Transforming Regina
Planning for 2040 and beyond

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•
Steven Kuski
•
Kyle Laskowski
•
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•
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Contents

1. Vision of Earth

Vision of Earth is comprised of volunteers from a variety of fields. We use our technical skills to deeply investigate various issues that face our society today, focusing on complex and controversial issues that demand patience and knowledge to understand.

1.1 Authors

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Ben grew up in central Saskatchewan near Prince Albert, but moved to Regina for eight years to attend university. While he is currently pursuing a master's degree in Physics at McGill University, he still manages to spend much of his time learning about, and developing, practical solutions to the intricate and substantial problems facing the world today.

Steven Kuski BA Economics, BBA Finance

Steven has been living in Regina for a little over ten years, and attending university for most of that time. He has spent most of his professional life as a civil servant, having worked at the provincial planning branch at Ministry of Government Services and currently as an Economic Statistician at the Ministry of Finance.

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Hailing from Guernsey, Saskatchewan, Kyle attended the University of Regina in order to better understand the workings of the universe. Kyle has long held a deep interest in large-scale energy systems. Pursuing this interest has led him towards study of the political, economic, and social realities of societies and how they relate to the way these same societies choose to solve the problems they encounter.

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Originally from Saskatoon, Scott attended the University of Saskatchewan. He lived for a time in Cambodia, working on local energy projects directed at poverty alleviation. Presently he is working for an international energy and environmental consulting company; his areas of expertise involve: energy efficiency, cap and trade modeling, carbon markets and energy supply and reliability. He is currently residing in Regina, working within provincial-based industrial and commercial demand-side management programs.

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Robert has been living in Regina for about twenty years. He is passionate about anthropology and Asian studies. He has studied at SFU in Vancouver and has a minor in mandarin Chinese. He is currently pursuing an MBA at the U of R while working full-time as a software developer.

1.2 Contributors

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Jeff runs a consulting company in Regina, Canada. When he isn't supporting complex software systems, he puts his time and money into creating a world without banks - and the war, ecological and social collapse that inevitably result from them - via p2p finance. He is also an amateur musician and an outspoken free software advocate.

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Currently a student at the University of Manitoba, Alana was born and raised in Regina. She is keenly interested in the balancing of natural sciences and art in design and architecture.

2. Intent

This document intends to map out a credible path toward continued prosperity and ecological effectiveness for the city of Regina, with a particular focus on the Rosemont / Mount Royal area. Drawing upon literature from a diverse set of fields, we sketch out the long term global, national, and local trends that seem likely to significantly impact the people of Regina and the Rosemont area through and beyond the year 2040. With the context firmly established, the remainder of the document investigates the major sets of challenges that our region is likely to face during this interval and practical solutions for them.

This document is arranged as follows: Firstly, the executive summary gives an overview of the entire document and illustrates the investments, advocacy, and regulatory changes that seem best suited to maximizing the long-term prosperity and sustainability of Regina and Rosemont. Secondly, we lay out in detail the global, national, and local concerns that will set the stage for Regina's development

through 2040. Lastly, we describe in detail the research and calculations that motivated our choice of policy recommendations.

Timelines are employed at the beginning of each chapter to clearly illustrate the major steps needed in order to transform Rosemont, and Regina in general, such that the area achieves long-term prosperity and ecological effectiveness. The items in each timeline are explored in detail during their corresponding chapter.

3. Executive Summary

3.1 Context

The best data available indicates that the world is very near peak oil, with very significant declines in world oil production predicted for the next few decades. The recent boom in North American shale gas has staved off the peak in continental natural gas production, delaying it at least several years, perhaps beyond 2020. Energy prices through to 2040 are expected to significantly increase, but are also expected to be highly volatile. The 'energy economics' of the 21st century clearly predict a contraction in the total primary energy supply of the world. This has deep economic ramifications even for societies (like ours) which are located in areas that produce large amounts of highly-valued energy commodities.

The economy of Saskatchewan (and of Regina), is expected to continue to do very well through 2040. The driving forces of the continued boom are likely to be the same primary contributors we have today, namely oil and potash. However, most of the economy is not comprised of these industries, and will face very significant challenges as the age of cheap energy ends.

3.2 Transport

Regina should undertake a city-wide transition away from auto-centric development. Firstly, the City should strive to curb automobile usage, employing a diverse set of policies and investments in parallel. Secondly, alternatives to personal auto usage such as public transit, ride-sharing, and active transport need to be improved and incentivized. Credible alternatives must be offered in place of automobile transport to achieve a successful transition. Lastly, the City must plan transportation and land usage at a single desk, recognizing the inherent linkages between the two.

In order to reduce the desirability of single-occupancy automobile travel, the City should:

- consult with communities to identify desirable and effective traffic calming measures

- reduce the subsidy of auto transport inherent in the provision of parking by:
    - reducing the subsidy and availability of publicly-funded parking spaces
    - removing minimum parking spot requirements currently in Regina Bylaws
    - encouraging large employers to negotiate deals where they acquire bulk discount transit passes for employees if they reduce or eliminate their free employee parking.
- create peak-time high-occupancy vehicle lanes on expressways, such as Lewvan, eventually extending to major arterial roads and to all hours of the day
- implement, in conjunction with SGI, a long-term plan to automate the levy of road costs directly on the vehicles using the roads via standardized tracking of all vehicles

On the flip side, the City should also vigorously promote high-density transportation modes by:

- implementing carpool ride-finding software akin to that provided by other Canadian cities
- improving the viability of car shares by:
    - extending some of the traffic and parking rights of transit and taxis to car share vehicles
    - counting car share parking spots as multiple in existing mandatory minimums
    - expanding the ability of R-cards to be recharged online and also used for other transport-related purchases such as taxi rides and car share uses.
- proactively preparing City Bylaws and transit plans for the advent of self-driving road vehicles

Specific to expanding public transportation, the City should:

- conduct comprehensive multi-modal transit planning
- integrate active transport infrastructure around transit stops
- create flexible multi-person and multi-modal (transit, taxi, car share, future jitneys) passes
- develop a building-integrated transit shelter program
- implement audio and visual prompts on buses for upcoming and current stops
- continue providing online real-time bus location tracking
- create an electronic route-planning service
- transition the bus fleet to electric or hydraulic hybrids

- implement jitneys as a new transit mode, with an eye towards automating them when the technology becomes available (or alternately, open up the possibility for private investors to provide jitney services in the city, integrating with a single rate payment system via the R-card).

Active transportation must be considered much more prominently in City planning. To these ends, the City should:

- undertake replacement of standard pedestrian intersection lights with countdown-style signals
- in conjunction with local public health authorities, develop investments in bike lanes and multi-use pathways as preventative public health measures
- significantly raise the required amount of bicycle parking in the Zoning Bylaw and also increase the breadth of buildings to which this applies
- encourage employers to provide shower access and bicycle parking rather than auto parking for employees
- consider the prospects of a bicycle rental program in Regina as the city densifies
- replace current parking lanes on Rosemont thoroughfares such as Dewdney, McCarthy, Mikkelson, 4th Ave and 7th Ave with shared use bicycle and turning lanes
- conduct local community consultations on the subject of safe and socially acceptable multi-modal transport development

3.3 Land usage

Future changes in land usage should be oriented towards creating a variety of high-density zones focused along transit routes. Future developments on the edge of the city must be walkable, dense, cost-effectively using existing water and sewer infrastructure, and effectively connected with transit.

The City has a wide variety of tools at its disposal for achieving increased densities and business development along transit routes. For these areas, we recommend a multi-pronged approach that will:

a. provide tax breaks for infill development,
b. streamline and eases the process of changing zone toward higher density (or towards mixed-use and light commercial),

c. permit higher-density buildings such as duplexes, townhouses, and fourplexes within the R1 zone, and
d. explicitly require mixed-income development for all major housing projects.

To allow commercial urban agriculture to flourish in Regina, the City should place strict rules on what pesticides and herbicides can be used within the city so that crops can avoid contamination. Additionally, the City should take proactive steps to ensure that urban agriculture businesses within the city will be legally allowed to sell their produce locally. In this respects, Regina should join the many cities in North America that are putting distinct effort into updating their bylaws to allow this lucrative business model to exist.

To foster cooperation between businesses within the same area, the City should create a system through which businesses can apply to create a business improvement district (BID), expanding on the model of the Regina Downtown BID. These structures have been shown to be well-suited to dealing with local business concerns, such as built environment, without the City becoming directly involved. Later, allow BIDs to meet some regulatory guidelines as a group rather than individually, thus saving on compliance costs.

In order to accurately assess the stresses created on public infrastructure by a building and lot, we recommend the creation of an individual parcel assessment (IPA) system. City inspectors would be able to accurately estimate the number of residents, the property value, and the stormwater load created by that parcel of land. This information would be used for accurate property tax assessments, stormwater charges, and as the basis for progressive city utility prices where the cost per unit water increases with higher usage per person. Lastly, such data could also be used in cooperation with SaskPower and SaskEnergy to institute progressive per-capita rates for electricity and natural gas.

3.4 Energy usage

Improving the energy efficiency of the buildings and systems of the city will improve long-term prosperity. The City is well-suited to provision expert, reliable advice to residents regarding home energy investments. Additionally, the City directly invests in energy-using systems such as lighting, and it may also play a major role in defining what sort of energy innovation businesses can exist in the city. However, the most important role for the City with regards to energy is the requirement of minimum building standards.

The City should install LED street lights in the area of Rosemont as a pilot project. Data from the pilot project would be used to perform an economic analysis, informing further efforts by the City in this direction. Since LEDs already deliver substantial returns on investment, it behooves the City to keep track of ongoing and future developments in lighting technologies so that future choices can be well-informed.

The City should investigate the innovative approach taken by US companies like Transcend Equity, who have created an innovative new business model for implementing energy efficiency retrofits for buildings. It seems likely that the 'business of efficiency' will be extremely valuable in the decades to come, a development that the City must ensure that it is ready for.

As solar PV is nearing grid parity, it is clear that rooftop solar installations will play a large role in the future of Regina, the sunniest city in Canada. Municipal government is well-suited to providing guidance and information to residents who are interested in installing such a system. The provision of expertise and information by the City is predicated on the understanding that effective use of solar energy in the coming decades will be an important part of the city's long-term prosperity.

Heat pump technology seems poised to make a similarly large impact on Regina life. Thus, we recommend that the City conduct its own heat pump pilot project(s) and share the results with residents. If proven to be economical, the City should undertake expertise-sharing with residents in a similar fashion to that described above for solar, and for similar reasons.

The City should develop a pamphlet that lays out the different measures that residents can take to save on electricity and energy. The program could be a joint venture with SaskPower and SaskEnergy. The costs involved to develop and administer a program such as this are expected to be quite small, and the dividends will accrue to the community, both individually and as a whole, over the long term.

As natural gas prices rise, we suggest taking a look at community level digesters. A full feasibility analysis would need to be conducted to determine the payback period for such a system, the size of system, the amount of energy that could be created using organic waste.

Regina should require all newly constructed buildings to adhere to a more stringent, more sustainable standard. A common and easily achievable North American standard is LEED certification. These buildings are only a few percent more expensive up-front than traditional ones, and even with the currently low energy prices they have payback periods on the order of 10-15 years. Regina could require LEED certification of new homes by ~2018, LEED Silver by ~2026, and a standard equivalent

to the Passivhaus (or to the Factor 9 prototype) by ~2034, with an eye towards a net-zero standard around 2050. These are very affordable steps forward, representing increases in up-front costs of a few percent each, and perhaps ten percent total. It is worth stressing that these buildings have lower total lifetime costs than traditional ones because their energy needs are vastly reduced.

The area of Rosemont could act as a pilot for Canada to implement a similar type of program as Germany with their Passivhaus retrofit program[1]. Alternately, the City could require that all homes sold and bought in Regina be brought up to specific building standards--similar to the program currently taking place in San Francisco. This second approach is desirable since it utilizes market forces more naturally than direct investment in retrofits by the government. The specific building standard chosen should be tailored to the specifics of the climate and current housing stock in Rosemont, though LEED certification is a natural step forward, and Passivhaus (or Factor 9) provides a solid medium-term goal.

3.5 Water

Prudent use of existing water infrastructure appears to be the most cost-effective path forward for the City. Thus, the following recommendations focus primarily on maximizing the longevity and effectiveness of Regina's existing systems.

Cost per unit water should increase with increasing usage per-person to encourage additional conservation. This change would be coupled with the creation of the individual parcel assessments system discussed in more detail in the land usage chapter.

To protect public health, the water supply should be treated with activated carbon year-round (rather than only for May-Dec) to combat the effect of endocrine disruptors.

The city should build an advocacy framework around its existing xeriscaping literature to reduce the resource drain of lawns. Additionally, the City should employ those methods to maximal effect in public spaces.

Since stormwater infrastructure is expected to be a significant hurdle for Regina's development beyond a population of 235,000, the City should implement sustainable urban drainage systems such as raingardens, bioswales, green roofs, and rainwater capture systems. With the transition to IPA discussed earlier, residents will have an incentive to adopt these changes as well. The City can facilitate these changes by providing local, expert advice on how stormwater can be effectively dealt with at its point of origin.

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1 Passivhaus Institute.

Regina should be poised to take advantage of the results of an ongoing local investigation by the National Research Council Centre for Sustainable Infrastructure Research into household uses of greywater. City regulations surrounding grey water will need to be revisited and modernized to make technologies such as rainwater capture and usage explicitly legal.

3.6 Social sustainability

To improve the resilience, engagement, and social health of communities within Regina, the City should undertake systematic and lengthy local consultations with residents, focusing on simultaneously engaging as broad a spectrum of residential subcultures as possible. To this end, the consultations should employ multiple mediums, including Internet and mobile communications, phone-ins, local meetings, and focus groups. These consultations should evolve into a cyclic system of citizen consultations on all subjects, differentiated by locality, and aiming at long-term co-creation of local and city plans by citizens, experts, and elected officials.

To foster greater social mobility and to reduce the socially exclusionary nature of expensive regions of the city, all major housing developments should be mixed-income, providing a minimum of 10% of all housing units that are oriented towards low-income residents. The City should be actively involved in the process of planning the land use changes that lead to this development, allowing it to easily streamline the process for developers. If added incentives are needed, developers can be attracted and retained with high-quality plots of land, temporary tax breaks, and expedited review processes with the City.

Lastly, in order to ensure that equity is conscientiously pursued throughout municipal government, the City should establish a task force to continually review, report, and act toward achieving the equitable accessibility of all public services.

4. The world in the year 2040

Regina will be affected in the next several decades by global trends and events. The purpose of this section is to sketch out some of the more predictable global trends that are relevant to the sustainable development of Rosemont. In an effort to be practical and brief, this section will only focus on a few major world-shaping issues that have particular relevance for the long-term development of Rosemont.

4.1 Rising oil prices

Saskatchewan and other Great Plains provinces and states are blessed with large quantities of recoverable oil. For the foreseeable future, these jurisdictions will continue to sell this oil for substantial profit. At the time of this writing, even with the cost of a barrel of West Texas Intermediate (WTI) around $80, local drilling activity continues to grow. In the long term, increased pipeline capacity will bring the price of WTI in-line with Brent Crude which more accurately reflects the global oil market and is currently selling for around $100 per barrel. Barring large-scale shocks and large economic downturns, the demand for oil is expected to continue growing for decades to come.

On the supply side, the best data available indicates that we are very close to the peak production of oil globally. The most barrels of oil produced in a single day was in 2007. Production has been roughly constant since 2005, even as the price of a barrel of oil has gone up on average about 15% per year during that time. All indicators are thus pointing to the fact that we are at, or very near, global peak oil.[2] A study released by the International Monetary Fund in May 2012 delves into the tricky problem of predicting future oil prices. The new model they are studying, which predicts oil prices significantly better than all previous attempts, forecasts that oil prices will roughly double within the next decade.[3]

4.1.1 Global trends dictate local prices

Despite large local and semi-local production of oil, the Regina area will be subjected to the effects of the global energy market in the coming decades. The price for mobile, globally-traded, ubiquitous fuels like gasoline and diesel is defined by what everyone in the world is willing to pay for them, not by proximity to a source of production. Put another way, our local reserves of oil will be a source of local wealth, but they will not protect Saskatchewanians from rising global oil prices. Even oil-rich places like Saskatchewan will be subjected to the economic effects of high oil prices today and into the future.

Due to the unstable and incredibly interconnected nature of the global economy, it is expected that the price of oil will continue to be highly volatile. Supply crises such as wars and geopolitical uncertainties have already shown to drive up oil prices significantly. The continuing unrest in the Middle East coupled with a lack of global political will to build long-term peace essentially ensures that such instability will continue into the coming decades.

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2 Oil's tipping point has passed. J. Murray, D. King. Nature. Jan 2012.

3 The Future of Oil: Geology versus Technology, IMF Working Paper, Benes, et al. May, 2012.

These factors make it reasonable to predict that the prairies, Regina, and Rosemont will see volatile and increasing gasoline and diesel costs, which our current lifestyles are heavily dependent upon. Increasing vehicle efficiency and changing transportation trends will partially mitigate the impact this has on the life of Rosemont citizens.

4.1.2 Volatility means difficult policy

Predictable, stable increasing fuel prices would be an easy target for policy action. Higher volatility means that the effect, and the effectiveness, of targeted policy actions are not as clear. It makes planning harder to do and political will harder to come by.

Due to all the aforementioned issues, our recommendations include many actions by the City of Regina that will help to reduce the role that personal vehicle transportation plays in the life of the average Rosemont citizen.

4.1.3 Irreplaceability

Despite decades of intense research into the subject and billions of dollars spent by many organizations, no credible plan exists to replace oil with alternative products or processes. Cost-effective and scalable alternatives for even the specific commodities of gasoline and diesel fuel do not currently exist. All potential alternatives are not yet well enough developed to supplant the historical role of oil in producing our dominant transportation fuels. Although efficiency measures can be significant in changing energy usage, they cannot close the gap between growing demand and shrinking supply. Conceivably, humanity may achieve a sudden and unexpected breakthrough in energy technologies on the road to 2040, but we should be prepared for a path without one.

These changes represent a seismic shift in the nature of our primary energy supply, which will have correspondingly acute effects on the future of our society. The automobile-centric development pursued in North America for the better part of the last century will be supplanted with a more holistic reshaping towards communities based on the realities of transportation and habitation in an age of high energy costs. This transition will happen whether we are prepared for it or not. It is in our best interest to be on the leading edge of this transition, predicting these changes so that we can orient our development towards long-term prosperity that will not be susceptible to these shocks.

4.2 Volatile and rising natural gas costs

Just as with oil, our region has a fairly secure local supply of natural gas through 2040. Similarly, the global and greater regional context will greatly affect the local price of natural gas.

In Regina, natural gas is primarily used for industry and building heating. In the broader prairie context, natural gas is also used to produce nitrogen fertilizer, an important factor in the price of industrially grown food. Additionally, natural gas is increasingly being used for electricity generation. According to the U.S. Energy Information Administration (EIA), American natural-gas-based electric generating capacity increased by 59% during 2001 - 2011 and now constitutes 25% of America's electricity generating capacity[4]. SaskPower, according to their 2011 annual report, says that it has increased its natural gas generating capacity by 377% over the past decade and it now constitutes 32% of Saskatchewan's electrical generating capacity[5]. Natural gas is also being considered as a transportation fuel in the trucking industry. The Conference Board of Canada recently published an article discussing the viability of using natural gas as a fuel for large trucks and trains[6]. This issue is of specific importance to Regina because of the rapidly expanding global transportation hub to the west of the city.

Historically, the systems that provide electricity, transportation and home heating have drawn from independent energy sources, namely coal, oil and natural gas. These three energy systems largely operate independently with little price correlation between them. This has provided protection against supply shocks and price volatility, since one resource does not play a dominant role in all three markets. However, in today's world natural gas has become the fuel of choice for home heating, new electric power plant construction, and is capable of making significant inroads in the transportation sector. This growing dependence on a single resource will increase our vulnerability to supply shocks and price volatility.

