IRM in Colwood

Towards "Grid Positive, Carbon Neutral and Water Smart"

Prepared for:

City of Colwood

14 November 2008

fidelis resource group

fidelis
resource group

Michael Baxter
Engineer
City of Colwood
330 Wishart Road
Victoria B.C. V9C 1R1

14 November 2008

Dear Mr. Baxter,

IRM IN COLWOOD

On behalf of Fidelis Resource Group Inc., I am pleased to submit a summary of the report on Resources from Waste for Colwood. We have applied the Integrated Resource Management (IRM) approach that we initiated for the Province last year. The report has, as requested, been broadened for Colwood to include aspects of reduction in resource use and integrated energy design and related considerations.

We believe that the application of the IRM model for recovering resources from liquid and solid waste streams and integrating this with water reuse and energy is an appropriate model to achieve Colwood's goals of being 'grid positive, carbon neutral and water smart'. While there are opportunities to recover some revenue from waste streams, because Colwood has the majority of its population on septic systems, these opportunities are limited.

We have considered how Colwood might undertake IRM as a municipality, but most of the waste and revenue streams are likely to be optimised by a more regional approach. We thus conclude that while Colwood can undertake some parts of IRM on its own initiative, the City will wish to consider integrating resource recovery from waste streams with its neighbouring municipalities. There will be a much greater likelihood that resource recovery will be more viable and reduce costs to taxpayers than otherwise and thereby support meeting commitments to waste treatment being undertaken by the Capital Regional District in response to the directive from the Minister of Environment. There are grants available from the Federation of Canadian Municipalities to support such an initiative.

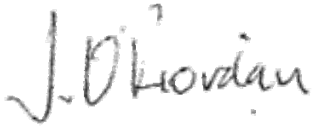
We feel that Colwood should consider moving towards a more detailed design for a demonstration waste treatment facility located in the vicinity of Wishart School/City Hall with the energy from sewage treatment supplying both the school and the Municipal Hall. This will help Colwood meet its Climate Charter commitment to be carbon neutral by 2012. The Wishart site is fed entirely by Colwood wastes and thus a controllable demonstration project that will benefit the taxpayer.

We also conclude there is benefit in increasing Colwood's community outreach on sustainability through community engagement and coordinated support. These aspects mostly relate to energy savings support that goes beyond the current grant programs and encouragement, the success of which will be improved by greater facilitation. These can be aimed at reducing the taxpayer's cost while improving community energy independence and carbon reduction. Other more detailed recommendations and explanations are included in the technical report.

This study is a conceptual design and will require more detailed analysis before your municipality can make a decision on whether to pursue the IRM model or individual components of it. The report is still in draft and we anticipate that we will have to undertake revision once it has been presented to your Council and received input.

Lastly, this abbreviated report is provided as a simplified study and we recommend reference to the full technical report to address any detailed questions. While this study can stand alone, it should be read in conjunction with and as an extension of the technical report, to which it relates.

Yours truly,



Jon O'Riordan on behalf of
Fidelis Resource Group Inc.

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Assumptions and Limiting Conditions

The information in this document was compiled only to offer a preliminary assessment of the potential for resource recovery in the City of Colwood. The authors have prepared this document at the request of the City of Colwood, solely for this purpose.

Information in this report from which conclusions have been derived has been provided by third parties. While reasonable skill, care and diligence have been exercised to assess the information acquired during the preparation of this report, no guarantees or warranties are made concerning the accuracy or completeness of this information. This document, the information it contains, the information and basis on which it relies and factors associated with implementation of resource recovery are subject to changes which are beyond the control of the authors. The information provided by others is believed to be accurate.

IRM requires an inter-disciplinary approach. As a result, components of the document were prepared by professionals in one field who are not also qualified in the other fields of study. While diligence has been applied, the scope of this report did not allow for full cross-verification of all analyses.

This report includes screening-level estimates which should not be relied upon for design or other purposes without verification, for example through detailed feasibility studies. The authors do not accept responsibility for the use of this report for any purpose other than that stated above and do not accept responsibility to any third party for the use, in whole or in part, of the contents of this document. This report is intended to provide a preliminary assessment of the potential for resource recover in the City of Colwood and cannot be applied to other jurisdictions without analysis. Any use by the City of Colwood, its sub-consultants or any third party, or any reliance on or decisions based on this document, are the responsibility of the user or third party.

Parties seeking to rely on this report should not do so without first satisfying themselves to the accuracy and extent of the contents, which have been prepared for the specific purposes of the client.

Stephen Salter PEng, David Jackson PEng, Patrick Lucey RPBio, and Cori Barraclough RPBio have consulted on resource recovery to Royal Roads University, and their participation in this study has been accepted by both the City of Colwood and Royal Roads University.

Authors:

This report was prepared by Fidelis Resource Group (Chris Corps, B.Sc., MRICS; Patrick Lucey, M.Sc., R.P. Bio.; Cori Barraclough, M.Sc., R.P. Bio.; and Jon O'Riordan, Ph.D.) with Farallon Consultants Ltd. (Stephen Salter PEng); WorleyParsons Komex (Dave Jackson PEng); and Judith Cullington & Associates (Judith Cullington, M.A.).

Integrated Resource Management

WHAT IS IRM?

Integrated Resource Management (IRM) refers to an approach that was developed for the Province of British Columbia in a report entitled *Resources from Waste: Integrated Resource Management Phase I Study Report.*[1] IRM is built on a series of principles including:

- **Resource use reduction**: The first step in IRM is to minimise use and wastage, through conservation and recycling. Any remaining 'wastes' become candidates for resource recovery.
- **Resources not waste**: IRM considers waste to be 'a resource in the wrong place'. In the IRM model, every waste stream is considered as a potential resource.
- **Integrated thinking**: IRM is a cross-disciplinary approach, including input from ecologists, economists, engineers, planners and others.
- **Geographical integration**: IRM includes the entire community within the system boundary, including near-neighbours even if they are part of a different municipality.
- **Driven by the business case**: IRM looks for the highest and best use for resources, and the best net revenues. The environment is part of the business case. IRM design is driven by the question of how to maximise value from waste, in ways that reduce costs to taxpayers.

