downstream slope of the check dam should be 3H:1V (minimum)
- Upstream slope of the check dam should be 2H:1V (minimum)

Construction Considerations (Rock Check Dam)

- Height and spacing between structures should be designed to reduce steep channel slope to intervals of flatter gradient
- Rock check structures should be constructed of free draining aggregate
- Aggregate used should have a mean diameter (D_{50}) of between 75 mm and 150 mm and must be large enough to remain in place during high velocity flow situations. Maximum rock diameter should not exceed 150 mm if the structure is to be used as a sediment trap.
- If rock check structures are in channels with significant high flows, they must be properly designed for stone size and structure spacings

Construction (Sandbag Check Dam)

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Place sandbags by hand at check structure location with geometry similar to that shown for the rock check dam
- Check structure should extend from one side of the ditch or channel to the other
- Structure should be constructed so that centre of the crest is depressed to form a centre flow width which is a minimum of 0.30 m lower than the outer edges
- Height of check structures should be less than 0.8 m to avoid impounding large volumes of runoff
- Downstream slope of the check dam should be 2.5H:1V (minimum)
- Upstream slope of the check dam should be 1.5H:1V (minimum)

Construction Considerations (Sandbag Check Dam)

- Height and spacing of check structures should be designed to reduce channel slope to intervals of flatter gradient
- Sandbags should only be filled ¾ full to allow bag to mould to contours, allowing continuous contact between the bag and the soil

Construction (Straw Bale Check Dam)

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Excavate a trench approximately 0.15 m deep with a width of two straw bales at the straw bale check structure location
- Place two rows of straw bales in excavated trench perpendicular to flow direction ensuring bales are staggered so that no joints are aligned on the upstream and downstream rows. Ensure twine or wire is not in contact with the soil
- Infill all joints with straw
- The centre of the crest of the check structure should be at least 0.15 m lower than the outer edges along the channel walls
- Drive two 1.2 m long square section wooden stakes through each straw bale, ensuring each stake is embedded a minimum of 0.15 m into soil
- Backfill and compact the upstream and downstream edges of the check structure to seat the straw bales into the base of the ditch
- Geotextile wrapping may be specified; the geotextile should be pinned to the straw bale subgrade

Construction Considerations (Straw Bale Check Dam)

- Height and spacing of structures should be designed to reduce gradient to a flatter grade
- To avoid impounding large volumes of runoff, check structures should be a maximum of one straw bale high
- Straw bales should be:
  - Machine-made
  - Weed free cereal crop straw such as wheat, oats, rye, or barley
  - Tightly compacted and bound with two rows of wire or synthetic string and shall show no signs of weathering
  - No more than year old

Check Dams

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP20

Construction (Log Check Dam)

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Embed ends of logs at least 0.5 m into channel or ditch bed
- Ensure there are minimal gaps between logs
- Install horizontal cross brace at top of the downstream side of structure to connect logs together providing integral support
- Structure should extend from one side of the ditch or channel to the other
- Structure should be constructed so that centre of the crest is depressed to form a centre flow width which is a minimum of 0.30 m lower than the outer edges
- To avoid impounding large volumes of runoff, check structures should be less than 0.5 m in height above the base of the ditch.

Construction Considerations (Log Check Dam)

- Height and spacing of structures should be designed to reduce gradient to a flatter grade
- Wood check dams should have their spacing and height design according to the anticipated hydraulic condition (flow depth and velocity)
- Bracing should be installed to provide support to embedded logs

Inspection and Maintenance

- Inspect barriers at least once a week and before and after each significant rainfall event (more than 25 mm in a 24 hour period)
- Remove sediment build up before it reaches one half the check structure height
- Erosion repairs should be made immediately to prevent failure of the structure
- Replace dislodged materials immediately or consider a more robust structure

Similar Measures

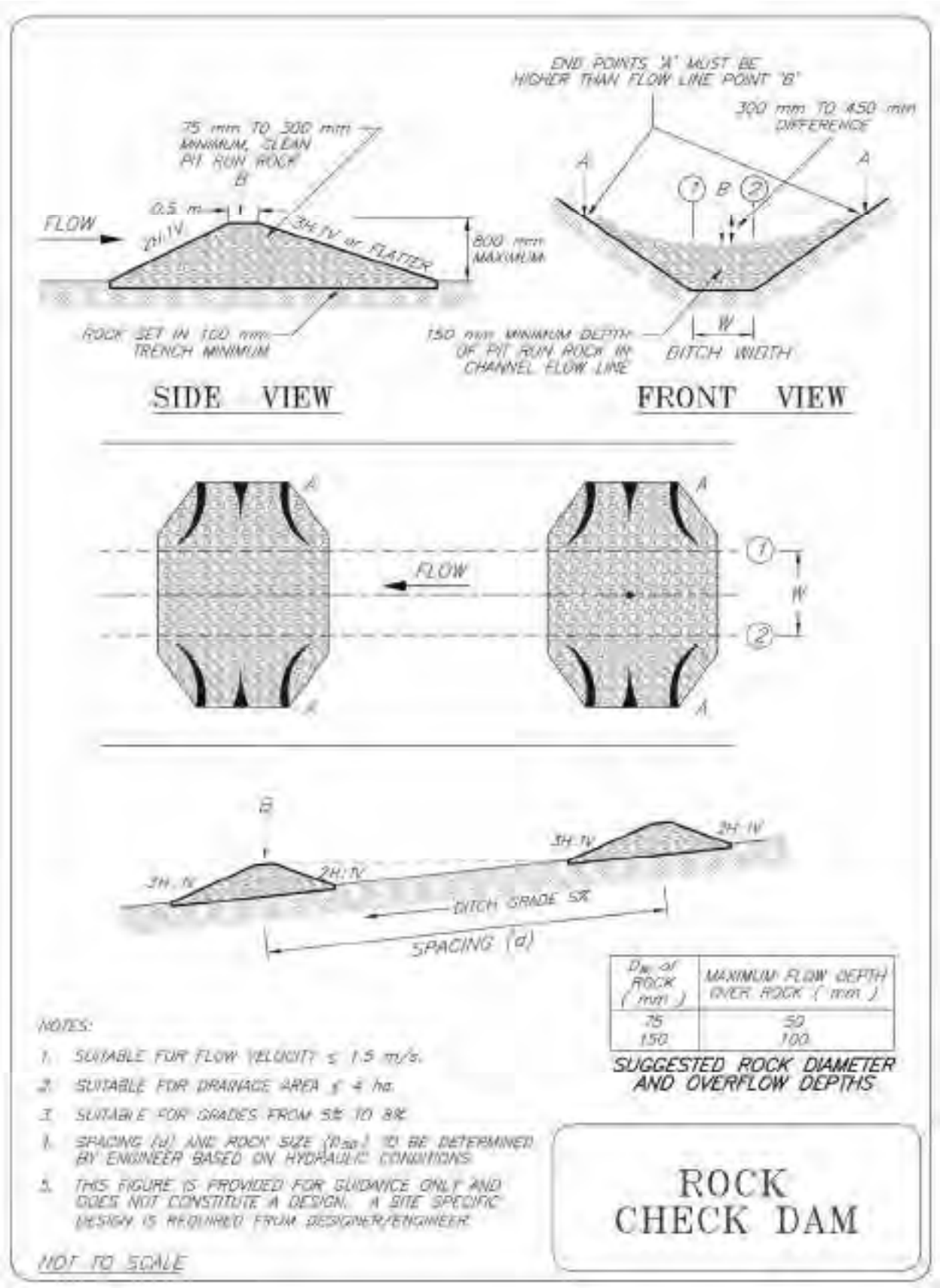
- Synthetic permeable barrier

Check Dams

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP20



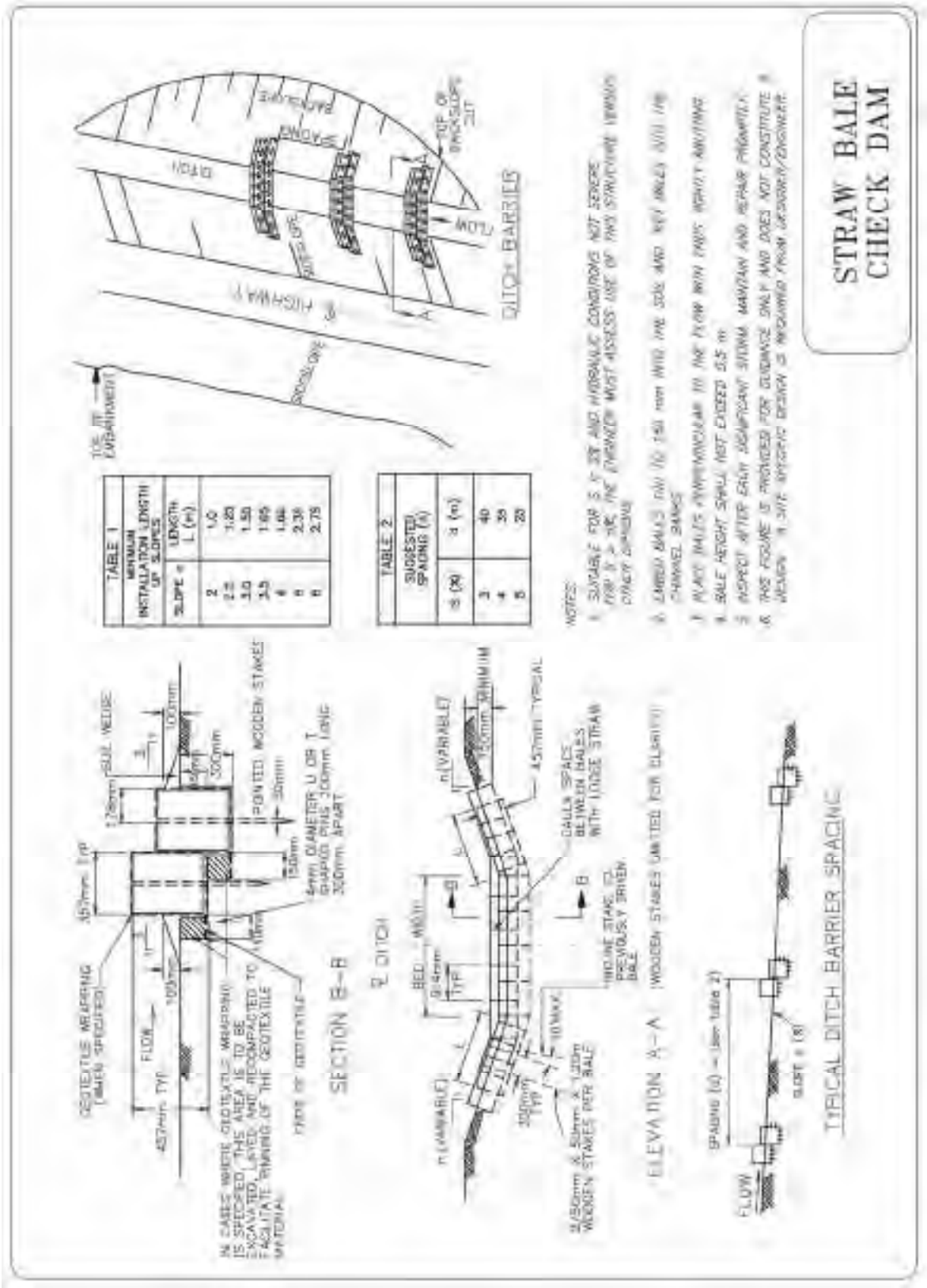
D_{50} of ROCK (mm)	MAXIMUM FLOW DEPTH OVER ROCK (mm)
75	50
150	100

Check Dams

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP20

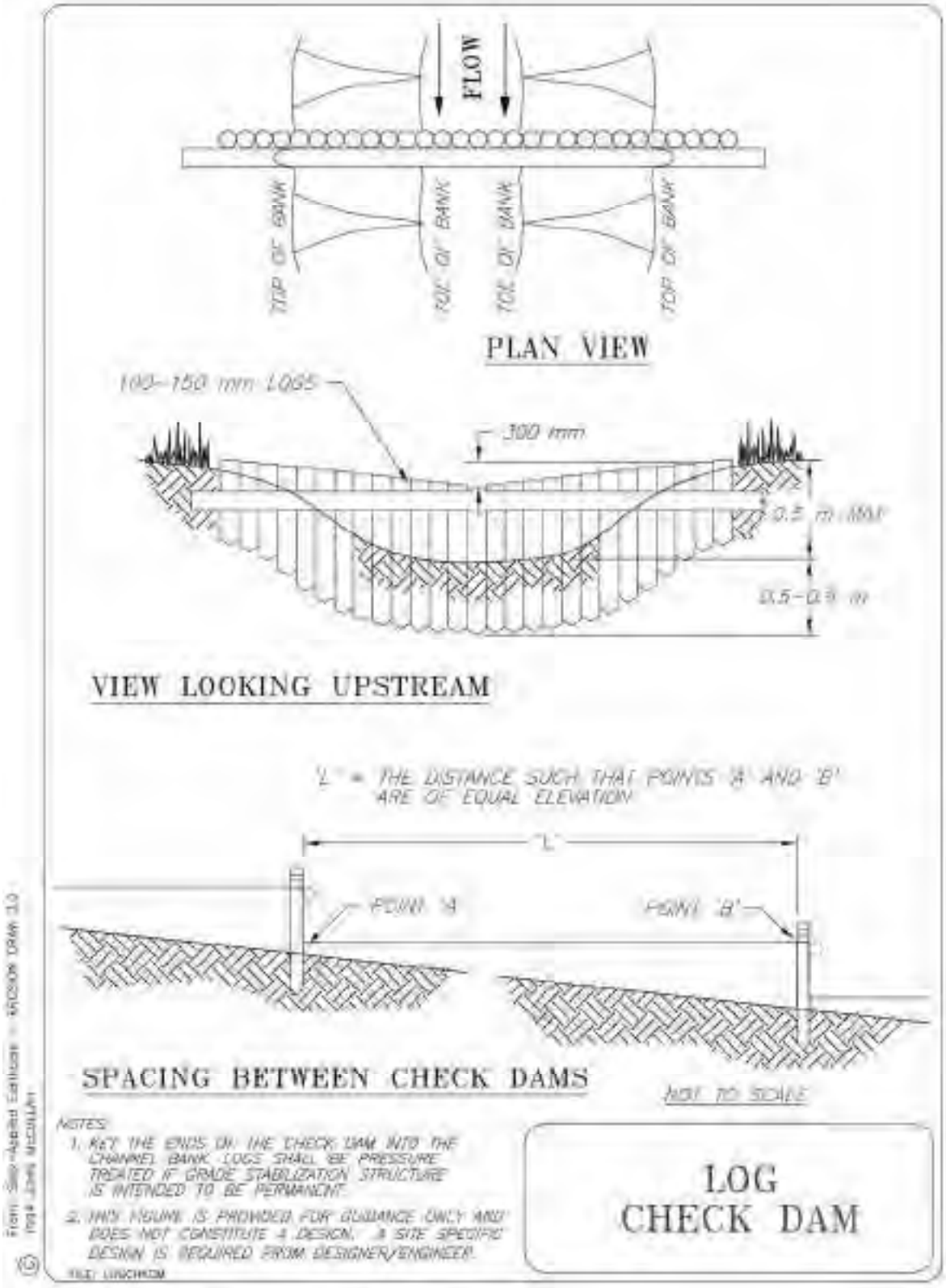


Check Dams

Erosion Control: ***Runoff Control***

Sediment Control: ***Settling***

BMP20



Diversion Ditch

Erosion Control:
Runoff Control

BMP21

Description and Purpose

- Channels or swales commonly located along the crest of cuts slopes to intercept and convey runoff away from bare soil slopes and to minimize erosion of slopes from sheet flow
- Often convey water to slope drains which carry water downslope

Applications

- Permanent measure
- Effective method of intercepting runoff to avoid excessive sheet flow over slope
- Effective at reducing erosion on cut slopes in highly erodible soils
- Can be used in conjunction with slope drains
- May be lined with vegetated or non-vegetated erosion control BMPs, but this requirement may be appropriate only in highly sensitive areas
- Can be used in conjunction with sediment control measures, such as check structures or permeable synthetic barriers, but this requirement may be appropriate only in highly sensitive areas

Limitations

- Ditch may require lining to minimize soil erosion from concentrated flow
- Ditch may require detailed design by qualified personnel if flow velocities and/or volumes are large
- Channel must be graded to maintain adequate depth and positive drainage; ponding and breaching of the channel could lead to overtopping of the channel and downslope erosion
- Removal of sediment build up and ditch maintenance may be difficult due to limited access space, because diversion ditches are commonly constructed at slope crests

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Use backhoe to excavate the ditch a minimum offset distance of 2 m between the crest of the cut slope and the top of the diversion ditch sideslope
- Place and compact excavated soil to form a dyke between crest of highway slope and diversion ditch channel to provide adequate depth of the diversion ditch
  - The consequence of failure of this dyke will determine the level of compaction effort required
  - Sideslopes of the diversion ditch should not be steeper than 2H:1V (depending upon material type)

- The depth of the diversion ditch (from base of ditch to top of embankment) should be a minimum of 1 m in depth; the width of ditch should be 1 m minimum
- The ditch should be graded at a minimum of 1% to promote positive drainage and outfall

Construction Considerations

- Channel should be graded towards nearest outfall or drainage pipe

Inspection and Maintenance

- Inspect ditches at least at biweekly intervals and after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
- Repair any damage to channel immediately

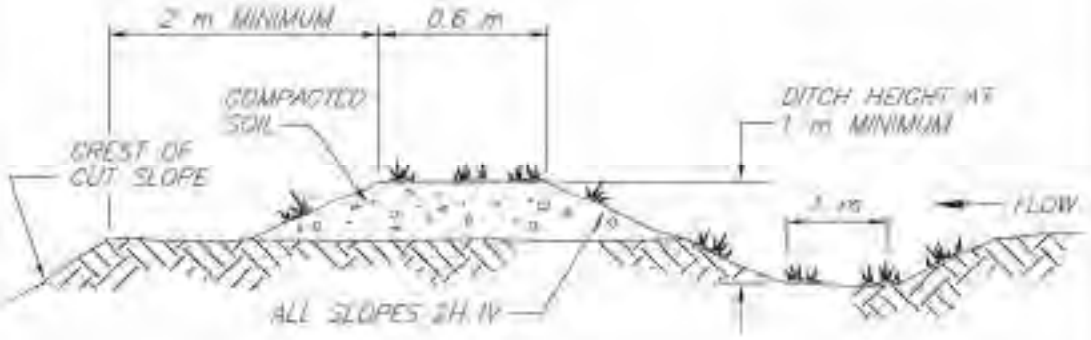
Similar Measures

- Berms
- Barriers

Diversion Ditch

Erosion Control:
Runoff Control

BMP21



TYPICAL DIVERSION DITCH

NOTES:

1. THE DITCH BEHIND THE DYKE SHALL HAVE POSITIVE GRADE TO A STABILIZED OUTLET.
2. THE DYKE SHALL BE ADEQUATELY COMPACTED TO PREVENT FAILURE.
3. FOR SENSITIVE HIGH RISK AREAS, THE DITCH SHALL BE STABILIZED WITH TEMPORARY OR PERMANENT SEEDING OR RIPRAP.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

DIVERSION DITCH

FILE: TYPDIVDIT

Energy Dissipators

Erosion Control:
Runoff Control

BMP22

Description

- Minimizes scour at flow impact location with dissipated flow energy
- Hard armour (rip rap, gravel, sand bags, concrete) placed at pipe outlets, in channels and downstream of check structures to reduce velocity and dissipate energy of concentrated flows
- Standard drain trough terminal protection structure generally used on bridge headslopes

Applications

- Permanent measure
- May be used at outlets of pipes, drains, culverts, conduits, or channels with substantial flows
- May be used at slope drain outlets located at the bottom of mild to steep slopes
- May be used where lined channels discharge into unlined channels
- May be used as a splash pad downstream of gabions, check structures, berms, barriers, and silt fences to prevent erosion caused by overtopping

Advantages

- Reduces flow energy in a relatively small area

Limitations

- Small rocks or stones can be dislodged during high flows
- Grouted rip rap may break up due to hydrostatic pressure, frost heave, or settlement
- May be expensive if construction materials (rip rap, gravel, or concrete) are not readily available
- May be labour intensive to place and construct
- Extreme flow velocities may require paved outlet structures, stilling basins, plunge pools, drop structures, baffles, or concrete splash pads which will require special design by qualified personnel. Energy dissipators constructed of rip rap may not be adequate for extreme flow velocities

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Grade the area to final design grades and elevations
- Sub-excavate energy dissipator location to thickness of energy dissipator
- Place filtration bedding material on base of excavation

  - Bedding can be comprised of well graded sand and gravel or non-woven geotextile
  - Acts as separating filter between fine grained subgrade and riprap size energy dissipator material
- Place energy dissipator material (rip rap, gravel, sand bags, concrete) over filtration bedding material
  - Top of energy dissipator should be flush with surrounding grade

Construction Considerations

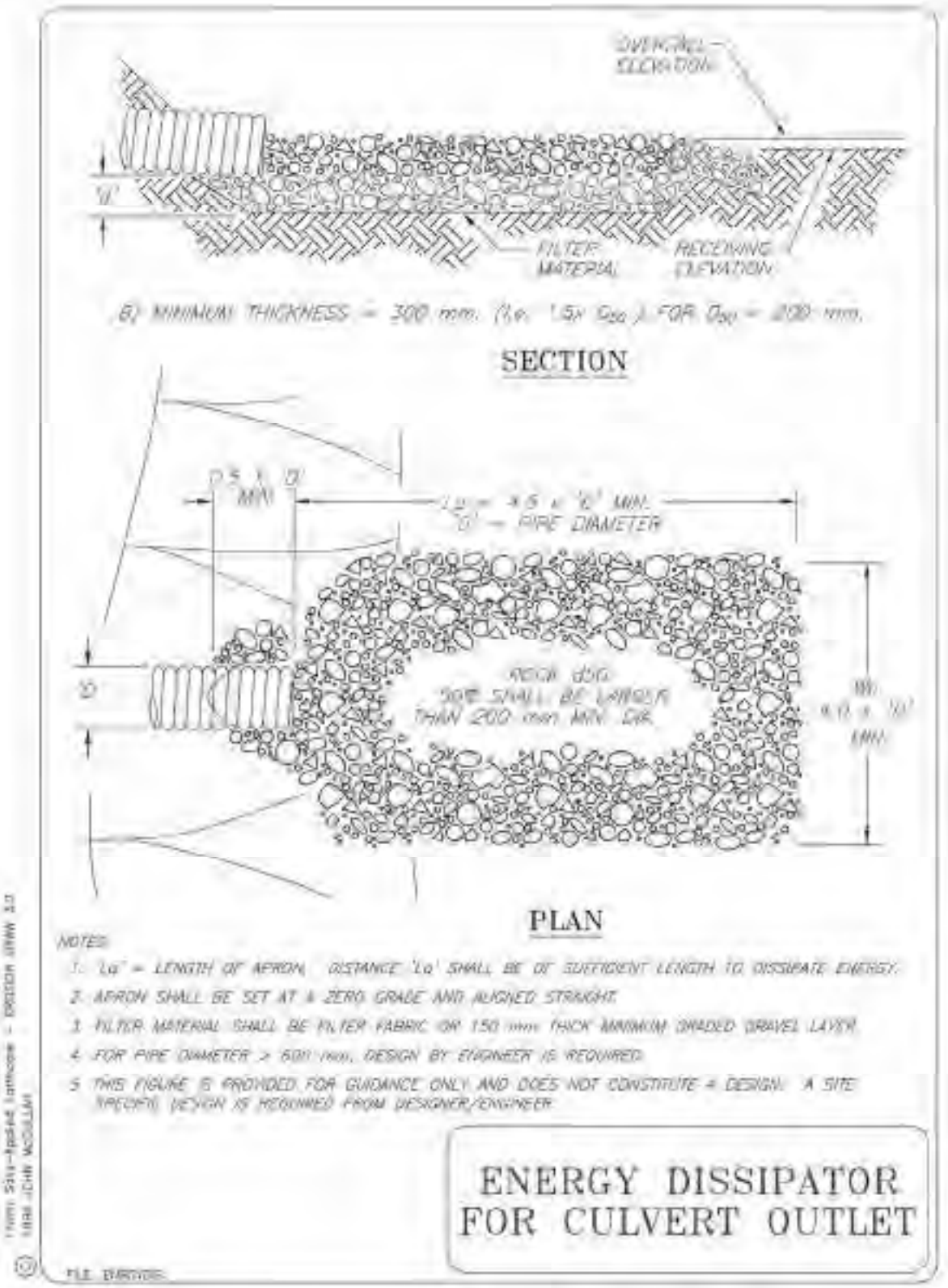
- Length of energy dissipator (L_a) at outlets shall be of sufficient length to dissipate energy
  - L_a = 4.5 x D (where D is the diameter of the pipe or channel at the outlet)
  - Energy dissipator should extend upstream of the outlet approximately a minimum distance of 0.5 x D
- Width of energy dissipator (W_a) at outlets shall be of sufficient width to dissipate energy
  - W_a = 4 x D
- Thickness of energy dissipator (d_a) at outlets shall be of sufficient thickness to dissipate energy
  - d_a = 1.5 x maximum rock diameter (with a minimum thickness of 0.30 m)
- Energy dissipator (splash pad, apron) shall be set at zero grade and aligned straight, with the direction of flow at the outlet
- Bedding (filtration) layer can comprise either non-woven geotextile or a minimum of 0.15 m well graded sand and gravel layer
- Energy dissipator should be constructed of well-graded rip rap
  - Minimum d_{50} = 150 mm. Preferable d_{50} = 300 mm
  - Minimum thickness = a) 1.5 x d_{50} or b) 0.30 m to 0.45 m thickness. (a or b whichever is greater)
- Energy dissipator shall be designed to accommodate a 10-year peak runoff or the design discharge of the upstream channel, pipe, drain, or culvert, whichever is greater

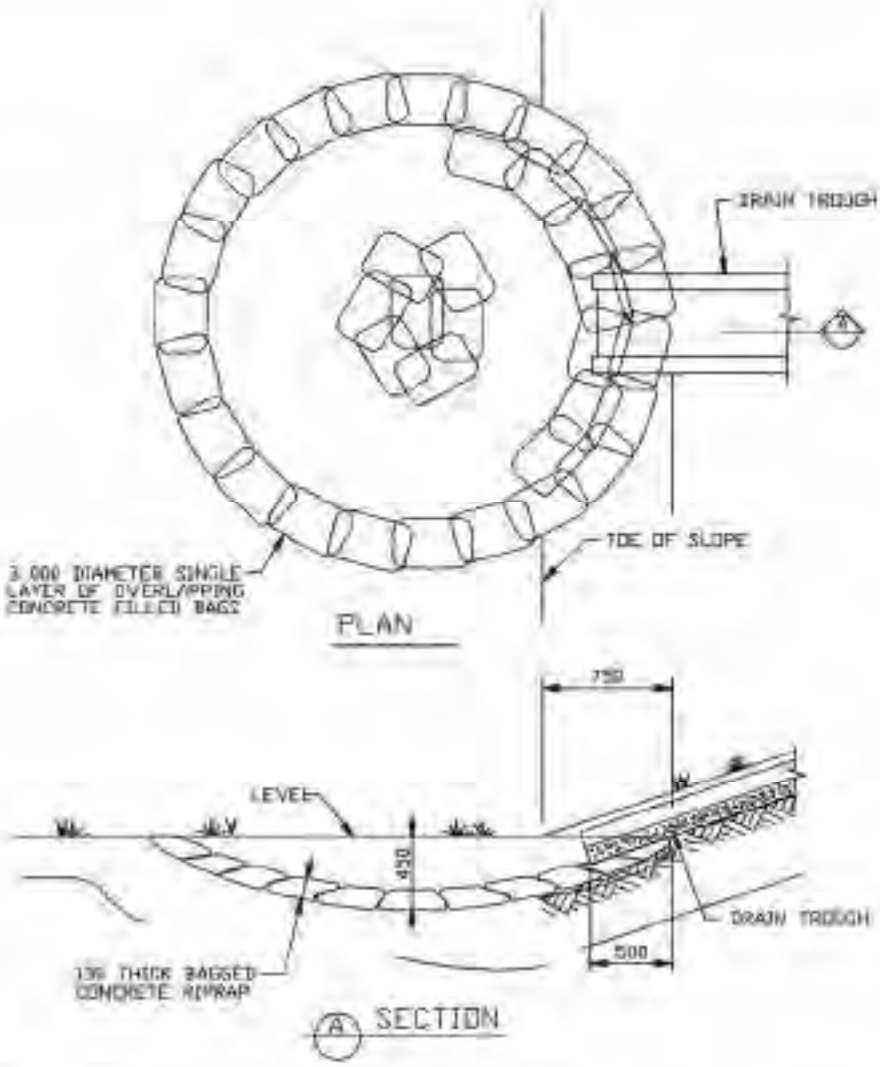
Inspection and Maintenance

- Periodic inspections to check for damage should occur at least once a month, or after storm events (1:2 year storm and/or 40 mm rainfall over 24 hour duration)
- Any damage should be repaired immediately

Similar Measures

- Gabion mattresses


OVERFLOW ELEVATION
'D'
FILTER MATERIAL
RECEIVING ELEVATION
B) MINIMUM THICKNESS = 300 mm. (i.e. 1.5x D50) FOR D50 = 200 mm.
SECTION
0.5 x 'D' MIN.
'Lo' = 4.5 x 'D' MIN.
'D' = PIPE DIAMETER
ROCK D50 SHALL BE LARGER THAN 200 mm MIN. DIA.
'W' = 4.0 x 'D' MIN.
PLAN
NOTES:
1. 'Lo' = LENGTH OF APRON. DISTANCE 'Lo' SHALL BE OF SUFFICIENT LENGTH TO DISSIPATE ENERGY.
2. APRON SHALL BE SET AT A ZERO GRADE AND ALIGNED STRAIGHT.
3. FILTER MATERIAL SHALL BE FILTER FABRIC OR 150 mm THICK MINIMUM GRADED GRAVEL LAYER.
4. FOR PIPE DIAMETER > 600 mm, DESIGN BY ENGINEER IS REQUIRED.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.
ENERGY DISSIPATOR FOR CULVERT OUTLET
FILE: ENERGY01



GENERAL NOTES

- DIMENSIONS ARE GIVEN IN mm. DETAILS ARE NOT TO SCALE.
- PLACING OF BAGGED CONCRETE RIPRAP SHALL START AT THE BOTTOM CENTRE OF THE DISHED AREA AND SHALL PROCEED IN A CONTINUOUS SPIRAL FASHION OUTWARD UNTIL THE ENTIRE DISH IS COVERED. EACH CONCRETE FILLED BAG SHALL LAP OVER THE EDGES OF THE PREVIOUSLY PLACED BAGS.