The price of natural gas in North America can be extremely volatile. The reasons for this go beyond the scope of this document, but it is worth noting that Natural Resources Canada, in their publication "Canadian Natural Gas: Review of 2007-2008 & Outlook to 2020", pointed out that in 2008 the price of NYMEX natural gas increased by 80% in a single year, and then dropped by 47% in only five months.

The current North American price for natural gas is near historic lows, the result of the shale gas boom in the USA combined with the reduced energy consumption caused by the great recession. These prices are not expected to last beyond a few years for several reasons. Firstly, the shale gas boom is expected to peak very quickly (likely less than a decade from now) as all of the 'sweet spots'

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4 United States Energy Information Administration, Electric Power Monthly, April 2012

5 Energizing Growth. SaskPower Annual Report, 2011

6 Cheap Enough? Making the Switch From Diesel Fuel to Natural Gas, The Conference Board of Canada, Len Coad & Vijay Gill, April 2012.

are being exploited as rapidly as possible. Secondly, North American demand is not far below North American production currently. The decline of production from aging wells was leading North America towards declining natural gas production before the beginning of the shale boom. Traditional natural gas production is expected to continue to head into a decline in North America, and shale gas does not seem capable of closing that supply gap for long. Thirdly, the price discrepancy between North America and the rest of the world is currently justifying the construction of Liquefied Natural Gas (LNG) terminals which will tie North America's natural gas market to that of the rest of the world. Thus, prices in North America will begin to feel the ripple effects of the political and economic uncertainties present in the rest of the world, which have the potential to cause significant volatility in natural gas prices. The effects of the global market on price will be similar to the way the local price of oil is determined by the global market. In the energy-constrained world of the next few decades, energy commodities will be extremely highly valued. Since their transportation costs are a fraction of their current value, it seems likely that the future global economy will become an even more powerful determiner of local prices for all energy commodities including natural gas.

In order to mitigate the risks of relying on natural gas for many of our key systems, our policy recommendations will attempt to reduce the extent to which the residents of Rosemont will be exposed to the price volatility and rising cost of natural gas.

4.3 Food

The UN predicts that human population is on course to stabilize at roughly 9-10 billion some point before the year 2100. With concerted global efforts to alleviate poverty (entailing substantial international cooperation and investment), it is expected to be possible to level out human population at just below 8 billion by the year 2050.[7] In all of these situations, more food will be needed to feed the growing human population. Additionally, as emerging economies gain traction, their populations demand more meat. For the same number of calories delivered to humans, meat requires approximately ten times as much water and land to produce compared to plant-based foods.

The Saskatchewan economy will benefit from these trends in a few ways. Firstly and most obviously, Saskatchewan is a famed bread basket, producing immense quantities of food from its farmland. Secondly, Saskatchewan is a major exporter of potash, an important fertilizer. With food demand growing throughout the next several decades, it is expected that both of these food-related Saskatchewan export industries will do very well.

[7] Common Wealth by Jeffrey Sachs

On the flip side of things, the global market of food creates a situation in which food shortages worldwide can lead to substantial price hikes everywhere, including those places that are net exporters of food. Just as with any other commodity in a globalized market, the price is set by what everyone worldwide is willing to pay, not just where the commodity is produced. It can be thus expected that Regina residents will face rising food costs during the coming decades, due to increasing demand for food worldwide and the fact that there remains very little productive arable land unexploited in the world. Essentially all of the production increases that are predicted for the 21st century will be coming about through more intensive farming, including the use of fertilizers.

Additionally, the predicted rise in the prices of both oil and natural gas will have a direct effect on the cost of food. Oil is vital for the transportation system that makes the global food market possible. It is the primary source of energy for the mechanization of agriculture here and in the rest of the world. Natural gas is vital for the production of nitrogen fertilizers where it is used as a source of hydrogen and as a source of heat to create the high pressure and temperature needed to fixate nitrogen into ammonia. It has been estimated that approximately one third of the food consumed by humans is produced because of this industrial nitrogen-fixation technique, known as the Haber-Bosch process. A rise in the price of natural gas is thus expected to result in higher global food prices.[8]

In light of these facts, a number of our recommendations in this document will be oriented around the excellent possibilities for the deployment of urban farming in the city of Regina. In most cases this will simply involve regulation changes that make such urban cultivation explicitly legal. When we explore this subject in much more detail later in this document, it will become clear how this industry is expected to thrive in the coming decades as long as City regulations allow it to flourish.

4.4 Ubiquity of telecommunications

By 2040 the transition to the information age will be old news; mobile communications and computing will be a long-standing fact of life. This has consequences for how we design our planning and informational systems as well as for how humans are likely to interact. Glimmerings of this can already be seen, as today's communication systems allows for the real-time tracking of buses, the ability to call a cab from anywhere, and the opportunity to have a face-to-face conversation with people on the other side of the world.

Some of the innovations that will change our lives in the near future are already being built. Smart power grids are making distributed power generation and demand management easier, smart

[8] Nitrogren and Food Production, Vaclav Smil, University of Manitoba; Ambio Vol. 31 No. 2, March 2002

traffic lights can sense traffic flows and can adjust their behaviour accordingly, and the current move towards ubiquitous surveillance in some cities is an important and controversial transformation.

Long-term predictions of such a quickly developing form of technology are difficult. What we can reasonably expect however is that mobile communications and computing will become incredibly cheap and effective by today's standards. Some of the tasks, products, and services we interact with on a daily basis may be nearly unrecognizable in a few decades, while others will be essentially the same. Later in this document we explore a few of the context-relevant innovations that are being developed and implemented today.

5. Saskatchewan in 2040

5.1 Climate change

According to the best scientific data available today, climate change is likely to have a significant effect on most parts of the world by 2040. This section is based primarily on the April 2009 report entitled "Climate Scenarios for Saskatchewan" created by the Prairie Adaptation Research Collaborative (PARC), a collaboration between the governments of Canada, Alberta, Saskatchewan and Manitoba that studies climate change impacts and conducts adaptation research in the Prairie Provinces[9].

5.1.1 Heating and cooling degree-days

It is predicted that the 2020s will see temperature increases above baseline (average of 1961-1990) of between 0.5°C and 3.0°C, and the 2050s will see a rise between 1°C and 5°C. Most of this increase is expected to take place during the winter months, meaning fewer degree-days of heating will be needed to maintain buildings in the future in Saskatchewan. To be specific, the modeling employed by the PARC indicates that by the 2050s Regina will be requiring approximately 4730-4960 heating degree days, from a baseline of about 5570 heating degree days for the period 1961-1990. Thus, by the 2050s, we can estimate a reduction of roughly 13% from the baseline measurements. This would translate into a roughly a 13% reduction in the heating required by buildings in Regina. This trend is expected to continue into and beyond the 2080s, when Regina is expected to have 4400-4860 heating degree days.

It is expected that the number of cooling-degree-days (when air conditioning is needed) will increase 3 to 5 times in Regina by the 2050s. Taken together with the above trends, these facts may

[9] Climate Scenarios for Saskatchewan. Prairie Adaptation Research Collaborative. April 2009.

have significant relevance for many homes in Regina, and in particular Rosemont, which was built during the mid-20th century. As the effects of climate change continue to accumulate, these homes will be existing in an environment that is growing to be significantly different from that which they were designed for. Our recommendations for building construction and retrofits will be based on these predictions for the future of the Regina environment.

5.1.2 Growing season

Baseline measurements for the growing season (as defined by the number of degree days above 5 degree Celsius) for Regina are around 1670 degree days per year. By the 2020s this is expected to grow to 1800-1970 degree-days, and by the 2050s it is expected to grow further still to 2050-2200 degree days. For comparison's sake, it is worth considering that Kelowna, with one of the warmest climates in Canada (situated in the Okanagan Valley) and one of the longest growing seasons, has had over the last 30 years an average of 2231 degree days of growing season[10]. Climate change seems likely to bring the growing season length experienced in Regina much closer to that which is currently experienced in the Okanagan, a tremendous change from historical norms.

These observations will prove to be of particular significance when we discuss the possibilities for urban farming in Regina. As discussed in great detail in later section on urban agriculture, Kelowna is an excellent city to use as a role model due to its highly successful urban farming policies that have stimulated the emergence of very successful small-plot intensive farming operations within the city.

5.1.3 Precipitation

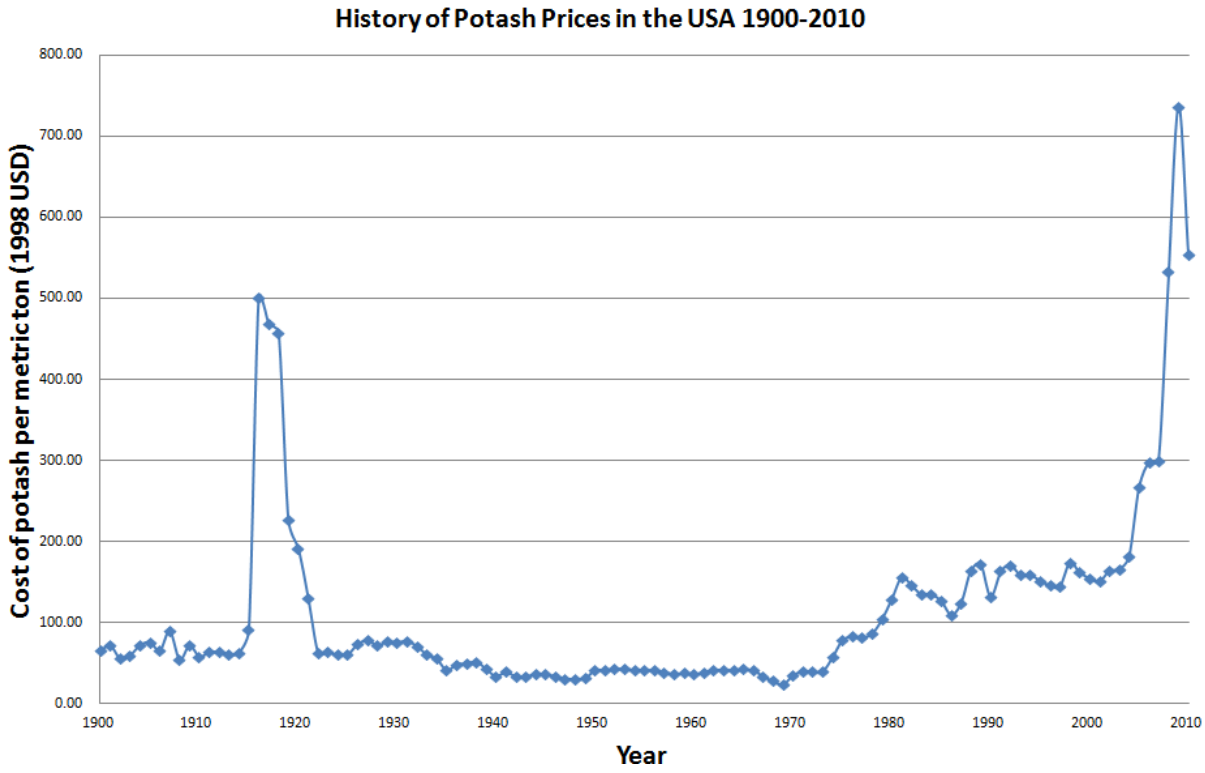
Annual moisture index values for Regina are expected to increase above baseline levels by 10% to 20% by the 2080s, with smaller increases for the 2020s and 2050s. One concerning aspect of the data from climate models is that the summer and fall months are likely to see a reduction in precipitation on the grassland areas of Saskatchewan, while the winter months may see an increase in precipitation. While the likely effect on the local agricultural industry is not clear, the City of Regina will need to prepare for more significant amounts of snow during winter and additional melt water in spring.

5.2 Economic prosperity

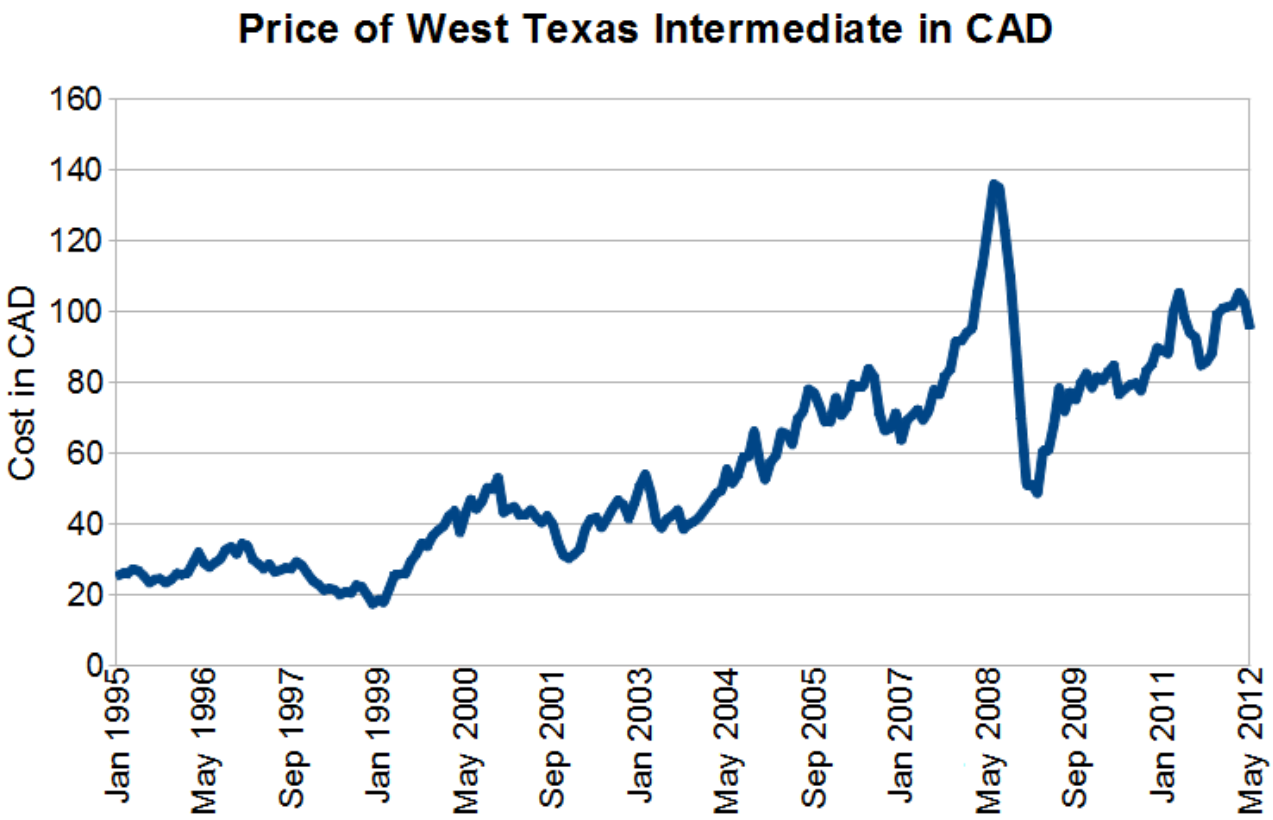
Saskatchewan is in the midst of an economic boom, a boom driven by the world's need for Saskatchewan's products. Saskatchewan is in the enviable position of producing a surplus of several valuable commodities, most notably food, fertilizer, oil, and uranium.

[10] Statistics for Kelowna Quails Gate, BC., The Weather Network

The ability of the world to increase production of these four commodities is limited, so as the world's population and wealth increases their supply will become increasingly constrained. The wealth generated by supplying the world with the materials it needs will drive growth in Saskatchewan, Regina, and Rosemont. Regina planners need to expect persistent population and economic growth in the coming decades.



U.S. Geological Survey. Historical Statistics for Mineral and Material Commodities in the United States. *Version 2011.*



Price of WTI crude in Canadian dollars, data from indexmundi*, which sourced from the* World Bank.

6. Recurring Themes

6.1 Lessons from similar cities

A recurring theme throughout this document is drawing lessons from the experiences of other cities as they attempted the implementation of policies that we are considering for Regina. There are a significant number of North American and European cities that have passed through a similar size and density profile to that which Regina will have from the present day through the year 2040. Some of these cities experienced significant 'growing pains' while others developed much more smoothly into productive and efficient economic centers. When drawing lessons from such development histories, we will attempt to be sensitive to any significant differences in cultural, technological, and economic context.

6.2 Density: The cornerstone of prosperity

A city is essentially a dense population of humans. We organize ourselves into cities because it is more efficient; people are more productive when they can draw upon the skills and abilities of others.

It is not coincidence that the greatest wealth is concentrated in the densest cities. As Regina grows, it must densify in order to capitalize on the significant benefits that accrue from higher population and employment opportunities. The benefits of density will be explored in much greater detail throughout this document. The following primer is meant to give the reader a taste of the central role that density plays in the design of a sustainable and prosperous city.

6.2.1 Cost

Increased density has many positive effects, one of which is a significantly lower cost of living. Using 2011 Regina building permit data, the average value of single detached homes (low density) are valued at $185,509 per unit. Apartment units (high density) are valued at only $81,276/unit. The cost savings continue when infrastructure cost are factored in. Roads, water mains, sewer, electricity, gas, and phone lines are all more expensive when spread out over a large service area with few customers. Even if the costs are not borne directly by the consumer, the businesses and governments that install and maintain these systems will have higher operating costs than they otherwise would. The significantly lower infrastructure costs associated with density are partly responsible for the much lower energy use per-capita and commensurate lower pollution and environmental impact per-capita than dense settlements have compared to more sparse ones.

6.2.2 Resilience

Higher density increases transportation options. In a low density environment, most destinations will be far away, and mass transit services will be unavailable, thus forcing people to use automobiles. This loss of freedom reduces economic resilience and creates a society which is particularly vulnerable to shocks in fuel prices. In a high-density environment, many destinations are within easy walking distance, and mass transit may be able to attract sufficient riders to be self-sustaining. A diversity of transit options increases personal welfare as well as provides the city with redundancy.

6.2.3 Innovation

The Federal Reserve Bank of Philadelphia released a report in 2006 which found that, all else being equal, a city that is twice as dense will have a per-capita patent forming rate that is about 20% higher. They studied a huge range of city densities, such that the highest density was twelve times that of the lowest. Thus, the implications for total per-capita innovation rate are striking. Regina's economic

profile, population, and density are all well within the range studied in this work, so the conclusions seem to be very relevant for planning the future of Regina[11].

6.2.4 Social health

The density of a community is also related to the social cohesion and life satisfaction of its citizens. One interesting example of a density-related personal happiness phenomenon is the "commuting paradox" where people voluntarily choose longer commutes in exchange for such things as cheaper housing or a higher paying job, thinking that through such an exchange they will achieve a higher quality of life. The data clearly shows that such a tradeoff tends to lead to significantly lower life satisfaction. The effect is so strong that a commuter would have to earn about 40% more than their current salary in order to be as happy as a non-commuter, all else being equal[12]. In later sections we delve more deeply into the connections between density and social health.

6.2.5 Ecological effectiveness

The above factors all help contribute to the reduced ecological impact of high-density human dwelling. Despite intuitive feelings to the contrary, dense cities are in fact much better for the environment than landscaped, sparse cities, even if most of their space is greenery. We believe it is very important for Reginians to understand this subject. The belief that suburbia is more conducive for human and ecological health leads to support for a set of development priorities that are not aligned with our actual wishes. A deeper understanding of human and ecosystem flourishing will lead to a rearrangement of developmental norms. This theme is built upon throughout the rest of this document.

6.3 Civic engagement

Citizen input and participation is fundamental to the success of any significant rethinking of the planning direction of a city or neighborhood. It is crucial that the City engage with citizenry early and deeply. Planners thus gain an opportunity to educate the public about the rationale for proposed developments, and citizenry get a chance to participate in the planning process for their community. Both sides benefit from the exchange. This leads to a converging understanding of both the challenges the community is facing and the tools that might be useful for addressing them.