Figure 1. Biogas Powered Bus in Sweden

In its full/optimal deployment, IRM has the potential to result in zero waste.

Figure 2 shows a traditional approach to liquid waste management, in which water is used only once before being expensively treated as 'waste' at a large treatment plant. This approach requires considerable taxpayer investment and reduces the opportunities for environmental and financial benefit from resource recovery.

By contrast, IRM (Figure 3) is designed to maximise the opportunities for resources recovery, using and an integrated business case. Resource use is minimised, and as much 'waste' as possible is recovered using localised treatment plants placed close to energy and water users. This creates multiple benefits including minimised cost to taxpayers, lower greenhouse gas emissions (GHGs) and reduced pollution.

[1] Corps CG, Salter SJ, Lucey WP, and O'Riordan J. Province of British Columbia, 2008. Resources From Waste: Integrated Resource Management Study Phase 1 Report. 181 pages. http://www.cd.gov.bc.ca/ministry/docs/IRM_report.pdf

Solid wastes are also considered a valuable resource, and used to support the production of clean energy (heat and electricity), fertiliser and biofuels.

Figure 2: Traditional Approach to Liquid Waste Management

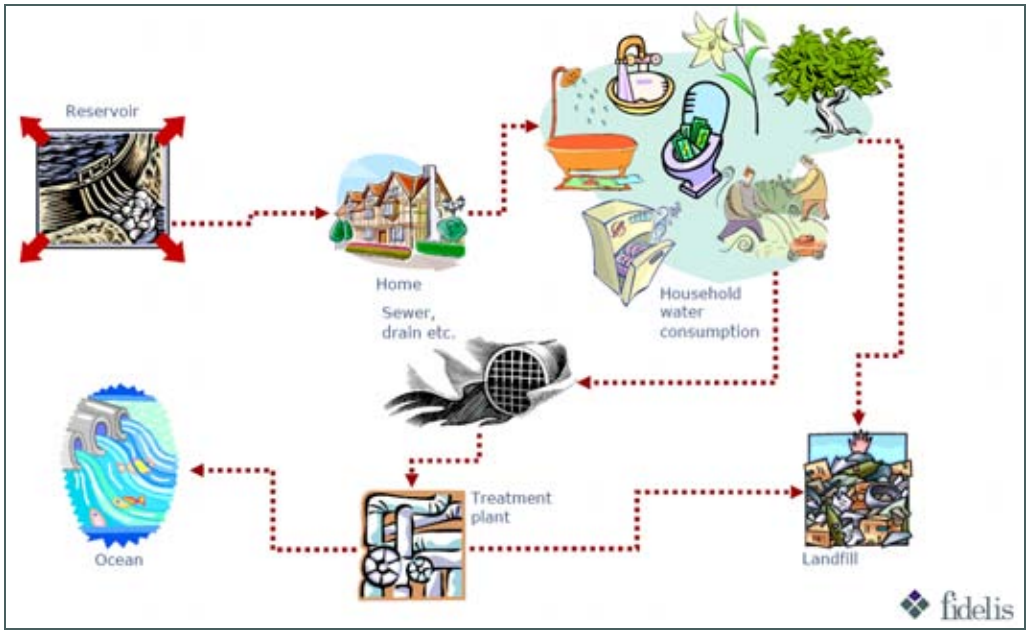
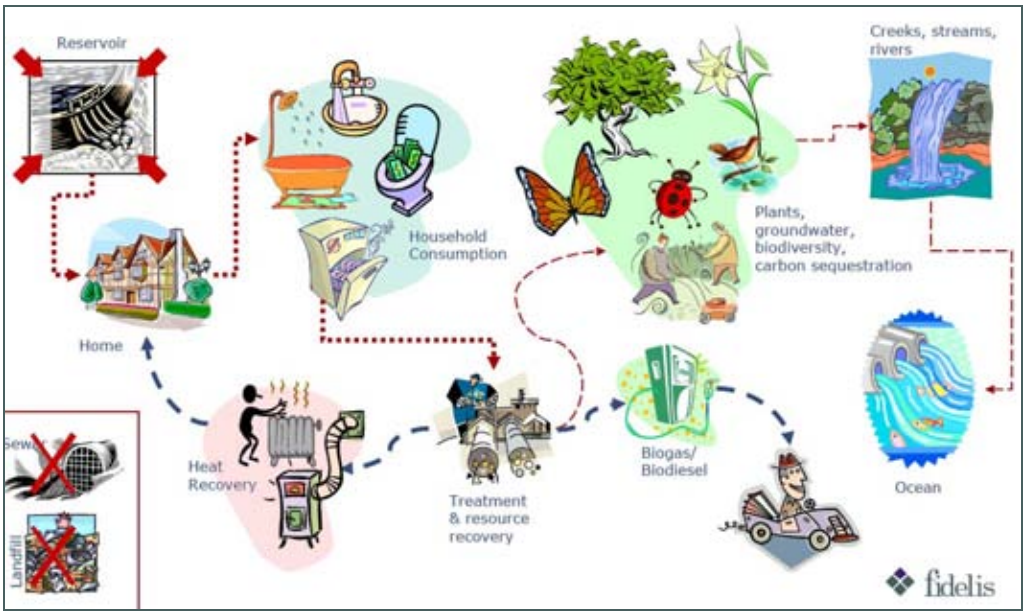


Figure 3: IRM Approach to Integrated Liquid/Solid Resource Management



IRM IN THE CAPITAL REGION

The study for the Province used the Capital Regional District (CRD) as an example to test the model at a concept level. The key conclusions were that, if fully implemented, the IRM approach has the potential within the CRD to:

- Power the equivalent of 10% of homes
- Heat the equivalent of 30% of homes
- Reduce greenhouse gas emissions by 25%
- Run the equivalent of 10% of cars
- Recover clean, usable water
- Limit tax increases

The scope of this provincial study included water, liquid and solid wastes and as a consequence of the report, the CRD is currently undertaking a more detailed analysis of the IRM model to apply a more integrated approach to liquid waste management in the core area.