  SOURCE: ALBERTA TRANSPORTATION SPECIFICATIONS FOR BRIDGE CONSTRUCTION DRAWING S-1410-91
- THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

ENERGY DISSIPATOR
FOR SEMI-CIRCULAR TROUGH DRAIN TERMINAL PROTECTION FOR BRIDGE HEADSLOPE

Silt Fence

Sediment Control: Settling

BMP23

Description and Purpose

- Permeable fabric barriers installed vertically on support posts along contours to collect and/or filter sediment laden sheet flow runoff
- Causes water to pond and sediment to settle out as fabric impounds water
- Decreases flow velocity in channels with low to moderate flows (<0.03 m^3/s)
- Entraps and minimizes coarse sediment from sheet flow or overland flow from entering waterbodies
- Perimeter control for sediment transport and deposition
- Also known as “sediment control fence”

Applications

- Temporary measure
- Used at bottom of cut or fill slopes to collect sediment laden runoff
- Used along streams or watercourse banks
- Used around stockpiles
- Midslope grade-break (using "J-hook" or "smile" pattern to cause ponding and sedimentation)

Advantages

- Low permeability silt fences have high ponding and settling capabilities for fine sand to coarse silt

Limitations

- **Successful performance is highly dependent on proper installation**; silt fence is commonly installed incorrectly and failures can cause erosion
- Applicable for sheet flow, normally cannot handle concentrated channel flow volumes
- May fail under high runoff events or due to damage caused during sediment removal
- Limited to locations suitable for temporary ponding of sediment laden runoff
- Low permeability silt fences may not be strong enough to support weight of water retained behind it and may require reinforcement (i.e. wire mesh and stronger support posts)
- Sediment build up needs to be removed at 1/2 height and on a regular basis
- Has a useable life of approximately one year, depending on maintenance and sediment requirement

Silt Fence

Sediment Control: Settling

BMP23

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Two methods of installation are commonly used:
  - Trench method
  - Mechanical (slicing) installation method (e.g. Tommy Silt Fence Machine or equivalent)

  The mechanical installation method is recommended because it results in less disturbance to native ground and in general provides a stronger end product
- Trench Method
  - Select the location of the silt fence (usually along contours)
  - Excavate a trench 0.30 m deep by 0.15 m wide for the entire length of fence
  - Drive the support posts a minimum of 0.6 m into the ground along the downstream side of the trench, spaced a maximum of 2 m apart; use a spacing of 1 m for critical water-retaining areas
  - Attach the wire mesh or snow fencing, if used as reinforcement to fence fabric, to the upstream side of each post with staples
  - Extend the filter fabric to the base of the trench and attach it over the wire mesh or snow fence, if used, on the upstream side of posts
  - Backfill and compact the soil in the trench, being careful not to damage the fence
- Mechanical Installation Method
  - Select the location of the silt fence (usually along contours)
  - Use a mechanical installation machine to embed the fabric a minimum of 0.2 m to 0.3 m into the ground. One mechanical installation method involves slicing (with special equipment) the geotextile fabric to embed it into the ground without excavation or backfill. This results in only minor disturbance of the ground and only minor tamping of the ground is required for compaction.
  - Drive the support posts a minimum of 0.6 m into the ground, spaced a maximum of 2 m apart; use a spacing of 1 m for critical water-retaining areas
  - Attach the wire mesh or snow fencing, if used as reinforcement, to the silt fence fabric and to the upstream side of posts with staples
- Note on Type 2 Silt Fence
  - Heavy grade silt fence may be required by regulatory agencies for installation near watercourses
  - Type 2 silt fence uses steel posts, with filter fabric supported by wire fencing material and a compacted gravel toe anchorage

Construction Considerations

- Site Selection
  - Size of drainage area to a silt fence should be no greater than 0.4 ha

  - Maximum flow path length above silt fence should be no greater than 30 m
  - Maximum slope gradient above the silt fence should be no greater than 2H:1V
- Fence should be placed on the contour to produce proper ponding
- Fence should be placed far enough away from the toe of slope to provide an adequate ponding area (minimum of 1.8 m away from toe of slope is recommended)
- Ends of the fence should be angled upslope to collect runoff
- Fence should not extend more than 0.6 m above grade
- Posts can be wood or metal, depending on design and ground conditions
- Posts should be placed on the downstream side of the fence
- Posts should be driven at least 0.6 m into the ground
- Posts should not be spaced greater than 2 m apart
- Wire mesh or snow fencing may be placed between the posts and the filter fabric to provide additional strength and support reinforcement
- Filter fabric should be cut from a continuous roll to avoid joints. If joints are necessary, filter fabric should be wrapped around the fence post with a minimum overlap of 0.2 m, and staples should be used to attach the fabric to the post
- Fence (and wire mesh or snow fence, if used) should be attached to the posts with heavy duty staples, tie wires, or hog rings
- Fence (and wire mesh or snow fence, if used) should be dug into a trench at least 0.30 m deep to prevent undercutting of fence by runoff
- Trench backfill should be compacted
- Long runs of silt fence are more prone to failure than short runs
  - The maximum length of each section of silt fence should be 40 m
  - Silt fence should be installed in 'J' hook or 'smile' configuration, with maximum length of 40 m, along contours allowing an escape path for ponded water (minimizes overtopping of silt fence structure)

Inspection and Maintenance

- Inspections should occur twice per week and after significant storm events (1:2 year storm event and/or >40 mm rainfall over 24 hours duration)
- Repair undercut fences and repair or replace split, torn, slumping or weathered fabric immediately
- Sediment build up should be removed once it accumulates to a depth of 0.2 m or at 1/2 height of fence
- Remove fence after vegetation is established
- Deactivate fabric by cutting off the top portion of fabric above ground; the bottom trenched-in portion can be left in-ground to minimize ground disturbance

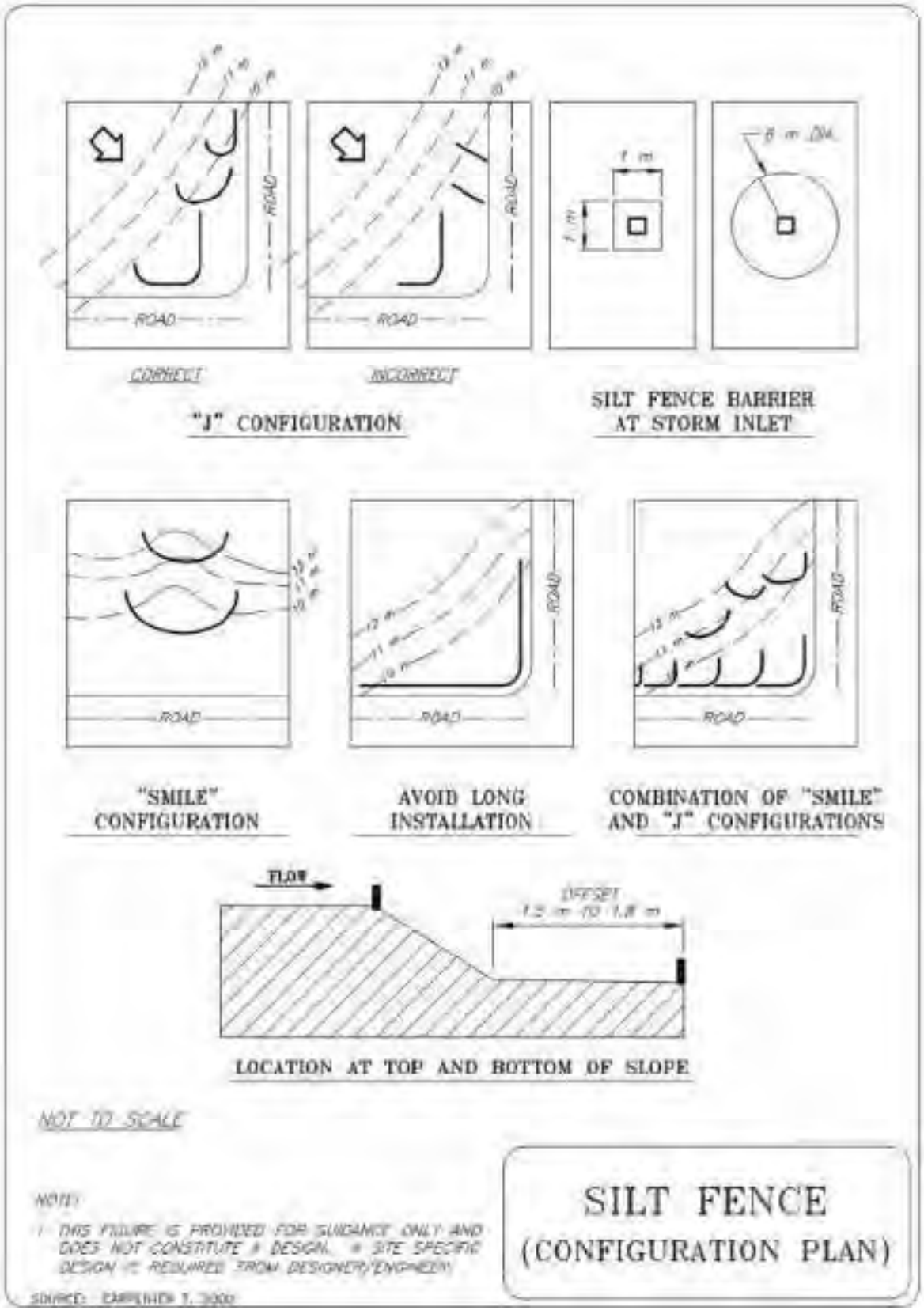
Similar Measures

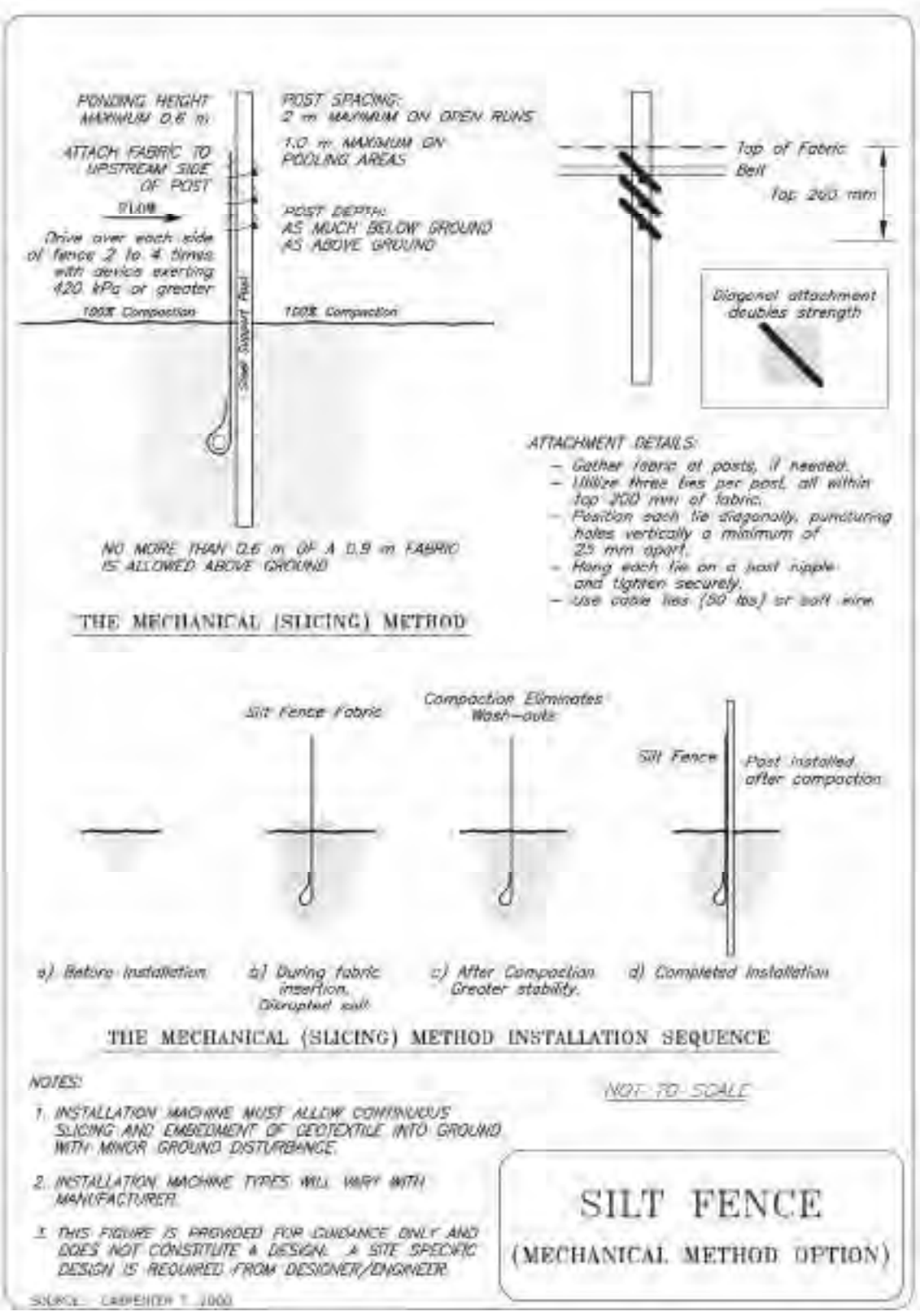
- Check Dams
- Permeable synthetic barriers

Silt Fence

Sediment Control:
Settling

BMP23

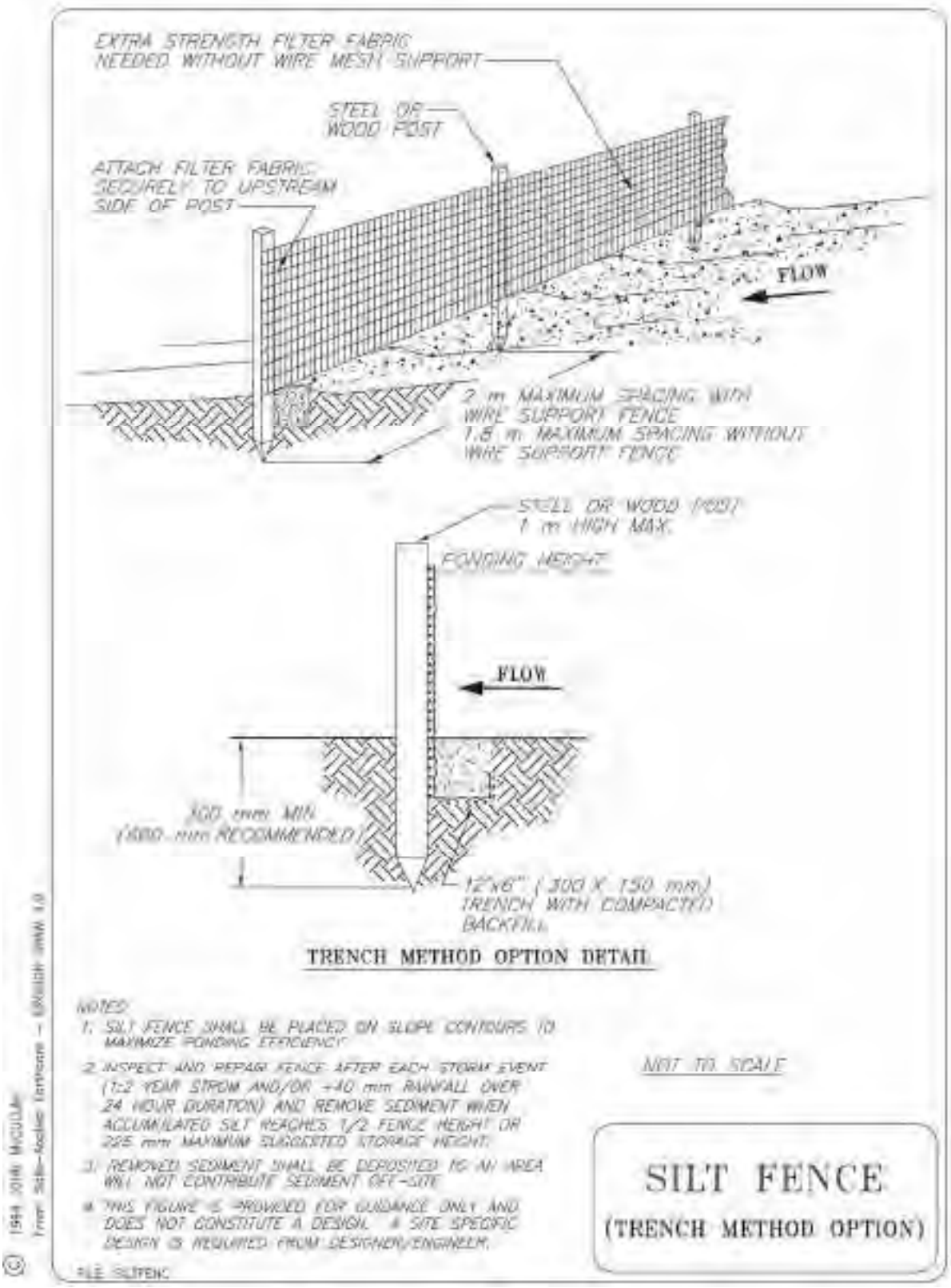



PONDING HEIGHT MAXIMUM 0.6 m
ATTACH FABRIC TO UPSTREAM SIDE OF POST
FLOW
Drive over each side of fence 2 to 4 times with device exerting 420 kPa or greater
100% Compaction
POST SPACING:
2 m MAXIMUM ON OPEN RUNS
1.0 m MAXIMUM ON POOLING AREAS
POST DEPTH:
AS MUCH BELOW GROUND AS ABOVE GROUND
100% Compaction
Steel Support Post
NO MORE THAN 0.6 m OF A 0.9 m FABRIC IS ALLOWED ABOVE GROUND
Top of Fabric
Bell
Top 200 mm
Diagonal attachment doubles strength
ATTACHMENT DETAILS:
– Gather fabric at posts, if needed.
– Utilize three ties per post, all within top 200 mm of fabric.
– Position each tie diagonally, puncturing holes vertically a minimum of 25 mm apart.
– Hang each tie on a post nipple and tighten securely.
– Use cable ties (50 lbs) or soft wire.
THE MECHANICAL (SLICING) METHOD
Silt Fence Fabric
Compaction Eliminates Wash-outs
Silt Fence
Post installed after compaction
a) Before Installation
b) During fabric insertion. Disrupted soil
c) After Compaction Greater stability.
d) Completed Installation
THE MECHANICAL (SLICING) METHOD INSTALLATION SEQUENCE
NOTES:
1. INSTALLATION MACHINE MUST ALLOW CONTINUOUS SLICING AND EMBEDMENT OF GEOTEXTILE INTO GROUND WITH MINOR GROUND DISTURBANCE.
2. INSTALLATION MACHINE TYPES WILL VARY WITH MANUFACTURER.
3. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.
NOT TO SCALE
SOURCE: CARPENTER T. 2000
SILT FENCE
(MECHANICAL METHOD OPTION)

Silt Fence

Sediment Control:
Settling

BMP23



Brush or Rock Berm

Sediment Control:
Settling

BMP24

Description and Purpose

- Temporary barriers of brush and/or rock wrapped in geotextile and secured in place to intercept sediment laden stormwater runoff from disturbed areas, retain sediment, and release water as sheet flow

Applications

- Temporary measure
- Perimeter control
- Near toe of slopes subjected to sheet flow and rill erosion
- Along crest or tops streams and channels
- Around drain inlets
- Maximum drainage area of 250 m^2 per 25 m length of barrier

Advantages

- May be equally effective as silt fences

Limitations

- Temporary measure only
- Maximum drainage area of less than 250 m^2 per 25 m length of barrier
- Sufficient area behind berm required for ponding and clean out of sediment
- Not effective for diverting runoff (allows runoff to seep through)
- Rock berms are expensive to remove at completion of service life
- Not to be used across ditches, channels, or swales where high concentrated flows are anticipated

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Brush berm
  - Size of the brush berm will vary depending upon amount of material available and condition of the site
  - The height of the berm shall be at least 1 m and the width shall be a minimum of 1.5 m at its base
  - Berm is constructed by piling brush, roots, stumps and/or stones into a mounded row along contours
    - During clearing and grubbing, equipment can push the material into windrows along toe of slopes or other areas prone to erosion

  - Geotextile is then laid across the berm, with edges overlapping, and secured in a trench immediately upstream of the berm
    - Trench shall be 15 cm wide and 15 cm deep and shall run for the entire length of the berm
  - The geotextile in the trench shall be staked down with stakes spaced approximately 1 m apart
  - The trench is then backfilled and compacted over the staked geotextile
  - The geotextile is anchored with twine/wire to stakes on the downstream side of the berm
- Rock filter berm
  - Constructed similar to brush berm, replacing brush with rock (D_{50} = 75 mm to 150 mm)

Construction Considerations

- Use rock or brush material smaller than 150 mm in diameter, or use geotextile to encapsulate the material
- There is no predetermined shape for berms
- Water must be forced to pond behind the berm to encourage settling
- Brush barriers can generally be constructed of clean organic material made available from clearing and grubbing operations that is normally burned or discarded
- Rock and brush berms are temporary measures and should be removed upon completion of service life, after revegetation of areas upslope

Inspection and Maintenance

- Inspect berms on a weekly basis and before and after significant rainfall events (1:2 year storm event and/or 40 mm rainfall over 24 hours duration)
- Reshape berms as needed and replace lost or dislodged rock, brush, and/or geotextile
- Inspect for sediment accumulation and remove sediment when depths reach approximately one-third the berm height or 300 mm, whichever occurs first
- Inspect for toe undercutting, weathered/deteriorated geotextile, and end runs and erosion of the berm and repair immediately

Similar Measures

- Berms/barriers
- Check dams
- Permeable synthetic barriers

Brush or Rock Berm

Sediment Control:
Settling

BMP24

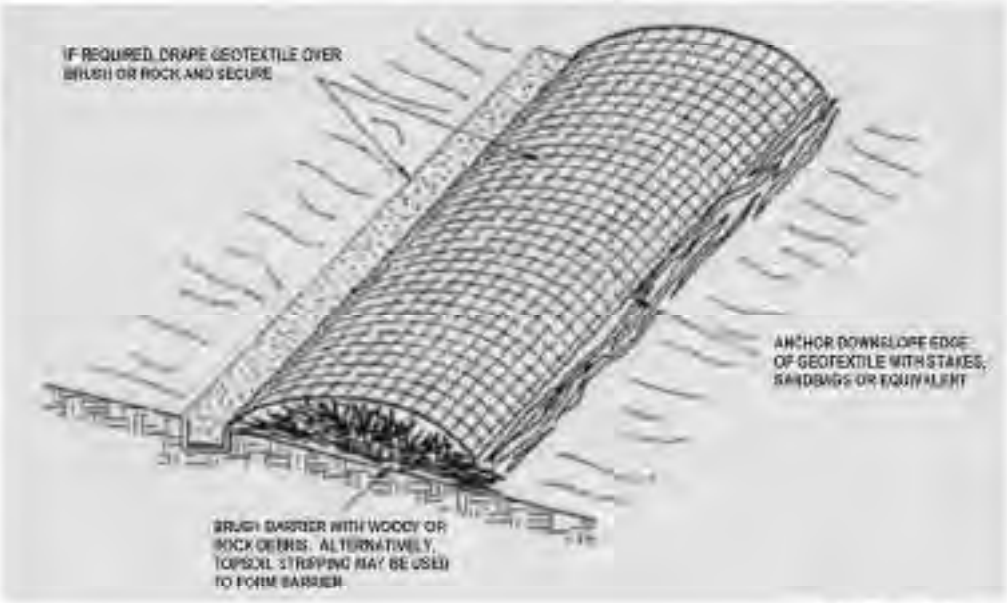
Design Considerations

- Material properties
  - Rocks
    - Shall consist of hard, durable, clean mineral particles free of organic matter, clay lumps, soft particles, or other substances that might interfere with drainage and filtering properties
    - D_{50} of 75 mm to 150 mm preferable
  - Brush
    - Material shall be less than 150 mm in diameter

Brush or Rock Berm

Sediment Control:
Settling

BMP24



NOT TO SCALE

NOTES:

1. EXCAVATE 150 mm X 150 mm TRENCH ALONG UPSTREAM SIDE OF BRUSH OR ROCK BERM.
2. DRAPE GEOTEXTILE OVER BRUSH OR ROCK BERM ENSURING UPSTREAM SIDE IS IN TRENCH.
3. BACKFILL AND COMPACT SOIL OVER GEOTEXTILE IN EXCAVATED TRENCH.
4. SECURE GEOTEXTILE OVER BRUSH OR ROCK BERM BY STAKING ON DOWNSTREAM SIDE OF BERM.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER

BRUSH or ROCK BERMS

Drain Inlet Sediment Barrier

Sediment Control:
Settling

BMP25

Description and Purpose

- Temporary devices constructed to minimize the amount of sediment entering a storm drain by ponding sediment laden runoff at the inlet
- Storm Drain Inlet protection can consist of the following measures:

  - Block and Gravel Sediment Barrier – Option 1
  - Block and Gravel Curb Inlet Sediment Barrier – Option 2
  - Sand Bag Curb Inlet Sediment Barrier – Option 1
  - Sand Bag Curb and Gutter Sediment Barrier – Option 2
  - Silt Fence Sediment Barrier

Applications

- Temporary measure
- Used where storm drains are operational prior to establishing vegetation on disturbed drainage areas
- Can be effective where drainage enters municipal sewers or watercourses
- Used for small, nearly level (less than 5% grade) drainage areas
- Used as curb inlet barriers in gently sloping ditches and gutters
- Used where drainage area is 0.4 ha or less
- Used in open areas subjected to sheet flow and concentrated flows less than 0.014 m^3/s
- Block and gravel bag barriers are applicable when sheet flows or concentrated flows exceed 0.014 m^3/s and is necessary to allow for overtopping to prevent flooding
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected and overflow capacity is required

Advantages

- Easy to install and remove
- Sand bags may be reusable

Limitations

- Ponding around inlet may result in local flooding
- Use only when ponding will not encroach into vehicular traffic, onto erodible surfaces and slopes or beyond the limits of the construction site
- Frequent removal of sediment may be required for high flow situations

Drain Inlet Sediment Barrier

Sediment Control:
Settling

BMP25

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Place inlet sediment barrier around entrance to drain/pipe. The option appropriate for use is dependent on site conditions.
- Silt fence barrier can be used for soil surfaces
- Gravel or aggregate filled sand bags should be used for asphalt or concrete surfaces
- Aggregate filled sand bags
  - Place sand bags stacked one or two bags high around inlet
- Gravel barriers
  - Place concrete blocks stacked one or two blocks high, with cavities of blocks aligned with direction of flow, around inlet
  - Wrap 13 mm wire mesh around concrete blocks
  - Place 25 mm to 38 mm diameter rock around block and wire mesh assembly ensuring rock extends down from top of blocks to asphalt or concrete surfacing
- Gravel filter curb inlet
  - Place concrete blocks stacked one or two blocks high around inlet, with cavities of blocks aligned with direction of flow, forming a 'U' shape
  - Wrap 13 mm diameter wire mesh around concrete blocks
  - Place 25 mm to 38 mm diameter rock around block and wire mesh assembly ensuring rock extends down from top of blocks to asphalt or concrete surfacing

Construction Considerations

- Gravel or aggregate filled sand bags should be used for asphalt or concrete surfaces
- Aggregate filled sand bags
  - Sand bags should be filled with pea gravel, drain rock, or other free draining material
  - Gravel or aggregate filled sand bags should be filled only three-quarters full to allow sand bag to be flexible to mould to contours, maintaining continuous contact with surface
  - Barrier should be placed at least 0.1 m from inlet to be protected
  - Several layers of sand bags should be overlapped and tightly packed against one another
  - A one sand bag wide gap should be left in the lowest point of the upper layer to act as an emergency spillway
- Gravel filter inlet berm and gravel filter curb inlet
  - Slope gravel towards inlet at a maximum slope of 2H:1V
  - Maintain at least 0.3 m spacing between toe of gravel and inlet to minimize gravel entering inlet

  - 25 mm wire mesh may be placed over inlet to prevent gravel from entering the inlet
- For drainage areas larger than 0.4 ha runoff should be directed towards a sediment retention device designed for larger flows before allowing water to reach inlet protection structure
- Use aggregate sand bags filled with 25 mm diameter rock in place of concrete blocks for gravel filter inlet berm or gravel filter curb inlet

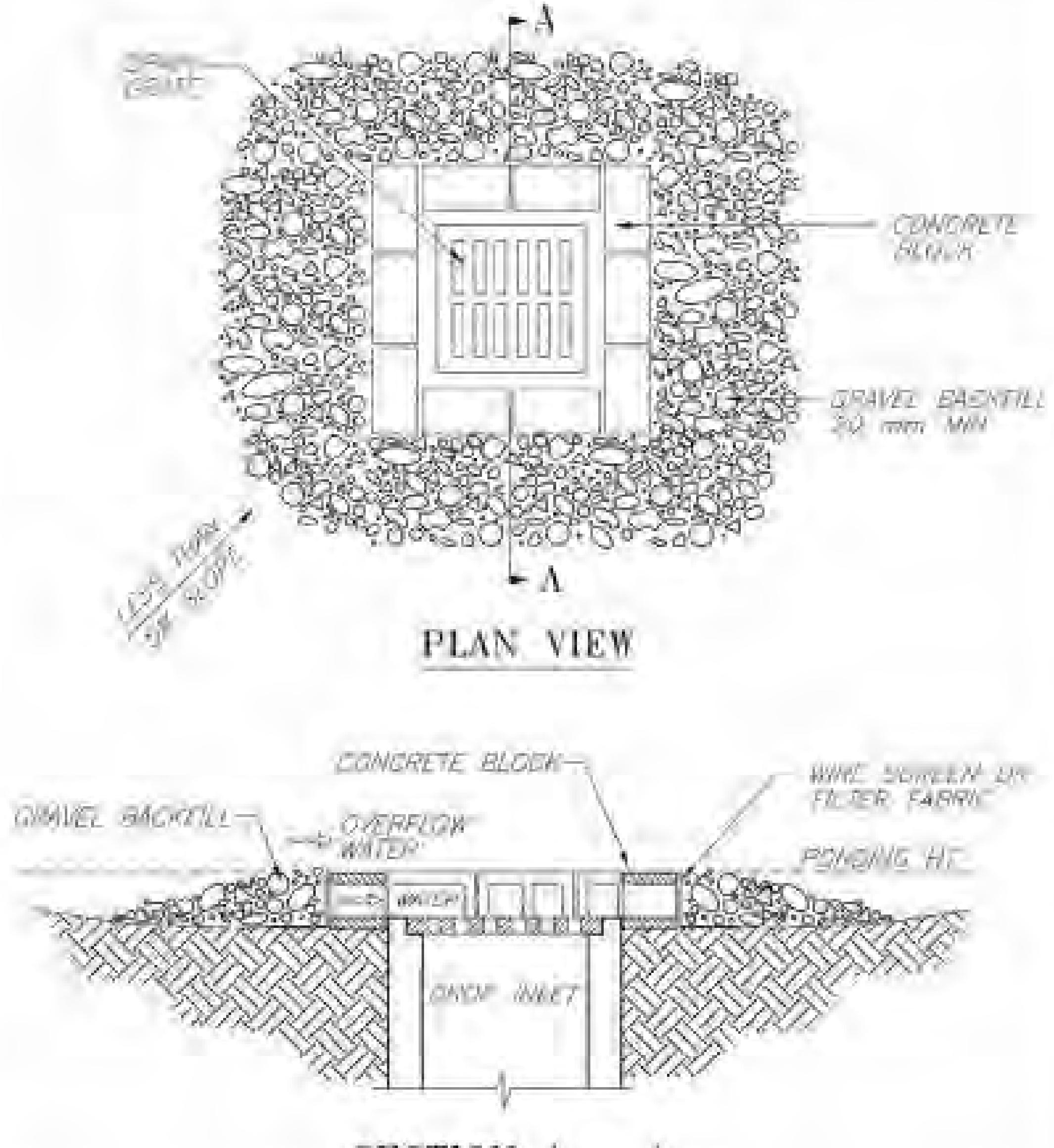
Inspection and Maintenance

- Inspect barriers at least once a week and before and after each significant rainfall event (1:2 year storm and/or 40 mm in a 24 hour period)
- Remove sediment build up after each storm event
  - Sediment and gravel should not be allowed to accumulate on roads
- Replace gravel if it becomes clogged with sediment
- Remove all inlet protection devices when inlet protection is no longer required

Drain Inlet Sediment Barrier

Sediment Control: Settling

BMP25



NOTES:

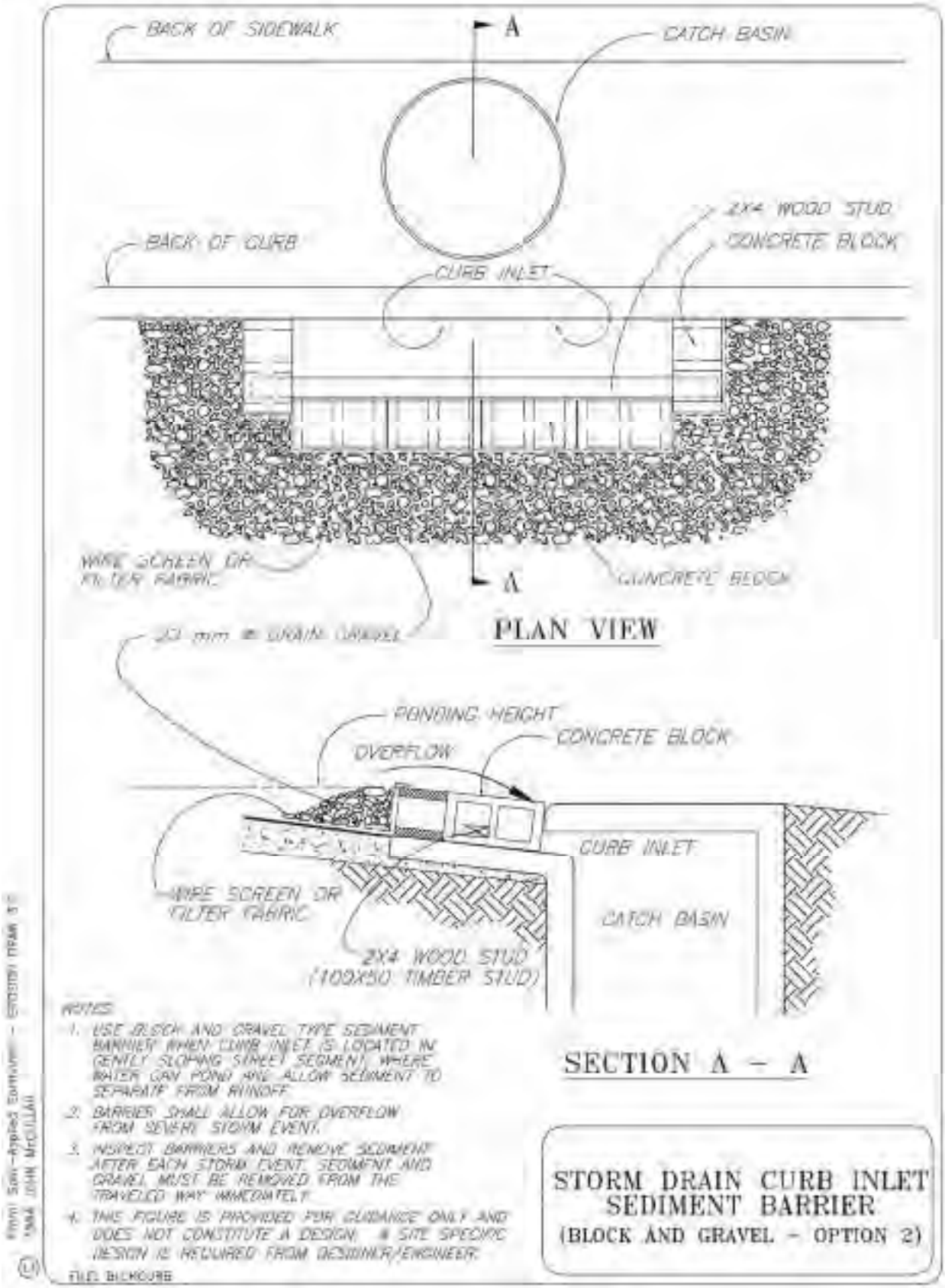
1. STORM DRAIN DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%).
2. EXCAVATE A BASIN OF SUFFICIENT SIZE ADJACENT TO THE STORM DRAIN DROP INLET.
3. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. A TEMPORARY DYKE MAY BE NECESSARY ON THE DOWNSLOPE SIDE OF THE STRUCTURE.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