Lastly, the very nature of effective civic engagement is important for the social cohesion of the neighbourhood, and the acceptance of new developments by the citizens. Rather than feeling like the

[11] Urban density and the rate of invention, Federal Reserve Bank of Philadelphia, August 2006.

[12] Stress that doesn't pay: The commuting paradox, Alois Stutzer & Bruno S. Frey, The Scandinavian Journal of Economics, Volume 110, Issue 2, June 2008.

subjects of a social infrastructure experiment, members of the public are more likely to feel a sense of ownership of the transitions; embracing and understanding that changes should be made rather than merely being incentivized or coerced into change by proverbial carrots and sticks. Thus, the planning process as a whole benefits from the technical expertise of the planners, the tacit neighbourhood knowledge of the citizens, and the community-building nature of the conversation.

The City of Regina already has civic engagement listed as a major priority, and has in fact taken strong initiative with recent projects such as Design Regina. These are certainly steps in the right direction. Civic engagement will come up repeatedly in this work because of its central role in building a prosperous and happy community.

6.4 Inclusive accounting

The total costs and benefits of municipal regulations and infrastructure choices go far beyond the monetary record books kept by the City. Government choices can deeply affect the long term economic, physical, and social well-being of citizenry. When discussing transformative change and social investment at the City level, it behooves us to consider deeply the broader ramifications of policy choices. There is no doubt that these concerns should play a major role in any planning process.

In fact, this sort of inclusive accounting is already cited as a priority by the City. The Regina Development Plan[13] states the following two overarching policy priorities:

a. To promote a sustainable community and encourage development that contributes to maintenance or improvements to the quality of urban life.
b. To ensure that development occurs in a cost efficient, environmentally responsible and socially equitable manner.

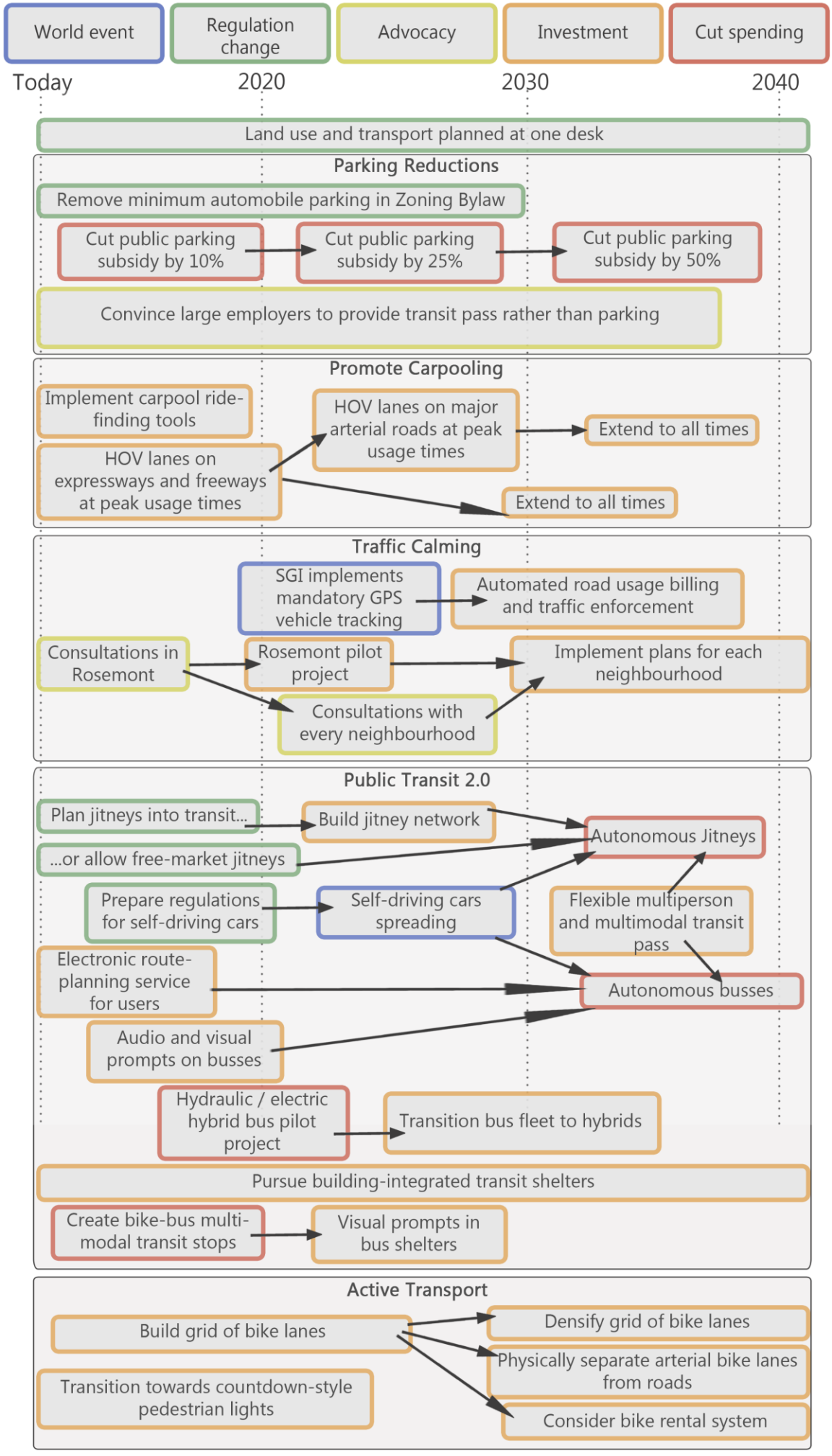
As things stand, municipal planning authorities face the inevitable reality of the dominance of monetary accounting. Everyone is familiar with measuring costs and benefits in dollars, so discussions naturally trend in that direction. Indeed, even this document is a good example of the dominance of such thinking, as we have emphasized prominently those recommendations that are best for the City's conventional bottom line.

Distinct efforts need to be made to adopt an inclusive approach to planning including both deep civic engagement and broad considerations of costs and benefits. This document attempts to regard City governance as the vehicle for those investments in social prosperity and well-being which are well-suited to the scale and scope of municipal government. In doing so, we may consider investments

[13] Regina Development Plan, City of Regina Planning and Sustainability Department, April 5th, 2011.

and policy changes to improve aspects of citizen life that are outside of the traditional purview of City planning.

Transportation



7. Transportation

7.1 Starting points and general plan

Transportation is a crucial aspect of the effectiveness and efficiency of a civilization. An ideal transportation system will be able to conveniently and cheaply move goods and people from where they are to where they want to go. It is important to keep in mind that transportation is an expense; it is in almost all cases a means unto an end and not an end unto itself. Therefore, the time, effort, and resources we direct towards transportation are extracted from our society's total wealth. This is why it is important to create a transportation system which places the smallest per-capita burden on the society, while maintaining overall system effectiveness.

Thus, access to an effective transportation system is necessary to facilitate goals ranging from obtaining food to reaching worthwhile employment. This section presents practical steps towards sustainable infrastructure and transport organization intended to maximize the long-term well-being of citizens and provide effective solutions for the achievement of transport-related goals.

7.1.1 Where are we today?

In a manner similar to most North American cities, Regina has engaged in nearly a century of auto-centric development. Today Regina's transportation system is thoroughly dominated by automobiles. A personal automobile has become a necessity for the majority of the population.

The costs of sustaining the current transportation system have been increasing for many decades, and are predicted to continue to rise. Increasing costs for automobile transportation have come about primarily through increasing fuel costs and time costs. Time costs rise as the city expands and it simply takes more time to get from one place to another. Also, since automobile transportation has a very low capacity rating, as the city grows arterial roads become clogged and congestion slows traffic.

Regina's economy has been booming and the population growing. Most of the resulting development has been guided by auto-centric thinking, resulting in many low-density Greenfield developments, which further exacerbate the costs of transportation for all residents.

The transportation problems faced by a growing city are primarily related to capacity. Roads which were designed to satisfy the needs of a few are now being forced to satisfy the needs of many. If this is to happen without placing unnecessary burdens on society, then the capacity of the transportation system must be increased. To optimize prosperity it is necessary for a growing city to shift along the transit modal curve, replacing low capacity transportation infrastructure with high capacity infrastructure, and low capacity modes with high capacity ones.

Transportation policy must adapt to reflect Regina's current situation while including and accommodating careful predictions of future trends. Forward-looking policy assures us that future investments in construction avoid the possibility of building transportation infrastructure that ends up as a significant liability for the citizens of Regina.

7.1.2 Where are we going?

By the year 2040, the transportation system of Regina will have undergone significant changes. Reasonable estimates of fuel costs and demographic shifts indicate that over this time period we will see changes in the average age of transportation users, the efficiency and size of vehicles, and the modal mix of transportation. Specifically, the average commuter will be aging, personal vehicles will on-average become smaller and more efficient, public transit will be in greater demand due to increasing costs of running a vehicle, and active transportation will become more prevalent.

Changing demographics coupled with economic forces will require us to rethink transportation, especially for the elderly and those of limited mobility. While active forms of transportation improve health and are already a growing trend throughout the population, throughout the next few decades as the population ages we will have a growing group of people less and less able to cycle, walk long distances, and drive safely. Public transportation policy must be cognisant of these trends in order to play an effective role in Rosemont.

An important part of building a transportation strategy for 2040 involves reducing the stress that rising cost will place on our citizens and municipal budgets. This is best accomplished by encouraging/facilitating transportation modes that will be least affected by changes in energy prices. It is no surprise that the transportation systems that are least affected by changes in energy prices are also those systems that use very little energy and have the smallest environmental footprint. Since these three factors co-vary, it is possible to design systems that are resilient against energy price shocks, cost-effective, and environmentally friendly.

Due to their clear and immediate impact on the lives and well-being of citizens, changes to transportation policy are not to be made lightly. Delays, bottlenecks, traffic jams, and re-routing of transport are sources of significant stress for citizens and businesses who are concerned with getting to their destinations. The recommendations in this section are made with these concerns held firmly in mind.

7.1.3 Overview of Rosemont transport changes

On the following page, we have illustrated the Rosemont implementation of our transport recommendations. Blue lines mark the existing bus routes through Rosemont, and the wide bands of colour act as a guide for the eye with regards to the walkability of various parts of Rosemont. Red lines and color bands mark the locations of our proposed bike lanes. Most of the bike lanes would be implemented by transforming current parking lanes into lanes that can only be used by bicycles and turning vehicles. Precise descriptions of our proposed lanes can be found in Appendix A. Multi-modal transit stops are marked with blue dots. The following subsections explain our proposed bus routes, bike routes, and inter-modal stops.

7.1.3.1 Bus routes

Our proposal does not include a change to the existing bus routes, since we believe that they serve the current community effectively. As Rosemont densifies in the coming decades, we recommend that Regina transit carefully study possible additional routes. We note that 7th Ave is a probable candidate as a development corridor due to its central location between 4th and Dewdney, its existing commercial and dense residential development, and its relatively congestion-free traffic.

7.1.3.2 Multi-modal stops

Our proposed inter-modal stops are intended to serve passengers who would like to use non-walking active transport modes to get to transit. Initial stages of development would merely be bicycle racks placed at or very near the transit stop, along with lighting and surveillance to discourage theft. Long-term plans for these stops must be laid in the future, as active transportation modes continue to develop and change along with culture. It is possible that in 2040 these inter-modal stops will offer long board and ski racks, or infrastructure for active transport modes that do not exist today.

Several of the multi-modal stops we have proposed will integrate nicely with existing institutional buildings. For example, if the stops in front of schools are timing stations, where the bus is guaranteed to wait a minute or two, then students and transit riders will be able to walk from some degree of shelter (perhaps added to some of the buildings). Even if they need to cross the street to reach the bus, the 1-2 minutes that the bus might wait at these stops would be well worth it, since this will substantially improve the comfort level or riders waiting for buses in inclement weather.

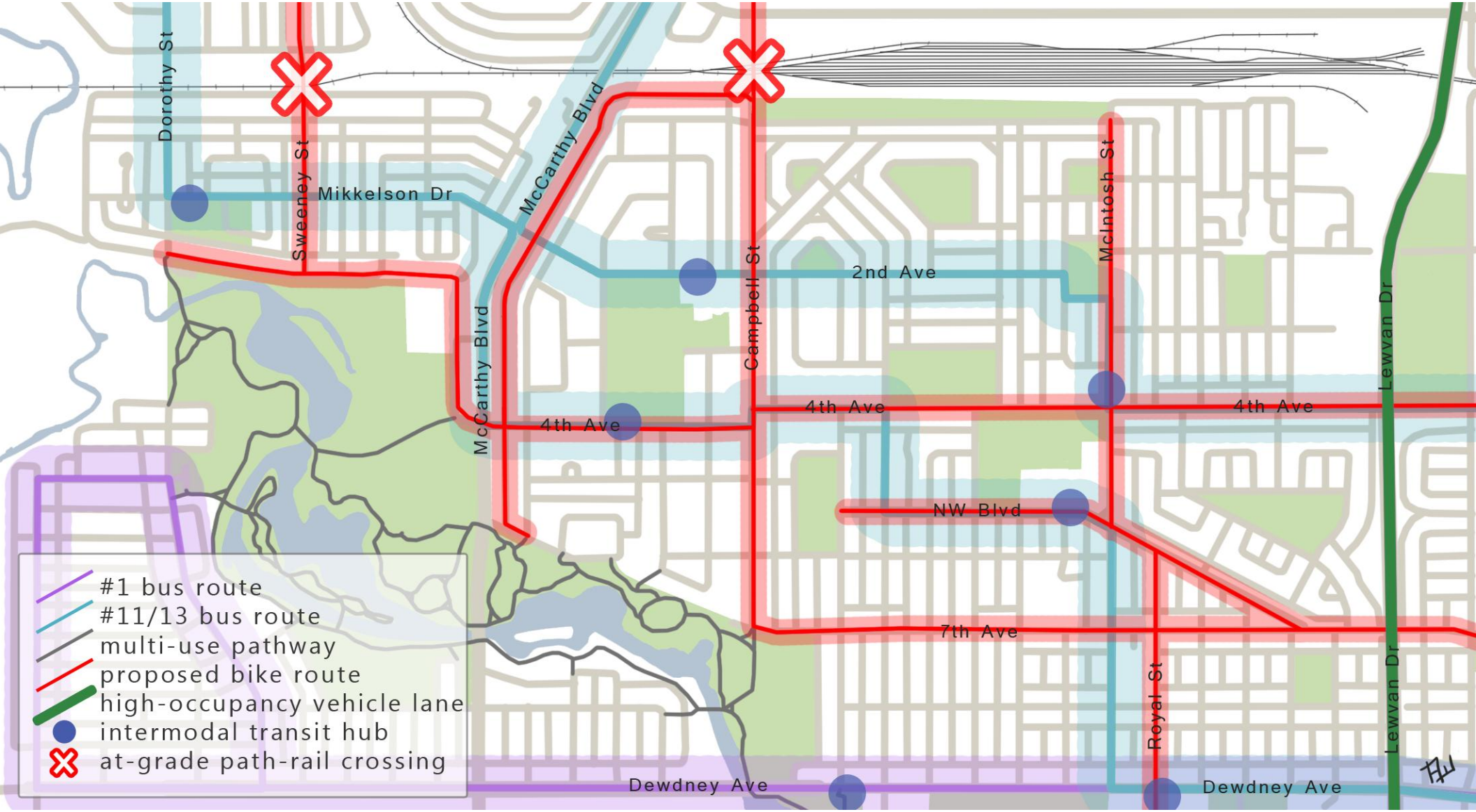
7.1.3.3 Bike routes

Bicycle lanes and paths were suggested in such a way that cyclists will be able to effectively navigate Rosemont without utilizing the largest, fastest, and most heavily-used roads: Lewvan,

Dewdney, and McCarthy. Instead, bike paths were placed on interior corridor roads such as 4th, 7th, McIntosh, and Campbell, and also on roads that are parallel to major thorough fares, such as the alleyway just to the east of McCarthy. The intent is to integrate bicycle and vehicle traffic where reasonable, but to keep them distinct where there are likely to be significant frictions between modes that would be dangerous to users.

For all bike lanes on major roads, such as those on 4th, 7th, McIntosh and Campbell, the bike lanes would replace the current parking lanes on those roads. The bike lanes would be intended for use only by bicycles and turning vehicles. In this sense, they would be akin to the existing bike lane on Wascana Parkway. The long-term plan by ~2030 would be to physically separate the lanes on these major roads from the main driving area by a small median. In Canadian cities such as Montreal, such separated bike lanes have proven to be a boon for active transport, sometimes carrying more people than the main road.

The illustration of all of these concepts on the following page is somewhat resolution limited, so we have made available a high-resolution version of this image on the Internet, which can be found by following this link.


Dorothy St
Sweeney St
Mikkelson Dr
McCarthy Blvd
McCarthy Blvd
Campbell St
McIntosh St
2nd Ave
Lewvan Dr
4th Ave
4th Ave
4th Ave
NW Blvd
7th Ave
Royal St
Lewvan Dr
Dewdney Ave
Dewdney Ave
#1 bus route
#11/13 bus route
multi-use pathway
proposed bike route
high-occupancy vehicle lane
intermodal transit hub
at-grade path-rail crossing

7.2 21st century transport planning

7.2.1 Density

Population density is an extremely important variable in determining the overall effectiveness of a transportation system, as a dense city can support transit modes that take better advantage of economies of scale. Dense cities with low per-capita energy usage for transportation are cities that are well protected against shocks or rises in energy prices.

High density increases the number of short distance trips relative to the number of long distance trips, this allows walking to satisfy a larger percentage of total trips made within the city. Well-planned density means that amenities are close to home and public transit can move most people to most destinations in a timely and cost-effective manner. It encourages active transport and mass transit over single-occupancy vehicular transport. Density is both a goal and a means to an end, but it must be planned for carefully or it can become a curse rather than a boon.

The primary transportation mode of Regina is currently the personal vehicle, which is a low-capacity mode of transportation. To facilitate higher density, higher capacity transportation modes are needed. Public transit is a high capacity mode of transportation which becomes increasingly cost-effective when operating in denser locations. In high density locations, public transit can provide vastly more accessibility to a given location than personal vehicles, while at low densities the opposite tends to be true. Many Reginians have experienced this effect firsthand, as it is often necessary to walk a kilometer to attend a Rider Game at Mosaic Stadium. In order for Regina and Rosemont to maximally capitalize on the benefits of higher densities, the transportation modal split must shift towards public transit.

A growing urban land footprint causes a different sort of modal shift; velocity must increase to accommodate larger transport distances. Auto-centric development dictates that at the same time, road capacities must also rise to meet increasing demand. Unsurprisingly, there is a strong and well-established inverse relationship between vehicle miles traveled (VMT) and city density[14]. It is thus clear how auto-centric development was self-reinforcing during the era of cheap oil. Multi-lane freeways to and from city centers along with their requisite arterial roads pushed the suburbs towards lower and lower density, while that lower density also caused an increased need for long-distance high-speed transport. This trend has caused the number of vehicle kilometers driven by Americans to grow

[14] Suburbanization and energy, Deron Lovaas, Natural Resources Defense Council, Washington D.C. Encyclopedia of Energy, Vol 5, 2004.

three times faster than population since 1980 and nearly twice as fast as the rate of vehicle registrations during the same period[15].