WHY SHOULD COLWOOD CONSIDER IRM?

Colwood has committed to a future where it will be grid positive, carbon neutral and water smart. The IRM approach outlined in this report is one of the more innovative approaches to attaining these goals.

Two global factors are the drivers for this future vision for Colwood:

- Reduction in the use of fossil fuels, a major contributor to climate change, is mandated by the Province and a major factor in the Climate Action Charter signed by Colwood and the Province. Carbon pricing will add to the costs of using fossil fuels and provide an incentive for use of sustainable energy sources. Communities that do not adapt their energy use will face decreasing competitive advantage and consequent impacts on taxpayers through affordability, etc.;

- Climate change is affecting the weather, resulting in increasing frequency of summer drought, intense wind and rainstorms, sea rise and a variety of other consequences. Communities that do not adapt to these changes will increasingly find it difficult to maintain themselves and their way of life.

The City of Colwood asked Fidelis to examine whether IRM might help Colwood to become 'grid positive, carbon neutral and water smart'—which provides focus for Colwood in addressing climate change and fossil fuel depletion.

- **'Grid positive'** means that a community contributes more energy to the grid than it takes from it. This is achieved in two ways: reducing the amount of electricity that is used and generating energy from non-fossil fuel sources to supply the remaining needs.

- Being **'carbon neutral'** implies that there is no net release of carbon dioxide and other greenhouse gases into the atmosphere. It is a complex term because there can be carbon offsets (e.g., by planting trees that will sequester (take up) carbon), and some forms of fuel (such as biofuels from plants) are seen as carbon neutral as they are only releasing the carbon that

was taken up as those plants grew. It may be very difficult to become entirely 'carbon neutral'; however the intent is to dramatically reduce the carbon emissions from the City, homes and businesses.

- Being **'water smart'** implies reducing the use of potable water by using non-potable alternatives where appropriate, re-using water as much as possible and then returning clean water to streams and groundwater to support healthy aquatic ecosystems.

Achieving these goals will benefit Colwood in several ways:

- As a signatory to the Climate Action Charter, Colwood has committed its operations to be carbon neutral by 2012. The Premier recently announced that municipalities who commit to this goal, and publicly report on their plan and progress, will be eligible to receive a full refund on their carbon tax.[2] IRM may assist in reaching this goal;
- The Ministry of Community Development has stated that infrastructure funding will favour communities who are innovative and 'green';
- If IRM can provide waste management options that return revenue, residents will benefit from improved services at reduced taxpayer cost.

IRM Components

The Four "R's"

The first step in IRM is to minimise use and wastage, through the "reduce, replace, re-use" approach (see Table 1). The remaining waste is recovered and put to beneficial use.

Table 1: The Four "Rs"

	Water Examples	Energy Examples	Materials Examples
Reduce	Use low flow appliances Let lawns go brown in summer	Use energy-efficient appliances Turn off appliances when not in use	Purchase durable items rather than 'throw-aways' Use less paper
Replace	Capture rainwater for irrigation, toilet flushing, laundry, etc.	Install solar hot water tanks Use geoexchange for heating	Use cloth bags rather than plastic Use paper with high recycled content
Reuse	Re-use greywater (where permitted)	Capture heat before it leaves the building (e.g., warm water from showers, heat from dryers)	Refill containers rather than buying new
Recover	Use reclaimed, treated water for irrigation, enhancing streams & recharging groundwater	Reclaim energy from liquid and solid wastes	Reclaim energy from liquid and solid wastes

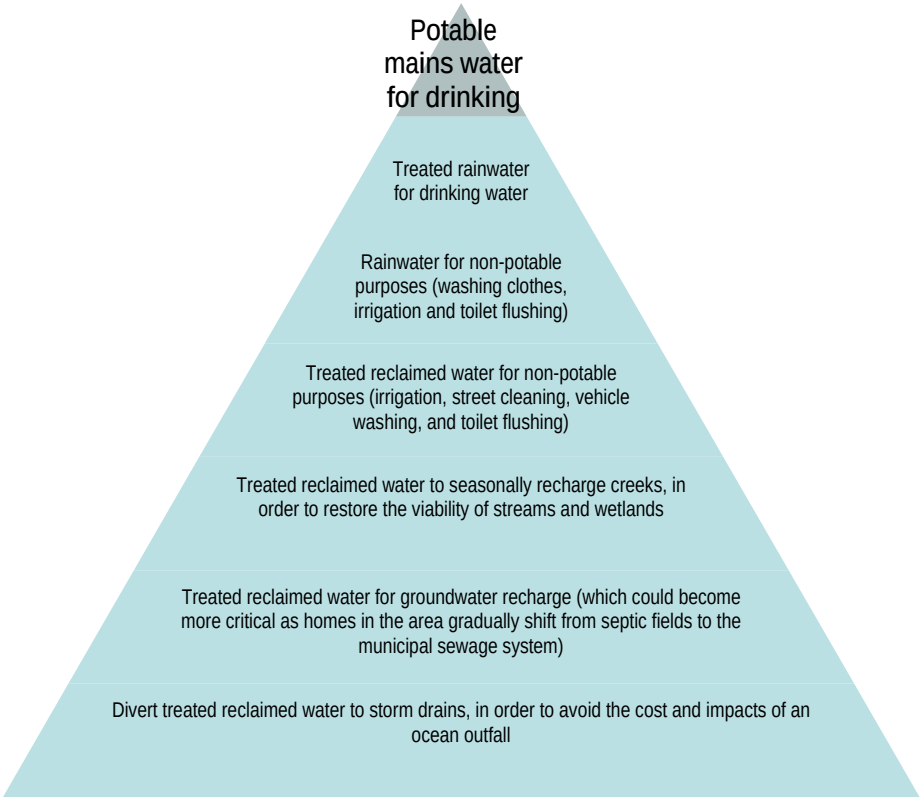
[2] http://www2.news.gov.bc.ca/news_releases_2005-2009/2008OTP0235-001451.htm

Water Recovery and Stream/Groundwater Augmentation

Less than one percent of treated, clean, drinking water is actually used for drinking or cooking. The IRM principle is that the quality of water should be matched to the needs of the environment and people, so that potable water is reserved for drinking while reclaimed water is used for a variety of non-potable purposes. This is known as a "fit-for purpose" approach.