STORM DRAIN DROP INLET SEDIMENT BARRIER
(BLOCK AND GRAVEL – OPTION 1)

Drain Inlet Sediment Barrier

Sediment Control:
Settling

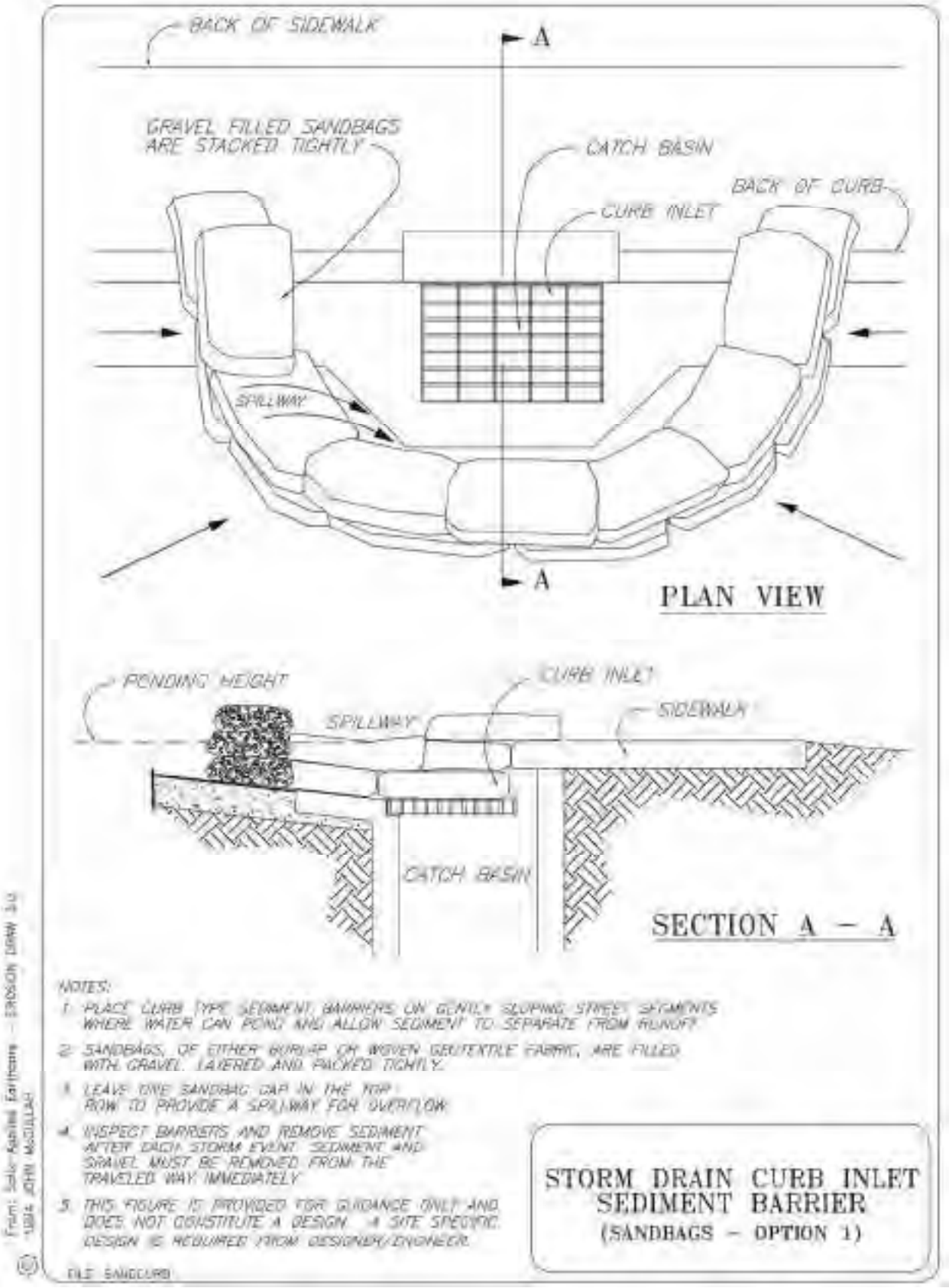
BMP25



Drain Inlet Sediment Barrier

Sediment Control:
Settling

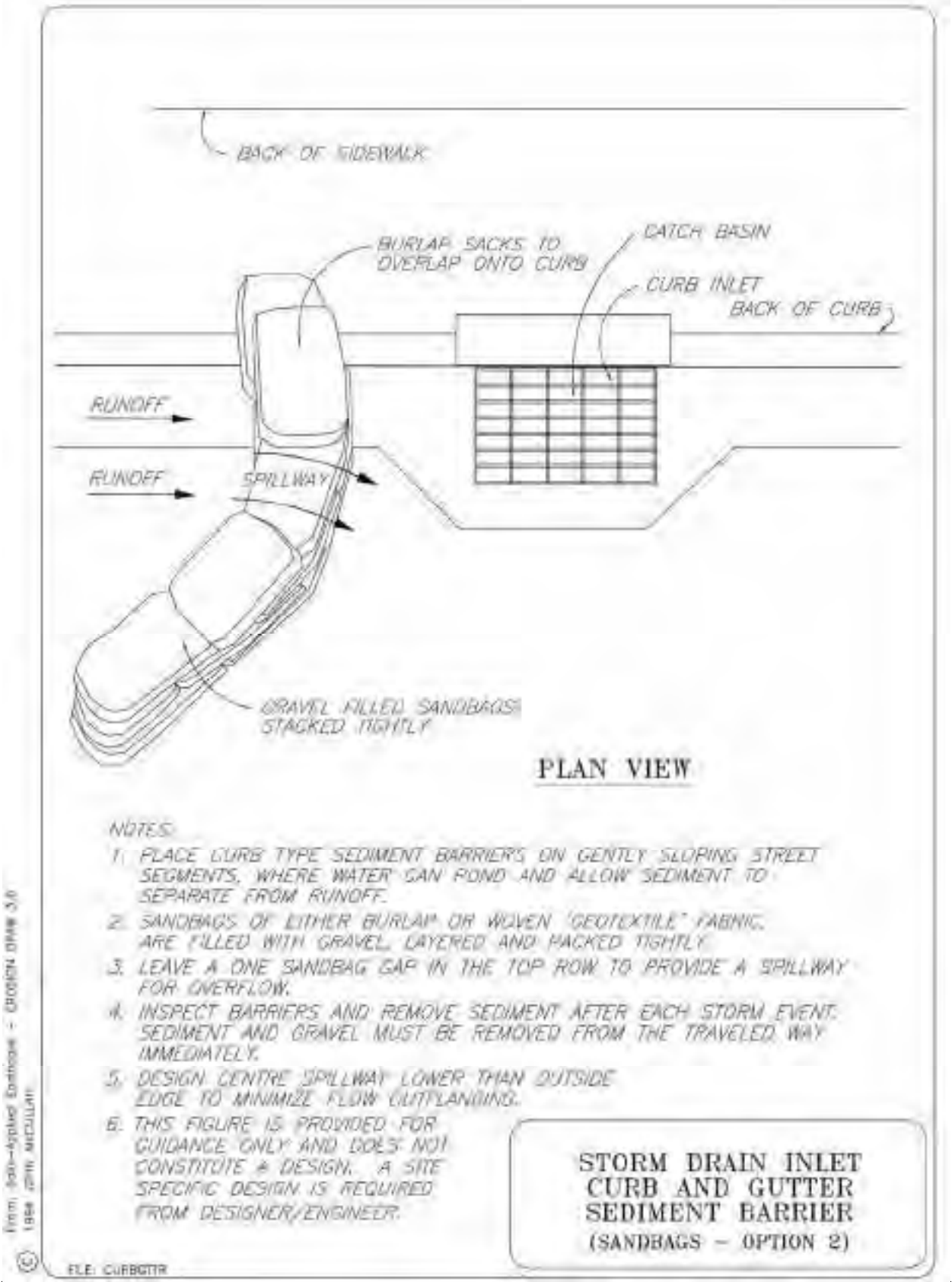
BMP25



Drain Inlet Sediment Barrier

Sediment Control:
Settling

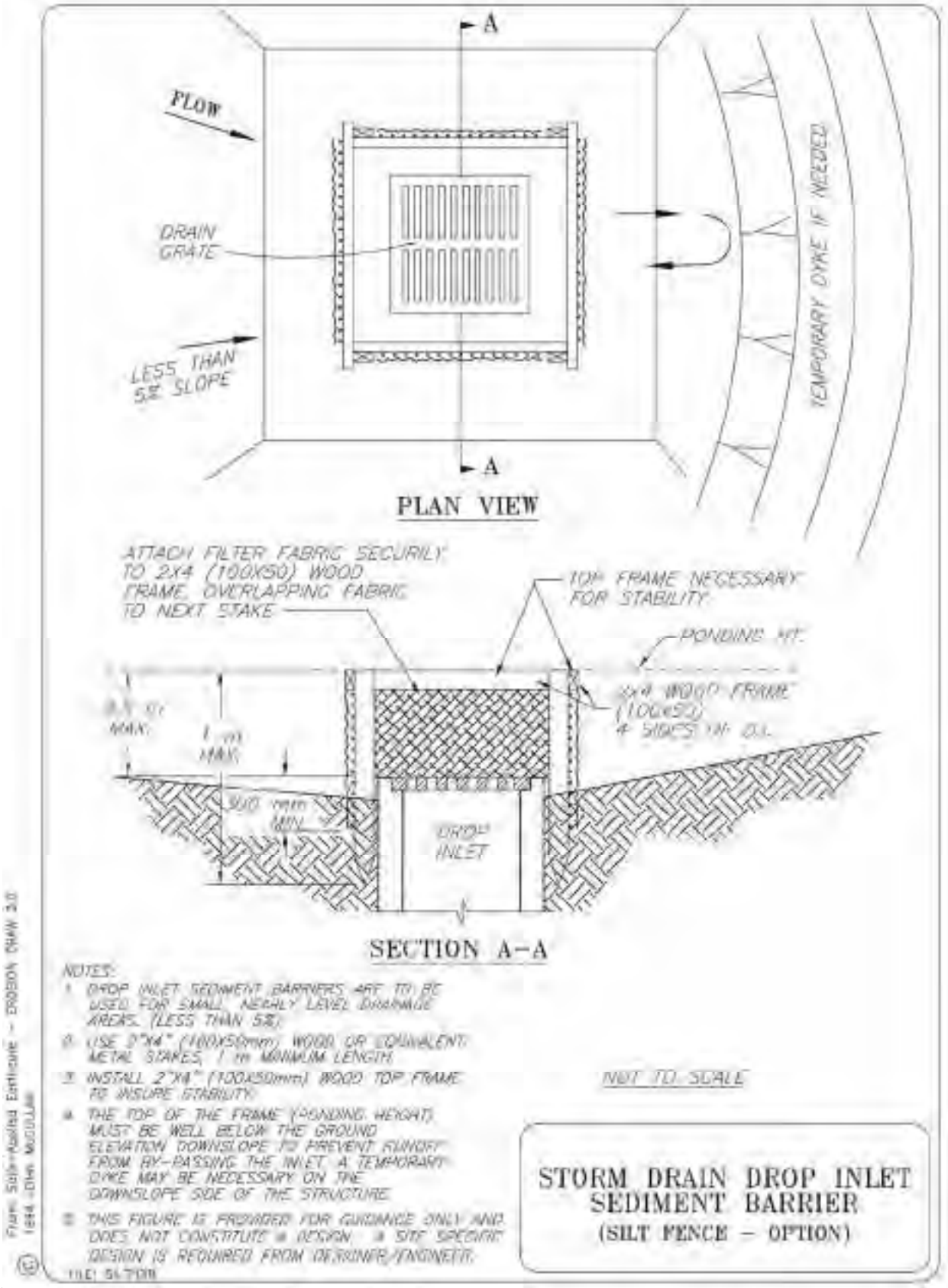
BMP25



Drain Inlet Sediment Barrier

Sediment Control:
Settling

BMP25



Continuous Berm

Sediment Control:
Settling

BMP26

Description and Purpose

- Constructed of sand or gravel-filled geotextile
- Used to divert and intercept sheet or overland flow
- May be used to form ponds and allow sediment to settle out

Applications

- Temporary measure
- May be used in place of silt fences to retain sediment on construction sites

Advantages

- Trenching not required as weight and flexibility of berm allows continuous contact with ground surface

Limitations

- Requires Continuous Berm Machine (CBM) for construction

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Use CBM to form berm a minimum of 2 m away from toe of slope to provide adequate ponding area on upstream side of berm
- Follow operating procedures for CBM
- Use of woven geotextile is preferred due to higher tensile strength and small deformation
- If required, 50 mm diameter (recommended) PVC drainage pipes may be inserted in downstream side of berm, spaced 100 to 150 mm apart, to facilitate drainage
- If required and appropriate, slits may be cut in upstream side of berm to facilitate filtering and drainage

Construction Considerations

- Berm constructed of sand, aggregate, or other pervious soil encased in geotextile fabric
- Maximum berm height is approximately 0.4 m
- Higher permeability fill materials should be used in ‘drainage chambers’ in low areas

Inspection and Maintenance

- Minimal maintenance is required
- Inspect berms on a weekly basis and before and after significant rainfall events (1:2 year storm and/or 40 mm rainfall over 24 hour duration)
- Inspect for sediment accumulation and remove sediment when depths reach approximately one-third the berm height
- Inspect for toe undermining, weathered/deteriorated filter fabrics, and end runs and erosion of the filter and repair immediately
- Damaged sections may be repaired by restapling or placing another section of continuous berm upstream of the damaged section to provide seal-off
- Removal of berm is accomplished by splitting the berm, spilling fill material and removing fabric

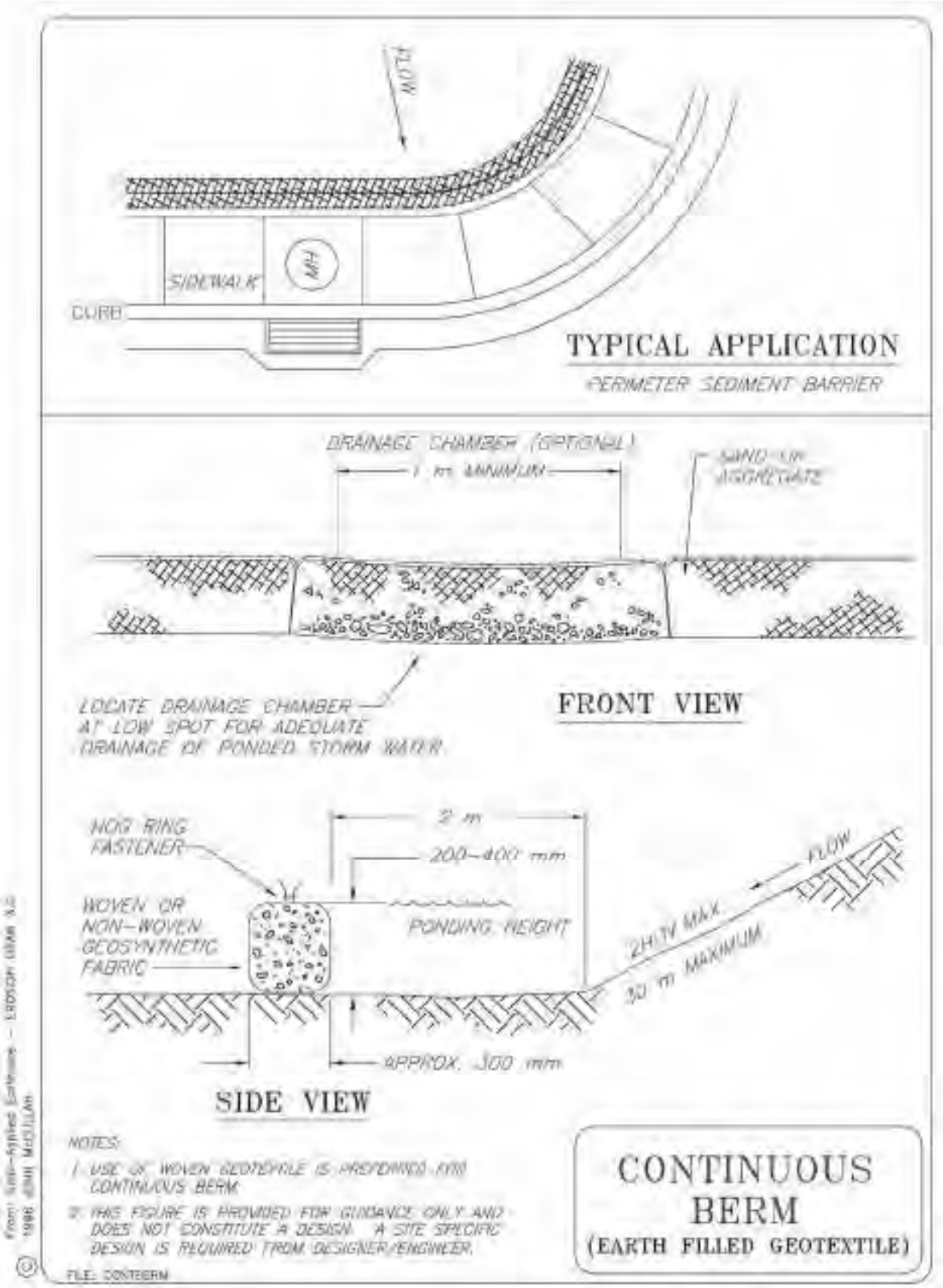
Similar Measures

- Berms/barriers
- Sand/gravel bag barriers

Continuous Berm

Sediment Control:
Settling

BMP26



Earth Dyke Barrier

Sediment Control:
Settling

BMP27

Description and Purpose

- Barrier constructed of compacted soil to intercept and divert flow of runoff water away from sensitive areas or water bodies
- May require a spillway outlet of erosion-resistant granular material constructed to allow exit of diverted water to less sensitive areas.

Applications

- Temporary or permanent measure
- Used instead of (or in conjunction with) diversion ditches
- Placed along contours at toes of slopes to divert runoff from sensitive areas
- Used to divert water to sediment control structures

Advantages

- Easy to construct
- Can be converted to sediment basin or trap with the design of a permeable filter berm at the exit spillway area

Limitations

- Generally, an earth dyke barrier can be 1 to 2 m in height. Design by a geotechnical engineer is required for barriers greater than 3 m in height in accordance with dam design guidelines and regulatory requirements. The consequences of failure will influence the level of design and construction requirements.

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Construct barrier from bottom up by placing and compacting subsequent lifts of soil
- Degree of compaction of each lift to be determined by the design engineer based on consequences of failure

Construction Considerations

- The barrier shall be trapezoidal in section
- Low barriers should have the slopes tailored to the construction material used
  - 1.5H:1V for granular soils (predominantly gravel)
  - 2H:1V or flatter for compacted mixed or fine grained soils
  - Slope should be a minimum of 3H:1V for uncompacted fine grained soils

Inspection and Maintenance

- The degree and extent of inspection and maintenance performed on an earth dyke barrier is directly related to the consequences of failure. Depending on the consequences of failure, an engineer experienced in embankment design and inspection may be required for inspection, design of remedial measures and supervision of their implementation.
- Inspect barriers on a weekly basis and before and after significant rainfall events (1:2 year storm and/or 40 mm rainfall over 24 hour duration)
- Piping failures may be remedied by replacing saturated soils with drier compacted soil and/or by placement on the failed area of a stabilizing toe berm constructed of granular materials over non-woven geotextile
- Inspect for sediment accumulation and remove sediment when depths reach approximately one-half the barrier height
- Deactivate and remove barrier once soils upslope have stabilized and return barrier location to conditions that are equivalent or better than prior to barrier construction

Similar Measures

- Continuous berms
- Sand/gravel bag barriers

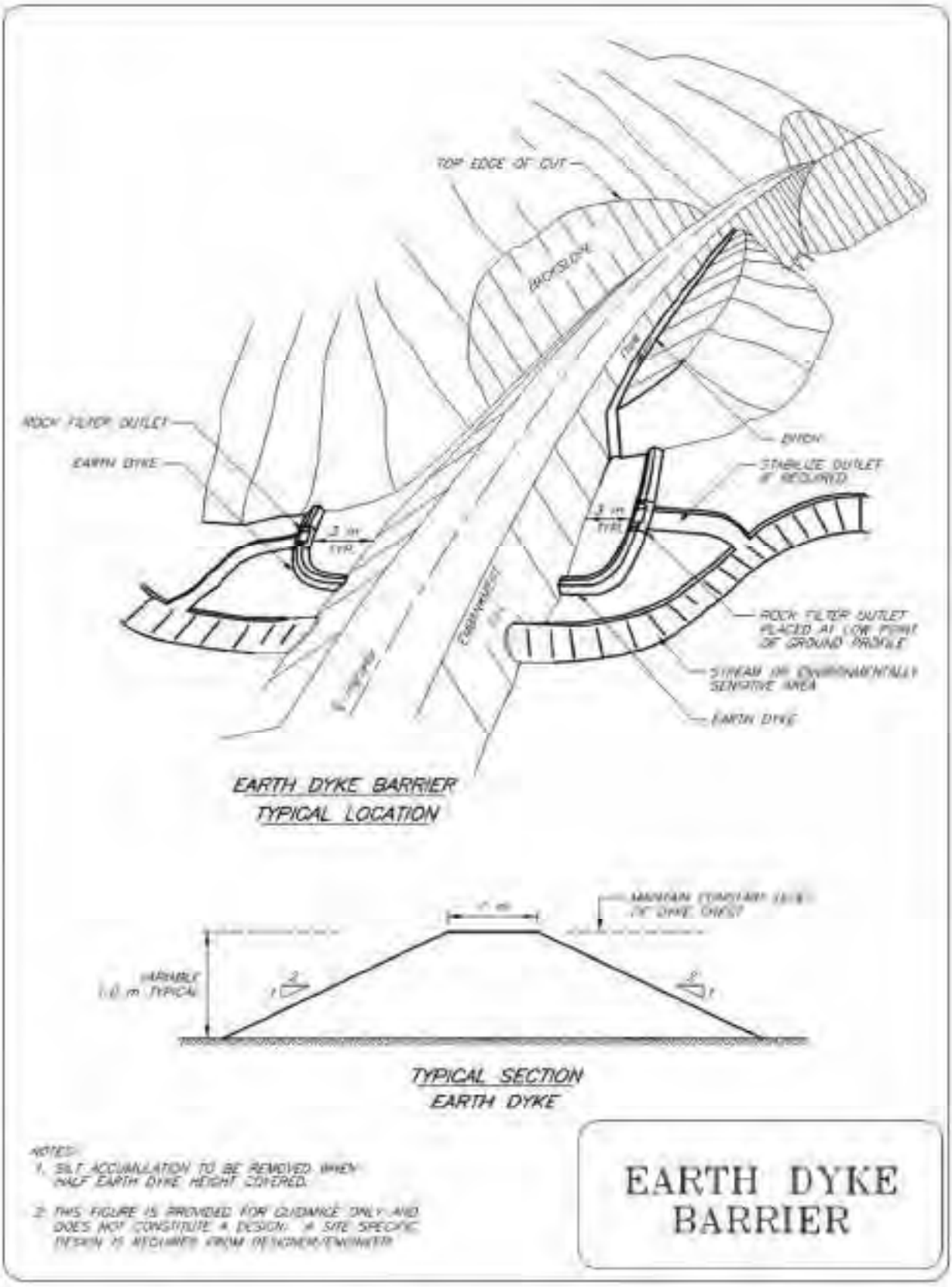
Design Considerations

- Geotechnical design required for barriers constructed of fine grained soils and greater than 3 m in height

Earth Dyke Barrier

Sediment Control:
Settling

BMP27



Sediment Traps and Basins

Sediment Control:
Settling

BMP28

Description and Purpose

- Low height dam enclosure for impoundment of sediment laden storm water, sedimentation and release of treated runoff
- Used to trap sediment laden run off and promote settlement of sediment prior release
- Constructed by excavating a pond or building embankments above the original ground surface
- Sediment traps and basins can be divided by size of pond impoundment enclosure
  - Basin (Type I) for pond area $\geq$500 m^2
  - Trap (Type II) for pond area $\leq$500 m^2

Applications

- Temporary (for construction period) or permanent measure
- Used at terminal or selected intermediate points of concentrated runoff for impoundment of runoff and sedimentation of silt prior to release of treated runoff
- Used as a sediment control measure at outlets from construction sites where runoff may enter watercourses, storm drains, or other sensitive areas
- Used where there is a need to impound a significant amount of sediment from significant areas of land disturbance
- Removal of small diameter particles may require use of flocculants. This should be done with caution to prevent adverse effects on aquatic life
- Sediment basins (Type I) used for disturbed drainage areas greater than 2.0 ha
- Sediment traps (Type II) used for disturbed drainage areas of 2.0 ha or less
- Where practical, contributing drainage areas should be subdivided into smaller areas and multiple sedimentation impoundment installed

Advantages

- High capacity of runoff impoundment and more efficient means of sedimentation necessary along perimeters of construction sites with high risk sensitive environmental areas and watercourses
- Sediment can be cleaned out easily
- Robust
- Can be deactivated easily by breaching the enclosure dyke

Limitations

- Requires specialized design by qualified personnel
- Sediment traps and basins do not remove 100% of the sediment; net efficiency for sedimentation of silt may be around 50% dependent on design
- Anticipated service life of 3 years or longer due to possible clogging of outlets in the long-term

- Sedimentation traps and basins with a riser outlet should have an auxiliary spillway with adequate erosion protection to permit overflow in the event that the riser pipe outlet clogs during a storm event
- For drainage areas greater than 40 ha, multiple basins may be required
- Efficiency of sedimentation is very dependent on surface area; sediment basins require large surface areas to permit settling of sediment
- Fences and signage may be required to reduce danger to the public
- May provide breeding habitat for mosquitoes and other pests
- Sediment traps only remove medium and large diameter silt particles and upstream erosion or sediment control measures are required to reduce the amount of sediment laden to the runoff at downstream sensitive areas
- Periodic removal of accumulated sediment is required

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- The consequences of failure for any water retaining structure will determine the level of effort in the design and construction phases. The construction guidelines presented herein are minimum requirements. A geotechnical engineer should design water retaining structures if warranted by the consequences of failure
- All footprint areas for embankment dykes should be stripped of vegetation, topsoil, and roots to expose a mineral soil subgrade
- Embankment fill material should be clean mineral soil with sufficient moisture to allow proper compaction
- Fill should be placed in lifts not exceeding 150 mm in compacted thickness and should be compacted to a minimum of 95% Standard Proctor maximum dry density (SPD)
- The main outlet structure should be installed at farthest possible point from inlet
  - The outlet should be placed on firm, smooth ground and should be backfilled to 95% SPD
  - Proper inlet and outlet protection should be installed to protect from scour
  - The outlet pipe should consist of corrugated steel pipe to protect against pinching and blockage
- The embankment should be topsoiled, seeded or protected with gravel or riprap immediately after construction
- Construct an emergency spillway to convey flows not carried by the principal outlet
  - The emergency spillway should consist of an open channel (earth or vegetated) over native undisturbed soil (not fill)
  - If the spillway is elevated, it should be constructed of rip rap
  - The spillway crest should be depressed at least 0.15 m below embankment

Construction Considerations

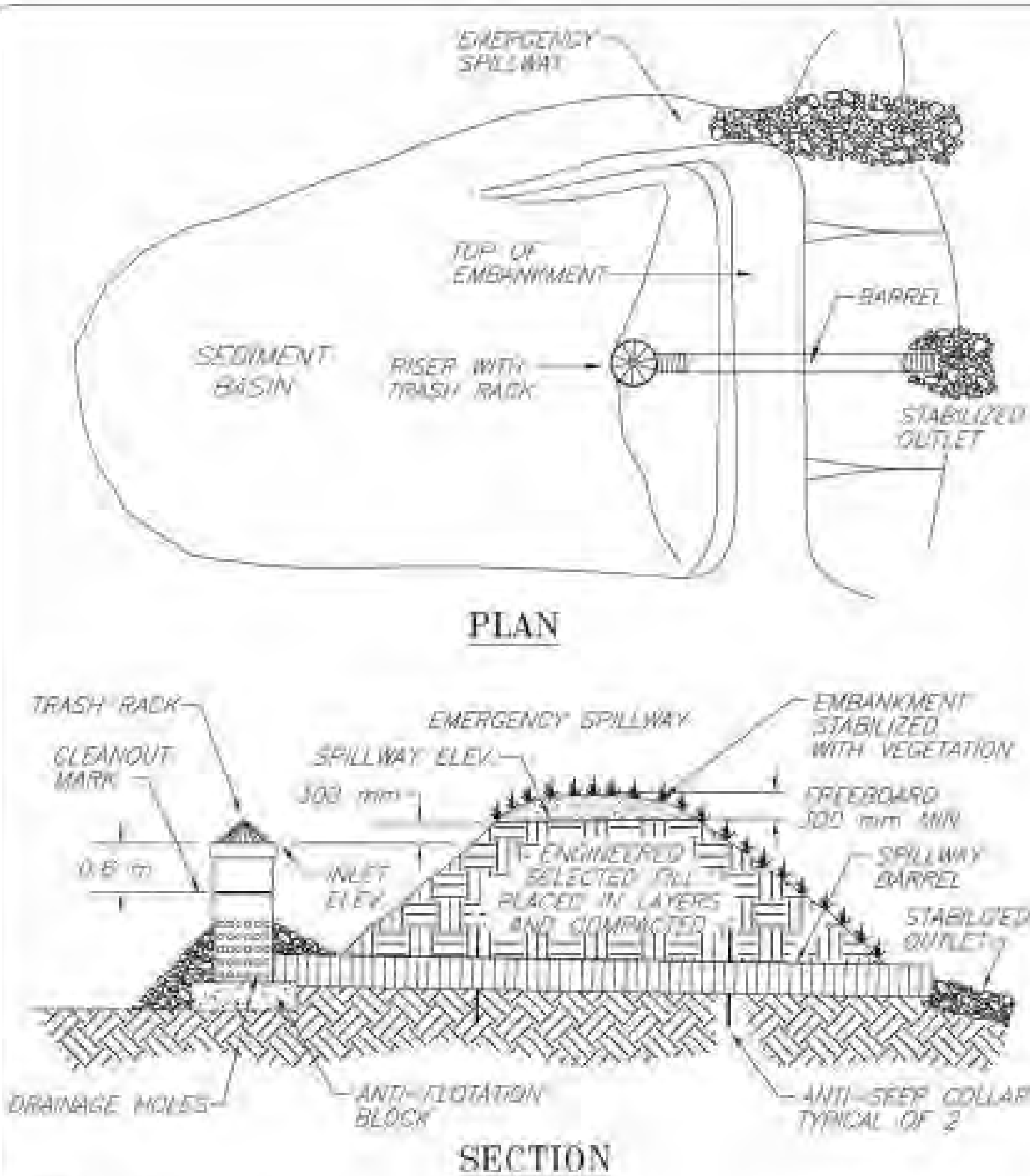
- It is preferable to strip to mineral soil only along the footprint area required for dyke construction; the pond floor centre area can be left cleared but unstripped
- The pond can be constructed by excavating, constructing embankments, or a combination of the two methods
- Baffles should be provided to prevent short-circuiting of flow from inlet to outlet. The optimum ratio of flow length to flow width is 5:1
- Construct sediment ponds and basins at the construction site perimeter prior to wet season and construction activities
- Sediment pond/basin bottom should be flat or gently sloping towards outlet
- Dyke slopes should not be steeper than 2H:1V and should be well-compacted
- Basins should be located where:
  - Low embankment can be constructed across a swale or low natural terrain
  - It is accessible for maintenance work, including sediment removal

Inspection and Maintenance

- Regular inspection is required to identify seepage, structural soundness, outlet damage or obstruction and amount of sediment accumulation
- Inspections should be performed weekly and after significant storm events (1:2 yr storm and/or 40 mm rainfall in 24 hours)
- Sediment should be removed upon reaching 1/2 height of the containment berm or within 0.4 m of crest of embankment
- Sediment traps may be deactivated or removed after vegetation of previously disturbed upstream areas has been established

Design Considerations

- The design can use a riser outlet option or a permeable rock berm outlet option. The permeable rock berm outlet option is recommended for most applications
- Minimum particle size for rock rip rap shall be 200 mm
- If the design of a riser outlet is utilized
  - Main outlet pipe shall be fabricated from corrugated steel pipe conforming to CSA standard CAN 5-G401-M81 or the latest revision thereof
  - Outlet pipe shall consist of a horizontal pipe welded to a similar vertical riser at a 45° mitre joint
- Close to the base of the riser pipe, a 100 mm diameter hole shall be fabricated and a mesh with 12 mm square openings tack welded over the hole as a screen
  - A similar hole shall be provided along the riser pipe immediately above the elevation of the maximum sediment buildup (usually 0.4 m below crest of embankment)