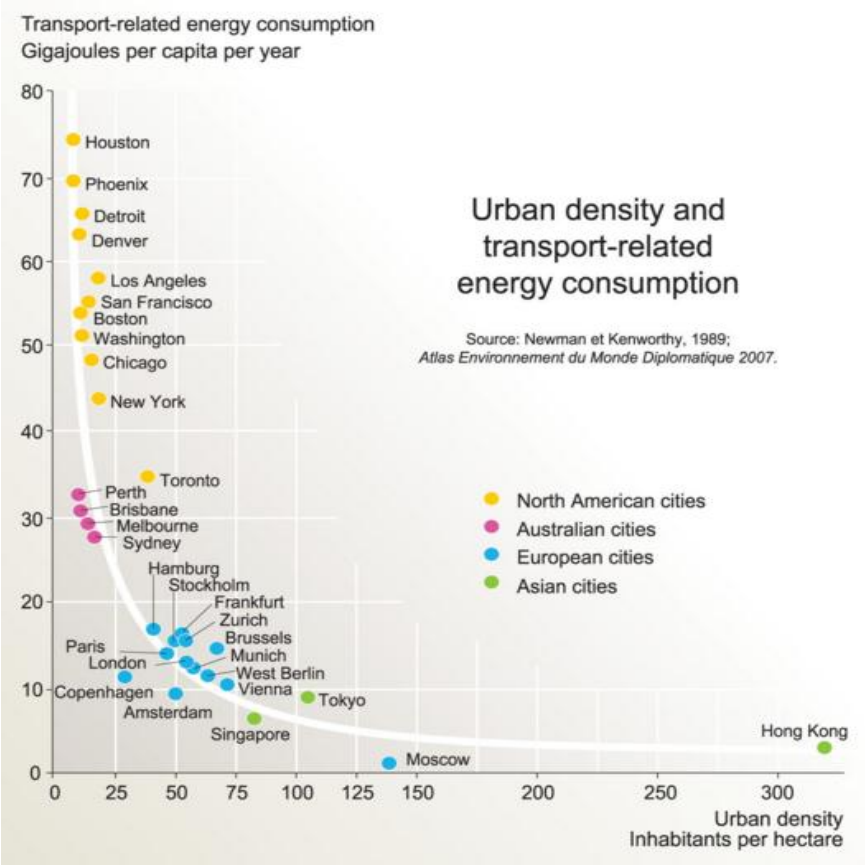


Image from Emmanuelle Bournay, UNEP/GRID-Arendal from Kick the Habit: A UN Guide to Carbon Neutrality, United Nations Environment Programme, 2008.

The economics of this approach are hitting a wall in the current era of rising oil prices. A 2005 study conducted on cities in the US found that for every dollar a household saved by living in the suburbs rather than the city core, they paid an extra 77 cents in transportation[16]. Adding concern to this statistic is the fact that the aforementioned study looked only at an era when oil was selling for under $50/barrel, and gasoline prices were significantly lower than today. This statistic illustrates vividly the dramatically rising economic challenges faced by outer-ring suburbs.

[15] Growing Cooler: The Evidence on Urban Development and Climate Change. Reid Ewing, et al, Urban Land Institute, 2007.

[16] Something's gotta give: Working families and the cost of housing, Barbara J. Lipman, Center for Housing Policy, New Century Housing, Vol 5, 2005.

The challenge facing us at the beginning of the age of high-price oil is to plan for an intelligent transition from this spiraling auto-centric development towards a comprehensive transit and land use plan that is well-suited to the demands and constraints of this era. Specific policies in this section and throughout the document as a whole are oriented towards increasing population density in effective ways.

7.2.2 Encouraging transitions: Creating new opportunities

In the interests of long-term prosperity, public policy can encourage changes in culture. In this case we are seeking to disincentivize single-occupancy personal vehicles while improving the viability of alternatives. A major lesson learned in Freiburg, Germany, during their transition away from car-centric development was that viable alternatives needed to be offered in conjunction with the creation of disincentives for automobile travel.

> "Freiburg has simultaneously made public transportation, cycling, and walking viable alternatives to the automobile, while increasing the cost of car travel. Improving quality and level of service for alternative modes of transportation made car-restrictive measures politically acceptable."[17]

The policies presented here attempt to follow this principle. In some cases, this exchange is very clear, such as abolishing the 2:5 parking policy[18] used by the provincial government along with a change to providing provincial government employees with transit passes. This exchange disincentivizes driving while simultaneously incentivizing transit usage. As explained in detail the parking section of this document, this specific transition would actually spend less government money than the status quo, making this a particularly good example of an exchange that creates a win-win-win situation for the long-term prosperity of Regina.

Transitions can also share benefits in unexpected ways. For instance, a modal shift towards local economies, active transport, and greater transit usage will reduce the strain on the existing road infrastructure, leading to reduced traffic congestion and commute times for auto users. The benefits of this modal shift are thus shared by all modes, and again represent a win-win-win situation for the City and its citizens.

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[17] Buehler, R., Jungjohann, A, Keelev, M. and Mehling, M. (2011) 'How Germany Became Europe's Green Leader: A Look at Four Decades of Sustainable Policymaking', Solutions Journal, October 2011.

[18] The 2:5 parking policy states that Government Services will provide 2 parking stalls for every 5 full time equivalent employees.

7.2.3 Plan transit and land use at a single desk

One of the lessons learned during the development of many cities, including Freiburg Germany, is that transit and land usage need to be planned in concert. These two aspects of development have a profound effect on one another. It is crucial that the authorities in charge of planning these developments consult extensively with one another.

7.3 Personal automobiles

In the interests of density, energy efficiency, and long-term citizen well-being, this section will be focusing on ways to shift our development priorities away from automobiles. The goal of these actions is to incentivize transitions toward:

- other modes of transport
- better driving habits
- safer, less congested streets
- better, more efficient, and fewer vehicles

An important threshold effect for the achievement of these goals is "car dumping", where a household chooses to reduce the number of cars that they drive by one. If the combination of other modes of transport that are available is flexible and effective enough, people can avoid the significant added expense of an additional vehicle. Public policy towards these ends is easily justifiable even if only done from a purely economic point of view. Traffic reduction is extremely valuable because it allows the City to avoid the costs of additional construction and maintenance. By shifting away from personal vehicles and reducing congestion, citizens will experience shorter commute times, less stress, reduced road noise, and cleaner air.

Personal vehicles also place a large financial cost on the owner and maintainer of personal vehicles. In 2010, Saskatchewan residents spent $3.542 billion purchasing, maintaining and fueling their personal vehicles, which is more than is spent on Recreation, Entertainment, Education, and Cultural services combined[19].

When the total time cost of personal automobiles is tallied (including the cost of working to earn needed money and all other car-related activities), the net 'effective speed' of automobile travel tend to be lower than the same calculated speeds for bicycles and transit. Additionally, any improvements in actual road speed for cars will have minimal effect on this number, while for transit

[19] Saskatchewan Provincial Economic Accounts, Government of Saskatchewan, Bureau of Statistics, Ministry of Finance, Dec 2011.

and bicycles they would have a huge effect. This is due to the high monetary and time costs of activities that are directly related to running personal automobiles.[20]

7.3.1 Existing subsidies for cars

A common thread of conversation in discussions of transportation systems is the degree to which public transit tends to be subsidized by various levels of government. What is generally missing from the discussion is an equivalent discussion of the subsidization of automobile travel. It is important for any discussion of the economics of transport to be based on credible estimates of these facts.

The Institute of Transportation Studies at UC Davis found that direct expenditures on auto-related infrastructure and services are over $100 billion per year in the US and that this value is in fact significantly larger than the revenue from auto-related taxes. Their conclusion is that automobiles in the US are subsidized by about 20-70 cents per gallon of motor fuel. This cost is borne by the rest of society through other avenues like income tax.[21] This number would certainly be higher if indirect effects of auto-centric spending were tallied such as health damage due to air pollution, noise, diffuse infrastructure, climate change, and economic instability.

Municipal spending can be a large chunk of this subsidy. The maintenance of auto-related infrastructure in Regina is a non-trivial expense for the City. Since the energy economics of personal automobile usage are in imminent decline, we recommend that the City embark on a proactive transition of subsidies away from car ownership towards the transportation methods of the future. The rest of this chapter will explore how this can be done.

7.3.2 Traffic calming

The goal of traffic calming is to nurture quiet, safe communities by reducing the speed and frequency of vehicles passing through. Neighbourhoods often prefer to have reduced speed limits within their boundaries. Reduced noise and danger are important to residents, as is the feeling that traffic in the neighbourhood is intrinsically local. Residents tend to be significantly bothered by thoroughfares located in close proximity to their home, or by significant amounts of traffic from distant parts of the city.

These wishes and hopes are in opposition with many intrinsic motivations of car users. When on familiar roads, such as those near their home, people often feel confident going at a higher speed

[20] Effective Speeds: Car Costs are Slowing Us Down. A report by Paul J. Tranter. School of Physical, Environmental and Mathematical Sciences, UNSW@ADFA, Canberra, ACT, Australia

[21] Do Motor-Vehicle Users in the US Pay Their Way? Delucchi, Mark, Institute of Transportation Studies, University of California - Davis, Jan 2007.

than they would in an area that they are not familiar with. This is corroborated by the City of Regina's page on traffic calming, which says that "Most speeding on residential streets is done by motorists who live in that area."[22] Striking a balance on these issues is something best done on a community level, as we shall now explore.

7.3.2.1 Case study: Freiburg traffic calming

Freiburg, a Bavarian city of population 220,000 in the south-west corner of Germany, was an extremely auto-centric city in the mid 1960's. Their development up to that point was qualitatively very similar to that which Regina has undergone to present. Today they are held up as a major exemplar of how to accomplish a transition away from being an auto-centric city. Since the mid 1960's they have accomplished a tripling of bicycle trips, a doubling of transit usage, and a reduction in car trips from 38% to 32%.[17]

The path that the people of Freiburg took to where they are today is very informative to us as we study very similar transitions in Regina in the coming decades. The approaches they implemented were not technological in nature, nor particularly tied to the culture, climate, or era in which they were applied. Thus, they appear to be robustly generalizable to Regina today.

At present, about nine out of ten Freiburgers live on traffic-calmed streets with speed limits of 30 kilometres per hour or less. Some areas have limits at an incredibly low value of 7km/h! How did they get to this point?

Initially, the municipal government worked with urban communities who had shown the most interest in traffic calming measures in the past. Implementation in these neighbourhoods was a proof of concept, enabling other areas of the city to see what effects such measures had on the community before committing to such changes themselves. Community engagement was essential for the process of planning such changes as well as their eventual adoption. Since the people who would be most affected by the measures were the citizens themselves, they needed to be on board with the changes that were on the table. Changing the speed limits required city planning and citizen agreement; changing the driving culture required community engagement.

7.3.2.2 The silver buckshot of traffic calming

In the world of traffic calming, there is no silver bullet. A variety of efforts need to be undertaken in tandem in order to effect major change. A neighbourhood that is greatly in favour of traffic calming measures may implement speed limit reduction, vertical deflectors such as speed tables

[22] Traffic Calming, City of Regina, 2012.

or humps, horizontal deflectors such as traffic circles, shared space for multimodal traffic, local-only parking systems, improved enforcement (either through engagement with city police or automated traffic enforcement systems which are becoming widely available), and undertake efforts within the community to firmly establish a culture that embraces lower speeds. Together, a set of changes such as these are guaranteed to reduce the likelihood of high speeds on neighbourhood streets and to encourage non-local motorists to go elsewhere for routes and/or parking.

Communities are likely to be interested in changes such as this because of the significant benefits they gain in terms of increased safety, reduced noise and congestion, and availability of local on-street parking. The City has a vested interest in seeing these changes go forward because they are a very low-cost way of creating a set of significant disincentives for driving within the city. If these measures are implemented throughout a city in conjunction with a corresponding improvement in the viability of alternative forms of transportation, there will certainly be a reduction in vehicle usage and traffic congestion. Such an implementation is desirable for both motorists and non-motorists because it incentivizes non-auto modes of transport and leads to fewer vehicles being on the roads creating congestion in the busiest parts of the city.

7.3.2.3 Implementation in Regina

City government is best suited to facilitating community consultations, providing expert advice, and overseeing an open process by which neighbourhoods can elect to reduce their local speed limits. The City of Regina should create a clear and transparent system through which neighbourhoods can elect to enact traffic calming measures in their neighbourhood including reduced speed limits. The premise of this effort is that traffic calming leads to safer and quieter communities, reduces road congestion, and incentivizes transit usage and active transport. Additionally, as stated above, the process must include efforts to improve the viability of the alternative forms of transport available to a community. Without viable alternatives, no improvements in the modal split can occur.

The City of Regina currently maintains web pages on the subjects of speed limits and traffic calming. The current page for “Requests to Lower or Increase Speed Limits” claims that lowering speed limits will not improve the safety of a community. The literature on speed limits seems to indicate that this is actually an open question. It has been shown in a number of studies that reductions in posted speed limits on slow city roads leads to no difference in speed driven or accident rate. On the other hand, preliminary results may indicate that there significant system-wide effects that emerge as lower speed limits are posted in an urban setting. Both of these major groups of findings indicate that lower speed limits either maintain or reduce the incidence of traffic accidents on low-speed city streets.

Another important concern about this approach to traffic bylaw decision-making is that the current site is designed for use by individuals. This approach must be transformed so as to engage communities within the city, and not simply to provide a contact form for individual citizens. The new approach must be built around a holistic understanding of the variety of ways that traffic calming can be achieved and how they act synergistically together. The central thread of the conversation should be the outcome desired by the community with regards to traffic in their neighbourhood. Communities are likely to be galvanized by a thought such as "We want to reduce the speed of vehicles in our neighbourhood," which can then be brought to the city planners for detailed discussions about implementation.

7.3.2.4 Implementation in Rosemont

The City of Regina should enter into consultation with already established community groups in the area such as the Rosemont – Mount Royal Community Association and also advertise to all residents that such consultations are being opened up. The goal of such engagement would be to help identify which areas have a majority of people interested in traffic-calming their neighbourhood and also which areas have the most problems with non-local traffic. To be maximally effective, these consultations will be inclusive, well-advertised, and engage residents on a range of issues. Open citizen consultation of this sort will help clarify the specific and general concerns that the community has in Rosemont.

Specifically with regards to traffic calming, the consultations would begin the process of identifying the streets and intersections of interest as well as begin to take stock of the full gamut of options available for traffic calming. All changes to speed limits and built environment would be coupled with efforts to begin nurturing a culture that embraces calmed traffic in these areas, spearheaded by interested locals and empowered by City expertise.

7.3.3 Parking

A parking spot is required at both ends of every trip taken in a personal automobile. The need for parking has placed many significant costs upon society, far more than most people realize. Nearly all houses in Regina have driveways and a double or even triple car garage. These architectural features exist to accommodate personal vehicle transport, and represent a noteworthy part of the cost of housing in Regina. Away from home, parking requires land, maintenance, accessory roads, and necessitates a reduction in the density of all other activities or immense expenditures in underground or high-rise parking lots.

In many situations, parking is the Achilles heel of the personal automobile system because it bars access to dense sections of the city by creating bottlenecks inhibiting optimal utilization of existing roadways. Most of the roads in Regina can carry more cars, but if there is no place to park, people cannot use the roads to travel. If there is no alternative to personal vehicle transportation, this can curtail the growth or densification of a neighbourhood.

To protect neighborhoods from being strangled by a lack of parking, the City is currently subsidizing automobile travel by providing public parking spaces along most residential streets. Additionally, City bylaws mandate large quantities of parking stalls for commercial and residential developments within the city, paid for by the developers. Thus, both City revenues and corporate investment is being funneled into the subsidization of automobile travel.

The secondary effects of this subsidization are noteworthy. We are legislating reduced density by effectively mandating that our developments be built further apart, and thus losing many of the benefits that higher density can afford us including more cost-effective infrastructure, better transit, greater viability of active transport, more resilient communities, and boons to our innovative capacity (as discussed in the density section of the introduction). We are creating vast tracts of impermeable surfaces that contribute enormously to our storm water surges. We are introducing market distortions, leading to reduced productivity of land than which would be accomplished if the market were allowed to react freely. We are encouraging automobile usage with all of its associated dangers, stressors, noise, congestion problems, and air-quality impacts. Current development patterns try to optimize the effectiveness of the personal automobile. The prioritization of auto-centric development comes at the expense of the effectiveness of the transportation system as a whole.

7.3.3.1 Case study: The Province of Saskatchewan's 2:5 parking policy

The province of Saskatchewan today uses a parking policy that was born out of emergency budget cuts in 1993. Prior to 1993 the province tried to provide all its employees with parking if they wanted it. As part of budget balancing measures it was decided that the parking expense needed to be "temporarily" reduced and it was arbitrarily decided to reduce parking availability to 2 stalls for every 5 full time equivalent (FTE) employees. This hasty budget measure created problems, the least of which is that some ministries needed more than 2:5 parking stalls to carry out their normal operations. The ineffectiveness of the temporary policy has resulted in it being largely ignored and parking is today provided in large quantities.

By 2009 parking was being provided at roughly 4:5 FTE's. However, the economic boom was pushing up the cost of real estate in the downtown to the point where parking was again at the forefront

of citizen's minds. The province began exploring the idea of replacing the temporary 2:5 parking policy. A report was written that concluded parking should be provided based on the actual needs of government, as is done in every other province, this would have the effect of eliminating the surplus parking currently provided to employees. Realizing this would be met with strong opposition, the report recommended providing all employees in relevant areas with bus passes. It was found that bus passes could be provided to all relevant employees at less cost than the current cost of providing parking stalls.

Using 2011 figures we can recreate that calculation, the average cost of a parking stall in downtown Regina is $2016/year.[23] This is significantly less than the $722/year for a year of bus passes for an individual. Assuming the 2:5 policy was strictly enforced, per-capita parking costs would be $2016 * 40% = $806.40, $84.40 more than the cost of a bus pass per annum. By using the current estimates for the percent of employees who are provided with parking stalls, the same calculation yields per-capita costs of about $2016 * 0.8 = $1612.80, which is $980.80 more per year than the cost of providing bus passes to the same employees.

Unfortunately these reforms did not receive sufficient support from senior officials, and were subsequently abandoned without further discussion. It is our opinion that such policy reforms should be reopened for discussion and implementation.

This example serves to highlight the economics of transit usage vs parking provision by large institutions in Regina. The City can encourage these major institutions to take a second look at their parking policies. Changes like this would reduce expenses for institutions, ease some pressure off of the price of land in downtown, significantly improve transit ridership (and thus service), and disincentivize employees from automobile usage in the city core, thus leading to reduced congestion and improved efficiency of downtown. Efforts by the City could help create a virtuous circle of improving density and transit usage in the downtown. The next few sections will go into more detail about why we want this change to happen and how it can be done.

7.3.3.2 Economics of parking

The objective is not simply to reduce the supply of parking stalls, but to reduce the demand for parking by providing viable alternatives, thus leading to a fall in the price of parking that will increase the accessibility of personal vehicles to downtown. It will also increase the opportunity cost of operating parking lots (rather than other land uses), thus encouraging further development and densification; potentially creating a virtuous circle.

[23] Regina Office Study, City of Regina Open CMS, Feb 2012.

At present, many motorists are receiving the benefit of a parking stall without having to pay the full financial cost. This distorts the market since people who personally value the parking spot less than the market price are still acquiring them because their institution is shouldering the cost. If those people had to pay the full cost themselves, many would choose not to. This artificially increases the demand for parking and increases the price for everyone else. The higher price reduces accessibility for anybody not receiving the subsidized price.

Providing employees with transit passes is a subsidy of the transit system, but as was previously noted, this is a smaller subsidy than the current payments for parking. By subsidizing transit instead of parking, the downtown becomes more accessible because the bus system is a higher capacity transportation mode than cars. This is a direct benefit to the residents of Regina in general as well as the residents of Rosemont, many of whom require access to downtown.

7.3.3.3 Implementation

The City bylaws regarding parking minimums should be eliminated. The free market is capable of building and maintaining parking space as well as deciding the appropriate amount of parking to provide. To increase the effectiveness of the transportation system, we feel it is important to encourage a cultural shift in the direction of the proposed changes discussed above regarding the Provincial government's parking policy.

Now is an excellent time to pursue such changes as recent and expected development (Hill Tower 3, Gardens on Rose, FCC Tower 2, etc.) is increasing the population and demand for transportation downtown. If higher-capacity forms of transportation are not available to meet the increasing transportation demand, the price of parking will increase quickly, stifling future growth.