IRM promotes 'reduce, replace, re-use, and recover' to be water smart. Internationally, the practice to achieve this is by using a water use hierarchy as illustrated in Figure 4. This includes use of rainwater capture, as well as use of reclaimed water from treatment plants.

Figure 4: Water Use Hierarchy



Rainwater capture is commonplace in Australia and other countries where surface water and/or groundwater are not plentiful enough to supply the household or community. Rain tanks are easily retrofitted into existing homes and simple controllers allow the water source for toilets or laundry to be automatically switched from domestic mains water to rainwater when demand is sensed and there is water in the rain tank, requiring no action by the homeowner. This can save up to 40% of a household's drinking water supply which is normally used in these applications.

Treated water from WERCs (see below) can be used for a variety of purposes, including irrigation (e.g., of playing fields), toilet flushing, and street cleaning as well as for stream and groundwater recharge.

Stream and groundwater recharge is critical for the support of aquatic ecosystems. Stream and groundwater levels are dropping, leaving some (once year-round) streams to run dry in summer.

WATER AND ENERGY RECOVERY CELLS (WERCS)

In the Provincial study[3] Fidelis recommended the use of a series of small distributed Water and Energy Recovery Cells (WERCs) throughout the CRD to treat sewage and recover heat and water. These are compact, enclosed facilities like the one that is now operational in the heart of the Dockside Green development (Figure 5), which has a capacity of about 400 m^3 per day.

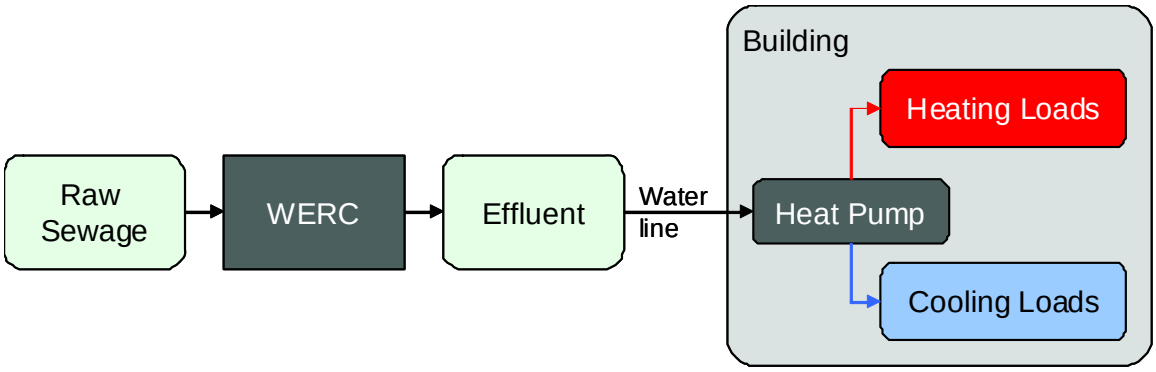
These WERCs treat water to a tertiary level (i.e., disinfected water that is safe for non-potable uses). After treatment, water is piped to heat pumps within nearby buildings. The remaining sludge can be used as fuel for a biogas digester (see below).

Figure 5 Dockside Green wastewater treatment plant, May 2008

Hot water from the heat pumps provides heat to the building's existing heating system through a heat exchanger (Figure 6). Once the heat has been extracted, the resulting cold water can be sent to clients looking for chilling (e.g., ice arenas). The water can then be used for a variety of non-potable purposes, including toilet flushing, landscape irrigation, street cleaning, streamflow augmentation and groundwater recharge.

The WERCs should be placed close to their clients for water and energy. They can be located on public lands, buried, or incorporated into existing buildings.

Figure 6 Schematic of WERC providing treated water to heat pumps



[3] Corps *et al.*, 2008. op. cit.

Biogas Digester

Anaerobic digestion is a means of composting organic material with bacteria in the absence of oxygen, a process which concentrates nutrients and produces biogas. Since the carbon in this gas (sometimes called biomethane) comes from food waste rather than fossil sources or from food crops, this fuel is carbon neutral.

Anaerobic digesters are fuelled by wet organic waste such as kitchen waste, restaurant waste, food factory waste, wastewater treatment plant biosolids, and manure. The resulting biogas can be upgraded and used to fuel vehicles or to replace natural gas in home heating, and the residues can be sent to the gasification plant (below) to help generate electricity.

Figure 7 Anaerobic Digesters in Kristianstad, Sweden

Sending wastes to the biogas digester reduces the amount of wastes going to the landfill. It avoids methane production from waste decomposition (that would otherwise contribute to climate change), and recovers this methane so that it can be used to replace fossil-based fuels.

Residues from anaerobic digesters that handle only clean (food) waste can be used as a fertiliser, displacing the use of synthetic fertilisers.

Gasification and Cogeneration

Gasification is a thermal process in which dry organic solids are converted into synthesis gas ("syngas") at high temperatures but with a controlled and limited supply of air. Synthesis gas consists of nitrogen, hydrogen, carbon dioxide, carbon monoxide, methane, and higher hydrocarbons.