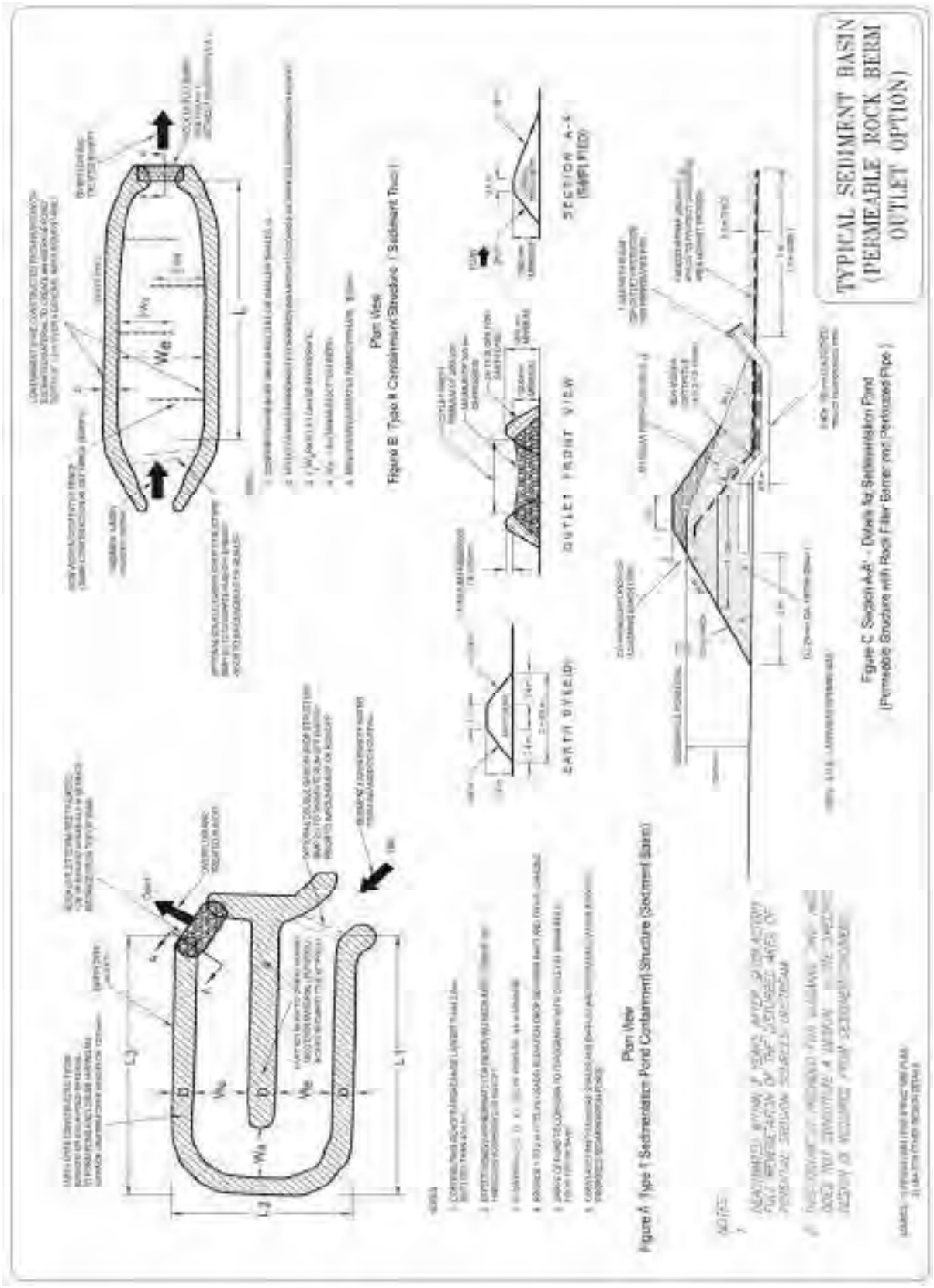
NOTES:

1. THE TEMPORARY SEDIMENT BASIN, DESIGNED BY A QUALIFIED PROFESSIONAL, IS REQUIRED FOR DISTURBED AREAS GREATER THAN 2.02 HECTARES (5 ACRES), WITH A DRAINAGE AREA LESS THAN 40.4 HECTARES (100 ACRES).
2. THE SEDIMENT BASIN MAY BE REMOVED WITHIN 2 YEARS.
3. HEIGHT OF ENGINEERED SELECTED FILL EQUAL TO 1 m.
4. FOR CONFIGURATION AND FLOW CHAMBER DESIGN (i.e. LENGTH(L) & WIDTH(W_e) OF BASIN), REFER TO NEXT PAGE.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

FILE: SEDBASIN

TYPICAL SEDIMENT BASIN (RISER OUTLET OPTION)

From: Soils-Applied Earthware — EROSION DRAW 3.0
1994 JOHN McCULLAH


TYPICAL SEDIMENT BASIN
(PERMEABLE ROCK BERM
OUTLET OPTION)
Figure B Type II Containment Structure / Sediment Trap
Plan View
OUTLET FRONT VIEW
SECTION A-A
(EMPTIED)
EARTH DYKE(S)
Figure C Section A-A' - Dykes to Sedimentation Pond
(Permeable Structure with Rock Filter Berms and Perforated Pipe)
Figure A Type I Sedimentation Pond Containment Structure (Sediment Basin)
Plan View

Storm Sewer Protection

Sediment Control:
Settling

BMP29

Description and Purpose

- Temporary modifications to storm sewer barrels to minimize the amount of sediment transported downstream through the storm sewer system
- Modifications may include:

  - Sealing of manhole and catchbasin inlets
  - Providing sediment controls at manhole and catchbasin inlets
  - Providing deep sumps in manhole and catchbasin barrels
  - Installing weirs at manhole and catchbasin outlets

Applications

- Temporary measure
- Used where storm drains are operational prior to establishing vegetation on disturbed drainage areas
- Can be effective where drainage enters municipal sewers or watercourses

Advantages

- Additional form of sediment control to prevent downstream transport
- Best suited to new developments

Limitations

- May reduce local capacity of storm sewer system
- Frequent removal of sediment may be required for high flow situations
- Temporary measures must be removed when storm sewer is expected to be fully functional

Construction

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Inlet sediment control is addressed in BMP25
- The storm sewer designer and owner should be consulted to determine design criteria for barrel sump or weir measures

Construction Considerations

- If flow cannot be accommodated by the storm sewer, ensure that surface flows are adequately managed

Inspection and Maintenance

- Inspect BMPs at least once a week and before and after each significant rainfall event (1:2 year storm and/or 40 mm in a 24 hour period)
- Remove sediment build up after each storm event. Sediment and gravel should not be allowed to accumulate on roads
- Remove all inlet protection devices when inlet protection is no longer required
- Remove all barrel sump or weir measures when the storm sewer is required to be fully operational

Pumped Silt Control Systems

Sediment Control:
Filtration

BMP30

Description and Purpose

- Sediment is extracted by pumping sediment laden runoff into a bag manufactured from a permeable geotextile. Water will filter through while sediment is retained within the filter bag

Applications

- Temporary measure
- Can be used in high risk areas to supplement performance of containment pond systems
- An example area would be where containment pond space is limited on construction site and appropriate sized containment pond cannot be constructed adjacent to high risk areas
- Useful for additional extraction of sediment dewatering sumps, sediment ponds, or other retention facilities with accumulations of sediment laden runoff

Advantages

- Filter bag is lightweight and portable
- Simple cleanup and disposal
- Sediment is captured within filter bag for removal from site

Limitations

- May be expensive: extra costs are associated with cost of filter bags and costs of pumping out retention facilities
- Power supply for pumps may be required
- Useful for only short periods of time and small volumes of water
- Refer to manufacturers' product performance information
- Can only retain particle sizes larger than the Apparent Opening Size (AOS) of the filter fabric bag
- Generally for available non-woven filtration geotextile, AOS values of 0.15 mm range or lower can be realistically manufactured. It is important to require manufacturer to provide performance specification and physical properties of the bags. The designer and supplier of the filter bag should choose the fabric and AOS based on the anticipated gradation of the sediments.
- Generally only suitable for use as an emergency measure for highly sensitive sites

Pumped Silt Control Systems

Sediment Control:
Filtration

BMP30

Implementation

(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

- Place filter bag on free-draining base (such as gravel pad or straw pile) on a slight slope, with opening to silt bag facing upslope
- Attach hose to opening of filter bag, and ensure a tight seal to prevent discharge of sediment laden runoff outside of bag
- Attach hose to pump and insert extraction hose into retention facility to be dewatered
- Turn on pump and remove sediment laden water until the filter bag is full of sediment
- Disengage pump once the filter bag is full, tightly close the filter bag opening to prevent spilling of sediment and remove the bag
- Repeat the process (using new filter bags) until the retention facility is dewatered to acceptable levels

Implementation Considerations

- Full filter bags can be removed from site or buried in designated locations on-site
- Care should be taken to ensure filter bag is not overfilled, which may cause it to tear and spill sediment
- Care should be taken when transporting full filter bags to prevent tearing

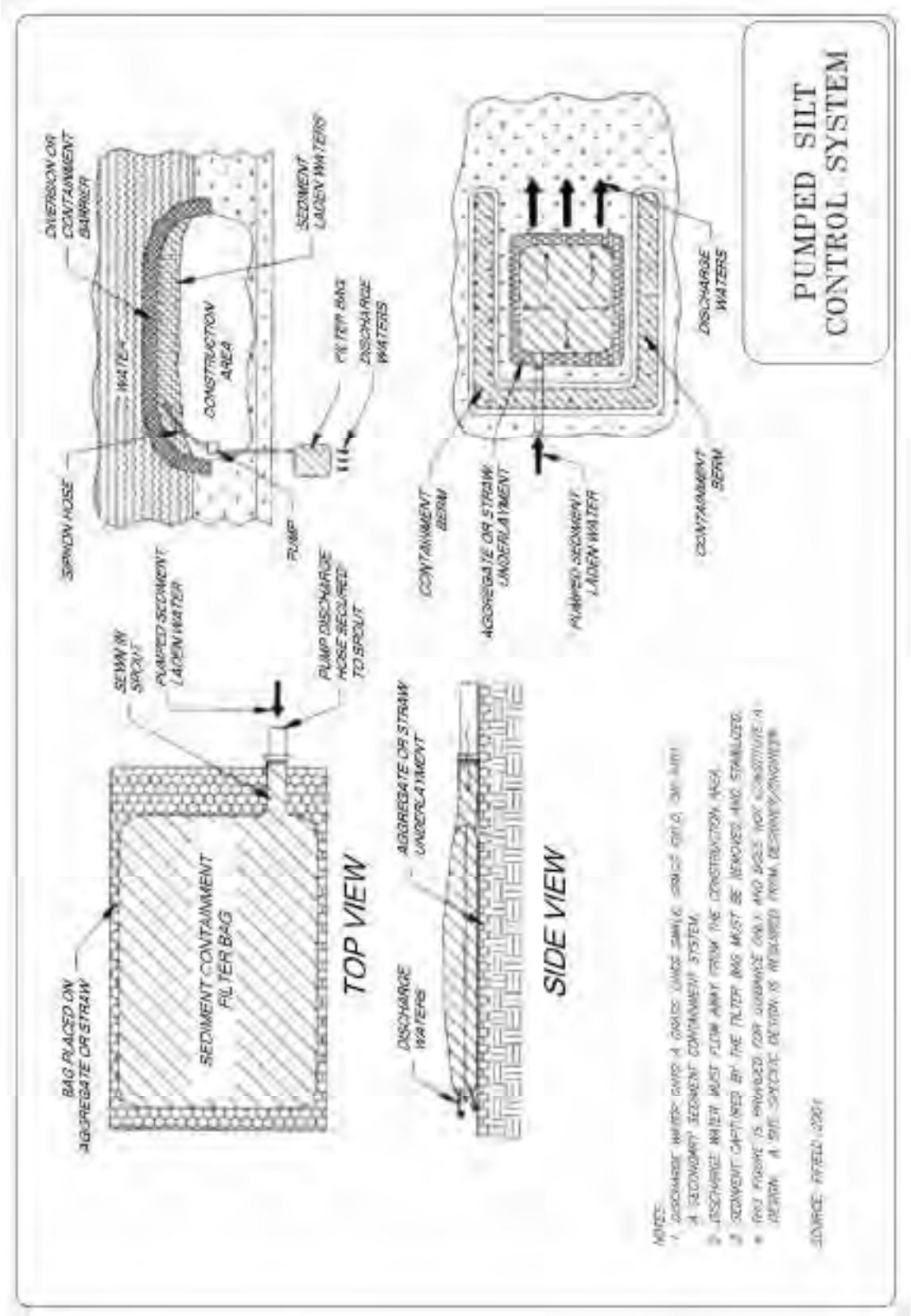
Inspection and Maintenance

- Inspect all hoses and connections before and during pumping operations to minimize leaks

Pumped Silt Control Systems

Sediment Control:
Filtration

BMP30



APPENDIX C.

ENVIRONMENTAL INCIDENT REPORT

ENVIRONMENTAL INCIDENT REPORT FORM

Date of incident: Approximate time of incident: Weather:

Location of Incident:

Detailed description of incident, events and causes:

Persons involved in the incident:

Person(s) contacted/notified (Contractor, Town of Ladysmith, EM, etc.):

Emergency Management BC notified?
EMBC case #:

Department of Fisheries and Oceans notified?
Name of officer:

MOE or MoF Notified?

Potential Environmental Impacts:

Mitigation and/or Clean-up Efforts:

Name and signature:

APPENDIX D.

GENERIC SPILL RESPONSE PLAN

Spill Response Plan

If a spill of fuels, oils, lubricants or other harmful substances occurs, the following procedures are to be implemented.

Response Steps

1. ENSURE SAFETY 2. STOP THE FLOW (if possible) 3. SECURE THE AREA
4. CONTAIN THE SPILL 5. NOTIFY/REPORT (PEP 1-800-663-3456) 6. CLEAN-UP

1. ENSURE SAFETY

- Ensure Personal/Public and Environmental Safety
- All onsite personnel wear appropriate Personal Protective Equipment (PPE)
- Determine the product spilled and circumstances before taking action
- Warn people in the immediate vicinity
- Ensure no ignition sources if spill is a flammable material

2. STOP THE FLOW (if possible)

- Close valves, shut off pumps or plug holes/leaks
- Stop the flow or the spill at its source
- Use appropriate response materials in spill kits if applicable

3. SECURE THE AREA

- Limit access to the spill area
- Prevent unauthorised entry onto the site

4. CONTAIN THE SPILL

- Block off and protect drains and culverts
- Prevent spilled material from entering drainage structures
- Use spill sorbent material to contain the spill
- If necessary, use a dyke or any other method to prevent any discharge on site
- Make every effort to minimize contamination

5. NOTIFY/REPORT

- Notify site supervisor, EM, and Town of Ladysmith
- When necessary, the first external call should be made to:
  Emergency Management BC (EMBC) 1-800-663-3456

5. CLEAN UP

- Clean up spill according to applicable regulations and best management practices
- Once clean up has occurred, confirmatory soil sampling may be necessary depending on the nature of the incident to verify appropriate clean up and remediation has occurred.

APPENDIX E.

ARCHAEOLOGICAL RESOURCES: CHANCE FIND MANAGEMENT GUIDELINES

Archaeological Resources: Chance Find Management Guidelines

Chipped stone flakes and core artifacts

Fire altered rock

Waterlogged basket (cleaned)

Shell midden deposits

INTRODUCTION

The BC Ministry of Transportation and Infrastructure (MOTI) is committed to the responsible management of heritage sites within its project sites. The intent of this document is to provide MOTI's Contractors and staff working in the MOTI South Coast Region with guidelines for the appropriate response to the discovery of known or suspected heritage sites during construction activities. The objective for providing this information is to minimize disruption to the activity while promoting the preservation and proper management of heritage sites.
The following sections:

1) Describe the provincial heritage regulatory framework;
2) Present step-by-step guidelines for heritage site chance find management, including a procedure for the identification, treatment and management options for human remains;
3) Identify the limitations of the Chance Find Management Guidelines; and,
4) Provide a list of heritage management contacts to be notified in the event that confirmed or suspected heritage resources are encountered during construction activities.

BC REGULATORY FRAMEWORK

Heritage sites in British Columbia are managed in accordance with the *Heritage Conservation Act* (RSBC 1996, c. 187). Section 12 of *the Heritage Conservation Act* (HCA) specifies that an individual (or corporation) must not damage, excavate, dig in or alter, or remove any heritage object from a heritage site, except in accordance with a permit issued by the Minister. The HCA confers automatic protection upon all heritage sites that pre-date AD 1846, regardless of whether they are recorded in the Provincial Heritage Register, and regardless of whether they are located on Crown land or private property. Certain sites, including human burials and rock art sites with heritage value, are automatically protected, regardless of their antiquity.

It's important to note that all archaeological sites, regardless of their condition, are protected by the HCA and that it does not distinguish between "intact" (i.e., those sites which are in a pristine, or undisturbed state) and "disturbed" (i.e., those sites which have been subject to alteration, permitted or otherwise) sites. Post AD 1846 historical heritage sites can be protected by Provincial Ministerial Order or Designation by an Order-in-Council.

GUIDELINES FOR CHANCE FIND MANAGEMENT

Step 1: If known or suspected archaeological materials or features are encountered, stop activity within 30 m of the find and secure the area. Suspected archaeological material (including excavated materials) should not be moved, removed or altered prior to inspection by a qualified archaeologist (unless necessary to address a site safety risk).
Step 2: Inform the Ministry Representative for your project.
Step 3: Stake or flag the site.
Step 4: The Ministry Representative will seek further direction from the Project Archaeologist. If the Project Archaeologist cannot be reached, the Ministry Representative will call the MOTI Environmental Coordinator. (contacts on next page).

Note: Based on the nature of the incident, it may be determined that there are no further concerns and activities may continue, or further assessment or mitigation may be required. See Management Options.

MANAGEMENT OPTIONS

In the event that an archaeological site is confirmed by the Project Archaeologist, discussions will occur between the Archaeology Branch, the contractor, First Nations, and the MOTI in order to select the appropriate management option*. First Nations will be informed within 24 hours. Options could include:

1) Avoidance through partial activity redesign or relocation. This results in reduced additional impact to the archaeological site and is the preferred option from a cultural resource management perspective and is the least expensive option. An archaeological impact assessment may be required to define site limits.
2) Application of temporary and/or permanent site protection measures as approved by the Archaeology Branch (e.g., fencing off the site, capping with soil). An archaeological impact assessment to identify site boundaries and archaeological monitoring to verify the effectiveness of protective measures may be required;
3) Archaeological mitigation consisting of controlled excavations or archaeological construction monitoring; and,
4) Monitoring of construction activities near the site by a professional archaeologist.

*A Site Alteration Permit under Section 12 of the HCA may be required prior to undertaking any of these options.

Bone and antler artifacts

CHANCE FIND – ANCESTRAL REMAINS

1) If suspected ancestral remains are encountered (either intact or disturbed), immediately stop construction activities, establish a 30m buffer and cover the suspected ancestral remains with a tarp.
2) Inform the Ministry Representative of the discovery;
3) The Ministry Representative will contact the Project Archaeologist; if the Project Archaeologist cannot be reached, the Ministry Representative will contact the MOTI Environmental Coordinator.
4) The Project Archaeologist will contact the Archaeology Branch, as well as First Nations with traditional interests in the areas within 24 hours.
5) While awaiting the Project Archaeologist to attend the site, the suspected ancestral remains must be guarded.
6) Do not undertake further work that could disturb the remains. This includes moving soil and/or spoil (unless necessary to address a safety risk);
7) The Project Archaeologist will visit the site with First Nations representatives;
8) If it is determined that the chance find is not archaeological in nature (i.e., forensic), the local policing authority and Office of the Coroner will be contacted by the Archaeology Branch;
9) If it is determined that the chance find is archaeological in nature (i.e. ancestral remains), discussions between the Archaeology Branch, First Nations, Project Archaeologist, Ministry Rep and the Contractor will identify appropriate follow up procedures including the appropriate treatment of the ancestral remains and reburial procedures.

LIMITATIONS

This document was prepared for the exclusive use of MOTI contractors for the specific application during investigation, construction and maintenance activities in MOTI's South Coast Region. Consistent with the intent of the *Heritage Conservation Act*, contractors are advised that if unanticipated cultural materials or features are encountered during investigation, construction or maintenance activities, all work in the immediate area should cease, and the guidelines for heritage site chance find management, as presented above, should be implemented. Should contractors have any concerns about archaeological deposits or human remains, an archaeologist should be contacted for direction. Note that although the HCA does not apply on federal land, these chance find procedures should be implemented.

CONTACTS:

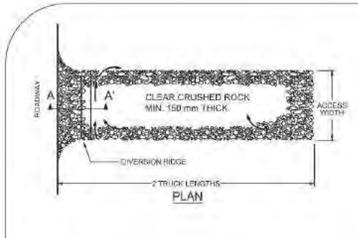
Ministry Representative / Project Manager: Michael Bateman
Tel: (778) 974-5339
Project Archaeologist: Patrick Dolan
Tel: (604) 664-3060
Archaeology Branch Reception:
Tel: (250) 953-3334 (daytime)

MOTI Environmental Coordinator: Joanne Letkeman
Tel: (236) 468-1984

SCHEDULE H - Erosion and Sediment Control Plan

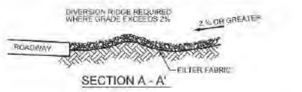
DP 3060-21-10

128 Rollie Rose Drive



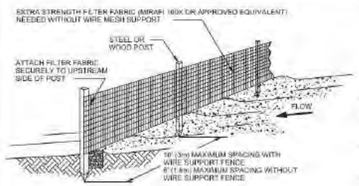
NOTES:
1. PLACE FILTER SOCK WITHIN CATCH BASINS WHERE WATER CAN SAFELY POND.
2. FILTER SOCK TO BE NON-WOVEN GEOTEXTILE FIBRT TO BIOLOGICAL DEGRADATION AND RESISTANT TO NATURALLY ENCOUNTERED CHEMICALS, ALKLIS AND ACIDS
3. INSPECT AND REMOVE ACCUMULATED SEDIMENT FOLLOWING EACH STORM EVENT.
4. DAMAGED FILTER SOCKS TO BE REPLACED IMMEDIATELY.

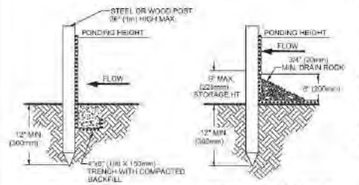
3. SILT SOCK



NOTES:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO ANY PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. IF THE ACCESS PAD ALONE IS INADEQUATE, WHEEL WASHING IS REQUIRED. THIS SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

1. GRAVEL ACCESS PAD





NOTES:
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" (225mm) MAXIMUM RECOMMENDED STORAGE HEIGHT.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

NOT TO SCALE

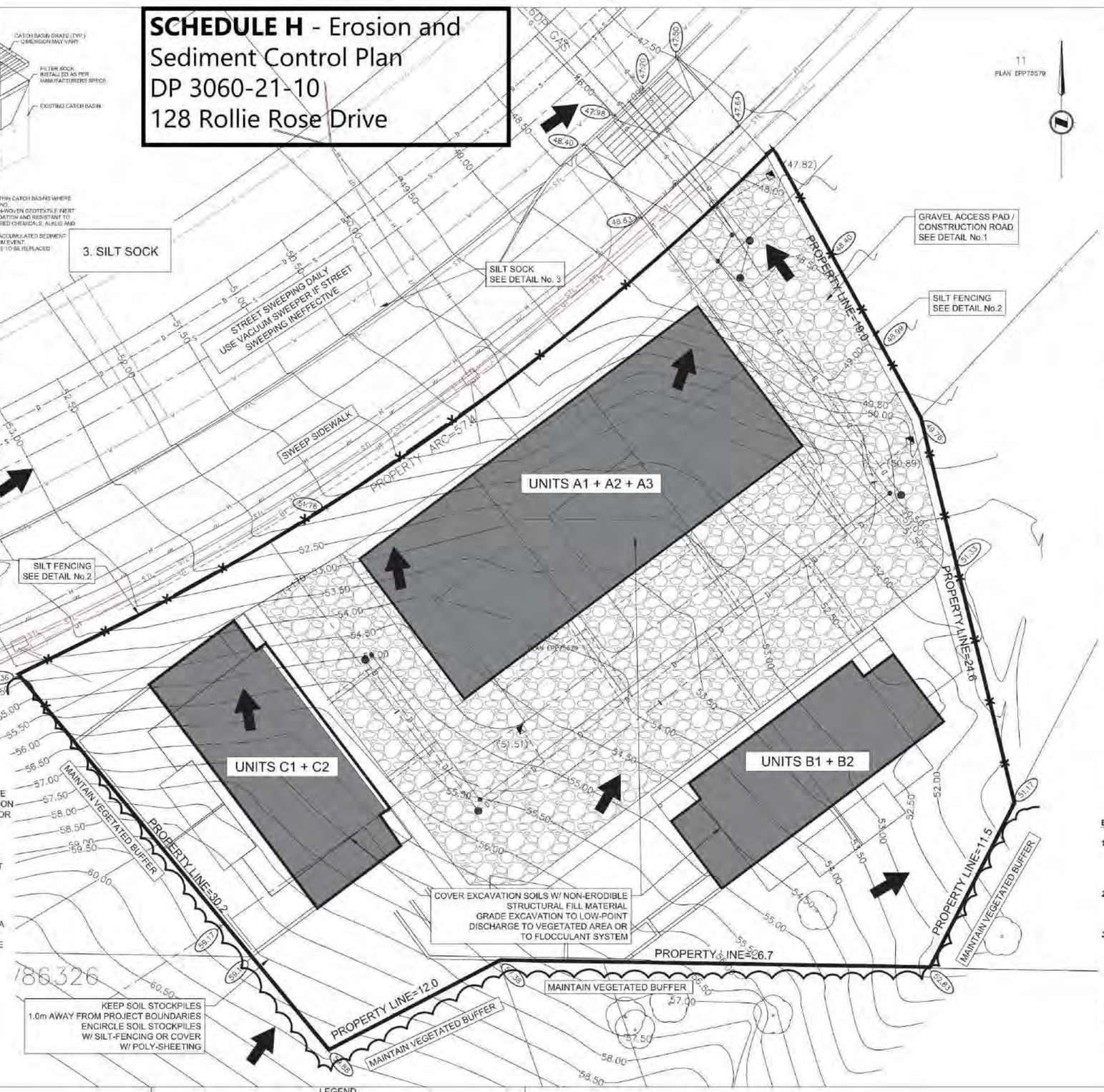
2. SILT FENCE

SEDIMENT CONTROLS (SC):

1. ***ACCESS PAD*** - CONSTRUCT AN ACCESS PAD TO REDUCE OFFSITE SEDIMENTATION. INSTALL PAD PRIOR TO USE OF HEAVY EQUIPMENT OR SITE GRADING OPERATIONS, AND MAINTAIN THE PAD THROUGHOUT CONSTRUCTION OPERATIONS. THE ACCESS PAD MAY BE REMOVED DURING PREPARATION FOR PAVING.
2. ***STREET SWEEPING*** - DURING CONSTRUCTION, USE STREET SWEEPING TO CLEAN STREET FROM SEDIMENT CAUSED BY CONSTRUCTION ON AN AS-NEEDED BASIS. DO NOT USE STREET WASHING AS IT CARRIES SEDIMENT INTO THE STORM DRAINAGE SYSTEM. SUMMER STREET SWEEPING ALSO REDUCES PROBLEMS OF WINDBLOWN DUST.

FLOCCULANT INJECTION SYSTEMS:

BASED ON THE EXPECTED DISCHARGE VOLUME WE (LEA) RECOMMEND THAT A BACKUP FLOCCULANT INJECTION SYSTEM BE ON SITE AT ALL TIMES. IF THE SUBJECT EXCAVATION THAT ARE SET TO DISCHARGE WATER OUTSIDE OF THE WORK AREA, BECOMES CONTAMINATED WITH SUSPENDED SEDIMENT, THEN USE OF THE FLOCCULANT SYSTEM WILL BECOME NECESSARY. AN EXTRA SUPPLY OF FOCCULANT AND A SPARE DEWATERING BAG SHOULD BE KEPT ONSITE AT ALL TIMES AS WELL.



GENERAL NOTES:

1. EROSION AND SEDIMENT CONTROL FOR THIS PROJECT WILL BE AS OUTLINED IN THE FISHERIES AND OCEANS CANADA AND MINISTRY OF WATER, LANDS AND AIR PROTECTION HANDBOOK ENTITLED "LAND DEVELOPMENT GUIDELINES FOR THE PROTECTION OF AQUATIC HABITAT, MAY 1992" AND "BEST MANAGEMENT PRACTICES FOR URBAN AND RURAL LAND DEVELOPMENT IN BRITISH COLUMBIA, JUNE 2004". IT IS INCUMBENT UPON THE CONTRACTOR TO ACQUIRE THESE GUIDELINES AND FAMILIARIZE THEM SELF WITH THE REQUIREMENTS THEREIN.
2. THE CONSULTANT ASSUMES NO RESPONSIBILITY FOR DAMAGES RESULTING FROM IMPROPER EROSION AND SEDIMENT CONTROL MEASURES UNDERTAKEN BY THE CONTRACTOR.
3. ANY DIRECTION GIVEN BY THE ENGINEER TO THE CONTRACTOR FOR EROSION AND SEDIMENT CONTROL AND NOT FOLLOWED BY THE CONTRACTOR WILL BE REPORTED TO THE TOWN OF LADYSMITH.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT NO MUD, DIRT, SOIL, SILT OR ANY OTHER SUBSTANCES ARE SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY, OR AREAS THAT LEAD TO CATCH BASINS CONNECTED TO PUBLIC SYSTEMS. THE CONTRACTOR IS TO CLEAN UP ANY SUCH MATERIAL IMMEDIATELY. STREETS ARE TO BE SWEPT WITH A VACUUM STREET SWEEPER AFTER WORK STOPPAGE EACH DAY.
5. PRIOR TO CONSTRUCTION, INSTALL A TEMPORARY GRAVEL ACCESS PAD TO LIMIT TRACKING OF SITE SOILS ONTO OFF-SITE ROADWAYS. THE WIDTH OF THE PAD SHOULD NOT BE LESS THAN THE FULL WIDTH OF POINT OF INGRESS OR EGRESS AND IN ANY CASE SHOULD NOT BE LESS THAN 6.0 m WIDE WITH A LENGTH OF NOT LESS THAN 20.0 m. THE GRAVEL PAD SHALL HAVE A MINIMUM THICKNESS OF 200 mm OF COARSE GRANULAR MATERIAL. 40 - 75 mm SHOT ROCK OR FRACTURED DRAIN ROCK UNDERLAIN WITH GEOTEXTILE FABRIC IS REQUIRED.
6. THE SITE ENTRANCE IS TO BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION. MAINTENANCE MAY INCLUDE THE PLACEMENT OF ADDITIONAL TOP DRESSING MATERIAL AS CONDITIONS DEMAND. A WHEEL WASH STATION SHOULD BE INSTALLED IF THE ACCESS PAD IS NOT WORKING. THE TEMPORARY ACCESS PAD MAY BE REMOVED DURING PREPARATION FOR PAVING.
7. PRIOR TO CONSTRUCTION, AREAS OF NO DISTURBANCE AND/OR VEGETATION TO BE RETAINED AND SHALL BE FENCED OFF AND/OR FLAGGED FOR PROTECTION. THESE MEASURES ARE TO REMAIN IN PLACE THROUGHOUT THE CONSTRUCTION PERIOD.
8. IF POSSIBLE, CLEARING AND GRUBBING OF THE SITE SHALL BE COMPLETED IN STAGES TO LIMIT THE DISTURBANCE AND POSSIBLE EROSION TO THE SITE.
9. THE CONTRACTOR IS TO GRADE THE SITE AND INSTALL DRAINAGE CONTROL MEASURES TO DIRECT SURFACE RUN-OFF TO ON-SITE SEDIMENT CONTROL POND(S) FOR DISPERSAL AND INFILTRATION.
10. IF GRADED AREAS WITHIN THE PROJECT WILL BE COMPLETED DURING THE WET SEASON (OCTOBER - APRIL), REVEGETATION AND/OR SURFACE EROSION MEASURES SHOULD BE CARRIED OUT WITHIN ONE WEEK OF GRADING COMPLETION.
11. SILT FENCING IS TO BE INSTALLED AROUND ALL STOCK/SPOIL PILES, OR PILES ARE TO BE OTHERWISE PROTECTED TO LIMIT EROSION.
12. THE CONTRACTOR IS TO CARRY OUT ROUTINE INSPECTIONS AND MAINTENANCE OF ALL EROSION AND SEDIMENT CONTROL SYSTEM COMPONENTS ON-SITE. AT A MINIMUM, THE CONTRACTOR SHALL INSPECT ALL BMP's WEEKLY AND PROVIDE A REPORT TO THE CONSULTANT FOR REVIEW.
13. DURING AND/OR FOLLOWING EACH SIGNIFICANT STORM EVENT, THE CONTRACTOR SHOULD OBSERVE THE SEDIMENT POND(S) AND / OR DOWNSTREAM STORM DRAINS TO CONFIRM THAT TURBID WATERS FROM SOURCES ASSOCIATED WITH CONSTRUCTION ARE NOT ENTERING THE STORM DRAINAGE SYSTEM. THE CONTRACTOR SHALL RECORD INSPECTION DATES C/W ANY SIGNIFICANT OBSERVATIONS AND ACTIONS TAKEN, AND THEN INFORM THE CONSULTANT AND TOWN OF LADYSMITH.
14. LEWKOWICH ENGINEERING ASSOCIATES (LEA) PERSONNEL WILL VISIT THE SITE TO ASSIST THE CONTRACTOR WITH THE IMPLEMENTATION OF THE ESCP DURING STORM EVENTS, AND TO PROVIDE INDEPENDENT ESCP REVIEW AND DOCUMENTATION. MODIFICATIONS TO THE ESCP, IF NECESSARY, WILL BE PROVIDED IN A WRITTEN MEMO FORMAT.