Employers in the downtown, especially the provincial government, should be encouraged to provide their employees with bus passes instead of parking. By doing so, they can save money, help to decongest the downtown streets, and improve ridership of public transit. To facilitate this transition, Regina Transit should be willing to offer bulk pass discounts for large employers seeking to provide hundreds or thousands of bus passes to their employees. Negotiations should be started with the school boards, university, students unions, and SIAST regarding the possibility of these institutions purchasing bulk bus passes. One approach to such deal-making would be to exempt large institutions from their minimum parking space provisions in exchange for an "equivalent" provision of transit passes to their employees.

Often the biggest barrier to taking the bus is not the financial cost but the transaction cost. People often don't have exact change, or have yet to purchase an R-card, or are inconvenienced with

purchasing new tickets or additional passes every month. Transitions such as those discussed above would reduce transaction costs by establishing long-term certainty through institution-supported passes.

7.3.4 Automating the shift of road costs

Congestion charges, such as the one currently in place in London, England, serve to disincentivize vehicular traffic in the city core while simultaneously providing an additional revenue stream to the City which can offset some of its automobile-related expenses. In this way, a congestion charge, or a similar approach, can shift some of the economic burden of road construction and maintenance towards the direct beneficiaries of such investment. Ideally such a system would be implemented in a broad area by a provincial licensing jurisdiction like Saskatchewan. This would reduce any possible localized price shocks that might turn large numbers of people away from the city.

The ubiquity of mobile telecommunications as well as stunning advances in automated optical technologies will make it possible, certainly within the next 15 years, to implement an affordable automated micropayment system for road usage within congested areas of the city including the downtown, Albert Street, Ring Road, and Victoria Avenue. Such a system might involve something as simple as cameras that can observe each major intersection in the city. These cameras will soon be capable of reading licence plates. Data would be fed to a central system which would levy micropayments (perhaps on the order of cents, or fractions of cents for passing through an intersection) on the individual's or company's licence renewal through SGI.

An alternate likely path is a regulation change that requires global positional system (GPS) boxes to be active in every vehicle on the road for insurance purposes. GPS transmitters are becoming extremely inexpensive, and data of that sort would be immensely valuable for accident tracking, stolen vehicles, and of course local use charges such as these. The benefits of such a system are likely to be substantial and the costs of implementation and maintenance quite minimal. Any system of congestion charges of this sort would have to be implemented in conjunction with SGI.

Systems of this sort are likely to be status quo by the year 2040, since they will also provide a cost-effective and reliable way to deal with traffic infractions of many sorts, similarly to how today there are red light cameras at several major Regina intersections. Policy would have to be carefully crafted to deal with vehicles from outside the province as well as disincentivize abuse or misleading of the system through such methods as licence plate obfuscation.

The data gained by such a system would also be invaluable for future transport planning. Regional statistics could be used to inform future public and private investments, policy changes, road repair priorities, and transportation research.

7.3.5 Carpool

Carpooling tends to be very cost-effective in terms of both time and money for users, and has the additional bonus of reducing both congestion on city roads and required parking. It is thus in the City's best interest to encourage carpooling when such interventions will lead toward a more effective city. Encouraging carpooling can be done in two general ways:

- provide improved informational tools (such as websites or apps) for setting up carpools
- provide incentives for carpooling and disincentives for single-occupancy vehicles.

The City can promote carpool at the individual or institutional level. Depending on the informational tools that exist (or are being planned), one or both of these levels might be the most effective path forward initially, though the long-term plan should include advocacy directed at both groups.

It is often relatively easy for employees and neighbours to organize their own carpooling, provided they are interested. An often overlooked facet of carpooling is that it nurtures community among the riders and cooperation in other spheres of their lives. Personal choices to start, or continue, carpooling may be strongly informed by experiences of happiness, socializing, and fraternity as well as reduced monetary cost and reduced stress.

Implementation at the institutional level could involve encouragement of parking availability reductions as well as advocacy and the provision of informational tools. Reduction in parking availability would be desirable for many employers, since they often foot the bill for many of the parking spaces available to their employees. As discussed earlier in the parking section, the City should come up with a modal-shift plan that allows businesses to lower their costs and also reduce the strain that their employees cause on the public roads through congestion.

7.3.5.1 High-occupancy vehicle lanes

High-occupancy vehicle (HOV) lanes are intended for use by vehicles carrying more than one person, often limited in applicability to only peak traffic times during the day. The literature on HOV lanes shows that despite perceptions of them being 'empty all the time', they move more people per lane than the other lanes, and generally at a higher speed[24]. As expected, they have also been shown to improve air quality and encourage ridesharing.

While Regina in general may have many choices for possible locations for such lanes, in Rosemont the choices are currently very limited. According to the Regina Traffic Flow Map, the four

[24] Frequently Asked HOV Questions, US Department of Transportation, Federal Highway Administration, 2012.

roads with the highest-traffic sections are 4th Avenue, McCarthy Boulevard, Dewdney Avenue, and Lewvan Drive in increasing order of number of vehicles per day[25]. All of these except Lewvan have a high number of dual-direction intersections with crossing roads. These intersections put fairly severe constraints on the contiguous length of a HOV lane that could be implemented. In the case of Lewvan, the intersections are more spread out and the street also has a higher speed limit. This is expected because Lewvan is a major arterial street for Regina. Implementation of a HOV lane should begin with Lewvan and other expressways before expansion of this concept is considered for arterial streets like the other listed above.

7.3.5.2 Carpool info and communication tools

Communication tools for commuters interested in carpooling have been shown to be a key aspect for the adoption of ridesharing in communities. A recent study analysed the carpooling literature and also conducted a case study of greater metropolitan Toronto[26]. They concluded that improved tools for ride-matching within communities would be very beneficial. The case study they looked at involved a tool called "Carpool Zone", which is a free online system for matching up carpool users in the Toronto area. This tool was created by Smart Commute, a program supported by municipal governments in the area as well as the provincial government (via Metrolinx, the transport authority for the greater Toronto area). Other municipalities in Canada could draw upon the extensive experience garnered by such a large scale implementation by an arm of the public sector.

Drawing on this experience, Regina could develop a practical tool for achieving ridesharing in the city. Drawing upon the experience of other Canadian implementations like Carpool Zone, this system would likely be cheaper to implement and more effective than its currently existing counterparts. Our recommendation would be that such a tool be built for both web and mobile technologies. Alternately, another excellent path forward would be providing a website with a well-documented application programming interface (API), which would allow interested citizens to build tools that provide access to that service for whatever platforms they enjoy (such as Google Android, iPhone, etc.). A local example of this phenomenon is the creation of the QC Bus Chaser App for the Android operating system by a resident of Regina who used the publicly available data from the TransitLive project[27] [28].

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[25] Regina Traffic Flow Map. City of Regina, 2009.
[26] The "Driving" Factors Behind Successful Carpool Formation and Use. Buliung, Soltys, Habel, and Lanyon. Transportation Research Board of the National Academies. 2008.
[27] QC Bus Chaser (BETA). Google Play.
[28] TransitLive. Real-time bus tracking for Regina.

7.3.5.3 Carshare

Carshares are organizations that allow people to gain partial ownership and access to a vehicle for a small monthly fee. Systems such as these allow one vehicle to serve many users. With the advent of advanced communication technologies, carshares are becoming more popular.

Most implementations are still small relative to the prevalence of individual car ownership, but fostering them can be a crucial step towards residents of a city achieving the all-important threshold where they realize that they do not need one of their vehicles. Maintenance costs for a typical vehicle are significantly higher than the cost of belonging to a carshare. The reduced availability of the carshare vehicle can be balanced with its lower monetary and time costs as well as the lack of need for an expensive permanent parking spot. It is often the case that people own vehicles only for relatively specific tasks such as grocery shopping and moving heavy items. If these uses are rather infrequent, predictable, and/or flexible, a carshare can be an excellent way to acquire those services without the trouble and expense of purchasing and maintaining a vehicle.

The Regina Car Share Co-operative is a local implementation of note[29]. The costs of membership depend on use, which can be a significant benefit for people who infrequently need access to a vehicle. They utilize a web login system for booking the cars.

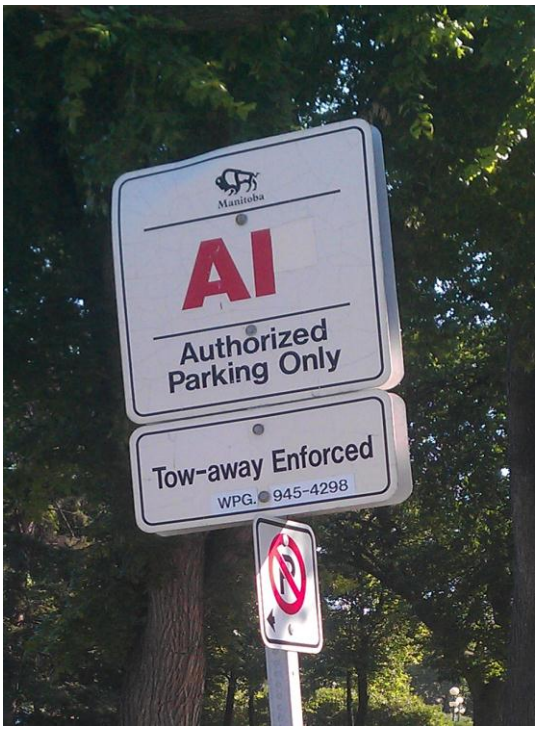
The City could take several actions to support the creation and success of car share cooperatives in the city. The following points are sourced from personal communication with John Klein, President of Regina Car Share Co-operative.

- Extending some of the traffic and parking rights of transit and taxis to car share vehicles.
- Modifying minimum parking spot requirements in the zoning laws so that car share parking spots count as multiple traditional spots, allowing for additional space to be cleared up for other uses as well as encouraging the provision of car share lots.
- Sharing knowledge about how the City maintains and coordinates its fleet of vehicles so that such knowledge can be applied on a smaller scale.
- Enable online R-card payments so that consumers can recharge their cards from the comfort of their home instead of having to go to a retail outlet to purchase additional tickets or passes.
- Provide systems for integrating the R-card with other modes of transport such as taxis, bike rentals or shares, and car shares. Future systems should continue to use radio-

[29] Regina Car Share Co-operative.

frequency identification (RFID) and subsequent similar systems to make payments extremely simple.

7.4 Self-driving vehicles



7.4.1 A fact of life by 2040

Self-driving vehicles will soon be driving on Regina's roads, and by 2040 will be ubiquitous. Google has had self-driving cars on the roads of San Francisco since 2010, and BMW began testing self-driving cars on the roads of Germany in 2011. The 2013 Mercedes S-Class is rumored to be the first self-driving car available to the general public. The technology is rapidly maturing, and it has already become clear that the largest hurdles yet to be to overcome are not technical but legal in nature.

There is an understanding that the system has to essentially perfect before it is released so that it can effectively garner the confidence of the public. This will delay broad implementation for at least a few years. On May 8th, 2012 the state of Nevada issued the first driver's licence to a Google self-driving car. It is worth noting that Google has clocked over 140,000 miles of driving with no accidents[30].

As mentioned earlier, the 2013 Mercedes S class is widely expected to be the first commercially available car with self-driving capabilities. However, to overcome licensing issues, the car will not exceed 30 km/h while in self-driving mode. This is because in many jurisdictions you do not need a driver's licence to operate a vehicle that does not achieve speeds above 30 km/h.

Self-driving vehicles will provide people who live in low density areas the ability to take their car to a high density area and not have to worry about parking. This will have a profound impact on the parking needs of the city, especially downtown. It seems likely that local parking will become a smaller priority for businesses, since self-driving cars can drop off and pick up their owners. Parking will become increasingly decoupled from usage areas.

[30] Google gets Nevada driving license for self-drive car. BBC, May 8th, 2012.

7.4.2 Personal ownership

7.4.2.1 People who cannot drive

Self-driving vehicles will provide mobility to people who currently are not able to drive a vehicle such as children, as well as some disabled and elderly citizens. This has already been seen with the early prototypes, as one of Google's most high-profile cases is that of a legally blind man who has regained his ability to navigate his city on his own thanks to his Google car[31].

7.4.2.2 People who can drive

In a similar fashion to public transit, a self-driving car would give owners the opportunity to engage in other activities during their trips. This fact was highlighted in Google's April Fool's joke for 2012, where they made a video detailing how race car drivers appreciate the fact that they will have time to do other activities during their races[32].

In practical terms, self-driving cars will offer significant benefits along these lines, in a similar fashion to how public transit enables alternate parallel activities. We expect that the car culture will attempt to resist this change in Saskatchewan because the great plains of North America have been particularly enthralled by the car-centric lifestyle. On the flip side however, we think that this innovation will be deployed at a rate somewhere between the norms for computing industry and auto industry. While computing tends to radically change in less than five years, the auto industry tends to transition much more slowly. Our prediction that self-driving cars will be essentially ubiquitous by 2040 is based on a rough average of these rates coupled with the expectation that law will be slow to change, but such change will be accelerated by intense efforts by industry giants like Google and BMW, in addition to the staggering economic benefits to the trucking industry of such a system.

However, the energy-economics of single-occupancy vehicles will not be significantly changed by the advent of self-driving vehicles. In the coming decades, it is likely that owning a personal vehicle will become prohibitively expensive for a growing portion of the population, regardless of whether that vehicle is self-driving or not. Additionally, the currently huge subsidies for personal automobile ownership and usage (which are discussed in an earlier section) are likely to be rolled back and turned into more direct costs.

7.4.3 Self-driving taxis

[31] Self-Driving Car Test: Steve Mahan. Google promotional video.
[32] Google Racing.

Potentially one of the biggest changes self-driving vehicles will be in the taxi industry. If the cost of taking a self-driving taxi can be reduced to the point where it is comparable to that of owning a car, many people will make the transition. This will have long-lasting implications for the way houses and neighbourhoods are constructed because the multiple-car garage that dominates the streetscape of modern neighbourhoods will not be necessary. Future developments and redevelopments may embrace alternate uses of the front yard space. This may open up a space for community, resulting in more vibrant neighbourhoods. Another possibility - one that we distinctly hope will come true - is that the additional space that is freed up in the city will be put to effective and healthy use by urban farmers implementing a pesticide and herbicide-free form of small-plot intensive farming that we discuss in much more detail in our section on urban agriculture. Regardless of the use this space is put towards, the changes in our land use and culture in the long-term will be momentous.

7.4.4 Public transport

Mass transit systems already see significant automation in some sectors. Especially with regards to light-rail, subway, and sky-train systems, it is generally not necessary for a driver to be present on each train, even though many transit authorities choose to do so. If autonomous vehicles are capable of almost entirely replacing human drivers for personal automobiles, it seems likely that the already significantly automated systems of mass transit will see additional automation.

In a later section, we will discuss in some detail how an interesting and currently rare mode of mass transportation, known as demand-responsive transport is likely to undergo a significant resurgence due to the advent of self-driving vehicles.

7.5 Public transit 2.0

The goal of this section is to recommend a clear path forward regarding public transportation in Regina based on the findings articulated in earlier sections of this document on future energy availability, the benefits of density, and the relative advantages of various modes of transport. It is thus important to recall two earlier sections of import to this discussion:

- Transit and land usage should be planned at a single desk.
- Encouraging modal transitions must involve the improvement or creation of credible alternatives along with disincentives for less desirable modes.

Just as with the earlier section on traffic calming, specific policy recommendations discussed here are not meant to be taken in isolation, but instead as part of an integrated vision for improved transport in Regina. A real-world implementation of a forward-looking transport plan should be a

combination of strategies to disincentivize automobile use combined with promotion of public transit and active transportation.

7.5.1 Regina transit policy

The City of Regina transit policy currently includes the goal of having 90% of new residential lots within 365 meters of a transit stop[33]. Many other mentions of promotion of public transport are evident throughout the official planning documents of the City of Regina, but we will not undertake an exhaustive review here. It is clear that the City of Regina's planners have long recognized the central role that public transit plays in the long-term future of Regina. We add our voices in support of their statements about the importance of public transit and methods for improving it. This section will follow along many of the themes already present in Regina's planning documents, but will also present a number of ideas that are likely to be entirely new to the public transit planning discussion in Regina or elsewhere.

7.5.2 Transit costs & subsidies

The cost of public transit is an interesting and nuanced topic. Here we will look at just a few of the most important findings available in the literature.

A major study in the USA found that, an average family in the US spends 19% of their income on transportation, while households with good access to transit spend less than half of that (only 9%)[34]. On a household or personal level, this means that good provision of public transit means that more money is available for other things. Reduced the cost of transportation is a significant cause of increasing productivity and genuine, real wealth generation, since we are doing more with less.

Financial subsidies for public transit systems can be substantial. In the US, the average subsidy for public transit systems is about 65%[35]. The corresponding number for Germany is about 22-30%, and for Freiburg, one of the example cities discussed earlier, the public subsidy is only 10%, one of the lowest in the developed world. High ridership and low costs per rider are the obvious direct causes, but it has been shown that population density and combined land use & transit planning underlie both of those factors.

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[33] Regina Development Policy Plan. Section 3.3.9.

[34] Realizing The Potential: Expanding Housing Opportunities Near Transit. Reconnecting America. May 13, 2007.

[35] Buehler, R & Pucher, J. Making public transport financially sustainable. Transport Policy 18(1), 128-136 (2011).

The most important comparison for transit subsidies is of course to existing personal automobile subsidies. Credible estimates of these subsidies in North America tend to conclude that the average subsidy levels of automobiles and public transit are roughly equivalent, though with significant regional variation[36]. Automobile users personally (and directly) see only about half of the total cost of their driving. Thus, as things currently stand, when a motorist reduces or eliminates their driving, they tend to personally receive less than half the total monetary benefits that their actions cause[37].

7.5.2.1 Deep costs

It is worth highlighting that the costs discussed in the previous section included many things that are generally not directly associated with the cost of a particular mode of transport. In the case of Regina, a shift towards public transit will help:

- increase the population density and land usage
- reduce traffic congestion
- reduce costs of road upkeep
- avoid new road expansions

As already discussed in detail, space requirements for public transit are lower than for personal autos, and thus lead to reduced traffic on the existing roads. This is also an important factor for road upkeep. In Regina, we have the additional concern of major snowfalls. Transit is much more resilient to large snowfalls than personal automobiles. Not only are buses able to navigate significantly deeper and messier snowfalls than most personal autos, they also require less road space per person (requiring fewer lanes to be plowed in order for the city's main arteries to function). Transit can help curb the growing cost of winter snow removal and the economic shocks caused by traffic disruptions during and after major storms.

7.5.3 Lower car ownership

The previous major section of this document dealt primarily with curbing the massive and growing costs of auto-centric development by disincentivizing vehicle use and ownership. In the spirit of that section, it is worth mentioning that good transit availability is itself a disincentive to both car ownership and driving. A 2006 study in the US found that over three quarters of transit zones (the half-

[36] Transit Evaluation: Determining the Value of Public Transit Service, TDM Encyclopedia, Victoria Transport Policy Institute, Updated 22 February 2012.

[37] Transportation Market Distortions, Berkeley Planning Journal, Litman, Todd, Victoria Transport Policy Institute, 2006. Department of City and Regional Planning, UC Berkeley.

mile radius around a mass transit station) had an average number of cars per household below one[38]. That is, proximity to high-quality transit is directly correlated with significantly lower car ownership.

7.5.4 Rate structures and systems

7.5.4.1 Multi-person pass

Freiburg Germany, in 1984, adopted the first monthly and annual transit ticket in Germany that was transferable to other users[39]. Changes in this direction are credited with helping improve transit ridership and community uptake.

7.5.4.2 Multimodal pass

A multimodal pass can be used on more than one form of transport. For Regina, such an implementation might allow seamless transition between buses, cabs, and car shares. In the future, rental bicycles could be added to such a system. In a later section we describe the autonomous jitney, a mode of transport that is likely to exist in cities like Regina prior to 2040.