A gasification plant requires dry organic waste (waste with a moisture content below 50%) such as wood residues, tree prunings, waxed cardboard, and construction, renovation, and demolition waste.

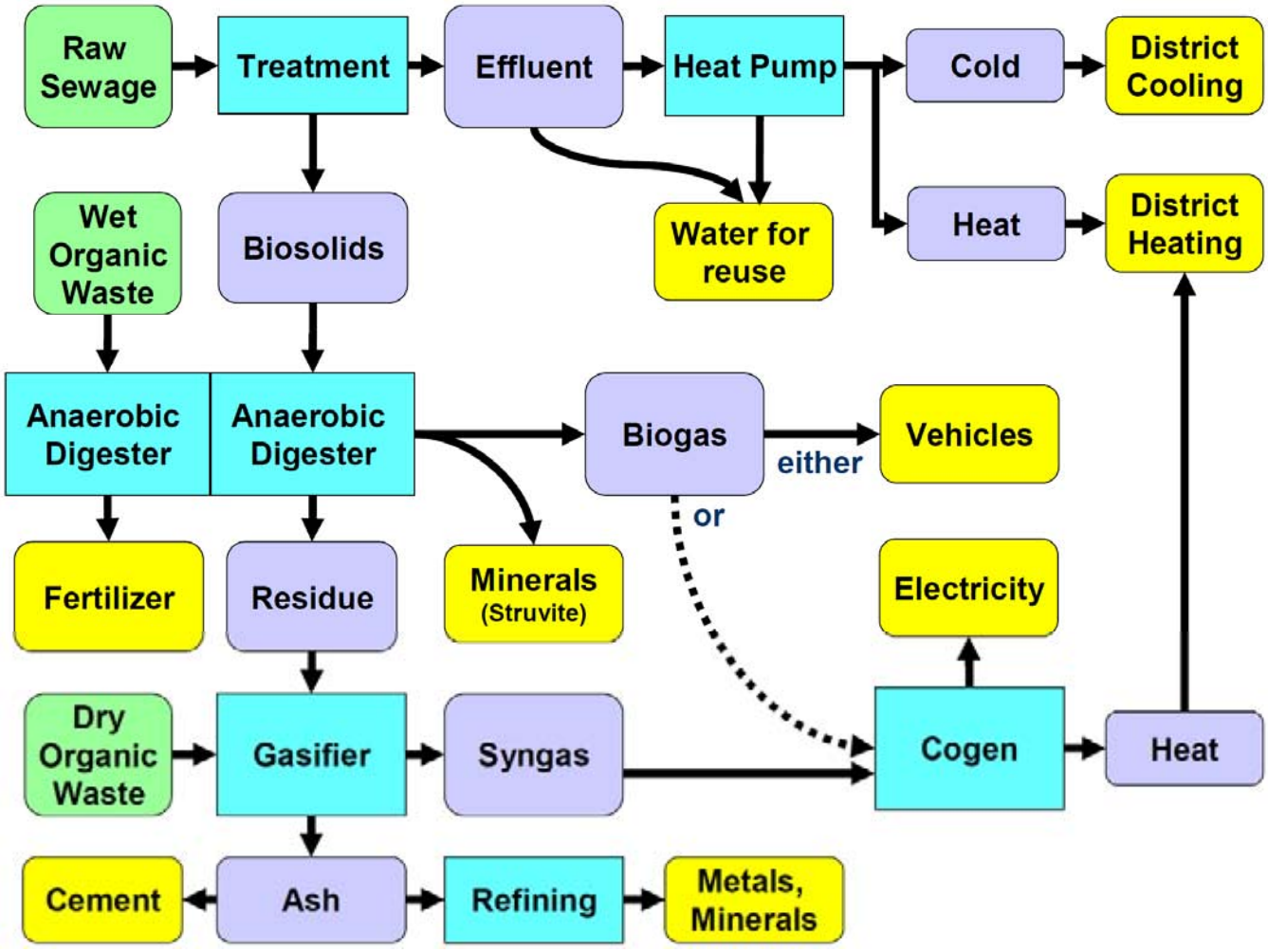
The resulting synthesis gas ('syngas') is not suitable for use in vehicles or as a replacement for natural gas, but can be burned for heat or in a cogeneration plant to produce electricity and heat.

Figure 8 Dockside Green Gasification Plant Under Construction, August, 2008

Depending on the gasification process used, the residue from gasification can take the form of powdered ash or a vitreous solid in which metals are bound and cannot readily leach into the environment. This material could be included with ore for refining by mines or used to reduce the greenhouse gas emissions of cement manufacturing.

These IRM elements are linked together as shown in Figure 9.

Figure 9: IRM Concept Diagram



A Possible IRM Approach for Colwood

IRM Components

1. Reduction in Water and Energy use

IRM places first priority on reducing water and energy use in the community, for example through more efficient appliances and use of on-site 'replacement' opportunities such as solar thermal and rainwater capture. The City can work with individual homeowners as well as new developments to reduce water and energy consumption in buildings.

2. WERCs

A conceptual approach for resource recovery places Water and Energy Recovery Cells (WERCs) at up to five locations in Colwood (see Figure 11):

1. Wishart School/City Hall
2. Dunsmuir School
3. David Cameron School
4. John Stubbs School
5. Royal Roads University/Colwood Corners/West Shore Parks and Recreation area