EROSION CONTROLS (EC):

1. ***RETAIN VEGETATION*** - PRIOR TO CONSTRUCTION, AREAS OF NO DISTURBANCE AND/OR VEGETATION TO BE RETAINED AND SHALL BE FENCED OFF AND/OR FLAGGED FOR PROTECTION. THESE MEASURES ARE TO REMAIN IN PLACE THROUGHOUT THE CONSTRUCTION PERIOD.
2. ***STOCKPILE PROTECTION*** - ALWAYS COVER STOCKPILES OF SILTY SOILS WITH A TARP OR PLASTIC SHEETING WHEN STOCKPILES WILL NOT BE USED WITHIN 2-3 DAYS, OR WHEN RAIN IS EXPECTED.
3. ***MULCHING*** - TO PREVENT AND CONTROL EROSION APPLY A THIN (25-50mm) LAYER OF ORGANIC/BIODEGRADABLE MATERIAL TO DISTURBED AREAS. THE MATERIAL SHOULD BE SPREAD UNIFORMLY AND BE FREE OF WEEDS AND COARSE MATTER, AIR DRIED AND APPLIED WITH A MULCH BLOWER, CHIP HANDLER OR BY HAND. THEN "TRACKED-IN" USING AN EXCAVATOR OR SUITABLE HEAVY EQUIPMENT.

RUNOFF CONTROLS (RC):

1. **SILT FENCING** - TO BE INSTALLED AS INDICATED ON THE DRAWING TO DIRECT TURBID WATERS TO SEDIMENT CONTROL FACILITIES.

REV No.	DATE	BY	P.Eng.	REVISION DESCRIPTION

LEGEND

DRAWING TITLE	EROSION AND SEDIMENT CONTROL PLAN
PROJECT NAME	128 ROLLIE ROSE DRIVE, LADYSMITH, BC
LEGAL DESCRIPTION	LOT 12, BLOCK 192, PLAN EPP75579, DISTRICT LOT 103, OYSTER LAND DISTRICT

ENGINEER'S SEAL	PLOT DATE	DRAWN BY	
PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA 45335 BRITISH COLUMBIA CANADA 2024-03-20	2024-03-18	LC	
	REVIEWED BY	SCALE	
	LC	AS NOTED	
EGBC PERMIT TO PRACTICE No. 1001802	PROJECT No.	DRAWING No.	
	E3072	E3072-01	

Lewkowich Engineering Associates Ltd.

APLIN MARTIN

ATTACHMENT - D

June 27, 2024

Our File: 23-8024

Town of Ladysmith
410 Esplanade, PO Box 220
Ladysmith, BC V9G 1A2

Attention: Julia Tippet:

Re: Site Rationale Letter for 128 Rollie Rose Drive, Ladysmith, BC

Dear Julia,

We are writing this letter to describe the development site and outline the request for a Development Variance Permit as set out on the Development Application Checklist.

The proposed development is to consist of seven (7) townhome units in three (3) separate buildings (Buildings A, B and C), with a footprint encompassing approximately 29.4% of the site area, which is within the permitted 33.0% site coverage. Building A would consist of three (3) units and would be set back from the property line along Rollie Rose Drive by 3.0m, on the north-west frontage, with entrances along the same frontage. Building C would consist of two (2) units and would also be setback 3.0m from the property line along Rollie Rose Drive but would be oriented almost perpendicular to Building A on the south-west frontage of the site. Building B would also consist of two (2) units and would be located on the south-east frontage of the site.

The seven (7) units are proposed to each have two parking spaces within an enclosed garage, with an additional two (2) visitor stalls on site outside the buildings, and four on street parking spaces available directly in front of the proposed development. The development also has seven (7) secured bicycle parking spaces as per Ladysmith requirements. The site will be accessible by vehicle through a proposed driveway on the north-east frontage of the development, which is a minimum width of 6.0m, with an onsite drive aisle between Building A and Building B of 8.0m in width, and a 6.0m wide drive aisle fronting Building C.

The site will be serviced to the existing Storm, Sanitary and Water Service Connections that were installed as part of the sub-division development on the north-east corner of the site.

Landscaping for the site will include aesthetically pleasing hardscaped areas consisting of pavers and hydra pressed slabs, while the softscape landscaped areas will include numerous shade trees and a large variety of shrubs mixed with groundcover and perennial plantings, taking advantage of the proposed stepped

retaining walls to create semi-private patio areas for Buildings B and C, and allowing for a beautiful front setback to complement the open front boulevard already in place.

Given the site grading and geometry constraints, the developer is requesting two (2) variances from what is permitted under the R-3-A zoning, as follows:

1. A variance in the front setback is being requested, reducing the setback from 6.0m to 3.0m.
2. A variance in the required buffer zone along the north-east property line, reducing it from 1.5m to 0.6m.

The above variances are being requested to maximise the utility of the site and provide homes for the growing population of the Town of Ladysmith, without incurring any negative impacts on the adjacent properties.

Front setbacks are generally required to minimize any conflict between offsite municipal infrastructure and private infrastructure, creating a more open feeling along a frontage for the public, and providing good sightlines for vehicular and pedestrian traffic. However, the frontage for this site is just over 8.0m wide from the PL to the gutterline, and approximately 5.5m wide from the PL to the gutterline of the on-site parking areas, and includes a Multi Use Pathway and a back boulevard for utilities, creating a pleasant open area along the Rollie Rose frontage, and given the site is on the outside edge of a curved road, the proposed buildings would not affect any sightlines.

Further to the above, reducing the front setback allows for additional distance from the environmentally sensitive area, placing any construction further from the SPEA boundary, and utilizing the existing driveway letdown location for site access allows for stepping of the retaining walls on the west frontage of the parcel, reducing the individual wall height and providing additional areas for plantings, improving the overall aesthetics of the site.

While the developer appreciates the importance of landscaped buffers, the positioning and grading of the driveway does not allow for the required 1.50m width for a landscaped buffer; the offsite letdown was completed previously as part of the subdivision works, and the steep driveway grading and special constraints to fit in the buildings does not allow for the buffer to widen along the Pl as the driveway continues onsite; the landscape architect is proposing supplementing the lack of a landscaped buffer with five (5) additional Maple trees along the southern portion of the site.

We trust this letter helps with the understanding of the proposed site development and provides clarity on why the requested variances should not have any negative implications for the development, the adjacent properties, and the public realm.

Yours truly,

APLIN & MARTIN CONSULTANTS LTD.

Prepared by:

Aird Garby, AScT, BC-CESCL
Project Coordinator

Reviewed by:

Scott Lewis, P.Eng.
Branch Manager

ABG:sal

STAFF REPORT TO COUNCIL

Report Prepared By:	Jake Belobaba, Director of Development Services
Reviewed By:	Allison McCarrick
Meeting Date:	December 17, 2024
File No:	5040-20
RE:	**Housing Needs Report and Consequential OCP Amendments**

RECOMMENDATION:

That Council:

1. Pursuant to sections 585.31 and 790(2) the *Local Government Act,* receive the December 17, 2024 report to Council as the Town's Interim Housing Needs Report;
2. Direct staff to publish the Interim Housing Needs Report to the Town's webpage pursuant to section 790(5) of the *Local Government Act*;
3. Having considered s. 475 of the *Local Government Act*, and in particular the matters set out in subsections (2)(a) and (b), resolve that:
    a. the Stz'uminus First Nation, is the only entity that is appropriate to consult in connection with "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190";
    b. consultation should be early but need not be ongoing;
    c. the consultation process described in the December 17, 2024 staff report to Council is sufficient in respect to the proposed Official Community Plan amendment; and
    d. staff be directed to refer "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No.2190 " to the Stz'uminus First Nation as set out in recommendation 3 for consultation in the manner described in the December 17, 2024 report to Council;

4. Give first and second readings to "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190";

5. Consider "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" in conjunction with the Town's Financial Plan, the Town's Liquid Waste Management Plan, and the Cowichan Valley Regional District Solid Waste Management Plan, pursuant to section 477(3) of the *Local Government Act*;

6. Consider "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" in conjunction with the Town's Interim Housing Needs Report and the housing

information on which the report is based, pursuant to section 473.1(2) of the *Local Government Act*;

7. Direct staff to refer "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" to School District 68 pursuant to section 476 of the *Local Government Act*; and

8. Pursuant to section 481.7(2) of the *Local Government Act*, review the Interim Housing Needs Report and "Town of Ladysmith Zoning Bylaw 2014, No. 1860" and resolve that further zoning amendments to meet the 20-year total number of required housing units are not necessary; and

9. Direct staff to proceed with scheduling and notification of a public hearing for "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw. 2023, No. 2190" pursuant to section 464(1) of the *Local Government Act*.

EXECUTIVE SUMMARY:

The purpose of this report is to introduce an interim and supplementary housing needs report pursuant to section 790 of the *Local Government Act* and consequential OCP amendments pursuant to section 473.1(5) of the *Local Government Act* for Council Consideration.

PREVIOUS COUNCIL DIRECTION:

Resolution	Meeting Date	Resolution
CS 2021-044	2021-02-16	That Council receive for information the Ladysmith Housing Needs Assessment Report.

INTRODUCTION/BACKGROUND:

In 2019 the *Local Government Act* was amended to require local governments to complete Housing Needs Reports. The legislation required a local government to complete Housing Needs Reports every five years. Requirements for Housing Needs Reports included projections for the number of housing units needed over a five-year period and "consideration" of the report when adopting or amending an OCP. The Town received its first Housing Needs Report on February 16, 2021.

In November of 2022, the Province enacted the *Housing Supply Act*. This act allows the Minister of Housing, after considering a municipality's housing needs report, and other pertinent information, to set housing targets for the municipality through a "housing target order". If the Minister determines housing targets are not being met, the Minister may appoint an advisor to review and report on the municipality's progress and issue directives to adopt or amend bylaws or issue permits. Detailed parameters for housing orders are outlined in the *Housing Supply Regulations*. The *Housing Supply Act* and regulations contain a list of "specified municipalities" which may be subject to housing target orders. The Town of Ladysmith is a specified municipality. To date, no housing target orders have been issued to the Town.

On May 2, 2023 the Town adopted it's new OCP. The housing projections in the OCP were based on the February 16, 2021 Housing Needs Report. Section 4 of Part 4 of the OCP reads as follows:

> "Ladysmith needs approximately 1,600 additional dwelling units by 2050 to accommodate housing needs for the projected population. This amounts to approximately 53 new residential units per year. However it is worth noting that current approved development – at the time of the writing of this OCP – already accounts for part of this supply. The land use plan in this OCP includes sufficient land to accommodate projected housing demand."

Following adoption of the OCP, zoning changes were made to implement it. These included:

- Bylaw 2140, adopted on July 4, 2023 to allow suites in duplexes and townhouses.
- Bylaw 2163, adopted on January 9, 2024, which consolidated the Live/Work Residential (R-2-LW) and parts of the Service Commercial (C-3) zone into the Downtown Commercial (C-2) zone and increased the allowable density and height in the C-2 Zone.
- Bylaw 2187, a companion bylaw to Bylaw 2186, adopted on September 3, 2024 expanded the range of uses and increased the permitted density in "Old Town".

In the fall of 2023, the Province passed the *Housing Statutes (Residential Development) Amendment Act* which mandated that municipalities allow Small Scale Multi Unit Housing (SSMUH) through their zoning bylaws. The Town made these changes on June 27, 2024 with the adoption of Bylaw 2186. The Town's "restricted zones" now allow up to four units per parcel in various forms[1]. However, the Town applied for "extensions" in areas where infrastructure cannot accommodate SSMUH and most of these extension requests were approved by the Province on September 16, 2024[2].

Table 1 provides a summary of the net potential impact (i.e. potential housing units) of the OCP and SSMUH implementation bylaws noted above.

[1] See the June 27, 2024 report to Council for more information.

[2] See the May 14, 2024 report to Council and Item 11.1.4 of the October 15, 2024 Council meeting agenda for more information

Table 1: Net Impact of Recent Zoning Changes on Housing Supply

Zones	Total Developable Area (m2) [3]	Floor Space Ratio (FSR) [4]	Total Parcels	Max. Potential Buildable Floor Area (m2) [5]	Approximate Max. buildout of units[6]
Previous Zoning					
R-2-LW	46,518	n/a	78	30,420	156
C-2	73,947	1.0	114	73,947	555[7]
C-3	5,339	0.5	7	2,670	0 [8]
R-2	597,988	n/a	835	325,650	1,670
R-2-A	101,405	n/a	93	36,270	186
RU-1	7,578	n/a	2	n/a	4
R-1	1,712,619	n/a	1,707	n/a	3,414
R-1-A	69,673	n/a	114	n/a	228
R-1-B	88,710	n/a	184	n/a	368
R-1-C	11,613	n/a	21	n/a	21
R-1-HCA	52,051	n/a	76	n/a	152
R-2-B	13,521	n/a	27	n/a	54
C-1	3,479	0.5	5	1,740	10
Total	**2,784,442**	**n/a**	**3,263**	**470,696**	**6,818**
New Zoning					
C-2 Zone: 1st Avenue[9]	15,609	3.0	32	46,827	334
C-2 Zone: Other Streets[10]	110,195	3.3	167	363,644	2,600
R-2	699,392	1.3	928	909,210	6,494
RU-1	7,578	n/a	2	n/a	8
R-1	1,712,619	n/a	1,707	n/a	6,828
R-1-A	222,047	n/a	395	n/a	1,580
R-2-B	13,521	n/a	27	n/a	108
C-1	3,479	n/a	5	5,763	41
Total	**2,784,441**		**3,263**	**1,325,443**	**17,993**
Net Increase in Potential Units					**11,176**

There is also existing zoning capacity in other residential zones including Comprehensive Development Zones, the Waterfront Area Plan Area and the R-3-A and R-3 zones. Table 2 summarizes residential development capacity in other residential zones.

[3] Includes all parcels with the specified zoning and excludes road right ways etc.
[4] The FSR specified in the zoning, if any
[5] The total floor area that can be built based on parcel area and zoning floor area limits.
[6] Estimated number of units based on unit and/or FSR limits. Where no unit limits apply an average unit size of 140m^2 (1,500 sqft) is used
[7] Based on previous Unit Per Hectare (UPH) limit of 75 units per hectare.
[8] The C-3 zone does not permit residential uses
[9] Parcels that only frontage 1st Ave.
[10] Parcels fronting at least one street other than 1st Ave.

Table 2: Existing Housing Capacity in Unamended Residential Zones

Zone	Percent Developed[11]	Total Parcels	Total Developable Area (ha)	FSR	UPH[12]	Unit Cap[13]	Max. Buildout[14]	Likely Buildout[15]
R-3 (General)	69%	36	37.65	2.00	60	-	2,259	695
8 White Street	100%	1	0.62	-	115	-	71	-
109 and 117 Buller Street	0%	2	0.12	-	93	-	11	11
9 White Street	100%	1	0.62	-	76		47	-
340 Second Avenue	100%	1	0.07	-	69	-	5	-
"The Jewell"	0%	1	1.96	-	115	-	225	225
R-3-A (General)	62%	62	74.99	0.66			3,535	1,333
"Lot 3" Upper Hannington Area	0%	1	5.33	-	-	190	190	190
1237 Fourth Avenue	0%	1	1.34	-	-	48	48	48
606 Farrell Road	13%	1	1.09	-	-	15	15	13
MHP-1	100%		29.43	-	20	-		-
R-4	100%	1	0.34	-	180	-	61	-
CD-2	0%	1	1.17	-	-	12	12	12
CD-3					-	-		-
Area A&B	0%	32	13.41	-	-	4/lot	128	128
Area C	0%	1	3.67	0.66	-	103	103	103
CD-4 (Waterfront Area Plan)	0%	5	33.19	-	-	125	125	125
CD-5	100%	1	0.20	1.50	-	180	180	-
CD-6	0%	1	0.15	1.30	-	12	12	12
CD-7	0%	1	12.67	-	-	282	282	282
Total							**7,310**	**3,177**

It must also be noted that large tracts of R-1 and R-1-A zoned land has not been subdivided (e.g. many areas in Holland Creek) and due to SSMUH rules, can be subdivided into hundreds of lots, each of which can accommodate 4 units.

[11] An estimate of how much of the zoned area has been developed which excludes sites with minimal or older improvements and vacant sites.
[12] The Unit Per Hectare limit specified in the zone, if any.
[13] The maximum number of units allowed in the zone, if any.
[14] The total number of units that can be built in a zone accounting for total area and zoning parameters.
[15] The likely number of units that will be built in the zone, when reducing the maximum number of units to account for the percentage of developed area in column 2.

The Town's current zoning capacity to accommodate housing development can be summarized as follows: when recent zoning changes and existing zoning and development conditions (i.e. age of existing improvements, amount of vacant land etc.) are accounted for, the Town currently has zoning in place to accommodate **well over 20,000 new units.**

The *Housing Statutes (Residential Development) Amendment Act* also changed the requirements for Housing Needs Reports. Specifically:

- Section 790 (2) of the *Local Government Act* and Section 23 of the *Housing Needs Report Regulation* now requires local governments to receive an "Interim" Housing Needs Report, no later than January 1, 2025.
- Housing Needs Reports must now include projections for a 20-year time horizon and use additional methods and parameters prescribed by the Province.
- Municipalities must amend their OCP's and, "if necessary", zoning bylaws to reflect their Interim Housing Needs Report no later than December 31, 2025.
- Interim Housing Needs Reports must contain a statement about the need for housing in close proximity to sustainable transportation infrastructure and a description of the actions taken since receiving the previous Housing Needs Report, to reduce housing needs.

The Province initially announced that the prescribed parameters for the Interim Housing Needs Reports would be released in January 2024 and staff had hoped to use the Town's Interim Housing Needs Report in forming their recommendation for the adoption of Bylaws 2163, and 2187. However, the parameters were not released until the summer of 2024, and since the above-noted bylaws were nonetheless consistent with the OCP, staff felt it was appropriate to align zoning with the OCP to support opportunities for housing construction rather than wait for the Province's parameters.

Meanwhile, UBC's Housing Assessment Resource Tools (HART) program was developing a model that local governments could use to complete their housing needs reports. Once provincial parameters were released, the Model became available online. It is free of charge to use and the only components of the Housing Needs Report the Model doesn't produce are the statements described above related to housing in close proximity to sustainable transportation infrastructure and actions taken following receipt of the previous housing needs report to reduce housing needs.

Staff used the model to produce the housing needs report in Attachment A and used the results to inform the required statements and the proposed OCP amendments described below.

PROPOSAL:

Interim Housing Needs Report

The HART report in Attachment A indicates a 5 year housing need of 729 units and a 20 year housing need of 2,476 units.

As noted above, section 790(3)(b) of the *Local Government Act* requires:

1. A statement about the need for housing in close proximity to transportation infrastructure that supports walking, bicycling, public transit or other alternative forms of transportation; and

2. A description of the actions taken by the local government, since receiving the most recent Housing Needs Report, to reduce housing needs.

For Statement 1, staff propose the following:

> "The Town's OCP defines "Priority Growth Areas" and "Strategic Infill Areas", where sustainable transportation infrastructure tends to be more concentrated, and where the OCP prioritizes both housing and sustainable transportation infrastructure investment. It follows that housing development should be concentrated in Priority Growth Areas and Strategic Infill Areas."

For Statement 2, staff propose the following:

> "Since receiving the most recent housing needs report in 2021, the Town has taken the following actions to reduce housing needs:
>
> 1) Adopted an award-winning OCP that includes, among other things:
>   a) land use designations and policies to increase density in Priority Growth Areas and Strategic Infill Areas and sustainable transportation infrastructure,
>   b) policies to improve the quality of housing for persons with disabilities,
>   c) appropriate and affordable housing as a top priority, and
>   d) prescriptions for zoning changes—many of which have already been implemented—to increase the supply and diversity of housing in Ladysmith;
>   e) the adoption of the 'Wheelhouse Model' to guide decision-making related to housing and support the variety of housing types needed to support Ladysmith's diverse housing needs;
>   f) policies to protect the supply of rental housing;
>   g) policies to discourage excessively large and relatively expensive housing units and diversify housing in existing single-family neighbourhoods;
>   h) policies that prioritize securing affordable housing during amenity negotiations and for financial incentives; and
>   i) policies to encourage "suite-ready" construction.
>
> 2) Adopted "Affordable Housing Reserve Bylaw 2021, No. 2097" which allows Council to set aside funds for the construction of affordable housing and related costs;
>
> 3) Rezoned and registered a housing agreement on 1260 Churchill, prior to the sale of the land by the Town, to allow for approximately 52 housing units, one of which must be rented or sold at below market rates in perpetuity;
>
> 4) Adopted "Business Regulations and Licensing (Rental Units) Bylaw 2021, No. 2093" to regulate renovictions and ensure minimum health and safety standards for rental homes in Ladysmith;
>
> 5) Adopted "Short-Term Rental Bylaw, 2024, No. 2188" and signed onto the Province's new STR Data Portal to support enforcement against unpermitted short-term rentals;

6) Adopted new Building and Development Approval Procedures Bylaws that streamline development approval processes;

7) Undertaken two reservoir upgrades valued at over 20 million to ensure adequate water supply for future housing developments;

8) Allocated funds to begin developing a monitoring program for purpose-built-rental housing in 2025;

9) Allocated funds to begin developing a comprehensive DCC, ACC tax exemption and DCC reduction program in 2025 with the aim of incentivizing growth in priority growth areas, streamlining development approval processes, making costs for housing developers more predictable and ensuring the Town has adequate infrastructure in place to service new housing developments;

10) Removed development permit requirements for most types of SSMUH;

11) Reduced minimum parking standards for residential development to make housing development more economical;

12) Undertaken remediation of over 10 hectares of Town-owned land to implement the Town's Waterfront Area Plan which, once complete, will allow for the construction of approximately 400 new homes and redevelopment of one of Ladysmith's largest brownfield sites;

13) Issued a building permit and DCC Waiver for the 36-unit "Heart on the Hill" affordable housing and community kitchen project developed by the Ladysmith Resources Centre Association (LRCA) in partnership with BC Housing;

14) Approved zoning amendments to allow the permanent, year-round use of the BC Housing/LRCA shelter at 631 1st Avenue, which is equipped to provide emergency housing for up to 10 people and support services for those experiencing homelessness;

15) Rezoned in accordance with the OCP and Provincial mandates to increase existing zoning capacity for housing by **over 11,000 units** increasing the existing zoning capacity to accommodate new housing by **well over 20,000 units**; and

16) Issued building permits for over **485 new housing units**."

Staff recommend accepting this report, the statements herein and the HART analysis in Attachment A as the Town's Interim Housing Needs Report.

OCP Amendments

Section 790(6) of the *Local Government Act* requires the Town to update its OCP to reflect the Town's Interim Housing Needs Report by December 31st, 2025. With the adoption of the OCP in May 2023, the Town was well positioned to meet this requirement and few edits to the OCP are necessary. Staff have drafted OCP amendment Bylaw 2190 to meet the requirements of the *Local Government Act*. The proposed bylaw includes the following amendments to the OCP:

1. Changes to housing projections in Part A to reflect the projections of the Interim Housing Needs Report. The proposed bylaw will also amend this section to provide a more detailed breakdown of allocated development capacity and how the allocated development capacity is sufficient to meet housing demand.

2. Changes to policies for the neighbourhood residential designation to:
    a. direct maximum allowable densities to areas that are best suited to sustainable transportation modes; and
    b. support densification only where infrastructure capacity is available, recognizing that it is currently not viable to increase density in certain areas until the infrastructure is in place to support it.

No further amendments to the Town's OCP are recommended at this time.

Zoning Review

As noted above, section 481.7 of the *Local Government Act* requires the Town to use its zoning powers to "accommodate at least the 20-year total number of housing units required to meet anticipated housing needs" and, within a year of receiving a Housing Needs Report, "review and, if necessary, adopt a zoning bylaw to permit the use and density of use" needed to accommodate the 20 year projected housing need in the Housing Needs Report (emphasis added).

The Town's 20 year housing need is 2,476 units. As noted above, the Town has zoning in place to accommodate well over 20,000 units, approximately 11,000 of which have been added since the adoption of the new OCP in 2023.

Subsequently, staff are not recommending further zoning amendments to accommodate housing needs at this time.

ANALYSIS:

Interim Housing Needs Report

The Housing Needs Report in Attachment A has been prepared using a widely used model that incorporates the Province's prescribed inputs for housing needs reports. The statement in this report related to housing in proximity to sustainable transportation infrastructure aligns with infrastructure conditions in the community and the OCP. The description of actions taken since the last housing needs report was completed not only meets the minimum legislative requirement of providing a "description" of steps taken to "reduce housing needs", but also highlights the substantial achievements by the Town in addressing housing issues in less than four years. Among other things, the Town has added more than 11,000 units of zoning capacity and issued building permits for over 475 homes (an 11.64% increase in Ladysmith's existing housing stock since 2021). Staff are certain that the *Local Government Act* requirements for this "description" have been met, and that the Town is clearly demonstrating that it is doing its part to address housing needs.

OCP Amendments

Due to the substantial housing, growth management and sustainable transportation policies in the Town's OCP, only minor amendments are needed to align with the technical requirements of the *Local Government Act* . The proposed amendments meet the minimum requirements of the *Local Government Act*; existing policies in the OCP adopted four months prior to the adoption of the *Housing Statutes (Residential Development) Act*, far exceed the minimum legislated requirements. Staff recommend adopting Bylaw 2190 as drafted.

Zoning Review

The review provided above indicates that, due in large part to Town-initiated zoning amendments to implement the OCP, current zoning can accommodate over 20,000 units. This is ten times the number of housing units needed to meet the 20-year projection in the Interim Housing Needs Report. While some lands zoned for housing are not immediately developable (i.e. lack of infrastructure, high construction costs due to site constraints, etc.), significant development potential exists (or has been added) to key growth areas with optimal development sites. This includes the Downtown and Old Town, where infrastructure capacity and significant redevelopment potential exits. Moreover, major sites already under development like Holland Creek and the Waterfront are expected to add a significant number of homes to Ladysmith's housing inventory. Holland Creek was originally planned to add approximately 1,000 homes, a number that may now triple as a result of the Province's SSMUH mandate. Once remediated, the Waterfront redevelopment is anticipated to add approximately 400 units, all within a 10-minute walk of the Downtown.

Subsequently, staff are certain further zoning amendments to meet provincial requirements to accommodate projected housing need are unnecessary.

ALTERNATIVES:

Council can choose to:

1. Adopt the Housing Needs Report and required statements with amendments specified by Council.
2. Defer consideration of the Housing Needs Report to a subsequent meeting of Council scheduled no later than January 1, 2025.
3. Defer consideration of Bylaw 2190 to a subsequent meeting of Council scheduled no later than December 31, 2025.
4. Direct that further housing-related zoning amendments be made and brought back for Council's consideration no later than December 31, 2025.
5. Refer the proposal back to staff for further review, as specified by Council.
6. Refer the Housing Needs Report and Bylaw 2190 to CPAC with a deadline for CPAC feedback and Council reconsideration no later than January 1, 2025.

FINANCIAL IMPLICATIONS:

Section 477(3)(a)(i) of the *Local Government Act* requires the Town to consider its financial plan when adopting or amending an Official Community Plan. The proposal was referred to Financial Services for comment (see 'Interdepartmental Referrals') and was returned noting that though additional housing units will generate additional taxation, there will be a corresponding impact on the Town's processing plants (Water and Sewer), resulting in greater operating costs. The current plants were built with future expansion considered but are not currently funded.

LEGAL IMPLICATIONS:

Standard requirements for Council consideration and referrals established under provincial legislation have been accounted for. At this time, there are no special legal considerations for this proposal.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:

Section 475 of the *Local Government Act* requires Council, when considering an amendment to the OCP, to provide one or more opportunities it considers appropriate for consultation with persons, organizations and authorities it considers will be affected. To meet this obligation, Council must specifically consider whether consultation should be "early and ongoing", and specifically consider whether consultation is required with:

1. The Board of the Cowichan Valley Regional District.
2. The Board of the Regional District of Nanaimo.
3. The Council of the District of North Cowichan.
4. First Nations, including the Stz'uminus First Nation, Hul'qumi'num Treaty Group and the Snuneymuxw First Nation.
5. The Board of School District 68.
6. The Provincial and Federal Governments and their agencies.

The Naut'sa Mawt Community Accord and Memorandum of Understanding between the Town and Stz'uminus First Nation require the Town to refer all OCP amendments to the Stz'uminus First Nation for comment. Similarly, section 476 of the *Local Government Act* requires the Town to refer the proposed OCP amendment to School District 68 for comments related to the impact on school facilities. Bylaw 2190 must also be referred to the Agricultural Land Commission (ALC) under section 475(4) of the *Local Government Act*, as the proposed changes may affect agricultural land.

Given that only minor changes to the OCP are proposed, staff are recommending that Bylaw 2190 be referred only to the School District, ALC and Stz'uminus First Nation.

If Council gives first and second readings to Bylaw 2190 a public hearing is required pursuant to section 464(1) of the *Local Government Act* and newspaper notification must be carried out pursuant to section 466(1) of the *Local Government Act.*

INTERGOVERNMENTAL REFERRALS:

As noted above, the application must be referred to the Stz'uminus First Nation, ALC and School District. No additional intergovernmental referrals are recommended at this time.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:

Because no zoning changes or major OCP changes resulting from the Housing Needs Report are proposed and changes to the OCP are required by Provincial law, the proposal was referred only to Finance for analysis pursuant to section 477(3)(a)(i) of the *Local Government Act.*

COMMUNITY PLANNING ADVISORY COMMITTEE (CPAC) REVIEW:

Under CPAC Terms of Reference, CPAC review of the Housing Needs Report and Bylaw is required only if referred by Council. Given CPAC's direct involvement in the development of the OCP[16], the OCP's strong alignment with the findings of the Interim Housing Needs Report, and the minor nature of the changes under Bylaw 2190, staff do not recommend referring the Housing Needs Report or Bylaw 2190 to CPAC.

ALIGNMENT WITH STRATEGIC PRIORITIES:

☒ Core Infrastructure
☒ Official Community Plan Implementation
☒ Waterfront Area Plan
☐ Economy
☐ Leadership
☐ Not Applicable

I approve the report and recommendation(s).

Allison McCarrick , Chief Administrative Officer

[16] There was CPAC representation on the OCP project steering committee.

ATTACHMENTS:

A. Housing Needs Report
B. Bylaw 2190

Calculating 20-year housing need

The following tables calculate 20-year and 5-year housing need according to provincial guidelines. Each table follows these guidelines exactly with the intention that the tables can be directly included in the required interim housing needs report (or included as an addendum to an existing housing needs report).

HART has produced this calculator to support communities in British Columbia satisfy a provincial requirement for interim housing needs reports. Methodologies for housing needs reports can vary widely, and while HART supports the standardization of methodologies for the purpose of provincial or national reporting, we did not have a role in developing the methodology, nor do we unequivocally endorse it. You can learn more about the HART methodology and what it can tell you about your community on our Housing Needs Assessment Tool page.

- *A note on terminology: we use the term RDA, where the province uses the term Electoral Area. For all intents and purposes, these are interchangeable in the calculator.*
- *A note on rounding: per provincial guidelines, the figures in Components A-F are not rounded and are shown to two decimal places. Total housing need is rounded in Table 13 to the nearest whole number, per guidelines.*

Component A: Extreme core housing need calculation

The following tables calculate the new homes required to meet existing Extreme Core Housing Need (ECHN) according to provincial guidelines.

Table 1a

The following table shows total owner and renter households in the four previous census years (Step 1).

EXPORT

Ladysmith T (CSD, BC)				
Total Households	**2006**	**2011**	**2016**	**2021**
Owners	2,575	2,710	2,990	3,170
Renters	605	700	720	760

Table 1b

The following table shows the total number and proportion of owners with a mortgage and renter households in ECHN in the four previous census years, to arrive at an average ECHN rate (Step 2).

Please note that data for owners with a mortgage is only available for 2021.

EXPORT

Ladysmith T (CSD, BC)									
	2006		**2011**		**2016**		**2021**		
Extreme Core Housing Need	**#**	**% of total**	**#**	**% of total**	**#**	**% of total**	**#**	**% of total**	**Average ECHN Rate**
Owners with a mortgage		n/a		n/a		n/a	40	1.26%	**1.26%**
Renters	75	12.40%	45	6.43%	50	6.94%	55	7.24%	**8.25%**

Table 2

The following table shows the estimated total of owners with a mortgage and renter households in ECHN in 2021 (Steps 3 and 4).

EXPORT

Ladysmith T (CSD, BC)			
Total Households	**2021 Households**	**Average ECHN Rate**	**Households in ECHN**
Owners	3,170	n/a	n/a
Owners with a mortgage		1.26%	40.00
Renters	760	8.25%	62.71
Total New Units to Meet ECHN - 20 years			**102.71**

Component B: Housing units and homelessness

The following table calculates the number of new homes required to meet the needs of the existing population of people experiencing homelessness (PEH), according to provincial guidelines.

Table 3

The following table shows the estimated number of homes required to meet the need of existing PEH households as a proportion of the regional need (Steps 1-3).

EXPORT

Ladysmith T (CSD, BC)				
	Local Population			
Regional Population	#	% of region	Regional PEH	Proportional Local PEH
87,330	8,800	10.08%	535	53.91

Total New Units to Homelessness Needs - 20 years	53.91

Component C: Housing units and suppressed household formation

The following tables calculate the number of new homes required to meet the demand from households unable to form due to a constrained housing environment, since 2006, according to provincial guidelines.

Table 4a

The following table shows the number of owner and renter households in 2006 by age of the primary household maintainer (Step 1).