7.5.4.3 Time and distance pricing

Time-of-day pricing would charge users different rates based on whether they were riding transit at peak times or off-peak times. Distance pricing would charge users based on how far they ride. Investigations into pricing schemes for transit indicate that transit fare systems that take into account both distance traveled and time-of-day are an excellent path to equitable revenue generation[40].

7.5.5 Transit development strategies

7.5.5.1 Multi-modal bus stops

At present Regina is a very low density city and the bus routes are few and far apart, this creates large parts of the city that are not immediately accessible to the desired bus stop. To help increase the accessibility of bus stops we suggest creating several multi-modal bus stops along each route. A multi-modal bus stop is a more robust bus stop that includes bike racks, or something that allows people to secure their active transport equipment prior to getting on the bus. The intent is to allow people to ride

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[38] Preserving and Promoting Diverse Transit-Oriented Neighborhoods. Center for Transit Oriented Development: A collaboration of the Center for Neighborhood Technology, Reconnecting America, and Strategic Economics. October 2006.

[39] Buehler, R & Pucher, J. Making public transport financially sustainable. Transport Policy 18(1), 128-136 (2011).

[40] Efficiency and equity implications of alternative transit fare policies. Cervero, R. B., Wachs, M., Berlin, R., Gephart, R. J. Urban Mass Transportation Administration. 1981.

their bikes to the bus stop thus increasing the catchment area of the stop. To provide security a camera which streams its content to the internet and creates a 48 hour archive should be used. This way a rider locking up their bike can check on it at any time from any internet connection. The camera will deter any act of vandalism, but in the event vandalism or theft takes place it will have been recorded, providing the police with strong evidence. By providing the internet stream the transit authority does not need to monitor cameras, this keeps costs low.

7.5.5.2 Building-integrated shelters

Major transit hubs often have official or de-facto shelters built into the nearby buildings. For example, the Riddell Centre at the University of Regina serves as the primary bus stop partially because transit users can see their bus from there, and reach it before it leaves, during the cold months of the year. Since the university is planning to expand the Riddell Centre, they should be encouraged to maintain and even deepen the relationship between the building and transit. Similar logic holds true for the new library expected to be constructed downtown. People will feel more comfortable taking the bus if the time they have to spend outside on a cold winter day is reduced.

7.5.5.3 Multimode lanes

As discussed in some detail in the earlier section on high-occupancy vehicle (HOV) lanes, transit speed, efficiency, and ridership could be improved by giving transit more road rights. We recommend that HOV lanes be expanded in both scope and the number of applicable hours so that transit and carpooling are encouraged during peak times.

Some cities have expanded this concept into the realm of multi-mode transit lanes, where the only allowed vehicles are buses and bicycles. While this might be a dubious path forward for Regina's roads, it may bear considering in some specific circumstances, such as in areas where buses are consistently traveling slowly and stopping often.

7.5.5.4 On the bus

High-quality information for riders can help improve ridership. Today, it is becoming rather inexpensive to implement what might seem to be quite sophisticated technologies for providing information to riders. For example, buses in Winnipeg, Manitoba and Kingston, Ontario will speak the name of each stop and also have the name displayed on a digital sign on every bus. This is extremely useful for new users of the system as well as the blind and deaf.

7.5.5.5 On computer or handheld

Digital technologies make it possible for high-quality information to also be provided to people who are looking for transport. Earlier, we mentioned the QC Bus Chaser App that allows people to track the real-time location of Regina's buses. This is an excellent example of the provision of digitized, accessible information for use by the public. We encourage continued efforts to provide informational resources to the public so that tools such as the QC Bus Chaser App can be provided to the public by citizens and businesses.

Specifically, Regina Transit should look into either the provision of its own route-planning data and software, or integration with Google Maps, following in the footsteps of other cities of similar size and maturity[41]. The provision of these services to smart phones is becoming expected of every city in Canada.

Further efforts could include letting citizens sign up to be on email lists so that they can hear about bus route changes that will affect them. This informational tool could also be used to conduct surveys of riders.

7.5.5.6 Modal split

For Regina, capital-intensive, high-speed and high-volume bus transit will continue to be focused on the trips to and from the city core, with one or more local switching stations at a central location for each major area of the city. This connection should be intermodal, embracing the less capital-intensive forms of transport, including jitneys (discussed in this later section) bicycles, skateboards, roller-blades, skiing, walking, etc.

7.5.6 Transit technology

Increasing usage of public transit is important to developing a sustainable future. However, even public transit is not free to run, nor does it operate independent of oil prices. Here, we want to introduce some improvements in public transit bus technology that both reduce both operating costs and petroleum dependence/fuel usage.

7.5.6.1 Hybrid buses

Hybrids are a step towards disentangling transit service from global energy prices. They have the added bonus of being a mature and proven technology that has been shown to be economically advantageous.

[41] Cities that have integrated with Google Transit.

7.5.6.2 Regenerative braking

The energy consumption of public transit is primarily due to that starts and stops that each unit must undergo. Fuel or energy is used both to accelerate and to maintain speed, but acceleration is vastly more energy-intensive than speed maintenance. The demands of servicing a bus route require a bus to stop and start many times. When stopping, the kinetic energy of the moving bus is converted into heat in the brakes, and is subsequently ejected into the environment. There are a number of ways to recover this energy, rather than simply letting it be dispersed as heat.

It is a standard feature of electric or electric hybrid vehicles to use "electric regenerative braking". Through regenerative braking, a significant but variable amount of the kinetic energy is captured and stored in the vehicle batteries for later use during acceleration. Early implementations (circa 1999) of electric hybrid buses in the United States demonstrated reduced fuel consumption of between 10% and 22% as compared to their equivalently sized diesel counterparts[42]. Significantly greater differences have been achieved since then, and the market has begun to rapidly innovate, including the deployment of electric, hydraulic, and flywheel energy storage technologies.

7.5.6.3 Electric hybrids

Advances in battery technology have produced relatively fast-charging batteries. By analyzing the route schedules of a bus system, recharging systems can be located where buses take breaks to synchronize their schedule, such as at the University of Regina or downtown. These en route charging systems reduce the amount of on-bus battery capacity necessary to enjoy the benefits of electric hybrid transit. This both reduces the cost of incorporating hybrid buses into the system, and reduces the space used on buses for storing batteries. An example of the implementation of this technology can be seen in the Scandinavian company Opbrid, who present various solutions along the continuum from mostly diesel-fueled to purely electric buses.

At present, hybrid buses are a better choice than purely electric for Regina-specific implementation since diesel can be used for part or all of the route. Charging stations may be expensive, so finding locations for many of them may be difficult. Also, public transit must still operate during electric power outages.

[42] New York City Transit Diesel Hybrid-Electric Buses: Final Results. DOE/NREL Transit Bus Evaluation Project. U.S. Department of Energy Office of Scientific and Technical Information. July 2002.

7.5.6.4 Hydraulic hybrids

This regenerative braking technology uses a hydraulic fluid, rather than electric motors, to capture the vehicle's kinetic energy. Hydraulic systems do not store as much energy as electric hybrids, but this is appropriate as they only capture braking energy, and are not expected to drive the bus all day. While electric hybrids are expected to be 'electric buses' for some of their route, the hydraulic hybrid only uses its energy storage to store braking energy for use during the next acceleration stage.

Because they do not have to store as much energy, and due to their simplicity, hydraulic hybrid buses are more comparable in price to a standard bus than electric hybrid buses. This reduced up front cost makes hydraulic hybrid technology cheaper to test and implement than full electric or hybrid technologies.[43]

Hydraulic hybrid buses can substantially increase the fuel efficiency of transit, but they do not enable the substitution of electricity for liquid fuels. It is worth noting that hydraulic pressure tanks use more space per unit energy stored than electric batteries. This is one reason why their usage is focused purely on recovery of braking energy.

7.5.7 Demand-responsive transit and share taxis

7.5.7.1 Jitneys

In the early 20th century, a niche opened up for small transit vehicles. In the United States, these vehicles were known by the colloquial term 'jitney', which was slang for five cents. These vehicles would take on and drop off passengers on an ongoing basis, and had very flexible routes. They were so successful in the US that central transit authorities pushed municipalities to ban their existence. The niche never closed however, and repeated attempts have been made to fill this gap in city transport systems. Today, 'dollar vans' operate on the fringes of New York City and jitney services (often known as 'share taxis') are beginning to spring up anywhere in North America where they can successfully be allowed under the laws. Worldwide, they are widespread and well-established[44].

Jitneys are very competitive because of the undesirability of both public and private transport during peak hours, as well as the time and monetary costs of owning and operating a personal vehicle. Their flexibility of routes leads to great speed in achieving destinations. Drivers need to be able to dynamically form and reform their route mentally as they drop off and pick up passengers.

Jitneys could be embraced in Regina bylaws as either an extension of the public transit system or as a free-market transportation akin to taxis. While the transit-oriented approach will entail

[43] Altair unveils world's first hydraulic-hybrid transit bus, Frank Sherosky
[44] Dark Age Ahead, Jane Jacobs, p 187, 2005.

significant planning from the City, the free-market approach would require very little. This is a situation in which government can step aside and let the market equilibrate naturally.

While we believe that current political and economic conditions would favour the free-market approach, we recommend that public transport solutions going forward to 2040 include vehicles akin to jitneys. The rest of this section will focus on how currently emerging vehicle, communications, and computational technology can radically transform our transportation systems through autonomous jitneys.

7.5.7.2 Autonomous jitneys

Previously, we discussed the ongoing emergence of self-driving vehicles. In the introduction we discussed how mobile communications and computing are already a fact of life, and will continue to increasingly pervade our lives for decades to come. The nexus of self-driving vehicles with ubiquitous communications and computation is what we call the autonomous jitney.

The autonomous jitney is a self-driving vehicle that can drive anywhere in a city carrying one or more passengers. It can drive itself to any address, and it is capable of solving its own route-planning even for multiple destinations. People can call an autonomous jitney via their cell phone, computer, or whatever telecommunication devices exist in the coming decades. The jitney system would be able to quickly respond to a person with the time that they will be picked up at.

Further iterations of the system would allow for people to request a quote from the jitney service as to when they could be picked up. When the system responded with the quote, the individual would have some limited amount of time to respond affirmatively that they want the ride before the quote expires.

Even with advances in technology such as they are, the deployment and maintenance of such a system would be a very significant task. In places such as Regina, it is unlikely that private capital will be able to build and implement such a system on the leading edge of the technological curve. It is much more likely that private systems of this sort in Regina would only follow several years (at least) in the footsteps of successful systems deployed in much larger cities. Also, there are very significant synergies to be exploited between the autonomous jitney system and the public transport system. The same routing and driving technologies that allow autonomous jitneys to exist could be applied to all sizes of transit vehicles. In this envisioning, jitneys fill much of the ‘last mile’ problem of transport, which is generally the area in which public transport is most lacking in large cities. Lastly, the adoption and use of such a system, just as with buses, is built on trust of the quality and safety of service. It is difficult for private companies to attain the level of trust of municipal systems in this regard.

The reasons above lead us to suggest that Regina Transit Services keep their eyes peeled for the emergence of these technologies in the coming years. Automated jitneys would add an incredible degree of accessibility, flexibility, and timeliness to the existing transport system. It seems likely that personal automobile ownership (and driving), will face increasingly strong competition from public transit systems in the coming decades. Innovations such as these may tip the balance still further in the direction of transit. We believe that Regina should choose to be on the leading edge of this technological curve because of the vast implications it has for transport, energy, and land use within the city.

7.6 Active transport

The proven benefits of exercise, even low-impact forms such as walking, are so substantial that they go far beyond what we can hope to discuss in the scope of this report. Some important ones to point out are reduced obesity[45], and reduced mortality considering all causes of death[46]. Our best understanding of human flourishing and community health leads us to state that the incorporation of additional active transport in our modal mix is very important. Individuals are happier and healthier when their communities are walkable and their daily trips involve some physical activity. Thus, in this section we assume that the incorporation of reasonable amounts of active transportation into the modal mix of Regina is a major development goal.

The aging demographics of Canadian society are an important factor in any discussions of active transport in Regina. Additionally, the extreme temperatures felt during a Regina year are a significant hindrance to all forms of active transport. While a few enterprising people, mostly the young, are willing to bicycle everywhere in the city during the dead of winter, the currently existing dangers and hardships of that mode make it infeasible for much of the population today and into the future. We have to look at our proposed and existing transport systems through lenses for every season and every personal activity level.

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[45] Inverse associations between cycling to work, public transport, and overweight and obesity: Findings from a population based study in Australia. Li Ming Wen, Chris Rissel. Health Promotion Service, Sydney South West Area Health Service, Australia, 2007.

[46] All-Cause Mortality Associated With Physical Activity During Leisure Time, Work, Sports, and Cycling to Work. Lars Bo Andersen, Peter Schnohr, Marianne Schroll, Hans Ole Hein, 2010.

Active transport is deeply connected to both land use planning and to the provision of public transport[47]. Suggestions in this section are thus entirely synergistic with the earlier sections of the transportation chapter and with the following chapter on land usage and zoning.

Economic trends in the direction of active, local transportation that we discuss in the next section are likely to be bolstered by efforts by advocacy from the City and citizen groups such as Bike To Work Regina, as both parties have a vested interest in helping Regina achieve smart transitions towards sustainable transport.

7.6.1 Economics of active transport

A 2009 study analyzed the walkability of 15 metropolitan areas from various regions of the United States and compared the local variation of walkability within each city against the local variation in prices of houses[48]. It was found that walkability was strongly correlated ($p < 0.01$) with higher home values for almost every location studied. A single point on the measured scale of walkability (www.walkscore.com), which ranges from 1 to 100, corresponded to an average increased home value in Seattle of $1400. That is, a slightly more walkable location in Seattle would benefit from house prices that are thousands (or tens of thousands) of dollars higher than an equivalent, though not quite as walkable location elsewhere in the city. The report summarizes some of their findings as follows:

> Houses with the above average levels of walkability command a premium of about $4,000 to $34,000 over houses with just average levels of walkability in the typical metropolitan areas studied.

The results of this study are a good indication that there is a pent-up demand for walkable housing in the US and that walkable housing is more valuable than car-dependent housing.

Bike path networks perform better economically for the society in general than other possible transportation investments if all costs are internalized for all forms of transportation[49]. Additionally, it has been shown even purely as a public health measure, building and maintaining multiuse pathway

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[47] Environmental Correlates of Walking and Cycling: Findings From the Transportation, Urban Design, and Planning Literatures. Brian E. Saelens, James F. Sallis, Lawrence D. Frank. Annals of Behavioral Medicine, 2003.

[48] Walking the Walk: How Walkability Raises Home Values in U.S. Cities. CEOs for Cities. 2009.

[49] Cost–benefit analyses of walking and cycling track networks taking into account insecurity, health effects and external costs of motorized traffic. Kjartan Sælensminde * Institute of Transport Economics, P.O. Box 6110, Etterstad, Oslo N-0602, Norway. Accessed October 25th, 2010.

systems is a cost-effective investment[50]. Lastly it has been shown that investments in bicycle (and transit) infrastructure are far more effective at raising 'effective speeds' in a society than similar investments in vehicular infrastructure[20].

7.6.2 Walking

Walking fills the gaps between all other transport modes for the majority of people. Walking is so commonplace, and assumed, that walking trips of less than a few hundred meters are generally not even counted in transportation surveys. One result of this fact is that many short-distance walking trips are never measured, so it often appears that people living in dense areas make fewer 'trips' than people living in sparse areas.

In the interests of sustainability, the most sustainable trip is the one that you don't have to make. This thought applies in two ways. Firstly, a traveler can ideally batch multiple trips into a single trip if their goals are close together or form a natural route. Secondly, we don't want to have to take a 'trip' to acquire an amenity. If it is right next door, or even within a block or two, it is unlikely to be considered a 'trip' in transport statistics.

7.6.2.1 Pedestrian-friendly development

Countdown-style pedestrian lights give people a numeric number representing the number of seconds remaining in the current walking phase of the intersection. This additional information leads to more effective intersections by optimizing the times that pedestrians take to cross the street and making it less likely that they will try to cross at the very last moment.

7.6.2.2 Commercial blend and density: Cathedral case study

Well-blended, medium density neighbourhoods with both residential and commercial development in close proximity are ideal. A Regina example of a neighbourhood that is designed more along these lines is the Cathedral area. Compared to Rosemont, Cathedral residents are 6.4 times as likely to walk as their mode of transportation and 2.3 times as likely to bike[51]. Cathedral's population density is about 27 people per hectare while Rosemont's is only 21. This is related to the fact that people in Cathedral are over 3 times as likely to live in an apartment as people in Rosemont.

Rosemont should attempt to nurture the creation of vibrant small-scale commercial enterprises such as those which exist on 13th Ave in Cathedral. Light commercial development and higher-density

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[50] Cost effectiveness of a bicycle/pedestrian trail development in health promotion. Wang, G., Macera, C.A., Scudder-Soucie, B., Schmid, T., Pratt, M., Buchner, E. Journal of Preventative Medicine, 2004.

[51] Regina Neighbourhood Profiles. City of Regina.

residential rezoning should be focused along existing transportation corridors. A key difference between Cathedral and Rosemont is that it is possible to easily walk to downtown from Cathedral, while that is simply not possible from Rosemont. Distinct efforts need to be made to create transport modal hubs in Rosemont that are integrated with expanding amounts of local commercial development. As much as is feasible, development should be oriented around the promotion of active transport within Rosemont, and the use of public transit for long trips. These issues will be discussed expanded upon in the next chapter which focuses on land usage.

7.6.3 Cycling

Urban cyclists are often able to attain short and medium-distance trip speeds that are equal to or higher than those attainable by autos. This was discussed quantitatively earlier, regarding the fact that the effective speed of bicycles can often be higher than cars[20].

7.6.3.1 Bike route expansion

As discussed earlier, the economics of active transport are quite clear. Investments in bicycle infrastructure are highly effective in terms of modal shifts, improved public health, and reduced overall mortality in the population. Bicycle lanes and multiuse pathways are both valuable ways forward. Improved cycling infrastructure helps and encourages both novice and veteran cyclists, including groups not typically prone to cycling.

7.6.3.2 Bike parking & showers

According to Regina Zoning Bylaw No. 9250, there are minimum numbers of bicycle parking spots required for certain types of commercial development[52]. We believe that this minimum amount should be increased significantly, and expanded to other forms of commercial development, for several reasons. Firstly, there is a significant dearth of bicycle parking in many areas of the city. Increase the amount of bicycle parking required for new or renovated developments at least, if not for all buildings. Providing some larger bicycle parking spots would be helpful in some areas, as some cyclists would prefer to be able to pull small trailers for carrying things like groceries and children.

One possible approach to improving the provision of cycling infrastructure would be to allow businesses to share such infrastructure in a way that works best for them. Later on, we discuss the idea of Business Improvement Zones, which would be one way for such cooperation to be encouraged.

Lastly, efforts can be made by the City to promote the provision of cycling infrastructure to employees by employers. This infrastructure should include both bike racks and showers if possible.

[52] Regina Zoning Bylaw 9250 Chapter 14. Page 14.9; 3.12 and Page 14.10, Table 14.3.

One possible implementation of such incentives would be coupled with the earlier discussion of alternative offerings for employee transport rather than the provision of parking spaces.

7.6.3.3 Long distance cycling

While most people do not consider cycling to be a long-distance transportation mode, it is worth noting as a taste of local flair that Regina is home to at least one prominent cyclist who has cycled farther than the circumference of the earth, and who can routinely travel more than one hundred kilometers in a day.[53]

7.6.3.4 Bike sharing programs

Cities such as Paris, Montreal, and Ottawa have implemented successful bike-sharing programs. Within prescribed rules and a timelines, a rider can rent a bike at one station using a credit card, and return it at another station.