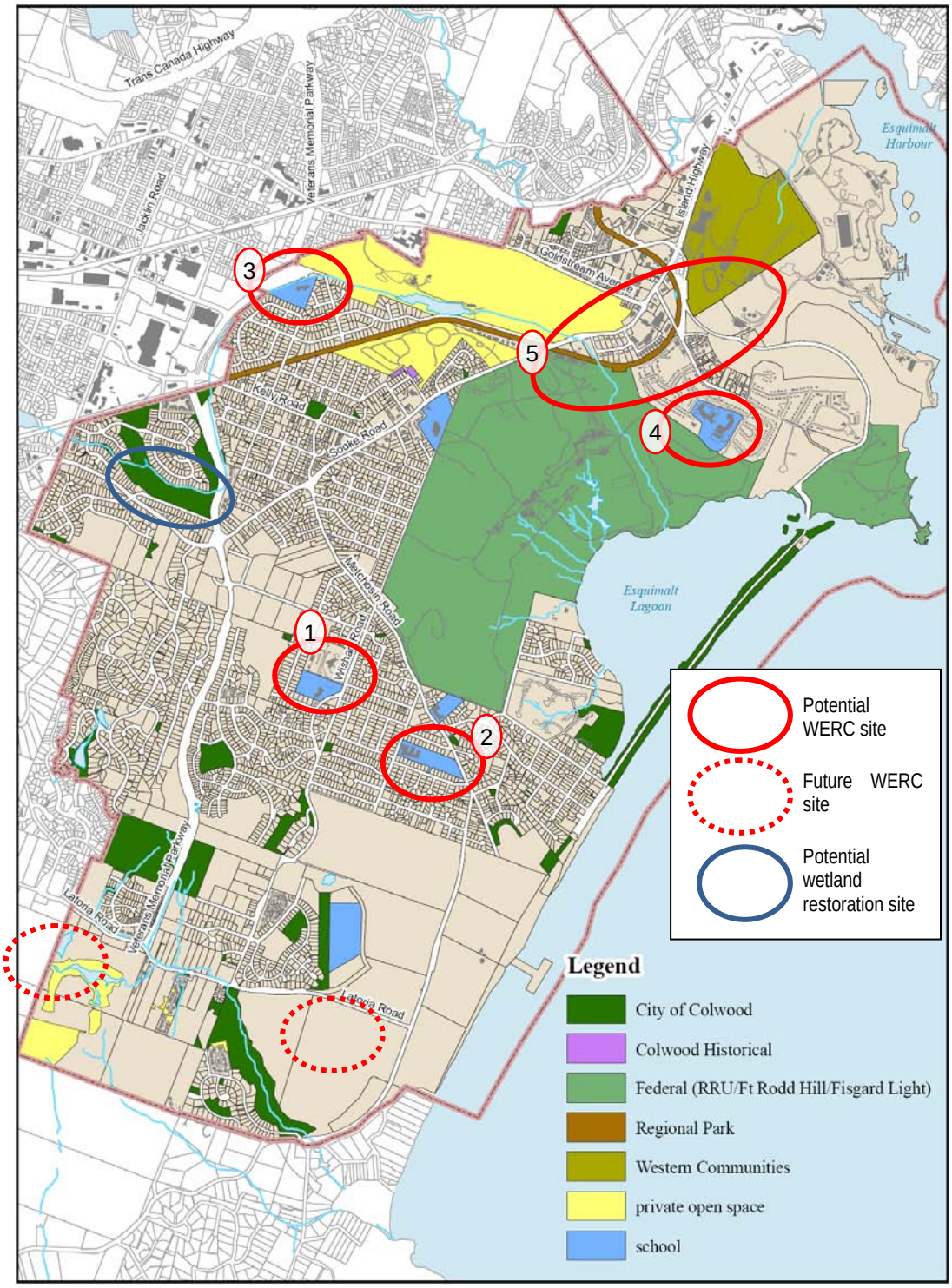
These are identified as sites next to existing sewer lines, and where there are users for the recovered heat and water.

3. Stream and Groundwater Augmentation

Treated water from WERCs could be used for a variety of purposes, including augmentation of low streamflows in summer (notably along Colwood Creek). In addition, this would provide an opportunity to restore and create new wetlands in Colwood Creek Park. Treated water could also be used to augment declining groundwater levels.

Figure 10 Colwood Lake adjacent to Royal Colwood Golf Course, summer 2003

Figure 11: Possible IRM Approach for Colwood



4. Energy Centre

An "Energy Centre" (a combined biogas/gasification/cogeneration/wastewater treatment plant) is proposed in the Royal Roads University/Colwood Corners/West Shore Parks and Recreation Centre area. This would accept sewage sludge from the WERCs, as well as wet and dry organic wastes from the West Shore. It would generate heat, electricity, and water that can be used by nearby clients at the University, Royal Colwood Golf Course, Colwood Corners and West Shore Parks and Recreation, as well as other commercial users on the Island Highway or in proximity to the Goldstream Avenue/Sooke Road intersection. We identified several possible locations for this plant, which can be designed so that it would fit into the community context.

A Possible IRM Approach

A more detailed report has been prepared for staff and Council that includes an initial technical assessment of IRM in Colwood. The report identifies the need to take an integrated approach, that stresses the importance of working in a regional context, with the CRD as well as with neighbouring communities; and emphasises the need for a 'whole community' approach so that individuals do not reap the benefit of profitable resource recovery opportunities, leaving the taxpayer to fund the unprofitable aspects.

The report identifies some options for procurement, i.e., how Colwood can achieve IRM components conceivably without borrowing, and without increasing taxes. While not easy, there are some opportunities to do this. We also identified some of the risks, such as regulatory and governance challenges.

The report notes that while there are some steps that Colwood could usefully take alone, an IRM approach will be of much greater benefit if applied sub-regionally (West Shore) or in some cases regionally (CRD-wide). We encourage Colwood to work with its neighbours and partners as they move forward with this approach.

Key conclusions of this study are:

- Portions of IRM can be implemented in Colwood, but IRM cannot be optimised if Colwood acts alone;
- Implementing all or some portions of IRM should benefit Colwood from resource, financial and environmental perspectives;
- Proper implementation of IRM is best undertaken in coordination with adjacent municipalities under an agreed plan, in a regional or sub-regional context;
- For the WERCs, the business case is considered marginal, i.e., would best be implemented in conjunction with an Energy Centre serving the West Shore) which has the potential for a positive business case);
- Broader implementation of IRM will require transfer payments to be made from more viable aspects of IRM to the less viable components. The total package is required if Colwood is to become grid positive, carbon neutral and water smart.