EXPORT

Ladysmith T (CSD, BC)		
	2006 Households	
Age – Primary Household Maintainer 2006 Categories	Owner	Renter
Under 25 years	10	50
25 to 34 years	200	70
35 to 44 years	480	120
45 to 54 years	530	90
55 to 64 years	525	110
65 to 74 years	400	60
75 years and over	425	105

Table 4b

The following table shows the number of owner and renter households in 2021 by age of the primary household maintainer (Step 1, cont'd).

EXPORT

Ladysmith T (CSD, BC)		
	2021 Households	
Age – Primary Household Maintainer 2021 Categories	Owner	Renter
15 to 24 years	15	15
25 to 34 years	160	110
35 to 44 years	420	145
45 to 54 years	450	120
55 to 64 years	700	115
65 to 74 years	885	115
75 to 84 years	400	90
85 years and over	140	45

Table 5

The following table shows the population by age category in 2006 and 2021 (Step 2).

EXPORT

Ladysmith T (CSD, BC)					
		2006		2021	
Age Categories – Household Maintainers	Age Categories – Population	All Categories	Summed Categories	All Categories	Summed Categories
15 to 24 years	15 to 19 years	485	780	380	670
	20 to 24 years	295		290	
25 to 34 years	25 to 29 years	310	635	385	770
	30 to 34 years	325		385	
35 to 44 years	35 to 39 years	460	1,005	505	1,035
	40 to 44 years	545		530	
45 to 54 years	45 to 49 years	600	1,185	460	1,020
	50 to 54 years	585		560	
55 to 64 years	55 to 59 years	620	1,115	690	1,475
	60 to 64 years	495		785	
65 to 74 years	65 to 69 years	410	745	800	1,585
	70 to 74 years	335		785	
75 years and over	75 to 79 years	350	700	480	1,035
	80 to 84 years	200		310	
	85 years and over	150		245	

Table 6

The following table shows the 2006 headship rate of each age category for both renters and owners (Step 3).

EXPORT

Ladysmith T (CSD, BC)					
	2006 Households		2006 Population	2006 Headship Rate	
Age Categories – Household Maintainers	Owner	Renter	Total	Owner	Renter
15 to 24 years	10	50	780	1.28%	6.41%
25 to 34 years	200	70	635	31.50%	11.02%
35 to 44 years	480	120	1,005	47.76%	11.94%
45 to 54 years	530	90	1,185	44.73%	7.59%
55 to 64 years	525	110	1,115	47.09%	9.87%
65 to 74 years	400	60	745	53.69%	8.05%
75 years and over	425	105	700	60.71%	15.00%

Table 7

The following table shows the potential 2021 headship rate of each age category for both renters and owners if the headship rate from 2006 remained constant (Step 4).

EXPORT

Ladysmith T (CSD, BC)					
	2006 Headship Rate		2021 Population	2021 Potential Households	
Age Categories – Household Maintainers	Owner	Renter	Total	Owner	Renter
15 to 24 years	1.28%	6.41%	670	8.59	42.95
25 to 34 years	31.50%	11.02%	770	242.52	84.88
35 to 44 years	47.76%	11.94%	1,035	494.33	123.58
45 to 54 years	44.73%	7.59%	1,020	456.20	77.47
55 to 64 years	47.09%	9.87%	1,475	694.51	145.52
65 to 74 years	53.69%	8.05%	1,585	851.01	127.65
75 years and over	60.71%	15.00%	1,035	628.39	155.25

Table 8

The following table calculates the number of suppressed households by subtracting actual households in 2021 from potential households in 2021 by age category, according to provincial guidelines (Steps 5 and 6).

EXPORT

Ladysmith T (CSD, BC)							
	2021 Potential Households		2021 Households		2021 Suppressed Households		
Age Categories – Household Maintainers	**Owner**	**Renter**	**Owner**	**Renter**	**Owner**	**Renter**	**Total**
15 to 24 years	8.59	42.95	15	15	-6.41	27.95	21.54
25 to 34 years	242.52	84.88	160	110	82.52	-25.12	57.40
35 to 44 years	494.33	123.58	420	145	74.33	-21.42	52.91
45 to 54 years	456.20	77.47	450	120	6.20	-42.53	0.00
55 to 64 years	694.51	145.52	700	115	-5.49	30.52	25.02
65 to 74 years	851.01	127.65	885	115	-33.99	12.65	0.00
75 years and over	628.39	155.25	540	135	88.39	20.25	108.64
Total New Units to Meet Suppressed Housing Need - 20 years							**265.52**

Component D: Housing units and anticipated household growth

The following tables calculates the number of new homes required to accommodate an increasing population over 20 years according to provincial guidelines.

Table 9

The following table shows the 20-year population projection and growth rate for your regional district (Step 1).

EXPORT

Ladysmith T (CSD, BC)			
Regional District Projections	**2021**	**2041**	**Regional Growth Rate**
Households	37,290	51,160	37.19%

Table 10

The following table shows the calculated number of new homes needed in the next 20 years according to the provincial guidelines, calculated with the average of the municipal and regional growth projections (Steps 2-5).

EXPORT

Ladysmith T (CSD, BC)				
Growth Scenarios	**Regional Growth Rate**	**Households**		**New Units**
		2021	**2041**	
Local Household Growth	n/a	3,925	5,427.00	1,502.00
Regionally Based Household Growth	37.19%	3,925	5,384.90	1,459.90
Scenario Average				1,480.95
Total New Units to Meet Household Growth Needs - 20 years				**1,480.95**

Component E: Housing units and rental vacancy rate

The following table calculates the number of new homes required to restore local vacancy rates to 3% according to provincial guidelines. Please note that in jurisdictions without vacancy rate data, the calculator will default to the provincial vacancy rate, following provincial guidance.

Table 11

The following table shows the difference between the existing total number of rental homes and the total number of rental homes required for a 3% vacancy rate (Steps 1-4).

EXPORT

Ladysmith T (CSD, BC)				
	Vacancy Rate	**Occupied Rate**	**Renter Households**	**Estimated Number of Units**
Target Vacancy Rate	3.00%	97.00%	760	783.51
Local Vacancy Rate	1.40%	98.60%		770.79
Total New Units to Achieve 3% Vacancy Rate - 20 years				**12.71**

Component F: Housing units and demand (the “demand buffer”)

The demand factor is a multiplier used to calculate additional local housing demand (or "demand buffer"), determined by the province.

Table 12

The following table calculates additional demand for new housing by applying your demand factor to the total of the other relevant components, according to provincial guidelines (Steps 1 and 2).

EXPORT

Ladysmith T (CSD, BC)	
Component	**Result**
A. Extreme Core Housing Need	102.71
B. Persons Experiencing Homelessness	53.91
C. Suppressed Household Formation	265.52
E. Rental Vacancy Rate Adjustment	12.71
Total	**434.85**
Demand Factor	1.29
Total New Units to Address Demand Buffer - 20 years	**560.00**

Total 5-year and 20-year housing need

Table 13

The following table sums Components A-F and rounds the totals to the nearest whole number to determine the total number of new homes needed in the next 20 years, according to provincial guidelines. It also displays 5-year housing need estimates using the multipliers provided in the provincial guidelines and BC Stats household projections from 2021 to 2026.

EXPORT

Ladysmith T (CSD, BC)		
Component	**5 Year Need**	**20 Year Need**
A. Extreme Core Housing Need	25.68	102.71
B. Persons Experiencing Homelessness	26.95	53.91
C. Suppressed Household Formation	66.38	265.52
D. Anticipated Growth	466.67	1,480.95
E. Rental Vacancy Rate Adjustment	3.18	12.71
F. Additional Local Demand	140.00	560.00
Total New Units - 5 years	**729**	
Total New Units - 20 years		**2,476**

The HNA Calculator was created by the Housing Assessment Resource Tools (HART) project in collaboration with Licker Geospatial Consulting.

Housing Assessment Resource Tools (HART)

Licker Geospatial Consulting

Attachment B

. **TOWN OF LADYSMITH**

BYLAW NO. 2190

A Bylaw to Amend "Official Community Plan Bylaw 2022, No. 2200"

The Council of the Town of Ladysmith in open meeting assembled enacts the following to effect changes to "Official Community Plan Bylaw 2022, No. 2200":

1. Replacing the section entitled "Housing Projections" in section 4 of Part A as follows:

   "Ladysmith needs approximately **730 additional dwelling units by 2030 and 2,500 additional dwelling units by 2045** to accommodate housing needs for the projected population. This amounts to approximately 125-150 new residential units per year. These projections are based on the Town's and CVRD's Housing Needs Assessments (2021), the Town's Interim Housing Needs Report (2024) and longer term age-specific demand projections, by utilizing a household maintainer rate demand model. However, it is important to note that zoning approved prior to, and after, the adoption of this OCP **provides sufficient development capacity (over 20,000 units) to accommodate projected housing demand."**

2. Subsection s. section 2.3. of Part B is amended to read as follows:

   "Multi-family housing is supported, where infrastructure capacity is available, on lots that are within a ten minute walk of all of the following: a park, a transit stop, and either a school or commercial area. Maximum FSR's should be reserved for sites that are within a ten minute walk of all of the following: a park, a transit stop, school and commercial area."

3. Replace the words "2021 CVRD Regional Housing Needs Assessment" with "the Town's Housing Needs Reports" in section 3, subsection 4 of Part D.

Citation

4. This Bylaw may be cited for all purposes as "Official Community Plan Bylaw 2022, No. 2200, Amendment Bylaw 2024, No. 2190".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
PUBLIC HEARING HELD PURSUANT TO SECTION 464(1)(a) of the Local Government Act on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2024

Acting Mayor (T. McKay)

Corporate Officer (S. Bouma)

STAFF REPORT TO COUNCIL

Report Prepared By: Julia Tippett, Planner
Reviewed By: Jake Belobaba, RPP, MCIP, Director of Development Services
Meeting Date: December 17, 2024
File No: ZBL 3360-23-09
RE: **Proposed Animal Control Bylaw and Consequential Zoning Bylaw Amendments**

RECOMMENDATION:

That Council:

1. Give first, second, and third readings to "Town of Ladysmith Animal Control Bylaw 2024, No. 2167";

2. Give first and second readings to "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169";

3. Direct staff to proceed with scheduling and notification of a public hearing for "Town of Ladysmith Zoning Bylaw 2014, No. 1860 Amendment Bylaw 2024, No. 2169" pursuant to section 464(1) of the *Local Government Act*; and

4. Direct staff to forward "Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169 to the Ministry of Transportation and Infrastructure, after third reading of the bylaw, pursuant to section 52 of the *Transportation Act*.

EXECUTIVE SUMMARY:

The purpose of this report is to introduce a proposal to repeal and replace the existing "Animal and Poultry Bylaw 1994, No. 1136" with a "Town of Ladysmith Animal Control Bylaw 2024, No. 2167". The new bylaw would add regulations for the keeping of backyard poultry on certain residential properties, animal welfare, and goats for vegetation management purposes. In addition, this report introduces a proposal for consequential amendments to the "Town of Ladysmith Zoning Bylaw 2014, No. 1860" in association with the proposed "Animal Control Bylaw 2024, No. 2167," including to facilitate the keeping of backyard poultry as an accessory use on residential parcels with single family homes as the principal use within specific residential zones.

PREVIOUS COUNCIL DIRECTION:

Resolution	Meeting Date	Resolution Details
CW 2024-032	2024-05-14	That the Committee recommend that Council: 1. Give first, second and third readings to "Town of Ladysmith Animal Control Bylaw 2024, No. 2167"; and 2. Direct staff to bring forward consequential amendments to the "Town of Ladysmith Zoning Bylaw 2014, No. 1860". *Motion Carried.*
CW 2023-073	2023-09-12	That the Committee direct staff to return to a future Committee of the Whole meeting with policy options for allowing livestock, under permit, for plant or weed control. *Motion Carried.*
CS 2023-019	2023-01-24	That Council: … 1. Refer consideration of backyard chickens to a future meeting after the adoption of the Official Community Plan (OCP), when it can be considered as an OCP Implementation Policy…. *Motion Carried.*
CW 2023-009	2023-01-17	That the Committee recommend that Council refer consideration of backyard chickens to a future meeting after the adoption of the Official Community Plan (OCP), when it can be considered as an OCP Implementation Policy. *Motion Carried.*
MS 2017-083	2017-11-27	That the Committee recommend that Council introduce an amendment to Animal and Poultry Bylaw 1994, No. 1136 that would permit the raising of hens in backyards in appropriate residential zones in Ladysmith. *Motion Defeated.*
CS 2017-255	2017-08-21	That Council direct staff to: 1. Conduct a public consultation with Town residents on the desirability and possible content of an amendment to the "Animal and Poultry Bylaw 1994, No. 1136" to allow the keeping of hens on residentially zoned properties in the Town of Ladysmith… *Motion Carried.*

INTRODUCTION/BACKGROUND:

Section 318 of the *Local Government Act* gives local governments the authority to adopt a bylaw that regulates the keeping of animals, including the authority to define areas in which animals may or may not be kept. The current "Animal and Poultry Bylaw 1994, No. 1136" does not permit livestock, including poultry and goats, to reside on properties less than 2.0 acres in size.

Other municipalities on Vancouver Island, such as the City of Duncan and the City of Nanaimo, allow the keeping of backyard chickens and/or poultry on appropriately zoned residential properties or on properties of a certain size. Similarly, the City of Parksville and the City of Port Alberni have adopted bylaws to allow and regulate the use of goats for vegetation control and management. The proposed Animal Control Bylaw and consequential Zoning Bylaw amendments were informed by policies from similar sized and/or nearby municipalities that allow backyard hens and ducks and/or have bylaws for goat vegetation management.

Town of Ladysmith Development Services and Public Works staff met with a local goat vegetation management business at Transfer Beach Park in early 2024 to better understand how goats are

used for vegetation management. The notable points from the meeting with the business owner include the following:

- Sheep tend to eat grass, whereas goats prefer woody and leafy plants.
- The appropriateness of a vegetation control site is determined on a case-by-case basis.
- Leaving the goats onsite overnight depends on property surveillance and the goats' safety.
- Several of the business owner's goats were obtained through a livestock supplier and would otherwise have been butchered[1].
- The Public Works Department would like to explore using goats as a more efficient way to manage vegetation in certain Town-owned areas.

Attachment C contains photographs taken during an outdoor meeting at Transfer Beach Park with a local goat vegetation management business.

Past Council Direction

Past Council direction has included the consideration of adopting bylaws that would allow backyard chickens on appropriate residential zones within the Town of Ladysmith. In 2017, public consultation was carried out under the direction of Council to gauge public interest and possible regulations of an amendment to the "Animal and Poultry Bylaw 1994, No., 1136" that would allow the keeping of hens for specific residential properties. Public engagement results were generally favourable towards the keeping of hens. In a survey carried out by the Town, 82 respondents were in favour of allowing backyard hens and 42 respondents were opposed. Staff brought forward the results of the consultation and a proposal that the Municipal Services Committee (now the Committee of the Whole) recommend to Council that an amendment to the Animal and Poultry Bylaw be introduced to allow raising hens on some residential properties. This proposal was defeated by the Committee.

In January 2023, Council passed resolution 2023-019 directing that backyard poultry be considered at a future meeting once the new OCP was adopted. The new "Town of Ladysmith Official Community Plan Bylaw 2022, No. 2200", which was adopted on May 2nd, 2023, contains a policy (Policy 2.4(ab)) supportive of small urban farms that allow animals such as chickens to encourage food production in public and private lands.

Town staff received direction from the Committee of the Whole on September 12, 2023, to return to the Committee with policy options to allow goats to be used for vegetation management and weed control. This direction came after a residential property had hired a local business employing goats for the removal of invasive plants. On May 15, 2024, staff brought forward an information report and draft Animal Control Bylaw regulating the keeping of up to six backyard poultry on certain residential properties and explicitly allowing goats for vegetation management purposes within the Town. The Committee of the Whole moved the recommendations to proceed to Council for the first, second and third readings of the proposed Animal Control Bylaw

[1] Baby male goats are often butchered because they do not produce milk.

and directed staff to bring consequential amendments to the Zoning Bylaw to align with the proposed Animal Control Bylaw.

PROPOSAL:

Except for the properties within the proposed backyard poultry exclusion areas (Attachment D), the keeping of up to six backyard poultry would be permitted on residential properties where the principal use is a single-family dwelling and where the property falls within any of the following zones: RU-1, R-1, R-1-A, R-2, R-2-B, and R-3. A property must meet all the conditions set out in the proposed Zoning Amendment Bylaw to lawfully keep backyard poultry within the Town. Livestock, defined in the Animal Control Bylaw, will not be permitted on residential properties less than 0.81 hectares in size, except for the temporary keeping of goats for vegetation management practices.

The proposed Animal Control Bylaw includes rules related to the size and siting of coops and pens, adequate animal care, prevention of nuisances, and mitigation of wildlife- associated risks. The bylaw proposes to allow any combination of adult female chickens (hens) and female ducks (also hens). Additionally, the proposed bylaw sets parameters for the number of goats permitted for vegetation control purposes, temporary fencing, wrangling and safe keeping of the goats, and associated business licensing requirements.

Enforcement for the keeping of backyard poultry would be complaint-driven, and staff do not recommend additional licensing requirements for the keeping of backyard poultry.

The draft “Town of Ladysmith Animal Control Bylaw 2024, 2167” and the “Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169” are included as Attachments A and B, respectively.

Staff propose the creation of education programming through the provision of an information handout on the proposed bylaw requirements to promote awareness of rules and best practices associated with the keeping of backyard poultry. See Attachment E for an example of what the information handout could look like.

A breakdown of the proposed Animal Control Bylaw regulations are provided in Table 1.

Table 1: Proposed Animal Control Bylaw regulations in Ladysmith.

Type of Bylaw Provisions	Specific Regulations
Keeping of Backyard Poultry	• Maximum (total) of 6 hens, which includes female chickens and female ducks, are permitted on residential properties that meet the Zoning Bylaw requirements and are outside of the Backyard Poultry Exclusion Area (see Schedule E) • Written consent from the registered property owner(s) stating the tenant renting the property may keep backyard poultry • Hens must not be kept in a dwelling or on a balcony, roof or deck • Hens must remain in their coop and pen except for when typical animal husbandry practices are necessary • Backyard poultry must not be kept in a cage except for transportation • Slaughtering of backyard poultry is prohibited, except as ordered by an authority having jurisdiction • No animal products from the poultry may be sold, except for eggs which must meet the BC Centre for Disease Control guidelines • Any eggs sold may only be consumed by those who purchased the eggs from the poultry owners (or their household members) • Separate, clean, wildlife- and vermin-proof food and manure receptacles are required (maximum volumes of 3.0ft^3) • Diseased poultry must be delivered to a veterinarian, landfill in a sealed bag, a farm, an abattoir, or other facility for appropriate disposal • Backyard poultry must not be left unattended for more than 12 hours

Coops and Pens	• The coop and pen must be fully enclosed with continuous animal-proof fencing • The coop and pen must be situated to reasonably prevent wildlife entry and must be constructed to prevent rodents from harbouring within or under the structures • A coop must have adequate litter for nesting and shall be cleaned weekly • Backyard poultry must be kept in a secure coop from sunset to sunrise • A pen shall be attached to or surround the coop and provide unobstructed access to the coop • Coops and pens must not be located: (1) in a front yard; (2) within 1.0 metre of any property line; and (3) within 3.0 metres of any dwelling unit • A coop shall: - Provide a minimum of 0.37m² and 0.6m³ of space per hen - Not exceed 10.0m² in floor area or 30.0m³ in volume - Not exceed 3.0 metres in height - Have adequate nesting space and perches for each hen - Be kept clean and in good repair • A pen shall: - Provide a minimum of 0.93m² and 1.0m³ of space per hen - Not exceed 10.0m² in area - Not exceed 3.0m in height - Be fully enclosed with corrosion-resistant wire fencing materials
Prohibition of Cruelty to Animals	• Animals must be provided with: 1. Access to clean drinking water and sufficient quantities and qualities of food to support animal health 2. Sanitary food and water containers 3. Opportunities for adequate exercise 4. Clean bedding material and a warm, dry shelter 5. Veterinary care, as needed • Animals must be provided with a shelter to protect them from weather and provide shade • Animals must have access to properly ventilated spaces • No animal shall be kept tied or hitched to a fixed object as a form of confinement

Goat Vegetation Management	• Goats may be used for vegetation clearing up to a maximum of 30 consecutive days • Total number of goats allowed per parcel shall be calculated at 1 goat per 100.0 square metres of parcel area up to a maximum of 30 goats • Goats must be contained within a temporary, animal proof fence while on a work site and must be appropriately cared for • Goats are only permitted to remain overnight if the wrangler or person on site has been trained to wrangle the goats and will remain on site • Overnight enclosed shelters are required to keep goats safe • Businesses using goats for vegetation management must hold a valid business licence with the Town • All dogs must be leashed where goats are at work

Table 2: Proposed Zoning Amendment Bylaw regulations for Animal Control Changes.

Type of Zoning Provision	Specific Regulations
General Regulations	• Coops and Pens are not considered accessory structures, except for the application of the following accessory building/structure regulations: - A maximum of 2 accessory buildings are permitted per property - Must be on the same property as the principal use (single-family dwelling) - Must not be used as a dwelling unit - Must meet the attic/roof height regulations for accessory buildings - Must not contain kitchen facilities • One self-contained trailer or recreational vehicle is permitted on a Single-Family Dwelling property to provide temporary accommodation of a goat wrangler, and one animal transport vehicle is permitted for vegetation management practices (up to 30 consecutive days)
Specific Regulations	• For produce stands, eggs may now be sold where backyard poultry is a permitted use (limited to one stand per property), in accordance with the Animal Control Bylaw • Where backyard poultry is permitted as an accessory use on residential parcels where the principal use is a single unit dwelling, a total of 6 hens are permitted provided that the following conditions are met: - The residential parcel is outside of the Backyard Poultry Exclusion Areas identified in the Animal Control Bylaw, Schedule A; - Backyard poultry must be housed in a coop and pen; - A coop and pen must be located at grade; - Backyard poultry use must meet all requirements established in the Animal Control Bylaw

Backyard Poultry as an Accessory Use in the following Residential Zones (where a Single Unit Dwelling is the principal use and where Backyard Poultry Exclusion Areas do not apply)	• RU-1 • R-1 • R-1-A • R-2 • R-2-B • R-3

ANALYSIS:

For the reasons outlined below, staff are recommending approval of the proposal.

Official Community Plan

Food security is identified as one of the most important actions within the Ladysmith/Stz'uminus Poverty Reduction Strategy (2022) and is recognized within the "Official Community Plan Bylaw 2022, No. 2200".

Table 1. provides a review of the OCP policies in relation to the keeping of backyard poultry and vegetation management using goats.

Table 1: *OCP Policies relating to backyard poultry and vegetation management using goats.*

OCP Policy Category and Policies	Comments
Part B: 2.4 General Land Use Policies	
Ecological and Resource Protection	
ab. Encourage food production in public and private lands and buildings. Examples include community gardens, Indigenous harvesting spaces, edible landscaping, permaculture, and small urban farms including those with urban farm animals such as chickens.	Allowing urban chickens encourages small scale food production. This can contribute to local food security and enhance education around home-based food production.
Part C: 4. Policies	
4. Parks and Open Space	
4.19. Consider the following opportunities for use in parks: • New models for promoting and sustaining biodiversity; • Planting of local and climate-adapted species, and the restoration of habitats;	Vegetation management using goats can contribute to a more balanced ecosystem by targeting and removing invasive plants and making resources and space available for native and climate-adapted species in Town parks. Employing goats for vegetation management is a model for promoting biodiversity and controlling invasive plant species. Temporary fencing and other control methods can be carefully placed as goats may also eat some materials that have not been targeted for removal.
4.22. Strive to eradicate invasive plants from Town parkland.	The proposed Animal Control Bylaw exempts government authorities, such as the Town of Ladysmith, from the bylaw regulations. This will allow the Town and other government authorities (e.g. BC Hydro) to employ goats for invasive plant removal without limitations. Although goats employed for invasive plant removal may not completely eradicate the invasive species, it can help reduce the abundance and growth of invasive plants. Repetitive use of goats for vegetation control (e.g., having

	the goats graze on the site annually) can reduce the presence and recurrence of some invasive plant species in that area where grazing was permitted.

Zoning Bylaw

The consequential Zoning Bylaw amendments listed above are proposed to align the Zoning Bylaw with the proposed Animal Control Bylaw. The zoning amendments will facilitate the keeping of backyard poultry in certain residential properties outside the Backyard Poultry Exclusion Areas zoned RU-1, R-1-A, R-2, R-2-B. and R-3 and where the principal use is a single-family dwelling. The amendments will also add definitions for clarity on the additional allowances and will permit the temporary overnight accommodation of a goat wrangler and goats for vegetation management.

Additional Considerations

Rationale for Proposed Backyard Poultry Regulations

The proposed regulations have been designed to ensure adequate space is provided for backyard poultry while limiting proximity to residential dwellings, protecting against potential wildlife conflicts, and addressing concerns associated with health, safety, and associated nuisances.

Some of the primary concerns associated with the keeping of backyard poultry in urban areas include the possibility of attracting wildlife and increasing the incidences of human-wildlife conflicts. Several regulations aim to mitigate these concerns by requiring exclusion areas around places more suitable for wildlife habitat, such as parks and forested lands. A 200.0-metre buffer was applied to the P-3 – Nature Park zone, and currently forested, undeveloped parcels of land. The exclusion areas in Attachment D are based on this buffer and provide separation between wildlife habitat and corridor areas from residential zones that allow backyard poultry. Additional provisions, such as requiring fully enclosed coop and pen structures surrounded by fencing and securing the backyard poultry inside the coop from sunset to sunrise, are intended to prevent wildlife from accessing the hens. Pens and their roofs must consist of corrosion-resistant metal wire with a minimum wire gauge of 14 and a maximum opening of two inches fastened to the structure with corrosion resistant staples to ensure backyard poultry enclosures are strong enough to keep out wildlife, such as raccoons and bears, and to prevent wildlife from becoming entangled in the wire fencing.

The proposed Animal Control Bylaw prohibits the sale of meat, manure, and other backyard poultry products, except for the small-scale selling of eggs in accordance with BC Centre for Disease Control's "Guidelines for the Sale of Foods at Temporary Food Markets[2]". These guidelines establish standards that reduce the risk of illness associated with the consumption of ungraded eggs, such as prohibiting the sale of cracked or dirty eggs that may be contaminated

[2] BC Centre for Disease Control's "Guideline for the Sale of Foods at Temporary Food Markets" establish the requirements for the sale of ungraded eggs

with pathogens that could cause an individual to become ill. The sale of eggs is limited to the direct consumer or household of the individual purchasing the eggs.

Rationale for Proposed Goat Vegetation Management

The Animal Control Bylaw proposes limits on the maximum number of goats onsite, proportional to parcel size, to ensure the herd can be adequately managed and contained and to mitigate any potential impacts, such as nuisances, on neighbouring properties. The proposed regulations include a maximum duration of 30 consecutive days for goat vegetation management to ensure the goats do not remain on a parcel in Town for extended periods of time. Measures are also proposed to ensure that, if goats are to remain onsite overnight, that a wrangler or property owner is present and properly trained and equipped to respond to the goats' needs. Goats must be kept inside a temporary shelter overnight to provide the animals with protection from weather and wildlife. Temporary animal-proof fencing made of woven wire, or like materials, must contain the goats while working to ensure they do not consume toxic plants and to provide protection against wildlife and other animals, such as dogs. The bylaw also requires owners to leash dogs where goats are working. In practice, "goats at work" signs will be posted at worksites advising owners to leash their dogs and dog owners can be fined if they allow their dogs to harass or attack the goats. This rule provides an extra layer of protection for goats, as dogs may find ways to breach the temporary fencing or harass goats from the fence line.

Benefits

Backyard Poultry

Allowing backyard poultry supports sustainability and food security, community building and social wellbeing, food waste reduction, and public education. Residents can keep poultry that produce eggs to mitigate high food costs and provide a regular food source. This can also encourage individuals to learn more about sustainable, local food production and animal husbandry practices. Backyard poultry can help control pest and insect populations, complementing urban gardens. Hens can be fed some types of food scraps to reduce food waste (which the Town must otherwise collect and dispose of) and reduce the cost of egg production.

Goats for Vegetation Management

Prescribed goat browsing is an effective and sustainable method of preventing, containing, and suppressing proliferation of invasive and non-native plant species. Goats are browsers and prefer a variety of woody plants, leaves, twigs, and shrubs, which includes some of the most invasive plant species on Vancouver Island including Scotch Broom, Himalayan Blackberry and English Ivy. Goats can help clear dry bramble or vegetation that would otherwise contribute to the risk of forest fires. Additionally, goats can reach difficult, steep terrain that may be less accessible to mechanical equipment and are gentler ecologically when removing vegetation than herbicides and mechanical-based vegetation control measures. The allowance of this practice would also support local businesses established in the region by permitting them to be hired for vegetation removal within the Town of Ladysmith.

The proposed Animal Control Bylaw also includes new regulations that will enhance enforceability of the humane treatment of animals within the Town of Ladysmith.

Challenges

Enforcement

Staff do not believe that licensing for backyard poultry should be required as it would strain existing staff capacity and resources. The proposed bylaw(s), if adopted, can be changed in the future should staff determine that the benefits of backyard poultry licensing necessitate its introduction. The proposed bylaw establishes requirements that must be met by those intending to keep backyard poultry, and these are enforceable with both warnings and—if necessary—fines.

Health Concerns

Public education on illness prevention measures, such as handwashing before and after handling poultry, maintaining the cleanliness of the enclosures, and obtaining veterinary care for ill birds, can help address health concerns associated with keeping backyard poultry. The proposed bylaw contains measures to address such concerns, such as requiring that backyard poultry owners follow the Canadian Food Inspection Agencies biosecurity procedures and obtain veterinary care to prevent or treat pain, suffering or disease of animals.

Wildlife Conservation

The keeping of backyard hens can lead to increased wildlife attractants within urban environments. In response to this threat, staff have established a Backyard Poultry Exclusion Area by buffering areas more suitable for wildlife habitat. Keeping backyard poultry on properties that fall within this area is prohibited in the proposed bylaw.

Staff have assessed the benefits and challenges associated with the proposed Animal Control Bylaw changes and understand that the introduction of animals may lead to an increase in human-wildlife conflicts. It is recommended that the proposed bylaw and consequential Zoning Bylaw amendments be revisited should there be an increase in human-wildlife conflicts, dangerous wildlife sightings, and/or the destruction of wildlife. Staff also recommend that education programming, such as information handouts, be developed and available to the public to ensure backyard poultry are adequately cared for in accordance with the proposed bylaw regulations and that necessary measures to mitigate possible wildlife conflict and health concerns are addressed. Lastly, it is important to understand that other activities that are already permitted, such as storing residential waste bins, pet food and grills outdoors can also contribute to human-wildlife conflicts if not managed properly. Holistically managing all wildlife attractants through public education is essential to ensure the success of the proposed backyard poultry program.

Recommendation

Staff recommend the proposed “Town of Ladysmith Animal Control Bylaw 2024, No, 2167” be given first, second and third readings, and consequential zoning amendments contained in the “Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169” be given first and second readings and proceed to a public hearing as the proposed bylaws are consistent

with the Official Community Plan and can be considered as OCP implementation and the community is anticipated to receive a net benefit from the bylaws' implementation.

ALTERNATIVES:

Council can choose to:

1. Defeat Bylaw 2167 and Bylaw 2169.
2. Elect not to hold a public hearing in accordance with section 464(2) of the *Local Government Act* and direct that staff publish notice of the application in accordance with section 467 of the *Local Government Act*.
3. Defer consideration of the application and refer the proposal to a subsequent meeting of Council.
4. Amend the proposed bylaws and give the bylaws first and second readings as amended.
5. Refer the application back to staff for further review, as specified by Council.

FINANCIAL IMPLICATIONS:

N/A

LEGAL IMPLICATIONS:

Standard requirements for Council consideration and referrals established under provincial legislation have been accounted for in staff's review of the application and in the recommendations of this report. At this time, there are no special legal considerations for this proposal.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:

If Council endorses the proposed bylaw amendments as recommended, notice of the public hearing for Bylaw No. 2150 will be provided in accordance with section 466 of the *Local Government Act*, "Town of Ladysmith Development Procedures Bylaw 2008, No. 1667"and "Public Notice Bylaw 2022, No. 2119".

Council can elect not to hold a public hearing under 464(2) of the *Local Government Act* because an OCP amendment is not required to approve the proposed rezoning. However, staff recommend holding a public hearing as the public may have an interest in the proposed amendments, OCP policies supporting the zoning amendments do not explicitly authorize all aspects of the proposal, and there are no material time savings from not holding a public hearing.

INTERGOVERNMENTAL REFERRALS:

The application must be referred to the Ministry of Transportation and Infrastructure as required under section 52 of the *Transportation Act*. Additionally, staff sent a courtesy email to the Ministry of Environment and Climate Change's Conservation Officer Services to request general comments on the allowance of backyard poultry in urban/suburban backyards and the use of goats for vegetation management practices.

The Conservation Officer expressed concerns that chickens, ducks, and other livestock and animal feed are attractants for dangerous wildlife, including bears and cougars. Conservation Officer

Services stated that bears have a strong sense of smell, and in their opinion, introducing backyard poultry and other livestock into the Town would lead to an increase in human-wildlife conflicts and the destruction of more wildlife. Due to these observations, Conservation Officer Services does not support the allowance of backyard poultry and other livestock animals within the Town of Ladysmith. Staff have designed draft regulations and area restrictions where backyard poultry would be permitted to help address some of these concerns.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:

The proposed Animal Control Bylaw was referred to Bylaw Compliance Officer at the time of its drafting. Bylaw Compliance made minor suggested edits and did not have concerns with the bylaw as proposed.