7.6.3.5 Informational tools

Bicycle route-planning software is an extension to transit and pedestrian route planning software. Cycling speed is impacted by hills, but they are luckily not an issue in Regina. Another interesting innovation exists in cities like Montreal, where independent groups are attempting to create multimodal transit planning software that can tell people how they can most effectively travel throughout the city based on a set of constraints. For example, if a person wants to travel to a distant location, and they have a bike, the system might recommend that they take their bike to the closest metro, load the bike on the metro, travel several stops, exit the metro, and finally bike the remaining distance. Montreal encouraged this sort of open development by deciding to open up its municipal data in a readily-accessible fashion so that citizens could use it to innovate. Innovation of this sort has the possibility of significantly improving the lives of citizens and providing greater transparency for municipal government[54]. Not all new informational tools need be digital only. Many cities, such as Winnipeg[55], offer free maps in both digital and physical form to encourage and empower users of active transportation. These maps show clearly and effectively the best infrastructure and routes available, as well as future planned routes and cycle repair locations.

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[53] Mike on Bike.
[54] Interview with Diane Mercier, Montreal's open data coordinator. Montreal Gazette. April 28, 2012.
[55] Winnipeg Cycling Map. City of Winnipeg.

7.6.3.6 Empathy between forms of transport

With increasing numbers of cyclists, cultural shifts in driving norms are necessary. From the perspective of cyclists, the lane changes and turns that many motorists make are dangerous to be near. Being protected, as motorists are, within a padded metal cage makes them significantly less fearful of the results of driving errors or unfortunate coincidences. On the flip side, cyclists tend to intensely feel their susceptibility, and are thus prone to be more risk-averse. Cyclists are often deeply terrified by their close calls with cars whose drivers think that they are just doing 'business as usual' driving.

A municipality has the power to entrench in law concepts regarding the fair treatment of motorists and active transporters. Also, the municipality is uniquely positioned to gently direct transport culture in a new direction within the city. To promote cooperation, the City should organize brainstorming sessions where city planners, cyclists, motorists, skateboarders, and any other interested citizens can get together to co-create a plan forward for Regina's transportation laws and culture.

7.6.4 Skiing

Cross-country skiing is an oft-overlooked form of effective winter transport. Regina's climate dictates that several months of the year are likely to be snow-locked. Skiing down or beside multiuse pathways may be a very effective way for active transportation to be extended into the wintertime in a safe and cost-effective manner. The equipment needed to cross-country ski is very minimal, and no additional infrastructure is strictly needed.

The City could ease the emergence of skiing as a viable mode of active transport by making sure that effective regulations exist for its use (just as with cycling), and perhaps by providing some physical changes such as plowing of lanes (leaving at least several inches of snow and ice) on or near multi-use pathways for use by skiers. Lastly, different modes of active transportation could be encouraged by a signage change for multiuse pathways, labeling them with a wider array of acceptable forms of transport (such as skateboards, skiing, roller blades, etc.).

7.6.5 Boulevards

Boulevards include infrastructure for safe active transport as well as vehicles. These sorts of roads can become an integral part of the social fabric of the community to a far greater degree than standard roads. In this respect they are appealing, friendly places where people can meet each other face-to face rather than through one or more layers of glass and metal. They also provide additional transport opportunities for people who cannot or will not drive, such as the elderly or disabled.


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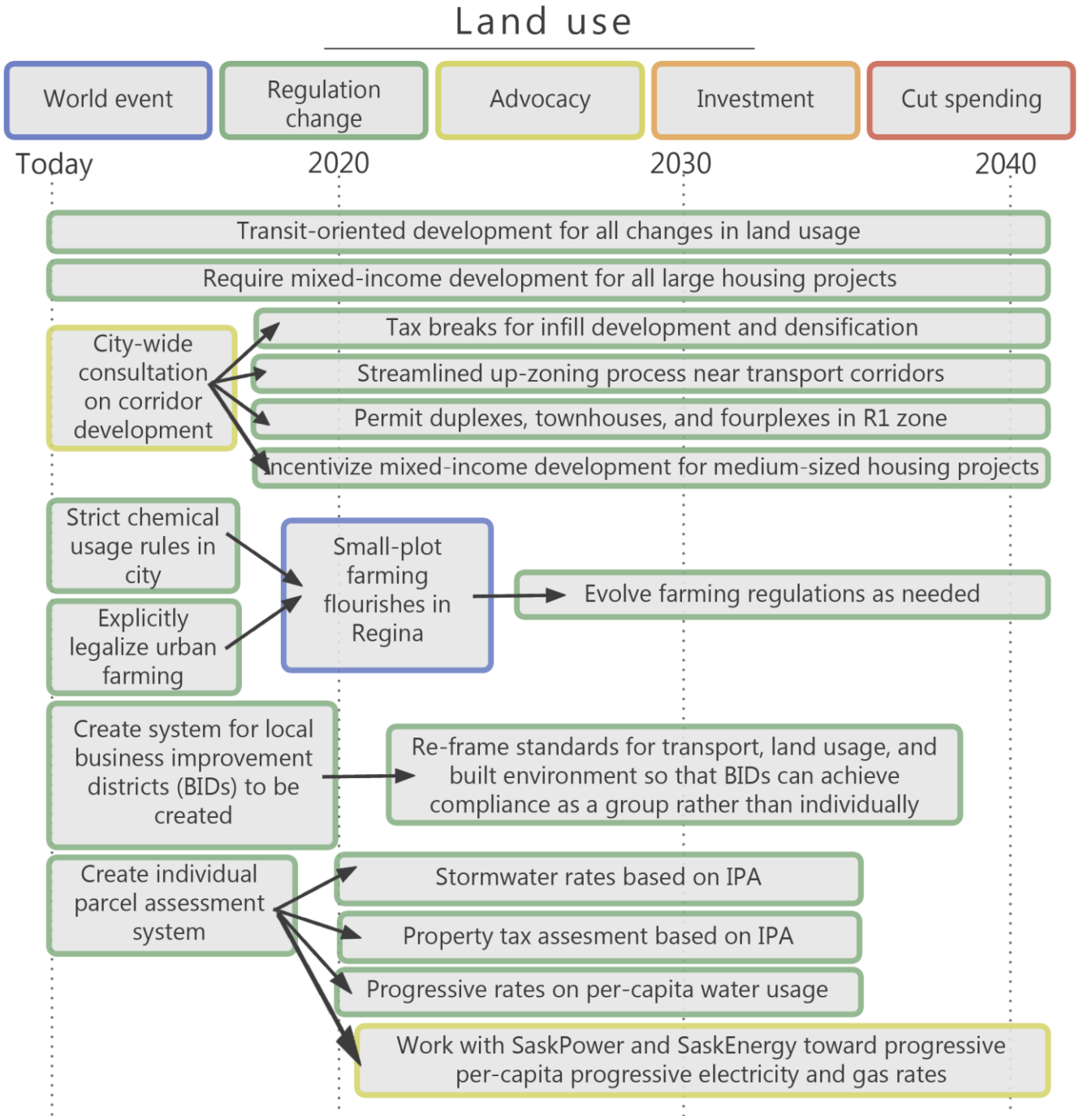
1.80
3.00



8. Land Use

8.1 Density

As discussed earlier, there are significant economic incentives for densification. The City benefits from the reduced need for additional infrastructure including roads, water, sewer, and stormwater drainage. The move towards densification also encourages the transport modal shift

towards transit and active transport. Thus, a virtuous cycle can be created if incentives towards density are coupled with land use flexibility increases that can help with the creation of local economies. The primary goal of this section will thus be to deliberately create programs for expediting and encouraging the rezoning of transit-corridor land towards higher densities.

On the flip side of things, it is desirable to also disincentivize things that lead towards sprawling development. The City should refuse to support sparse, distant development that will cause massive additional strain on the city infrastructure. Monetary, time, and stress costs will be incurred against the current residents of Regina due to continued development on the fringes of the city.

8.2 Development criteria

We recommend that that the City adopt a new set of criteria for proposed developments. Namely that any new development demonstrates that it will be a) walkable, b) dense, c) cost-effectively using existing water and sewer infrastructure, and d) intimately and effectively connected with the transit that will serve it. Unless the development can make a strong case that it is a cost-effective long-term investment for the City, it should be sent back for revision. The costs to the City are an important metric for the sustainability of a new development, including the degree to which the development puts extra strain on the water, sewer, and transportation systems. Transit-oriented development for a new area can lead to very minimal impacts on the existing roadways. Similar things can be said for LEED certified neighbourhoods and homes, since they put less strain on the major trunks of Regina's infrastructure.

Even beyond the up-front costs, these are good choices for the city in general. Communities built under these criteria have more economic staying power, as evidenced by the fact that dense, walkable neighbourhoods held their value much better than sparse ones did during the 2008 economic crash[56], as well as by the fact that house values are significantly correlated with the walkability of their location[48].

8.3 Land use and transportation planning

The deep connection between land use and transport planning was explored in the previous chapter, but it is worth restating here. A study on green policy-making describes how Freiburg Germany explicitly combined land use and transportation planning and how this was a crucial step in their movement towards a less car-centric and more sustainable city. As they focused new high-density

[56] CEOs for Cities: Driven to the Brink.

development along transportation corridors, they improved the ridership of their transportation system and the interconnection of the city. "In 2006, two-thirds of Freiburg's residents' jobs were located within a quarter mile of a light-rail stop."[17] This is a particularly vivid statistic given that, as described in our case study of Freiburg, it was a sprawling auto-dependent city in the mid 1960's.

8.4 Zoning Regina

Most of Regina, and very significant parts of Rosemont, are zoned as R1 - Residential Detached. The main concept of the R1 zone is to preserve the low-density suburban character of communities. This is the least dense residential zone, and is thus quite clearly a hurdle with regards to densification. As of 2006, Rosemont had a density of 21 people per hectare[57].

In order to navigate transitions towards higher density, some deep-seated cultural priorities will need to be reframed for life in the mid-to-late 21st century. The City of Regina may find it necessary to conduct a combined informational and consulting campaign for Regina residents. Similarly to other civic engagement plans present elsewhere in this document, the key to effective cultural change is engagement and co-creation of plans for the future.

8.5 Zoning Rosemont

In terms of prioritizing Rosemont's shift to a higher density of land usage, incentives towards rezoning specific areas should be put in place. For the locations illustrated on the next page the city should incentivize re-zoning of the suggested sort by offering a reasonable combination of tax breaks and expedited review processes. This section describes the general reasoning behind the incentives for zoning choices. The rest of this chapter explores in more detail why changes of this sort are desirable.

The goal of our proposed zoning incentives is to create corridors of commercial zones on major thoroughfares, surrounded by wider corridors of dense residential development. To see our proposed zones, see the image on the next page. Phase 1 of the rezoning focuses on Mikkelson, 4th Ave, and Dewdney as the primary development corridors. Phase 2 expands the corridor development to 7th Ave as well, since it is already contains some dense residential development and commercial zoning.

Both phases of proposed development are intended to synergize deeply with existing land uses on and near the transport corridors. Accessibility for all modes of transport was considered in the choice of development corridors and areas. As a whole, Rosemont will be significantly more commercialized than it is presently. This will co-evolve with greater local population density and the

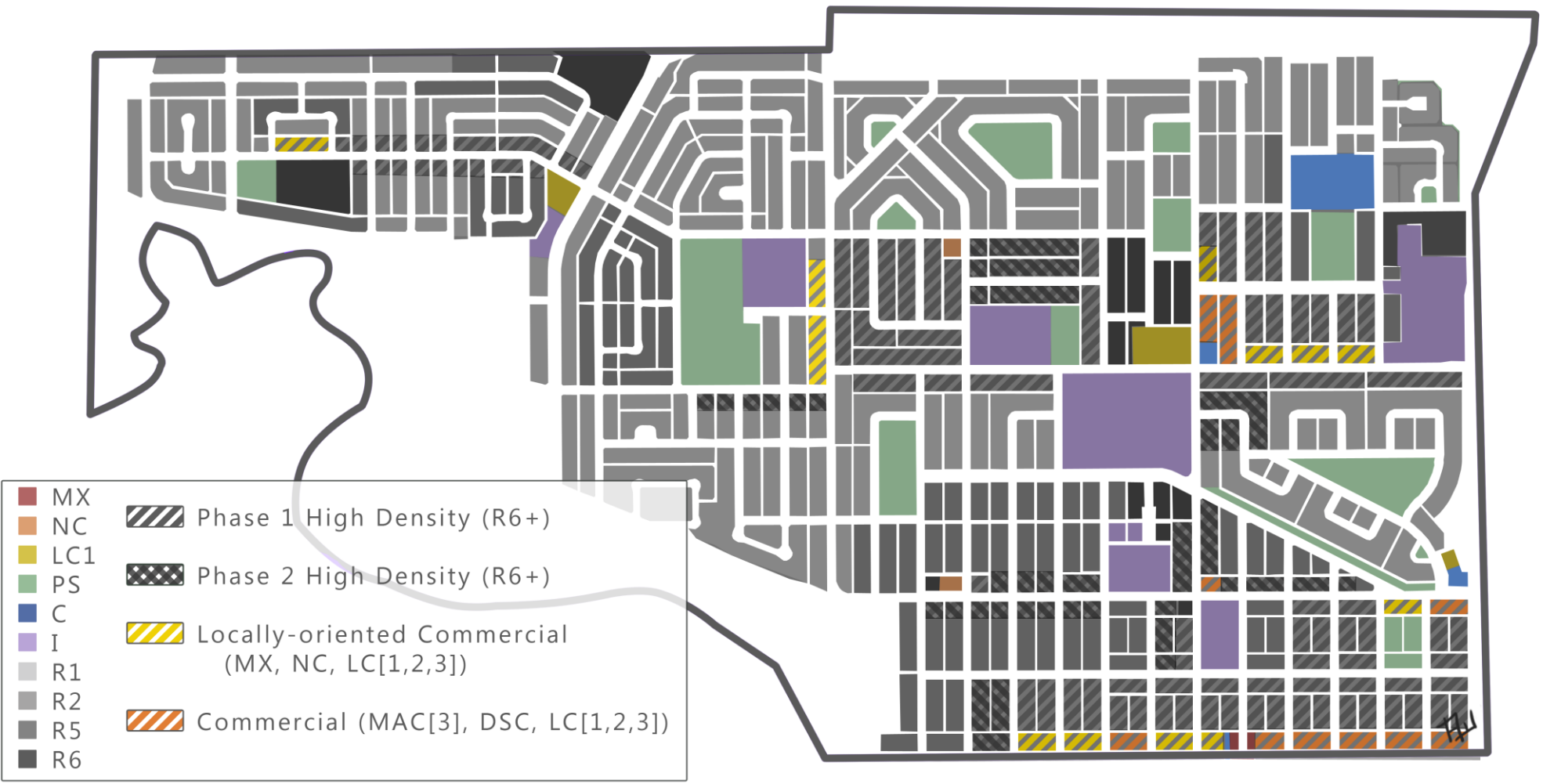
[57] Rosemont Neighbourhood Profile, City of Regina.

creation of local economies. With increases in the cost of personal motor transport, the mega-malls of north and east Regina will lose much of their competitive edge over small local shopping and services.

Development is focused near the south-eastern corner of Rosemont for two major reasons. Firstly, the housing stock tends to be progressively newer the further north-west one goes while in Rosemont. Thus, we expect that the south-east corner has a far more mature housing stock then the north-west, making it our prime candidate area for the application of incentives for renovation and replacement buildings towards higher density. Secondly, population density in Regina tends to be larger nearer to downtown, and nearer to major thoroughfares. The south-east corner of Rosemont is the closest to downtown, and also borders on two major roads: Dewdney and Lewvan, and includes two additional east-west corridors: 4th Ave and 7th Ave. For these reasons, the south-east should be shown higher priority for densification with mixed commercialization.

The figure on the following page is intended to illustrate all of the above aspects. Since this document is resolution limited, we have also made available a high-resolution version on the Internet, available at this link.

Additionally, Appendix B contains a figure that shows much of the same information, but using the backdrop of the zoning schematic maps provided by the city. This view may be useful for individuals who are comfortable studying zoning maps. Similarly, we have a high-resolution version of this second map available online.


MX
NC
LC1
PS
C
I
R1
R2
R5
R6
Phase 1 High Density (R6+)
Phase 2 High Density (R6+)
Locally-oriented Commercial
(MX, NC, LC[1,2,3])
Commercial (MAC[3], DSC, LC[1,2,3])

8.5.1 Resistance to densification

In many cases, a vocal minority of a limited number of citizens causes the withdrawal of housing proposals that involve anything other than single detached (regular houses). The community enjoys this type of area as it represents the American dream and a style of life that has been romanticized since the 50's. Proposals that involve housing forms which are only slightly different than single detached or that are of a slightly higher density, have been met with extreme opposition from groups wanting the rustic feeling of single detached dwellings.

Many people simply don't realise how big of an obstacle to convenience and sustainability the R1 (single-detached-only) zone is. As rezoning occurs and densification proceeds, the culture will naturally change and people will grow to desire living in walkable areas; in many cases as much or more than they desire the suburban lifestyle.

The market regulates density in that residents who prefer lower density areas will make the choice to move farther from work and utility in order to get that lower density.[58] The stronger the preference is for low density, the father they are willing to relocate from their place of work and from conveniences. Presumably, this will lead to them living in distant suburbs. However, there is no reason to impose an artificial preference for lower density; people will only move a distance based on the strength of their preference for low density in relation to the strength of their preference for a location near amenities. Those who wish to live in a more walkable and better-served (in terms of transportation and shopping) area will be willing to give up a lower density even though they might have otherwise preferred it. There is also no reason to regulate density for the sake of guaranteeing availability of lower-density areas. People will themselves move outwards to lower density areas if the preference is strong enough; otherwise they will grow to accept a higher density.

Density controls create two types of market distortions. First, housing is more expensive with controls than without. Second, commuting distance is longer with controls than without. If the metropolitan area is "open", residents choose among metropolitan areas so that utility is equated among all metropolitan areas. If all metropolitan areas have similar density controls, no residential reallocation among metropolitan areas results. If employers are also free to move among metropolitan areas, their locations depend on controls they are subject to in relevant metropolitan areas.

The most common defense of density controls is that "we just want low density." However, as the preceding analysis has shown, police power enforcement of densities below market equilibrium is more costly than can be justified in models of rational behavior and competitive markets.

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[58] Mills, Edward S. "Why Do We Have Urban Density Controls?", Northwestern University, 2002

The second defense is that to relax controls is to invite low income residents to 'flood' an area. Unfortunately this claim can be correct. The main thing for a city to consider is that the impact of relaxing controls in *all* areas (city-wide) is much less when it comes to this than when the controls are relaxed in only one area. When controls are relaxed in only one area (i.e. Rosemont) it would make sense that it would cause an influx of poorer people (and minorities), which tends to be undesirable to those craving low density.

There is, however substantial research that suggests[59] that population is likely to self-segregate by income and other characteristics among communities in a metropolitan area by virtue of plausible median voter-determined tax-transfer functions of local governments. This is one of the reasons why the City needs to act to create mixed-income communities by incentivizing higher densities and requiring the provision of low-income housing as some percentage of units in large projects. This subject is explored in more detail in the final chapter, where we discuss social sustainability.

Understanding why communities in a metropolitan area do not abandon density controls one at a time is not the same as understanding why communities institute them to begin with. Suppose a metropolitan area has a given set of communities, none of which has density controls. Then, based on neoclassical assumptions, none would rationally introduce controls. If one did, residents would move elsewhere to lower housing cost communities. It is much easier to understand why a community would not want to be the first to abandon controls than to understand why a community would want to be the first to introduce them.

Any proposed changes in the direction of density controls should be preceded by an educational program. One does not need to attend many cocktail parties in high income neighborhoods to understand how much said residents revel in 10-15 percent per year increases in their housing prices. However, few seem to understand that the benefits are mostly illusory, or that they result substantially from government restrictions on housing supply. Inevitably, high and rapidly increasing housing prices keep minorities, who are most vulnerable to high prices in good neighborhoods, out of the best neighborhoods and school districts. Government density controls impair the ability of developers to provide housing that is affordable to minorities in desirable communities.