- The primary reservations for implementing the IRM approach relate to resolving ownership of waste resources, addressing regulatory barriers, more detailed assessment, and reconciling control over resource supplies between municipalities and the Regional District.

- Even if resources-from-waste components of IRM are difficult to reconcile within current governance, other aspects can improve Colwood's sustainability; such as solar, heat pumps and passive solar in building designs. These components are individually viable and can be implemented with the encouragement and support of the City, to reduce taxpayers' costs;

- Overall, community support (from residents and businesses) will be needed to make Colwood more resilient to climate change and move further towards being grid positive, carbon neutral and water smart.

NON-IRM COMPONENTS

Our brief asked for comment on possible strategies for enhancing Colwood's sustainability, beyond purely IRM. We thus considered what other strategies might help to become more "grid positive, carbon neutral and water smart".

Increasingly, people and businesses are looking to reduce their energy bills. A variety of technologies help in this, including items such as solar panels and solar shading, heat pumps, and green roofs. Other well-known solutions are aspects such as improved insulation and more thermally efficient windows.

A variety of grants and support programs are available to help homeowners and businesses improve their home's sustainability, but for many people this remains complex and expensive. It is clear from the brainstorming session that there will be a potentially large benefit in ensuring that active steps are taken to reach out to the community.

We thus identified and recommend three main strategies:

- Form a "Sustainable Colwood Committee" to help connect people on energy and water strategies;

- Establish a "Sustainable Colwood" program to provide a bridge to citizens, to help through the complexities of becoming more sustainable. Ensure this reaches out to residents and businesses, working with and through the Sustainable Colwood Committee;

- Work on "Facilitated Financing" to help bring together financial support and enable people to understand the savings and secure a finance source.

While some of these aspects could be introduced individually we feel that the main benefit will be in introducing these initiatives together. They can be implemented with or without IRM and can help ensure a reduction in costs to taxpayers while improving sustainability in Colwood.

EVALUATING IRM

Both financial and non-financial aspects drive evaluation decisions, both in the public and private sectors. In this study we have concentrated on evaluating the financial aspects of IRM, since without enough money, the community may not be able to afford a solution. However in determining which

approach is desirable to achieve a "grid positive, carbon neutral and water smart" community, we recognise that non-financial aspects may influence or even determine a course of action. Also, we have attempted to identify how if the choice is less than affordable, how some innovation might be used to "raise the bar" and still achieve Colwood's goals.

Recommendations

Detailed recommendations are provided throughout the full technical report, but include the following actions in priority order.

Immediate Actions

1. **Engage with other West Shore communities to expand the boundaries of the IRM model and complete a more detailed business case for IRM implementation**

   IRM viability is best achieved through a partnership with other communities. Based on these discussions the following recommendations could apply to this broader partnership. This strategic approach should also include discussions with the CRD to ensure that current analyses being undertaken by the CRD can be made consistent with the recommended sub-regional approach.

2. **Establish a Sustainable Colwood Committee**

   This multi-party committee (including community representatives, developers, academia, City staff etc.) was identified at the August brainstorming session as a valuable forum for sharing information on energy, water and waste initiatives; as well as a sounding board for the development of an Energy and Resource Plan.

3. **Meet with Sustainability Facilitator for Vancouver Island**

   Fraser Basin Council has established new Sustainability Coordinators as part of the Smart Planning for Communities program. Coordinators can help to identify funding, strategic support, technical expertise etc. (at no cost).[4]

4. **Consolidate and reconcile resource control**

   The division of resource management responsibilities between Colwood and Capital Regional District will increasingly hamper the City's ability to manage resources on behalf of the taxpayer. It will benefit Colwood to reconcile these responsibilities, as well as planning, implementation, management and ownership of resources on behalf of the taxpayer.

[4] See http://www.fraserbasin.bc.ca/programs/smart_planning.html for more information. (Vancouver Island coordinator is Angela Evans, a former Saanich planner.) This would be an opportunity to explore whether the Sustainability Coordinator can play a 'value-added' role.

5. Apply for FCM and other funding to prepare an Energy and Resource Plan

Colwood's approach, especially if undertaken in partnership with neighbouring municipalities, has the potential to be a model approach from which other communities can learn. This template approach would enable Colwood to secure funding from various sources.

The Federation of Canadian Municipalities will provide funding for feasibility studies related to energy, waste and water (50% funding, up to $350,000).[5] The Ministry of Community Development, the Real Estate Foundation and others might also provide some funding.

'LOW-HANGING FRUIT'

These actions could be undertaken by Colwood acting alone, with or without broader regional or sub-regional implementation of IRM

6. Establish a "Sustainable Colwood" program for homeowners

This program would be designed to make it easy for homeowners to be more sustainable, bringing together the consultants, trades, builders, manufacturers and financiers to enable homeowners to improve their sustainability easily while lowering their costs.

This will help homeowners to recognise the economic benefits of energy and water reduction, as well as linking them to funding programs such as Solar BC and Live Smart BC.

7. Create a sustainable finance program to support homeowners

Structure a finance program with lenders that, through the City and without cost to the City or taxpayer, can be offered to residents as a quality-assured program at low cost for retro-fitting homes to be more sustainable. We envisage this would work with the Sustainable Colwood program to reduce homeowners' costs simply and easily without adding to the City's costs, i.e., a net taxpayer benefit.

8. Collaborate with Royal Roads University

Advance the plans for a clean Energy Centre which will convert solid waste into electricity, heat, and biogas in the vicinity of the University or Colwood Corners. This approach should involve the interests of other West Shore Communities.

9. Develop an Energy and Resource Plan

The Colwood IRM report is conceptual only. A more detailed plan, based on further discussion with the community, developers and others, and further analysis, is needed to more fully identify opportunities and challenges. This can be reinforced and assisted by the proposed Sustainable Colwood Committee and discussions with other West Shore municipalities.