The Parks and Public Works Departments expressed interest in hiring and using goat vegetation management businesses to help clear invasive plant species in Town parks.

COMMUNITY PLANNING ADVISORY COMMITTEE (CPAC) REVIEW:

As the proposed consequential "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169" is Town-initiated, and under the CPAC Terms of Reference, CPAC review of this proposal is not required.

ALIGNMENT WITH STRATEGIC PRIORITIES:

☐ Core Infrastructure
☒ Official Community Plan Implementation
☐ Waterfront Area Plan
☐ Economy
☐ Leadership
☐ Not Applicable

I approve the report and recommendation(s).

Allison McCarrick , Chief Administrative Officer

ATTACHMENT(S):

A. Draft Animal Control Bylaw, No. 2167
B. Draft Zoning Amendment Bylaw, No. 2169
C. Photos of Goats from a Local Vegetation Management Business
D. Backyard Poultry Exclusion Areas Map
E. Information Handout Example

Attachment A

TOWN OF LADYSMITH

BYLAW NO. 2167

A Bylaw to provide for the management and regulations in relation to animals in the Town of Ladysmith

The Council of the Town of Ladysmith in open meeting assembled enacts as follows:

1. Definitions

1.1 In this Bylaw, unless the context otherwise requires:

(a) "Animal" means any member of the animal kingdom, other than a human being (as defined in the *Community Charter).*

(b) "Backyard Poultry" means domesticated adult hens permitted on a *Residential Parcel of Land* pursuant to section 3 of this bylaw.

(c) "Business License" means a license to carry on business issued pursuant to "Business License Bylaw No. 1513, 2003 and all amendments thereto."

(d) "Intermunicipal Business License" means a business licence issued by the Licence Inspector of the Town of Ladysmith or another participating Local Government to carry on business within the boundaries of any participating municipality and issued pursuant to the Intermunicipal Business License Agreement.

(e) "Bylaw Enforcement Officer" means a Public Officer, as defined in the *Interpretation Act*, a Peace Officer, and those persons designated by the Town of Ladysmith as Bylaw Compliance Officers from time to time.

(f) "Coop" means a shelter for *Backyard Poultry* with a solid roof, floor and walls with entries and exits that can be secured with animal proof closures during the evening.

(g) "Hen" means a domesticated female chicken or domesticated female duck that is at least 4 months old.

(h) "Livestock" means an animal raised or kept for food, meat, milk or for wool or fiber, or a beast of burden, and includes, alpaca, cattle, donkeys, emus, goats, horses, llamas, mules, ostriches, sheep, or swine, including miniature pigs, and all other animals that are solely used for agricultural purposes. Livestock also includes wild animals kept in captivity for food or commodity production, including bison and ungulates.

(i) "Pen" means a fully enclosed outdoor space for Backyard Poultry.

(j) "Residential Parcel" means a parcel zoned to permit a single-family dwelling and excludes properties zoned for agriculture or a *Farm Use* pursuant to the *Agricultural Land Commission Act* and *Agricultural Land Reserve Regulations*.

(k) "Town" means the Town of Ladysmith.

(l) "Wildlife" means a wild animal.

(m) "Wrangler" means a person who transports animals to and from a work site, sets up fencing and provides 24-hour care and security for the animals.

2. General Provisions

2.1 General Provisions:

(a) A person shall not keep livestock on a Residential Parcel that is less than 0.81 hectares.

(b) A person must immediately remove and lawfully dispose of any excrement deposited by an animal in their care and custody on any public property or private property not owner or occupied by the owner.

(c) No person who has removed animal excrement may deposit the excrement into a municipal litter receptacle except where the excrement is securely contained in an impermeable bag or other impermeable container so as not to ooze, leak, or fall out, into a municipal litter receptacle.

3. Keeping of Backyard Poultry

3.1 Notwithstanding subsection 2.1(a) a person may keep Backyard Poultry on a residential parcel, subject to the following provisions:

(a) No person shall keep Backyard Poultry within the area shown on Schedule A.

(b) No person shall keep Backyard Poultry without the written consent of the owner of the parcel where the Backyard Poultry is to be located.

(c) No more than six Backyard Poultry may be kept on Residential Parcel.

(d) No person shall keep Backyard Poultry within a dwelling unit or on a

balcony, roof, or deck.

(e) No person shall allow Backyard Poultry outside of a Coop or Pen except to perform typical animal husbandry practices such as wing clipping and veterinary care.

(f) Coops and Pens shall not be located:

i. in a front yard.
ii. within 1.0 metre from any property line.
iii. within 3.0 metres of any dwelling unit.

(g) A Coop shall:

i. provide a minimum volume of 0.6 cubic metres per hen.
ii. provide a minimum floor area of 0.37 square metres per hen.
iii. not exceed a maximum floor area of 10.0 square metres or volume of 30.0 cubic metres.
iv. not exceed a height of 3.0 metres.
v. provide each chicken with its own nesting box and perch that is at least fifteen (15) centimetres long, and each duck with adequate ground-level nesting space.
vi. be kept clean, in good repair, and free of vermin.

(h) A Pen shall:

i. provide a minimum volume of 1.0 cubic metres per hen.
ii. have a minimum Pen area of 0.93 square metres per hen.
iii. not exceed an area of 10.0 square metres.
iv. shall not exceed a height of 3.0 metres.
v. be fully enclosed at all sides with corrosion-resistant metal wire fencing with a minimum wire gauge of 14 and a maximum opening of 2 inches (5.08 centimeters) securely fastened to the structure with corrosion-resistant fencing staples.
vi. be covered with a roof wire fencing meeting the criteria under subsection v.
vii. be kept clean, in good repair, and free of vermin.

(i) A Parcel on which Backyard Poultry are kept must have a continuous animal proof fence that encloses the Coop and Pen.

(j) A Pen shall be attached to or surround the Coop so as to provide the Backyard Poultry with full and unobstructed access to enter and exit the Coop at their leisure during daylight hours.

(k) All Backyard Poultry must be kept within a secure Coop from sunset to

sunrise.

(l) All Backyard Poultry shall be provided with adequate litter within the Coop to nest in which shall be cleaned weekly.

(m) Food and water receptacles shall be frequently cleaned and disinfected and located so as to avoid contamination by excreta and attraction of vermin.

(n) The owner must ensure that the Coop and Pen are situated in a way that would reasonably prevent entry by Wildlife and constructed to prevent any vermin from harbouring underneath or within it or within its walls.

(o) No person shall keep Backyard Poultry in a cage unless for the purposes of transport of the Backyard Poultry.

(p) Unless ordered to by an authority having jurisdiction, slaughtering Backyard Poultry is prohibited.

(q) Except for the sale of eggs, no person shall sell any products associated with Backyard Poultry, including manure and meat.

(r) Backyard Poultry eggs shall be sold in accordance the BC Centre for Disease Control "Guidelines for the Sale of Foods at Temporary Food Markets". In addition to the BC Centre for Disease Control guidelines, the following conditions shall be met:

a. The eggs must be produced on the property upon which the Backyard Poultry owner resides.
b. The eggs must be only for the consumption of the individual purchasing the eggs and/or that individual's household.

(s) The owner of Backyard Poultry shall ensure poultry food is stored and secured in vermin-proof and wildlife-proof containers, and that no more than 0.085 cubic metres (3.0 cubic feet) may be stored at a time.

(t) The owner of Backyard Poultry shall ensure manure is stored in an enclosed vermin-proof and wildlife-proof container that does not generate excessive heat or odour, and that no more than 0.085 cubic metres (3.0 cubic feet) may be stored at a time.

(u) A person shall not dispose of deceased Backyard Poultry other than by delivering it to a veterinarian, landfill in a sealed bag, a farm, an abattoir, or other facility with the ability to lawfully dispose of the carcass.

(v) The owner of Backyard Poultry must follow biosecurity procedures

recommended by the Canadian Food Inspection Agency.

(w) Backyard Poultry shall not be left unattended for periods of more than 12 hours.

4. Prohibition of Cruelty to Animals

4.1 No person shall keep any animal unless the animal is provided with:

(a) Clean, potable drinking water and food in sufficient quantity and of a recognized nutritional quality to allow for the animal's normal growth and the maintenance of the animal's normal body weight;

(b) Sanitary food and water receptacles;

(c) The opportunity for periodic exercise sufficient to maintain the animal's good health;

(d) Clean bedding material and an area maintained at a temperature warm and dry enough to prevent the animal from suffering discomfort; and

(e) The necessary veterinary care to prevent or treat pain, suffering, or disease.

4.2 No person shall keep any animal outside for more than 3 hours in any day unless the animal is provided with a shelter that allows the animal to move freely, and stand, sit or lie in a position that:

(a) Protects the animals from heat, cold and wetness; and

(b) Is shaded.

4.3 No person shall keep any animal confined in an enclosed space, including a motor vehicle, without sufficient ventilation to prevent the animals from suffering discomfort, heat stroke or injury.

4.4 No person shall keep any animal hitched, tied or fastened to a fixed object where a choke collar or choke chain forms part of the securing apparatus, or where a rope or cord is tied directly around the animal's neck.

4.5 No person shall keep any animal hitched, tied or fastened to a fixed object as the primary means of confinement for an extended period of time.

5. Goat Vegetation Management

5.1 Notwithstanding Section 2.1 (a) of this Bylaw, a person may keep goats on any parcel

of land within the Town, on a temporary basis, for vegetation management subject to the following requirements:

(a) Goats shall be used to clear vegetation for no more than 30 consecutive days.

(b) For the purposes of vegetation management, the total number of goats permitted on a parcel of land is to be calculated at one (1) goat per 100.0 square metres (1076.4 square feet) of parcel area to a maximum of thirty (30) goats per parcel.

(c) Goats must be contained within a temporary, animal proof woven wire (or similar material) fence at all times while on a work site or performing their vegetation management activities and must be cared for in a manner consistent with the requirements of the Society for Prevention of Cruelty to Animals and all other applicable regulations and legislation.

(d) Goats used for vegetation management shall not remain overnight onsite unless a Wrangler or a person living onsite has been trained and equipped to wrangle the goats is present.

(e) Any goats remaining onsite overnight shall be kept in a portable wildlife-proof enclosed and roofed shelter that is appropriately sized to accommodate each animal.

(f) Vegetation management using goats shall only be carried out by business holding a valid Business License or Intermunicipal Business License.

(g) A business providing goat vegetation management services must obtain and maintain third party liability insurance in the amount of $5,000,000.

6. Application

6.1 Any government authority, farm operation, or agriculturally zoned property is exempt from this bylaw.

7. Enforcement

7.1 A Bylaw Compliance Officer for the Town may enter onto any property in accordance with the *Community Charter* to inspect and determine whether the provisions of this bylaw are being met.

7.2 A person must not obstruct or interfere with a Bylaw Compliance Officer who has entered onto property pursuant to Section 7.1, or other person assisting the Bylaw Compliance Officer.

8. Offences and Penalties

8.1 A person who commits an offence is subject to the penalties imposed by the Bylaw, the Ticket Utilization Bylaw, and the *Offence Act* if that person:

(a) contravenes a provision of this Bylaw;

(b) consents to, allows, or permits an act or thing to be done that is contrary to this Bylaw; or

(c) neglects, refrains, or omits from doing an act or thing required by a provision of this Bylaw.

8.2 Each day that a contravention of a provision of this Bylaw occurs or continues to occur shall constitute a separate offence.

8.3 The minimum fine that shall be imposed for a contravention of this Bylaw is $100.00.

8.4 The maximum fine that shall be imposed for a contravention of this Bylaw is $10,000.00.

8. Repeal

8.1 "Animal and Poultry Bylaw, 1994, No. 1136" is hereby repealed.

9. Citation

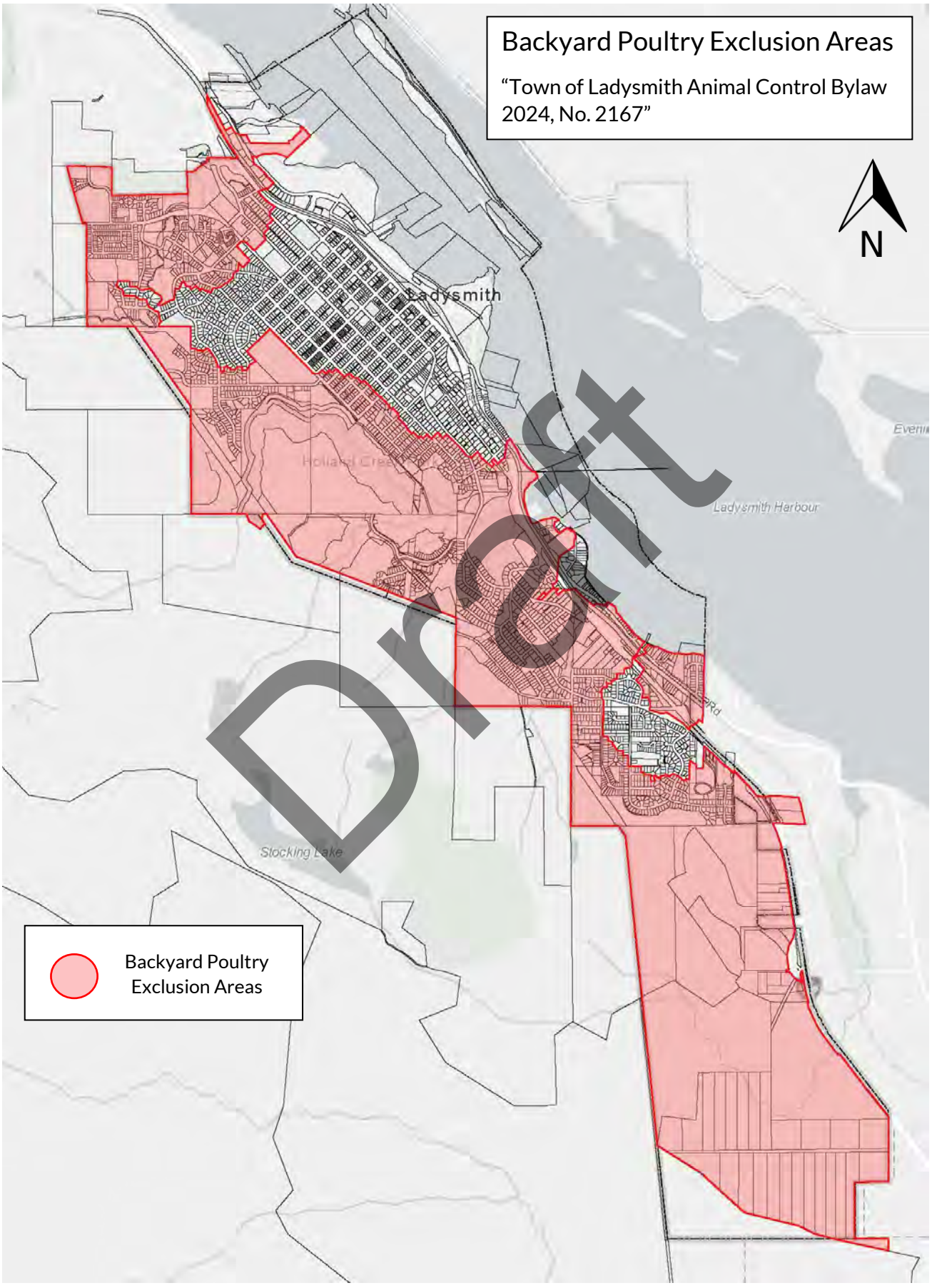
9.1 This Bylaw may be cited for all purposes as "Town of Ladysmith Animal Control Bylaw 2024, No. 2167".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2025

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S. Bouma)

SCHEDULE "A"


Backyard Poultry Exclusion Areas
"Town of Ladysmith Animal Control Bylaw 2024, No. 2167"
N
Ladysmith
Ladysmith Harbour
Stocking Lake
Backyard Poultry Exclusion Areas
Draft

Attachment B

TOWN OF LADYSMITH

BYLAW NO. 2169

A Bylaw to amend "Town of Ladysmith Zoning Bylaw 2014, No. 1860".

The Council of the Town of Ladysmith in open meeting assembled enacts the following amendments to "Town of Ladysmith Zoning Bylaw 2014, No. 1860":

1. Schedule A – Section 4.1 'Interpretation' is amended by adding the following new terms and definitions, in alphabetical order:

    a) Add a new definition of "Backyard Poultry":

    "shall have the same meaning as in "Town of Ladysmith Animal Control Bylaw 2024, No. 2167" and does not include *Farm Use."*

    b) Add a new definition of "Coop":

    "shall have the same meaning as in "Town of Ladysmith Animal Control Bylaw 2024, No. 2167.""

    c) Change the definition of "Fence" to:

    "means a *Structure* providing physical or visual separation or enclosure of a *Parcel* or portion of a *Parcel*, and does not include a *Retaining Wall*, *Landscaping*, or *Pen.*

    d) Add a new definition of "Pen":

    "shall have the same definition as in "Town of Ladysmith Animal Control Bylaw 2024, No. 2167.""

    e) Change the definition of "Produce Stand" to:

    "means a roadside *Structure* for the sale of products produced by *Backyard Poultry Use,* a *Farm Use* or *Urban Agriculture Use*, excluding *Cannabis*."

2. Schedule A – Part 5: General Regulations is amended as follows:

    (a) Add subsection 5.9(j) which states the following:

    "A *Coop* and *Pen* used for *Backyard Poultry* are not considered *Accessory Buildings* or *Structures*, except for the application of Sections 5.9(a), (d), (f), (h), and (i) to *Coops* and *Pens*."

(b) Add Subsection 5.17(b) which states the following:

"Notwithstanding Section 5.17(a), one self-contained trailer or recreational vehicle for providing temporary accommodation to a wrangler, and one animal transport vehicle for the purposes of vegetation management shall be permitted on a *Parcel* for the duration of the works, but in any case, for no more than 30 consecutive days per work site."

3. Schedule A – Part 6: Specific Use Regulations is amended to:

(a) Replace Subsections 6.10(a)(i) and (ii) with the following:

i) Shall be limited to one such *Use* per *Parcel*, as permitted only where *Backyard Poultry Use*, a *Farm Use*, or *Urban Agriculture Use* is permitted a permitted *Use*.

ii) Where *Urban Agriculture Use* or *Backyard Poultry Use* is permitted, the *Produce Stand Use* shall be limited to the sale of products grown and eggs laid on the *Parcel.*"

(b) Add Subsection 6.10(a)(vi) which states the following:

vi) Shall only sell eggs from *Backyard Poultry* in accordance with "Town of Ladysmith Animal Control Bylaw 2024, No. 2167."

(c) Add Section 6.12 "Backyard Poultry" which includes the following regulations:

a) Where *Backyard Poultry* is a permitted *Accessory Use* on a *Residential Parcel* and where the *Principal Use* is a *Single Unit Dwelling*, a maximum of six (6*) Backyard Poultry* shall be allowed on the *Parcel* provided that the following conditions are met:

i. The *Residential Parcel* is outside of the *Backyard Poultry* exclusion areas identified in "Town of Ladysmith Animal Control Bylaw 2024, No. 2167" Schedule A.

ii. *Backyard Poultry* must be housed in a *Coop* and *Pen.*

iii. A *Coop* and *Pen* must be located at *Finished Grade*.

iv. *Backyard Poultry Use* shall meet all requirements established in the "Town of Ladysmith Animal Control Bylaw 2024, No. 2167."

4. Schedule A – Add "*Backyard Poultry*, subject to Part 6, Section 6.12" as a permitted *Accessory Use* in the following *Zones*:
    a) RU-1
    b) R-1
    c) R-1-A
    d) R-2
    e) R-2-B
    f) R-3

Citation

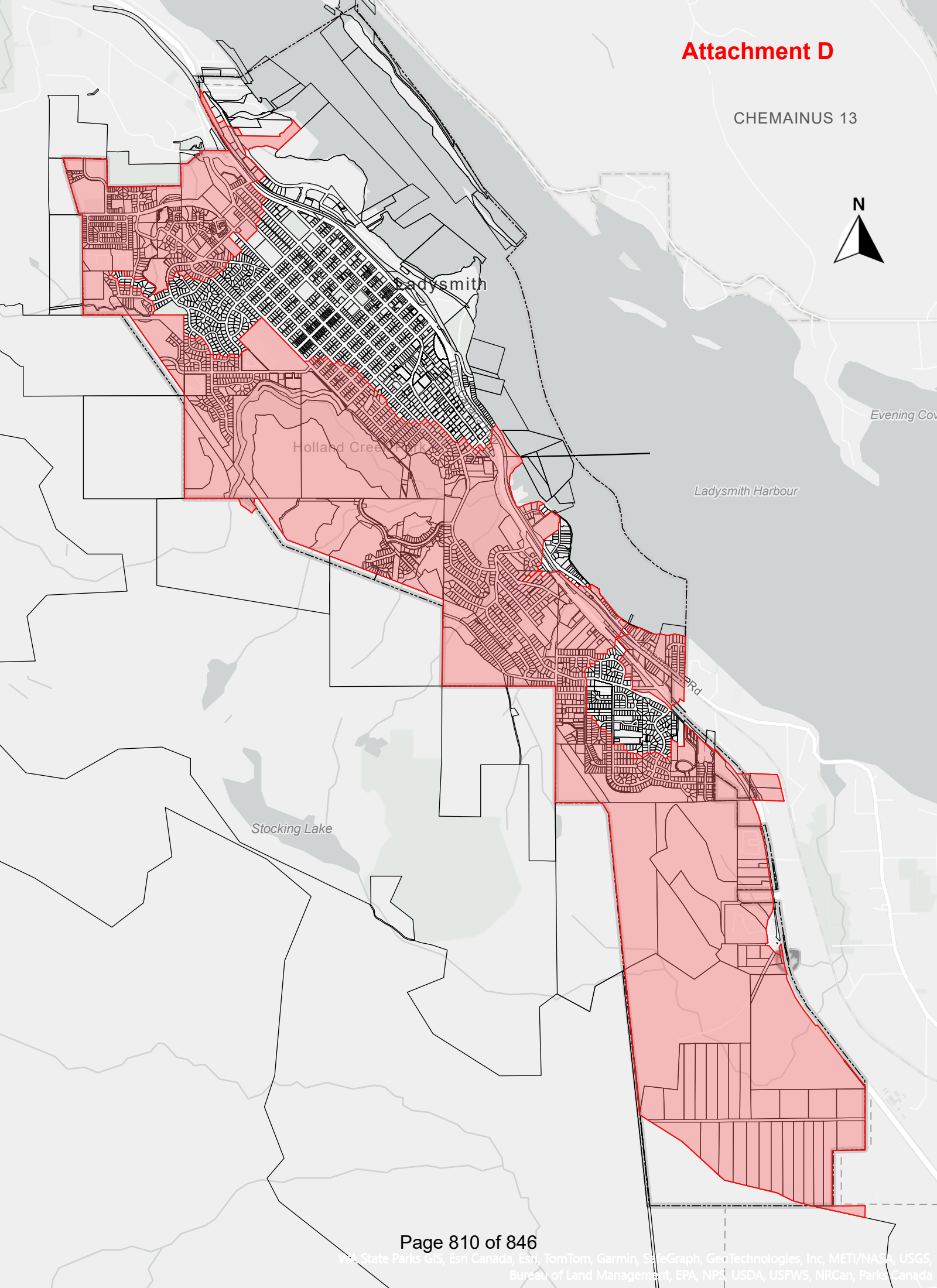
5. This Bylaw may be cited for all purposes as "Town of Ladysmith Zoning Amendment Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2169".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
PUBLIC HEARING HELD on the _____ day of _____, 2025
READ A THIRD TIME on the _____ day of _____, 2025
APPROVED BY MINISTRY OF TRANSPORTATION on the _____ day of _____, 2025
ADOPTED on the _____ day of _____, 2025

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S. Bouma)

Attachment C



Attachment E

Backyard Poultry Information Guide

The Town of Ladysmith has adopted a new Animal Control Bylaw (Bylaw 2024, No. 2167) that allows the keeping of backyard poultry in certain residential areas. The details and requirements for keeping backyard poultry are contained in the Animal Control Bylaw and the Zoning Bylaw 2014, No. 1860. This guide provides a summary of key considerations for residents thinking about keeping backyard hens (female chickens and ducks) in the Town of Ladysmith.

Benefits and Poultry-Keeping Considerations

Backyard chickens and other urban animals like ducks are supported in the Town's Official Community Plan to encourage food production and food security. Keeping backyard poultry can also provide opportunities for improved sustainability, community-building, food waste reduction, and education about local food systems and production.

Backyard hens and ducks can attract wildlife and increase incidences of human-wildlife conflicts. The Animal Control Bylaw includes regulations for the keeping of poultry that serve to manage associated risks of wildlife and vermin.

Diseases can pass between poultry and people, so be sure to follow good hygiene practices if you decide to adopt backyard hens.

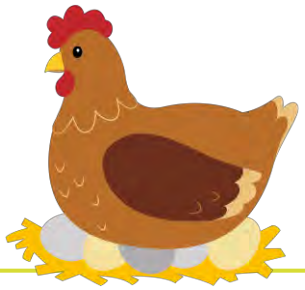
Steps to Keeping Backyard Poultry

Step 1 Review Town bylaws to see if you qualify to keep hens and ducks to make sure you understand the rules:

- Animal Control Bylaw 2024, No. 2167 (includes Backyard Poultry Exclusion Areas as Schedule A).
- Zoning Bylaw 2014, No. 1860.

Step 2 Understand best practices and responsibilities for keeping urban hens and ducks. You can find additional resources on the Town website at INSERT WEBPAGE LINK.

Step 3 If your property is allowed to have backyard poultry, make sure your coop, pen, and all other backyard poultry practices meet all requirements of the bylaws.



Key Rules and Regulations

Each single-family residential property outside of the Backyard Poultry Exclusion Areas can have up to six (6) hens (female chickens and ducks). Roosters, drakes and chicks/ducklings are not allowed under the new bylaw. Backyard poultry must be kept in an animal/vermin-proof coop and pen. Other specifications for the keeping of backyard poultry are contained within the Animal Control Bylaw 2024, No. 2167.

Coops must provide adequate space, nesting, and perching areas. Details are included in the bylaw.

Pens must be fully-enclosed and provide adequate outdoor space. Continuous animal-proof fencing must enclose coops and pens.

Owners must follow the Canadian Food Inspection Agencies biosecurity procedures and seek veterinary care early, as needed.

Selling eggs is permitted given they meet BC's rules for ungraded egg sales. The eggs, once purchased, shall not be resold.

No slaughtering of poultry or selling of other poultry products.

No coop or pen shall be located in the front yard, within 1.0 metre of any property line or within 3.0 metres of any dwelling.

Enclosures, litter, and other backyard poultry equipment must be kept clean.

General Questions or Complaints

Bylaw Compliance | Phone: 250.246.6446

Zoning Bylaw Questions

Development Services | Phone: 250.245.6415
Email: ds@ladysmith.ca

For wildlife sightings and encounters, contact the Conservation Officer 24 Hour Hotline at 1-877-952-7277.

Best Practices

- ❑ Learn how to prevent and detect disease in backyard flocks.
  - → Prevent contact with wild birds/other animals.
  - → Routinely clean their environment.
  - → Spot signs of disease and contact a veterinarian early.
  - → Keep new hens isolated until you are sure they are healthy.
- ❑ Research how to provide good, healthy living standards for hens and ducks.
  - → Chickens and ducks are social animals and a minimum of two female chickens, or two female ducks should be kept together to enhance their social wellbeing.
- ❑ Take biosecurity precautions to protect your own health.
  - → Always wash your hands before and after handling hens, ducks, or anything in their environment.
  - → Do not eat or drink within their living areas.
  - → Do not allow hens or ducks to enter your home and keep your shoes used for poultry care outdoors.
- ❑ Take steps to reduce and remove wildlife attractants.

MINUTES OF THE ACCESSIBILITY ADVISORY COMMITTEE
WEDNESDAY, OCTOBER 30, 2024
MEETING HELD ELECTRONICALLY VIA ZOOM

MEMBERS PRESENT

Diane Hobelaid, Chair
Councillor Ray Gourlay
Jordan Herbison
Andy Hobelaid
Shaun McKenzie
Christina Stephen

REGRETS

Councillor Amanda Jacobson

STAFF PRESENT

Sue Bouma (Manager of Corporate Services)
Nick Pescod (Communications & Engagement Specialist)

CALL TO ORDER AND ACKNOWLEDGEMENT	Ms. Hobelaid, Chair, called the Accessibility Advisory Committee meeting to order at 7:04 p.m., recognizing with gratitude that it was taking place on the unceded territory of the Stz'uminus First Nation.
AGENDA APPROVAL	*Moved and seconded:* That the agenda for the October 30, 2024 meeting of the Accessibility Advisory Committee be approved as presented. *Motion carried.*
MINUTES APPROVAL	*Moved and seconded:* That the minutes of the September 25, 2024 Accessibility Advisory Committee meeting be approved. *Motion carried.*
ACCESSIBILITY PLAN FRAMEWORK	The Committee provided suggestions regarding the Accessibility Plan framework. This revision process will continue at the next meeting.
NEW BUSINESS	S. Bouma advised that Joel Helland had submitted his resignation from the committee.

NEXT MEETING The Committee agreed to meet electronically for its next meeting on November 27, 2024.

ADJOURNMENT *Moved and seconded:*
That this Accessibility Advisory Committee Meeting be adjourned at 8:10 p.m.
Motion carried.

RECEIVED:

Diane Hobelaid
Chair

Sue Bouma
Corporate Officer

MINUTES OF THE ACCESSIBILITY ADVISORY COMMITTEE
WEDNESDAY, NOVEMBER 27, 2024
MEETING HELD ELECTRONICALLY VIA ZOOM

MEMBERS PRESENT
Diane Hobelaid, Chair
Jordan Herbison
Councillor Amanda Jacobson
Shaun McKenzie
Christina Stephen

REGRETS
Andy Hobelaid

STAFF PRESENT
Sue Bouma (Manager of Corporate Services)
Nick Pescod (Communications & Engagement Specialist)

CALL TO ORDER AND ACKNOWLEDGEMENT

Ms. Hobelaid, Chair, called the Accessibility Advisory Committee meeting to order at 7:04 p.m., recognizing with gratitude that it was taking place on the unceded territory of the Stz'uminus First Nation.

AGENDA APPROVAL

Moved and seconded:
That the agenda for the November 27, 2024 meeting of the Accessibility Advisory Committee be approved as presented.
Motion carried.

MINUTES APPROVAL

Moved and seconded:
That the minutes of the October 30, 2024 Accessibility Advisory Committee meeting be approved.
Motion carried.

ACCESSIBILITY PLAN FRAMEWORK

The Committee reviewed the updates made to the Accessibility Plan framework as a result of the October 30th Committee meeting and provided additional suggestions going forward.

NEW BUSINESS

NEXT MEETING

The Committee agreed to meet electronically for its next meeting on January 8, 2025.

ADJOURNMENT *Moved and seconded:*
That this Accessibility Advisory Committee Meeting be adjourned at 8:25 p.m.
Motion carried.

RECEIVED:

Diane Hobelaid
Chair

Sue Bouma
Corporate Officer

TOWN OF LADYSMITH

BYLAW NO. 2198

A Bylaw to amend the Sanitary Sewer Rates

The Council of the Town of Ladysmith in open meeting assembled amends "Sanitary Sewer Rate Bylaw 1999, No. 1299" as follows:

1. Delete Schedule "A" in its entirety and replace with the attached Schedule "A".

Effective Date

2. The provisions of this bylaw shall become effective and be in force as of January 1, 2025.

Citation

3. This bylaw may be cited as "Sanitary Sewer Rate Bylaw 1999, No. 1299, Amendment Bylaw 2024, No. 2198".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2024

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S .Bouma)

SCHEDULE "A"
TOWN OF LADYSMITH
"Sanitary Sewer Rate Bylaw 1999, No. 1299"

SCHEDULE OF RATES

CLASSIFICATION		Sewer Charge Per Month ($)
Residences or Apartments:	For each Dwelling Unit	$ 32.83
Motels & Auto Courts:	Premises of owner or operator For each rental unit	$ 32.83 $ 5.02
Mobile Home Parks:	Public rest rooms and/or service rooms For each mobile home with sewer connection	$ 32.83 $ 32.83
Hotels:	Owners or managers quarters Per apartment for rent Per room for rent	$ 32.83 $ 32.83 $ 5.02
Beer Parlours, Pubs, Licenced Cabarets & Lounges:	For each separately licenced area	$ 68.34
Cafes, Restaurants & Dining Rooms:		$ 68.34
Offices, Shops and Stores:	Per office, store & store unit not otherwise specified	$ 32.83
Store(s) and Suites(s) combined:	Per store unit Per suite	$ 32.83 $ 32.83
Stores(s) and Office(s) combined:	Per store unit per office unit	$ 32.83 $ 32.83
Office Building:	per office unit	$ 32.83
Laundry or Laundromat:		$ 108.59
Services Stations and Garages:	Without car wash With car wash	$ 32.83 $ 73.05
Public or Social Club with licenced bar:		$ 68.34
Church Hall, Public Hall or Lodge Room		$ 25.41
Hospitals & Nursing Homes	per bed	$ 15.26
Schools	per classroom, auditorium or office	$ 32.83

Effective January 1, 2025

TOWN OF LADYSMITH

BYLAW NO. 2199

A Bylaw to amend the Waterworks Regulations

The Council of the Town of Ladysmith in open meeting assembled amends "Waterworks Regulations Bylaw 1999, No. 1298" as follows:

1. Delete Schedule "A" in its entirety and replace with the attached Schedule "A".

Effective Date

2. The provisions of this bylaw shall become effective and be in force as of January 1, 2025.

Citation

3. This bylaw may be cited as Town of Ladysmith "Waterworks Regulations Bylaw 1999, No. 1298, Amendment Bylaw 2024, No. 2199".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2024

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S. Bouma)

SCHEDULE "A"
TOWN OF LADYSMITH
"Waterworks Regulations Bylaw 1999, No. 1298"

1. METERED SINGLE UNIT DWELLING

Per billing period:

Base Rate, including consumption to 25 m^3	$ 64.01	
Next 26 m^3 to 50 m^3	$ 1.1646	per m^3
Next 51 m^3 to 75 m^3	$ 1.3762	per m^3
Next 76 m^3 to 100 m^3	$ 1.6935	per m^3
Next 101 m^3 to 125 m^3	$ 2.2230	per m^3
Over 125 m^3	$ 2.9640	per m^3
Over 200 m^3 (April to September only)	$ 3.8532	per m^3

2. METERED SINGLE UNIT DWELLING WITH SUITE

Per billing period:

Base Rate, including consumption to 37.50 m^3	$ 96.02	
Over 37.50 m^3	$ 1.0585	per m^3

3. METERED SERVICE - all other users

Per billing period:

Base Rate, including consumption to 25 m^3	$ 64.01	
Over 25 m^3	$ 1.0585	per m^3

4. NON-METER SERVICE

Per billing period:	$ 92.81	per unit

5. BULK WATER RATE $ 2.67 per m^3

6. WATER SERVICE CONNECTION RATES

Where a service connection has not been previously provided to a parcel but where the Public Waterworks system front or abuts the parcel:

(A) Up to a 25mm (4") service connection including meter, meter box, meter setter, check valves, shut-off valves and other related appurtenances:	$3,000 per connection
(B) Larger than 25mm (4") shall be:	At cost but no less than $3,000 per connection

SCHEDULE "A" (cont.)