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[5] See http://www.sustainablecommunities.fcm.ca/GMF/Funding-Studies.asp.

10. Develop policies for new development/re-development regarding water and energy use

Ensure that new developments are highly water- and energy-efficient, to begin moving the community down a better path. Some of this has already started to take place; it needs to be enshrined in City policy to provide clear expectations and direction to developers.

11. Gather baseline data for water quality, groundwater, soils, and airshed

This information will be required to facilitate the Environmental Impact Assessment process that will be required to obtain permits for IRM components. This could be undertaken in cooperation with Royal Roads University.

12. Strengthen municipal processes to include triple bottom line

Include broader evaluation of development and operational activities so that items such as greenhouse gases, energy and financial considerations are integrated, allowing Council to take better, more informed decisions that move the community towards being "grid positive, carbon neutral and water smart".

13. Issue an RFP for a feasibility study for a WERC (suggested for Wishart School/City Hall); design and build the WERC

The feasibility study will bring a next level of detail to the proposed WERC, looking at how City Hall/Wishart School might serve as a demonstration project.

Design/build/operate as per the feasibility study.

'HIGH-HANGING FRUIT'

These actions are somewhat more complex and would involve partnerships with the CRD and/or neighbouring municipalities.

14. Integrate IRM with adjacent municipalities

Integrate IRM as part of a comprehensive resource management plan for the Region or West Shore.

15. Full implementation of a resource recovery approach

As outlined in the Colwood IRM Report—but likely with several refinements following recommended external discussions and further analysis. We recommend undertaking this in phases, subject to procurement and regulatory impacts.

Appendix 1. Authors

Fidelis Resource Group Inc comprises a multi-disciplinary team of professionals with extensive experience focused on sustainability. It was formed to address the need for a more integrated approach to everyday business, realising that a less segmented approach is needed to address the shortcomings that are increasingly challenging business, the environment and communities.

Fidelis comprises a core team of ecologists, governance and economic specialists, but with outreach to others including engineers, planners, facilitators and others helping deliver a cohesive approach to real estate, government, business and environmental needs, with a focus on a new, effective and efficient approach. For the client this translates to savings, resilience and improved connection across a wide range of disciplines.

Fidelis

Jon O'Riordan, Ph.D. directs Fidelis' governance, social and regulatory services. Jon is currently adjunct professor at the University of British Columbia in the Faculty of Interdisciplinary Studies. Jon has previously held several positions including Deputy Minister for the Ministry of Sustainable Resource Management with the Province of British Columbia and Assistant Deputy Minister with the B.C. Ministry of Environment.

Jon's role in the study was to assess the governance aspects of the project and implications for Colwood in the context of CRD and provincial regulation.

Patrick Lucey is President of Fidelis and directs ecological services. Patrick is responsible for ecological advice and direction to key projects such as Canada's first LEED® Gold building, LEED® Platinum Dockside Green, the 2010 Olympic Village and the British Properties' Rodgers Creek project, 210-acre subdivision in West Vancouver. He has an academic background in marine and freshwater ecology, political science and urban geography and supervises graduate students at the University of Victoria. Patrick is a Special Advisor to the British Columbia Government on Water Policy, Climate Change Action Plan and Green Cities Initiative programs.

Cori Barraclough is a freshwater ecologist with nearly two decades of experience in watershed management and stream restoration, both in urban and rural environments, She holds a master's degree in freshwater ecology from the University of Victoria specializing in ecological management of drinking water supplies. Ms. Barraclough recently served as a Special Advisor to the British Columbia Government on the provincial Water Policy. As a design team member, Cori unites the political, regulatory, ecological and social aspects of projects and supports and delivers team presentations to clients, regulators and the general public.

Patrick and Cori's roles were to assess the implications of water resource recovery and ecological implications, including related statutory compliance.

Chris Corps MRICS is Fidelis' Vice President, Economic & Financial. Chris is a Chartered Surveyor with 28 years' experience in economic modelling, consulting and management. He has held positions as Director in British Columbia government responsible for $7bn projected savings and the redesign of healthcare financial systems, as well as holding senior positions in consulting services companies advising on major projects. Chris is past chairman, RICS Canada and involved in setting valuation standards applicable to the professions members in 132 countries. He is co-founder and initiator of North American initiatives on IFRS and globally on sustainability.

Chris' role in the study was to assess and reconcile the overall financial and non-financial business case, including business case innovation.

Contributing authors

Stephen J. Salter, PEng, President, Farallon Consultants Limited.

Farallon Consultants Ltd. helps industrial clients and communities reduce their environmental impacts, through conservation and by recovering value from waste.

Stephen's role in the study was to describe how biofuels, heat energy, and electricity could be recovered from Colwood waste streams, to find the synergies among waste streams and potential uses for these resources, estimate the volumes of resources which could be recovered, model the changes in greenhouse gas emissions, model the infrastructure needed for resource recovery, and to estimate the cost of this infrastructure.

David A. Jackson, MSc.Eng., MA(Econ), P.Eng. WorleyParsons

Dave Jackson is Professional Engineer registered in B.C. and a Senior Environmental Engineer with the Victoria office of WorleyParsons, a 27,000 person international engineering company focussed on energy, resources and the environment. Dave has degrees in chemical engineering, environmental engineering and economics more than 25 years of professional experience. His specialities include advanced wastewater treatment technologies, upgrading wastewater treatment facilities, decentralized wastewater management systems, renewable energy systems and integrated rainwater management.

Judith Cullington, M.A., B.Sc., Principal, Judith Cullington & Associates

Judith Cullington specialises in helping communities work towards sustainable urban environments. She has a Masters degree in Geography, and more than 30 years experience working with federal, provincial and local governments and non-profit organisations. Her role in this study was to assist with local knowledge, and coordinating the preparation of the report.