Where a service connection has been previously provided to a parcel:

(C) Service connection including meter, meter box, meter setter, check values, shut-off valves and other related appurtenances and is the requested size:	$100 per connection
(D) Owner requested service modification including installation of a water meter, meter box, meter setter, check valves, shut-off valve and any other related appurtenances shall be:	At cost, but no less than $3,000 per connection

7. FINES

Every person who violates any provision of this bylaw shall be guilty of an offence punishable on summary conviction and shall be liable to a fine or to imprisonment for not more than 6 months, or both. Each day that a violation of the provisions of this bylaw occurs, exist or is permitted to occur or exists, shall constitute a separate offense.	$2,000 per offence

TOWN OF LADYSMITH

BYLAW NO. 2201

A Bylaw to amend
"Garbage, Recyclables and Organics Collection Bylaw 2005, No. 1588"

The Council of the Town of Ladysmith in open meeting assembled hereby amends "Garbage, Recyclables and Organics Collection Bylaw 2005, No. 1588", as follows:

1. Delete section 2 in its entirety and replace with the following:

"ADD-A-DAY"	means the scheduling system in which the day for collection advances by one weekday following any holiday recognized by the Town. There shall be no collection on Saturday, Sunday or holidays recognized by the Town;
"APPROVED DISPOSAL SITE"	means a site authorized by the Town of Ladysmith, the Cowichan Valley Regional District, or the Ministry of Environment, Lands and Parks for the deposit and disposal of garbage, recyclable materials, or all organics materials;
"BASIC SERVICE"	means the garbage, recyclable collection and organics collection service established under section 5 of this Bylaw;
"BASIC SERVICE USER"	means a person who must use the municipal garbage, recycling and organics collection service under section 4.1;
"BIOMEDICAL WASTE"	means waste that is generated by (a) human health care facilities, (b) medical research and teaching establishments, (c) clinical testing or research laboratories, and (d) facilities involved in the production or testing of vaccines, and contains or may contain pathogenic agents that may cause disease in humans exposed to the waste;
"BIWEEKLY SERVICE PERIOD"	means the collection of garbage every second week with the collection of recyclables on alternate weeks;
"CVRD"	means the Cowichan Valley Regional District;
"COLLECTION"	means the removal of garbage, recyclable materials, organics materials or all three by the Town or its contractor under this Bylaw;

"COLLECTION ROUTE"	means a route or routes established from time to time by the General Manager, Engineering and Public Works for scheduled Collection under the Garbage, Recycling and Organics Collection Bylaw 2005, No.1588;
"COMMERCIAL PREMISES"	means a building or part of a building occupied for the purpose of carrying on a profession, trade or business;
"COMMERCIAL WASTE"	means all refuse and waste and accumulation of waste and abandoned material resulting from the operation of a trade or business including paper boxes and packing cases, wrapping material, wrappings and all materials of like nature, other than Garbage;
"CONTRACTOR"	means a person under contract to the Town to provide a service;
"DIRECTOR OF FINANCE"	means the person duly appointed the Director of Finance of the Town;
"DIRECTOR OF INFRASTRUCTURE SERVICES"	means the person duly appointed the Director of Infrastructure Services of the Town;
"DWELLING UNIT"	means (a) single family dwelling, (b) in relation to a duplex, triplex or fourplex, each self-contained residential suite, or (c) a secondary suite;
"EXTENDED SERVICE"	means the additional garbage collection service provided under section 8 of this Bylaw;
"EXTENDED SERVICE USER"	means a person who receives extended service under section 8 of this Bylaw;
"GARBAGE"	means discarded matter, but does not include recyclable materials, organics materials or any material listed in section 12.1 of this Bylaw;
"GARBAGE CONTAINER"	means a receptacle of not more than 70 litres capacity with carrying handles and a waterproof cover used to collect and store garbage;

"GARBAGE TAGS" means single-use tags or stickers required to access extended service;

"GARDEN WASTE" means vegetation removed from gardens, lawns, shrubs and trees and includes prunings from shrubs and trees;

"GROUP HOME" means a dwelling owned by an incorporated non-profit society in good standing that has the care of persons as one of its objectives, and in which reside
(a) not more than five persons needing care, and
(b) not more than two adults who are paid to provide such care;

"HAZARDOUS WASTE" means any gaseous, liquid or solid waste that, because of its inherent nature and quality, requires special disposal techniques to avoid creating health hazards, nuisances or environmental pollution, and includes:
(a) paint
(b) oil
(c) gypsum
(d) toxic waste
(e) poisonous waste
(f) corrosive waste
(g) ignitable waste
(h) explosive waste
(i) other hazardous waste as defined by the Hazardous Waste Regulation of the *Environmental Management Act*

"IGNITABLE WASTE" means waste that is a
(a) flammable gas,
(b) flammable liquid, or
(c) flammable solid or substance susceptible to spontaneous combustion or substances that, on contact with water, emit flammable gases as defined in the Special Waste Regulation of the Province of British Columbia;

"MUNICIPAL COLLECTION SYSTEM" means a municipal collection system established under section 3 of this Bylaw;

"OPERATIONAL SAFETY" means issues related to the safety of persons, property or any workers involved in providing collection service;

"ORGANICS"	means kitchen waste that is compostable and includes egg shells, bones, tea bags, coffee grounds, paper, filters, dairy products (butter, cheese) fruits, vegetables, (no packaging) breads, pasta, cakes, biscuits, paper towels, napkins, paper plates, paper cups, pizza boxes, food soiled cardboard;
"ORGANICS CONTAINER"	means a container of not more than 45 litres capacity, with a tight seal for pest and odour resistance;
"PATHOLOGICAL WASTE"	means (a) any part of the human body, including tissues and bodily fluids, but excluding fluids, extracted teeth, hair, nail clippings and like parts, that are not infectious; (b) any part of the carcass of an animal infected with a communicable disease or suspected by a veterinary practitioner to be infected with a communicable disease, or; (c) non-anatomical waste infected with communicable disease;
"PRIVATE COLLECTION SERVICE"	means a garbage and recyclable collection service operating under a valid Town business licence and that is not operated by or on behalf of the Town;
"RECYCLABLE MATERIALS"	includes all recyclable (a) newsprint, (b) corrugated cardboard, (c) mixed waste paper, (d) metal food and beverage containers, (e) plastic containers, or (f) other material that is collected from time to time by the Town or its contractor as a recyclable product;
"RECYCLING BIN"	means a bin provided by the Town or its contractor for the deposit of residential recyclable materials;
"RECYCLING CONTAINER"	means a reusable container approved by the Director of Infrastructure Services used for the purpose of storing and collecting recyclable materials;
"RESIDENTIAL GARBAGE"	means garbage generated by the occupants of a dwelling unit;

"RESIDENTIAL RECYCLABLE MATERIALS"	means recyclable materials generated by the occupants of a dwelling unit;
"ROOMING HOUSE"	means a single family dwelling in which rooms are rented to more than five but not more than 16 persons, but does not include community care facilities within the meaning of the *Community Care Facility Act*;
"SECONDARY SUITE"	means a self-contained suite which is clearly subordinate to the principal dwelling as defined in the Town of Ladysmith Zoning Bylaw as a Secondary Suite;
"SERVICE PERIOD"	means the period of time associated with scheduled garbage collection services and consisting of the biweekly collection service period and the weekly collection service period;
"STREET"	means a highway;
"TOWN"	means the Town of Ladysmith;
"TRADE OR INDUSTRIAL WASTE"	means garbage resulting from the operation of industrial, commercial or institutional premises;
"UNSERVICEABLE PROPERTY"	means: (a) any property or dwelling unit to which access from a street is inadequate for service by reason of grade, road configuration, physical condition or narrowness of the public street or lane or other access route as determined by the Director of Infrastructure Services; or (b) any property or dwelling unit which by its lack of proximity to other dwelling units being provided basic service would result in excessively high costs or time being allocated to service as determined by the Director of Infrastructure Services; (c) any property or dwelling unit the Director of Infrastructure Services determines is unsafe to service;
"WEEKLY SERVICE PERIOD"	means scheduled collection service e provided on a weekly schedule using the add-a-day system.

2. Replace throughout the bylaw the term ""Director of Public Works" with "Director of Infrastructure Services".

3. Amend section 3.1 by replacing it with the following:
   "A municipal collection system is established to collect, remove and dispose of residential garbage, residential recyclable materials and residential organics."

4. Delete section 3.2 and 3.3.

5. Replace section 4 in its entirety with the following:
   "4.1 Subject to subsection 4.2, no person shall dispose of residential garbage, recyclables or organics except through the municipal collection system in accordance with this Bylaw."

   4.2 Subsection 4.1 does not apply to
   a) multi-family premises that consist of more than four dwelling units; and
   b) occupants of dwelling units who dispose of their residential garbage through a private collection service as permitted under section 7.3.
   c) commercial premises;
   d) industrial and institutional operations;
   e) an Unserviceable Property."

6. Replace section 5 in its entirety with the following:
   "5.1 Basic Service for each Dwelling Unit receiving the collection service, scheduled according to the Add-a-Day System, shall be as follows:
   a) recyclable materials, once every second scheduled recyclable collection, and
   b) garbage from one garbage container, once every second garbage collection, on alternate weeks from recyclable collection;
   c) organics from one organics container each scheduled collection."

7. Replace section 6.2 in its entirety with the following:
   "To be eligible for services, applicants under Subsection 6.1 must satisfy the Director of Infrastructure Services that the garbage, recyclable and organics collection service required by the applicant does not exceed four units."

8. Replace section 6.2.1 in its entirety with the following:
   "Fees for service shall be based on the number of units requested and approved for collection by the applicant."

9. Replace section 7 in its entirety with the following:
   " 7.1 The Town shall not collect garbage, recyclable and organics from
   a) a multiple family dwelling consisting of more than four dwelling units,

b) commercial premises that do not qualify for basic service under section 5,
c) industrial and institutional operations,
d) an unserviceable property.

7.2 An owner of premises listed in subsection 7.1 shall
a) arrange garbage collection by a private collection service that disposes of garbage at an approved disposal site, and
b) ensure that garbage is collected on a regular basis to prevent the development of noxious odours and the accumulation of garbage.

7.3 An owner of a dwelling or premises served by the municipal garbage collection system may apply, in writing, to the Director of Infrastructure Services for permission to have his or her garbage collected and disposed of by a private collection service.

7.4 The Director of Infrastructure Services may approve an application made under subsection 7.3 where the applicant demonstrates that the municipal garbage collection system does not provide service adequate to deal with the type or volume of garbage generated by the applicant.

7.5 If an application under subsection (7.3) is approved, the applicant shall notify the Director of Finance in writing of
a) the date private collection service will start, and
b) the name of the collection service to be used."

10. Amend section 12.1(g) by adding the term "large amounts" before "animal feces, waste, or related litter products,"

11. Amend 12.2 by deleting reference to "11" and replacing it with "12.1".

12. Amend section 13(c) by adding the term "loaded" before "garbage containers and recycling containers".

13. Delete section 16.2.

14. Amend section 19.2 by deleting reference to "17" and replacing with "19.1".

15. Delete section 9, 10, 11 and renumber accordingly.

16. Delete Schedule "A" in its entirety and replace with the attached Schedule "A".

17. Delete Schedule "B" in its entirety and replace with the attached Schedule "B".

Citation

18. This Bylaw may be cited for all purposes as "Garbage, Recycling and Organics Collection Bylaw 2005, No. 1588, Amendment Bylaw 2024, No. 2201".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2024

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S. Bouma)

SCHEDULE "A"

RATES AND CHARGES

1. A charge of Fourteen ($14.00) Dollars per unit per month is imposed on every owner of a dwelling unit.

2. The charge for garbage tags for extended service is $3.00 per tag.

3. All charges shall be due and payable when levied.

SCHEDULE "B"

FINE SCHEDULE

The following fines are prescribed for the purposes of this Bylaw:

OFFENCE	SECTION	FINE
Fail to dispose of garbage in accordance with the Bylaw	4.1	$100
Fail to provide for garbage collection	7.2	$50
Unacceptable material in container	11	$100
Fail to use suitable garbage container	12(a)	$50
Fail to use suitable recycling container	12(b)	$50
Fail to remove containers	12(g)	$50
Fail to secure plastic bags	12(I)	$50
Improper use of recycling container	13.1	$50
Place recycling bin on Town property	13.2	$50
Damage / tamper with recycling bin	13.3	$100

TOWN OF LADYSMITH

BYLAW NO. 2202

A Bylaw to Provide for the Borrowing of Money in Anticipation of Revenue

WHEREAS the Town of Ladysmith does not have sufficient money on hand to meet the current lawful expenditures of the municipality;

AND WHEREAS it is provided by Section 177 of the *Community Charter* that Council may, without the assent of the electors or the approval of the Inspector of Municipalities, provide for the borrowing of such sums of money as may be necessary to meet the current lawful expenditures of the municipality provided that the total of the outstanding liabilities does not exceed the sum of:

> The whole amount remaining unpaid of the taxes for all purposes levied during the current year, provided that prior to the adoption of the annual property tax bylaw in any year, the amount of the taxes during the current year for this purpose shall be deemed to be 75% of the taxes levied for all purposes in the immediately preceding year.

AND WHEREAS the total amount of liability that Council may incur is eight million dollars ($8,000,000);

AND WHEREAS there are no liabilities outstanding under Section 177;

NOW THEREFORE the Council of the Town of Ladysmith in open meeting assembled enacts as follows:

1. The Council shall be and is hereby empowered and authorized to borrow upon the credit of the Town of Ladysmith an amount or amounts not exceeding the sum of eight million dollars ($8,000,000).

2. The form of obligation to be given as acknowledgement of the liability shall be a promissory note or notes bearing the corporate seal and signed by the Mayor and the officer assigned the responsibility of financial administration of the municipality.

3. All unpaid taxes and the taxes of the current year when levied or so much thereof as may be necessary shall, when collected, be used to repay the money so borrowed.

Effective Date

4. This bylaw comes into effect January 1, 2025.

Citation

5. This bylaw may be cited for all purposes as "2025 Revenue Anticipation Borrowing Bylaw 2024, No. 2202".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2024

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S. Bouma)

TOWN OF LADYSMITH

BYLAW NO. 2203

A Bylaw to Repeal "Town of Ladysmith Downtown Development Cost Charges Reduction Bylaw, 2011, No. 1781"

The Council of the Town of Ladysmith in open meeting assembled enacts as follows:

1. "Town of Ladysmith Downtown Development Cost Charges Reduction Bylaw, 2011, No. 1781" is hereby repealed.

Citation

2. This Bylaw may be cited for all purposes as "Town of Ladysmith Downtown Development Cost Charges Reduction Repeal Bylaw, 2024, No. 2203".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2024

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S. Bouma)

TOWN OF LADYSMITH

BYLAW NO. 2204

A Bylaw to Amend
"Town of Ladysmith Fire Services Bylaw 2023, No. 2147"

The Council of the Town of Ladysmith in open meeting assembled amends "Town of Ladysmith Fire Services Bylaw 2023, No. 2147" as follows:

1. Delete Section 1 "Fire Services Act means Fire Services Act, RSBC.1996, c.144" and replace with the following: "Fire Safety Act means the Fire Safety Act, SBC 2016. c. 19".

2. Replace throughout the bylaw the term "Fire Services Act" with "Fire Safety Act".

3. Replace Section 2.4.3. in its entirety with the following:
   2.4.3. The Fire Chief shall take responsibility for all fire protection matters and other Incidents including the enforcement of applicable sections of the Fire Safety Act, and the Fire Code.

4. Replace Section 2.4.4 in its entirety with the following:
   2.4.4. The Fire Chief may appoint or designate other Officers of the Fire Rescue Department to act as Fire Chief on his behalf.

5. Replace Section 2.4.5 in its entirety with the following:
   2.4.5. Council designates as Fire Inspectors and / or Fire Investigators any member of Ladysmith Fire Rescue that has met the required training standard pursuant to the Fire Safety Act.

6. Replace section 2.8 in its entirety with the following:
   2.8. Jurisdiction of Fire Rescue Department:
   The limits of the jurisdiction of the Fire Chief and the Members of the Fire Rescue Department will extend to the area and boundaries of the Town of Ladysmith, and neither the Fire Chief or Members shall supply fire fighting services or respond to an Incident, nor shall any part of the fire Apparatus or Equipment be used outside the boundaries of the Town without:

   - the express authority of a written agreement providing for the supply of fire fighting services, or other incident response outside the Town boundaries; or
   - the approval of the Mayor, or in their absence, the Chief Administrative Officer; or
   - a request for assistance in accordance with the *Emergency and Disaster Management Act (SBC 2023 c.37)* as amended or re-

enacted from time to time.

Citation

7. This Bylaw may be cited for all purposes as "Town of Ladysmith Fire Services Bylaw 2023, No. 2147, Amendment Bylaw 2024, No. 2204".

READ A FIRST TIME on the _____ day of _____, 2024
READ A SECOND TIME on the _____ day of _____, 2024
READ A THIRD TIME on the _____ day of _____, 2024
ADOPTED on the _____ day of _____, 2024

_____
Acting Mayor (T. McKay)

_____
Corporate Officer (S. Bouma)

BYLAW STATUS SHEET
December 17, 2024

Bylaw #	Description	Status
2131	"Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw (No. 54) 2022, No. 2131" (10940 Westdowne Rd.). Changes zoning from Rural Residential (RU-1) to Manufactured Home Park (MHP-1).	First and second readings, December 20, 2022. Public Hearing and third reading December 19, 2023. MOTI approval received January 15, 2024. **Awaiting covenant.**
2133	"Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw (No. 56) 2023, No. 2133". Allows convenience store at 1132-1142 Rocky Creek Rd.	First and second readings, January 10, 2023. Public Hearing required. MOTI approval required. **Waiting on applicant to submit Development Permit per Council Resolution.**
2161	"Official Community Plan Bylaw 2022, No. 2200, Amendment Bylaw 2023, No. 2161". To expand the mobile home park at 10940 Westdowne Road.	First and second readings, November 21, 2023. Second reading rescinded, second reading as amended, December 5, 2023. Public Hearing and third reading December 19, 2023. **Awaiting covenant.**
2167	"Town of Ladysmith Animal Control Bylaw 2024, No. 2167". To manage and regulate the keeping of animals in the Town.	First, second and third readings, May 21, 2024. Consequential amendments must be made to the Zoning Bylaw prior to approval. **Awaiting consequential amendments to the Zoning Bylaw.**
2170	"Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw 2024, No. 2170". To reallocate units for a portion of the Holland Creek neighbourhood to create a smaller development footprint, eliminate the need for a crossing over Heart Creek and adjust triggers for infrastructure construction.	First and second readings, May 7, 2024. Public Hearing held May 21, 2024. MOTI approval received May 27, 2024. **Awaiting covenant.**
2171	"Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw 2024, No. 2171". To reallocate units for a portion of the Holland Creek neighbourhood to create a smaller development footprint, eliminate the need for a crossing over Heart Creek and adjust triggers for infrastructure construction.	First and second readings, May 7, 2024. Public Hearing held May 21, 2024. MOTI approval received May 27, 2024. **Awaiting covenant.**
2173	Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw, No. 2173	First and second readings, November 19, 2024. Public Hearing required.

2198	Sanitary Sewer Rate Bylaw 1999, No. 1299, Amendment Bylaw 2024, No. 2198	First, second and third readings, December 3, 2024.
2199	Waterworks Regulations Bylaw 1999, No. 1298, Amendment Bylaw 2024, No. 2199	First, second and third readings, December 3, 2024.
2201	Garbage, Recycling and Organics Collection Bylaw 2005, No. 1588, Amendment Bylaw 2024 No. 2201	First, second and third readings, December 3, 2024.
2202	2025 Revenue Anticipation Borrowing Bylaw 2024, No. 2202	First, second and third readings, December 3, 2024.
2203	Town of Ladysmith Downtown Development Cost Charges Reduction Repeal Bylaw, 2024, No. 2203	First, second and third readings, December 3, 2024.
2204	Town of Ladysmith Fire Services Bylaw 2023, No. 2147, Amendment Bylaw 2024, No. 2204	First, second and third readings, December 3, 2024.

FIRST AVENUE FREEHOLDERS

November 18, 2024

Randy Repass and Sally-Christine Rodgers
First Avenue Freeholders Corp
440 1st Avenue
Ladysmith, BC V9G 1B1

Mayor McKay and Council Members of
The Town of Ladysmith
410 Esplanade
Ladysmith, BC V9G 1A2

Dear Mayor McKay and Council Members,

Re: Request to Reinstate Development Cost Charge Bylaw No. 1781 for Ongoing Development Project

I am writing on behalf of the 440 1st Avenue (Islander Hotel) development project to express our concern regarding the repeal of Bylaw No. 1781, which provided a reduction in Development Cost Charges (DCCs) for qualifying projects. This unexpected policy change has presented a significant and unanticipated financial impact on our project, which had progressed under the understanding that Bylaw No. 1781 would apply.

Our project was initiated under the premise that Bylaw 1781's provisions would remain in place, commencing in 2022 and subsequent approval of the development rezoning completed in June of 2023. We have made substantial investments in good faith under the belief that these DCC adjustments would continue to be honored. The repeal of this bylaw in March was completely unforeseen. As the sole redevelopment application underway in the Downtown Specified Area, and one in which significant effort and cost are being expended to bring economic development while retaining and restoring an important heritage edifice, repeal of this bylaw without notice or consultation with us is concerning. While we have just successfully received council approval for our Development Permit and Variance following a year of process with your staff, this change has placed our project in a challenging position, one that jeopardizes not only the financial viability but also the positive contribution it was expected to bring to Ladysmith, including increased housing options and economic activity.

We respectfully request that the Town of Ladysmith apply the terms of Bylaw 1781, as it existed prior to March of 2024, to this already underway project. Allowing this exemption would not only prevent undue hardship but also demonstrate Ladysmith's commitment to supporting this project understanding the precariousness of the project's financial situation.

Thank you for your consideration of this request. We are eager to work together with the Town of Ladysmith to ensure a fair and equitable resolution that supports both our project's success and the community's growth.

Sincerely,

Randy Repass and Sally-Christine Rodgers
First Avenue Freeholders

TOPIC:	Communications & Social Media Policy	
POLICY No.:	04-1470-A	
APPROVED BY:		RESOLUTION No.:
ORIGINAL DATE:		AMENDMENT DATE:

Purpose
The purpose of this policy is to ensure clear, timely, and transparent communication between the Town of Ladysmith and the public. This policy promotes accessibility, consistency, and public engagement to foster trust, enhance civic pride and improve the Town of Ladysmith's relationship with its residents.

Scope
This policy applies to Town Council, Town staff, paid-on-call fire fighters and contractors employed by the Town.

Objectives
The Town's communication policy is designed to facilitate two-way dialogue with the community while maintaining consistency and accessibility across all platforms. To achieve this, the Town of Ladysmith will:

- Provide residents with timely, accurate, and relevant information about the Town's policies, programs, services and initiatives.
- Ensure that communication supports the town's values of inclusivity and accountability.
- Foster meaningful two-way dialogue between the town and residents.
- Respect access to information and the privacy rights of citizens and employees.

The Town of Ladysmith's communications will be driven by the following principles, designed to ensure open and effective communication with the public:

- **Transparency:** To foster public trust, the Town will provide clear, accurate, and open information about its policies, services, programs, and decisions.
- **Accessibility:** Communications will be presented in plain language and, where possible, made available in multiple formats to accommodate all residents, including those with disabilities and those without access to digital platforms.
- **Consistency:** The Town will maintain a consistent tone and message across all communication platforms, ensuring that information aligns with the Town's values and objectives. This includes a unified approach across social media, the Town website, newsletters, and other communication outlets.
- **Public Engagement:** Communication will aim to actively engage residents, offering opportunities for input on key decisions. Through public consultations, surveys, and meetings, the Town will encourage participation in shaping the direction of local governance.

- **Timeliness:** Communications will be delivered promptly, ensuring that residents receive up-to-date and factual information. The Town will prioritize the accuracy of the content to serve as a reliable source of information.
- **Community:** The Town will prioritize community needs by tailoring communication to different demographics. Feedback mechanisms, such as surveys and public engagement opportunities, will ensure that communication strategies are reflective of community interests.

Communication Channels
To effectively implement the communication policy, the Town uses the following multiple communication channels:

- Town website: ladysmith.ca
- Public engagement site: letstalk.ladysmith.ca
- Social media: Facebook, Hootsuite, Instagram, LinkedIn, TikTok, X (formerly Twitter), YouTube
- Public service announcements and media releases
- Newsletters, mailouts, inserts, brochures, signage and mass mailing

Roles and Responsibilities

- **Mayor and Council:** Serve as the primary public representatives of the Town and will be involved in significant announcements. Staff may also provide additional support for specialized communications.
- **Communications Team:** This includes the Communications & Engagement Specialist, Chief Administrative Officer (CAO), Manager of Corporate Services, Administrative Coordinator – Corporate Services, and Administrative Assistant – Corporate Services. Responsible for developing and implementing the Town's communication strategies, ensuring they align with this policy.
- **Town Departments:** Contribute to the creation of content by providing the necessary information and expertise in their respective areas.

Public Engagement
The Town of Ladysmith is committed to public participation and will use tools such as:

- **Public Consultations and Surveys:** Engaging with residents on matters that affect the community to gather feedback and shape policies.

Crisis Communication
In emergencies or crises, the Town will:

- Work with Emergency Management Cowichan, if necessary, to provide the public with real-time updates as the situation evolves.

- Use its website, social media, and local media outlets to rapidly distribute accurate and timely information
- Ensure that all messaging is consistent across channels to avoid confusion and misinformation

Social Media
The Town of Ladysmith uses social media to communicate with the public. The primary purpose is to share news and information about Town services, Town-sponsored or produced events, and to foster community outreach and engagement.

The Town of Ladysmith uses social media as a communication and engagement tool to:

- Enable the Town to communicate quickly and effectively
- Engage citizens at their convenience
- Foster two-way dialogue with the community
- Keep the public informed in real-time during various situations

The Town of Ladysmith's social media channels are guided by the Town's social media strategy, an internal document designed to ensure content is delivered in the most effective way possible.

Messages on the Town's channels may link to further information on:

- Town websites
- Appropriate affiliated agency sites, including other local, provincial, or federal governments, affiliated agencies, and Ladysmith community organizations

1) Social Media Management
Town of Ladysmith social media tools are managed by designated staff, including the Communications & Engagement Specialist and the Administrative Assistant, under the direction of Council and the CAO.

The Town, based on the advice of the Communications & Engagement Specialist and with approval from the CAO, may choose to:

- Launch a new or existing platform
- Terminate any existing social media channels at any time

2) Town Accounts
The Town of Ladysmith currently operates the following social media channels:

- Facebook
- Instagram
- LinkedIn

- YouTube
- X (Formerly Twitter)

The Town also uses Hootsuite to manage and distribute all its social media content.

3) Department Accounts
The following departments have been approved to operate their own social media channels, independent from the Town's main accounts:

- Ladysmith Fire Services – Facebook, Instagram
- Parks, Recreation & Culture – Facebook, Instagram

Departments not listed above may not create their own social media accounts without prior approval from the CAO. Departments must provide specific reasons for the need to have separate social media applications, how those social media applications will be maintained and monitored.

4) Authorized Personnel
The following personnel are permitted to post content and respond to comments on the Town's social media channels:

- CAO
- Manager of Corporate Services
- Communications & Engagement Specialist
- Administrative Coordinator – Corporate Services
- Administrative Assistant – Corporate Services

Town staff members are not permitted to post content on Town social media sites unless explicitly authorized. This applies to new content and responses to questions and comments from the public. Staff should refrain from responding to social media questions or comments. Only authorized individuals will respond to questions and comments.

Social media pages created by Mayor or Councillors to represent themselves for political purposes will be self-administered, and do not belong to, or reflect the positions of the Town of Ladysmith.

5) Content Guidelines
The Town's social media channels remain politically neutral and do not permit the posting of petitions, endorsements, advocacy, or other political messages. The primary purpose of the Town's social media channels is to share news and information about Town services, Town-sponsored or produced events, and to foster community outreach and engagement.

The Town's social media platforms are utilized in various ways, including but not limited to:

- Community awareness
- Community development
- Community services
- Employee recruitment
- Historical information about the Town
- Parks & Recreation programs and activities
- Public safety and weather emergencies
- Road closures
- Sponsored events

The Town of Ladysmith reserves the right to remove comments and block users who violate the following criteria:

- Posts must not be discriminatory, hateful, defamatory, or obscene
- Posts must not contain personal attacks, a harassing tone, or be used for personal gain or self-promotion
- Comments must be relevant to the topic and not used for solicitation or advertisement of any non-governmental organization, product, or service
- Comments from anonymous or fake accounts will not be tolerated
- Comments containing misinformation or disinformation will be removed

6) Confidentiality
The Mayor, Councillors, and Town staff must not divulge confidential information on social media, including but not limited to:

- Closed meeting items
- Human resources issues
- Emergency Operations Centre or Emergency Management Cowichan internal information

7) Policy Non-compliance
Content posted on the Town's social media channels that violates this policy will be documented and provided to the Manager of Corporate Services for consultation with the CAO and the Manager of Human Resources, for further review and action, if necessary.

8) Photo and Video
The Town of Ladysmith does not permit the reproduction or redistribution of photos or videos (in whole or partial) from its social media accounts for resale use.

Media Relations
The Communications & Engagement Specialist is responsible for receiving and forwarding media requests and directing them to the appropriate departments or channels. They will work with media outlets to ensure accurate information is provided and to meet deadlines whenever possible, while maintaining a respectful and professional working relationship with the media.

The Town reserves the right to stop accommodating media requests in cases where the respective media outlet continues to publish false or misleading information within their stories, or if their staff are abusive and/or uncooperative.

1) News Releases
All news releases and announcements must receive final approval from the Communications & Engagement Specialist, Manager of Corporate Services, the appropriate department directors as well as the CAO, when applicable, prior to distribution.

The Mayor or designate may also view these materials prior to distribution, at the discretion of staff.

The Town will maintain an archive of media releases, advisories, and public service announcements on its website related to but not limited to the following topics:

- Newsworthy events involving the Town
- Town initiatives and programs
- Notifications that materially affect residents

2) Spokespeople
The Mayor is the official Council media spokesperson. The Mayor may designate an alternate spokesperson on a case-by-case basis. The CAO is the official spokesperson for matters of an operational nature. The Communications & Engagement Specialist may also serve as the Town's spokesperson.

When an individual Council member shares their views, they should state that they are not speaking on behalf of the Town or the Council as a whole. Unless specifically authorized to represent the Town, all comments made by Council members, including the Mayor, should be understood as personal opinions. Town resources should not be used for public communications or events unless the member is officially representing the Town.

Branding
The Town of Ladysmith maintains a unified and consistent visual identity to ensure its roles and responsibilities are clearly recognized.

All communications from the Town, including signage, correspondence, or digital platforms, must be in line with the Town's visual identity.
The official municipal logo must appear on all Town communications including correspondence, publications, forms, facsimiles, advertisements, news releases, displays, signage, fleet vehicles, electronic communications and any other relevant communication mediums.

Where naming rights exist, additional branding may be included in line with contractual obligations, but this will not override Town branding unless authorized by the CAO. External organizations may wish to use the Town's logo to reflect the Town's official role or partnership in a program, service, or event.

All logo use requests from outside organizations should be directed to the Communications & Engagement Specialist or CAO for review and written approval, as appropriate. The Town of Ladysmith's Brand Identity Guide provides detailed guidelines on logo placement, colours, typography, and other branding elements.

Policy Review
This communication policy will be reviewed every three years or as needed to ensure it remains effective and up to date with best practices and the evolving needs of the community.