Furthermore, it is important not to let a vocal minority guide entire communities. It is important to reach an informed consensus. It is vital to educate people on the issue of density and how it relates to sustainability, and then consult with them via a poll to see how the community at large really feels.

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[59] Yinger, Closed Doors, Missed opportunities. New York, NY: Russell Sage. 1995

8.5.2 Within current zoning structures

Regina's Zoning Bylaw currently contains provisions for secondary suites, even in R1 zones. We believe that the City should attempt to streamline and clarify the process by which residents can install and register a secondary suite. As with many subtle issues in municipal bylaws, it is likely that most residents are not aware of this option or of the economic opportunity it represents for them. Unfortunately, secondary suites are a rather limited option within current laws, so uptake of this approach will necessarily be significantly limited. We will now look into some more effective options.

8.5.3 Upzoning

One approach that could be taken is upzoning currently existing land. For example, the City could provide incentives for - or actually force - transitions towards different zoning for existing neighbourhoods. In the vast majority of cases, we believe that incentives would be much more effective and equitable than any applications of force. Incentives might be as simple as a streamlined and clear process for achieving said zone change. Civic engagement would be necessary to ensure that communities are on-board with changes.

As to what zones would be desirable, the City has a number of different options already available in its zoning bylaw. In general, transitions towards the higher-numbered residential zones such as R5 and R6 would be desirable, since they allow higher-density development. Recent amendments to the Zoning bylaw allow the creation of Suburban Neo-Traditional (DCD-11) and Suburban Narrow Lot Development (DCD-12). Both of these are rather similar to R1, but provide some additional flexibility for denser development.

Additionally, land in well-traveled areas could be incentivized to transition towards mixed use or light commercial. Lighter Commercial zones mixed into residential areas furthermore promote the growth of small business. Small business owners have the opportunity to reach out to their own community and successfully start up their business within their own region. Shopping variety will change within the city. These mixed use/light commercial areas will also blend well with local community groups and will encourage development of culture within the city.

Diversifying our small shops and independently-owned business is no doubt a desire among all sectors of society. Few and far between are those who don't prefer the thought of shopping at local stores and supporting business whose owners can call them out by name. People living in the many low-density areas of the city are used to driving long distances to acquire any amenities, so they tend to go to major shopping areas, such as malls or big-box store areas like those found in the east and northwest ends of the city. They are unlikely to drive a medium distance to mixed-use communities in

order to do shopping there. However, if local shops and restaurants were to become available in their area, linked to their places of work by transit, this would likely change.

Specific recommendations as to how certain areas of Rosemont should be incentivized to change their zones are contained in the later section on Zoning Rosemont.

8.5.4 Zoning bylaw amendments

A study conducted in Regina by the Mayor's Advisory Committee on Housing in the year 2000 recommended several significant changes to the zoning bylaw[60]. Here we want to quote some of their recommendations regarding zoning bylaws:

> 8. That the City of Regina amend Zoning Bylaw No. 9250 to:
>
> - permit accessory suites in all residential zones.
> - allow a greater range of housing types (i.e. single detached, duplex, semi-detached, fourplexes, townhouses) as permitted uses in residential zones.
> - move some multiple-unit housing types (such as planned groups of dwellings) from the discretionary use category to the permitted use category of residential zones.

If implemented, these recommendations would have a profound effect on Regina as a whole, since the majority of the city's residential areas are currently zoned R1. We believe that this would have a very positive effect on the long-term well-being of Regina residents and the economic viability of the region over the long-term.

Also, a change of this sort would help alleviate the immense stress on Regina's housing. Regina has had among the lowest vacancy rates in the nation for several years now, and housing prices have undergone stunning increases during the same time. Allowing these more flexible land uses would allow the housing and land market to more freely equilibrate to existing demand.

An approach like this would also avoid some of the problems that might crop up with implementing zoning changes in local areas. Changes towards the provision of denser housing tend to attract a more significant number of low-income residents than areas with low-density. The reason this effect exists is because of the cost of single detached housing and the clearly stated limitations in density for R1. Incidentally, economic selectivity of zoning laws in this fashion has been dubbed 'exclusionary zoning', and has been the subject of a number of court battles on the basis of racial and economic discrimination being achieved through the implementation and maintenance of zoning laws

[60] The Future of Housing in Regina –Laying the Groundwork, Prepared By The Mayor's Advisory Committee on Housing, Page 36.

of this sort. A transition towards more high-density development being allowed city-wide would help avoid region-specific flows of low-income residents.

Furthermore, in denser zones such as R5 and R6, Discretionary use category forces developers who are contemplating large multi-unit development to undergo a lengthy approval process involving public consultation and City Council approval. Developers have indicated that this process is a significant disincentive to initiating multiple-unit developments in Regina[61]. One or two particularly vocal residents can derail the entire process. For this reason in R5/R6 zones building types currently in the Discretionary use category should be placed in the permitted use category. This is especially true in R6, where the building of high-rise apartments should typically be allowed in all cases.

8.5.5 Other municipal legislation

Another incentive pathway was explored by Regina in 2009, when the City passed "The Inner City Housing Stimulation Strategy Tax Exemption Bylaw, 2009."[61] This law gave 100% property tax exemptions to several developers predicated on their development of infill housing. Within these rules, they were declared tax-free for 2009-2013. This law demonstrates the City's interest in effective infill development. We believe that this approach should be expanded to change zoning restrictions as discussed above. Additional tax incentives for densification would be an excellent additional incentive for building owners. We recommend that such developments be focused towards densifying and diversifying the land usage on and near transportation corridors.

8.5.6 Case study: Rosemont Court

Intended for the former site of the St. Patrick's Elementary school in Rosemont, Rosemont Court is a noteworthy example of planned densification in the neighbourhood. The new development will be approximately 2.5 times the density of the surrounding area and is in fine position to make use of the nearby bus route on McIntosh, as well as our proposed bike lane along 7th Avenue.

However, there are some aspects of this proposed development that do not agree with our vision. The former school site contains play equipment, which can serve as a nexus for young local families to interact and form a community. Such a feature is not present in the current plans for Rosemont Court. The planned development provides excessive paved parking space, which is likely to lead to an increased burden on the storm water system compared to the existing site. Green space seems to have been minimally included on the site. The substitution of a few parking spaces for bicycle parking, as well as landscaped raingardens would go a long way to improving the sustainability profile

[61] Regina Bylaw 2008-76.

of this new development. Additionally, this large provision of parking will encourage additional car usage, even though the site is on a transit corridor.

That being said, more development like Rosemont Court, with a few sustainability-minded changes, would improve the density of Rosemont substantially, and help improve the social and economic vitality of the neighbourhood as well as its sustainability.

8.6 Deep connections to social sustainability

Integrating affordable housing initiatives in with transportation planning is crucial, since the cost of housing units in transit-rich neighbourhoods tends to be quite high. To create more social inclusion, development plans should be oriented towards mixed-income development. This factors in a crucial way into social sustainability as we discuss later.

8.7 Urban agriculture

Urban agriculture is a burgeoning new industry in North America. Urban farmers can bring less costly and fresher produce to market than rural industrialized farmers for certain crops because they are so close to their market. Nearby Saskatoon was the origin of a recent innovation of urban farming, known as small-plot intensive (SPIN) farming. SPIN farming has been stunningly successful during the last few years in many different cities across Canada and the US.

In order for commercial urban agriculture to flourish, a few changes need to be made in municipal laws. SPIN farmers in Kelowna, BC have been incredibly successful, so their experience and the conditions under which they achieved their prosperity will inform many of the following recommendations.

8.7.1 What is SPIN?

Small-plot intensive (SPIN) farming is intended for use in cities. The goal is to intensively cultivate a variety of primarily high-value crops and sell them immediately in the urban market. Since there are no long-distance shipping and distribution systems between plot and plate, SPIN farming can generally deliver fresh produce faster and cheaper than industrial rural farms. Curtis Stone of Green City Acres reports a net income for a full-time SPIN farmer as roughly $100,000 per acre. This very high value has in fact been far exceeded by some Canadian SPIN farmers, and indicates the immense value of urban cultivation.

8.7.2 Land ownership

SPIN farmers do not always own the land that they farm. One prominent example from whom we have learned a lot is Curtis Stone, who a few years ago founded Green City Acres in Kelowna, which is today an entirely bicycle-powered two-person company that is doing incredibly well[62]. Their approach is to deliver a box of food per week to the landowner in exchange for the use of their yard and water hookups. Landowner satisfaction is apparently extremely high, since they tend to be very pleased by a vibrant and beautiful garden replacing their previously drab and ordinary yard.

8.7.3 Pesticides and herbicides

In 2009, Kelowna passed a city bylaw putting very strict limitations on the types of pesticides and herbicides that can be used within city limits[63]. This turned out to be a huge boon for SPIN farmers in the city, since they no longer need to worry about neighbours spreading contaminants near their crops.

Regina should carefully look at stronger anti-pesticide and herbicide regulation so as to help urban farmers credibly achieve high-quality controlled growing conditions with minimal external contaminants. Due to the varied micro-environments created by SPIN farming and the farming techniques employed (such as companion planting), pests and weeds do not seem to have been a significant problem for most SPIN farmers.

8.7.4 Regulations for land use and food selling

Municipalities all across North America are struggling to update their bylaws in this era of exploding urban agriculture. For example, Vancouver is making great strides in updating its regulatory system for urban farming[64]. Kelowna's regulations were overhauled a number of years ago, allowing several SPIN entrepreneurs to begin operations[65]. We recommend that Regina follow in the footsteps of these municipalities and take proactive steps to open up the possibility for residents to rent out their lawns to commercial urban farming operations.

8.7.5 Competitive prices

In Kelowna, there is no subsidy for urban agriculture. Their competitiveness has come about naturally through biophysical facts and a growing culture of local food. Since the urban farmers have

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62 Green City Acres.
63 Pesticide Free. City of Kelowna.
64 City of Vancouver to weed out laws impeding agriculture. Vancouver Sun, April 2012.
65 Kelowna Bylaw 10300.

lower costs than the exurban ones, the market favours SPIN over rural farming for those products where SPIN is strong (fresh, fast-growing produce). Many top-end local chefs in Kelowna prefer the quality of the locally grown greens and vegetables. It behooves the City of Regina to encourage high-value use of land via techniques such as SPIN farming by encouraging a shift in social norms in the direction of the local sourcing of foods. This could be accomplished through the above listed regulation changes, civic engagement, and promotion of successful urban gardening stories from within the city.

8.7.6 Community uptake

As mentioned briefly above, landowner satisfaction with Green City Acres' operations is incredibly high. The gardened lawns are so beautiful and enticing that Green City Acres is overwhelmed with offers from other landowners who would like to have their lawn farmed. The community uptake in Kelowna has been deep and broad. The positive response does not come from just a few individuals, but from the very core of the local community.

We firmly believe that Regina's community uptake of SPIN farming could be very similar as long as the regulations are modified to allow this innovative form of entrepreneurship to flourish.

8.7.7 Pollinator pathways

These are vectors which can be followed by pollinators such as bees and butterflies into the city so that urban agriculture and vegetation can be healthier. Experts in forward-looking urban planning consistently recommend that such pathways be deliberately planned in the retrofitting of cities.

8.8 Business improvement zones

Several Canadian cities have created a new form self-governance for businesses and residents of specific sub-areas of their city. Known as a Business Improvement Zone (or District) (BIZ or BID), this structure provides a forum for the development of local physical environment plans. For example, in Winnipeg, the BIZ structure is intended to "serve as a tool for organizing businesses toward cooperative efforts and is often key to developing a more attractive physical environment and a more successful business area."[66] Once created, a Winnipeg BIZ can gain "direct control over the appearance and image of their area." The Winnipeg implementations pay special attention to built environment, so that business can together decide how to organize their locale. In the Winnipeg case, the requirement for the creation of a BIZ is democratic, requiring a supermajority of both employees and dollar value in

[66] City of Winnipeg: Planning, Property, and Development Department: Business Improvement Zone.

an area. Additionally, if any significant equity complaints are filed by local businesses, the City has the right to disallow the BIZ to be created, or modify its terms.

Regina has a roughly similar creation in the form of the Regina Downtown Business Improvement District, which was created in 1981. Its mandate is:

> Regina Downtown seeks to promote and enhance Downtown's unique neighborhood. It does so by serving and acting as an advocate for its members through strategic initiatives and partnerships in support of the Regina Downtown Neighborhood Plan Vision.

And its vision for downtown is:

> Regina Downtown will support the creation of a complete and sustainable downtown neighbourhood, where entrepreneurship and cultural vitality flourish and a diverse community of people thrive in an active, safe, accessible, inclusive and beautiful public realm.

What we recommend is the creation of a system similar to that which exists in Winnipeg for the creation of new Business Districts. In this fashion, other areas of the city (such as Rosemont) can benefit from the added ability to control and coordinate some aspects of their local business environment. This would be a method for non-downtown business districts in Regina to gain legitimacy through a transparent process administered by the City.

Business districts can act as a forum and mediating table for local business issues. Additionally they could be the level of implementation of some of the other recommendations in this document - namely the provision of nearby bicycle and/or vehicle infrastructure as opposed to these aspects requiring the direct involvement of each business. This idea can also be framed as minimizing the 'transaction cost' of regulatory paperwork and effort, since businesses could solve a given problem once as a group rather than many times individually.

8.9 Zoning information incentives

It is a widely-known fact that the assessment value of property in Regina lags significantly behind changes in real value. Sometimes this is merely due to the fact that market adjustments can be rapid, but it appears that very often the case is that internal renovations have gone unreported, since they would typically represent an increase in property value and thus property tax. This may in fact represent a significant amount of lost City revenue. The next section will use this knowledge as part of the inspiration for rethinking some aspects of property assessment in the city.

8.9.1 Accurate property assessment

In order to effectively inspire densification and sustainable resource usage, the City should charge progressive rates for water and sewer. That is, the more that is used, the higher the cost per unit water. This approach was used by the City of Los Angeles in recent years, and has seen water usage remain flat, while a million new citizens have joined the city. Economic incentives of this sort are very functional, so we should use them to maximize the cost-effectiveness of our infrastructure and minimize our environmental impact.

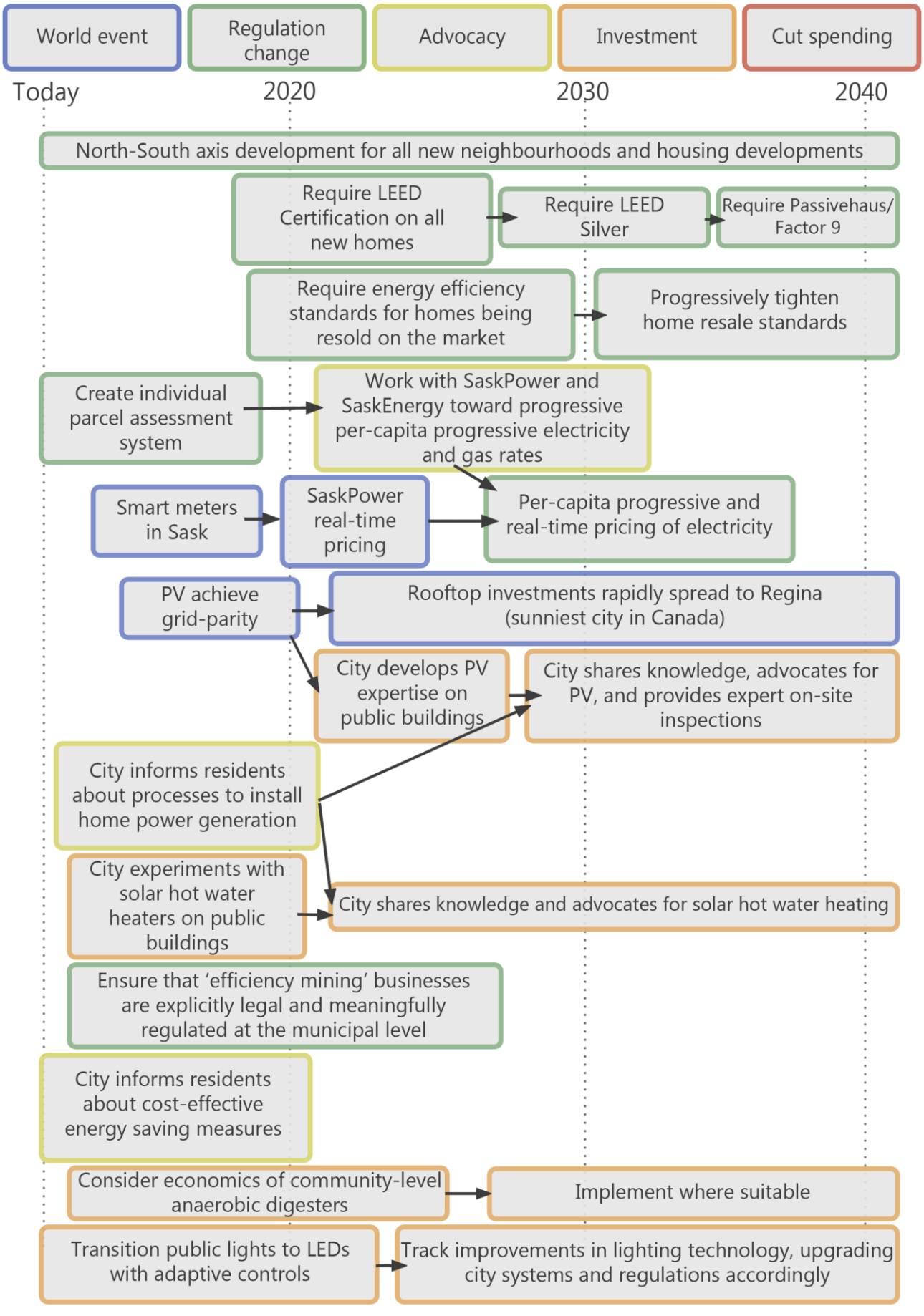
Tiered, progressive rate systems are thus a good starting point. We suggest that Regina Water & Sewer immediately move in this direction, since billing is already based on usage. More steeply progressive rates on usage will encourage conservation. There is precedent for this change, since Regina already has in place a cost-effective Water Conservation Program that managed to significantly reduce usage in the city by charging rates for usage. Extending this program to progressive rates would create additional incentives for reduced water consumption and would prolong the viability of current infrastructure, thus avoiding very significant costs to the City.

Additional change needs to occur, or this approach could falter when combined with efforts to densify. Densification means that more people will be using some water hookups than others. The progressive nature of our proposed water rates would thus act as a form of disincentive for densification. Ideally the progressiveness of the rate structures could be tuned to the number of residents for a building. Thus, to achieve this, there needs to be effective data on the number of residents (or even just rooms) in a house. Simply using the zone of the building would be a rough measure of the number of inhabitants, but it is by no means accurate when one considers that R1 housing can easily range from one to six or more occupants in a single detached dwelling. In order to get more specific, we need to use assessments of the number of bedrooms in each house, but as we just pointed out, the public data tends to significantly lag the private reality.

We propose that property taxes and City utility rates be slowly raised over time, according to an automatic formula, between verified inspections by the City. That is, if a homeowner never gets an inspection, the rates they pay for property taxes, water & sewer, and garbage collection will slowly get higher. Inspections could have a standard lifetime, perhaps on the order of five years, after which rates would again start to roll upwards. In this way, residents are incentivized to keep the City informed of the state of development of their homes, because otherwise they will end up paying higher rates than they would otherwise. Careful implementation would be necessary to ensure that the system would be equitable, accessible, and clear.

This approach could be broad, hopefully allowing a single inspection to assess home value, number of residents, and stormwater contribution (due to impervious surfaces). All of these values could be placed on this scale, incentivizing building owners to keep their information up to date. This would be our preferred implementation of individual parcel assessments (IPA), which are discussed in some detail later with regards to stormwater surges.

Energy


World event
Regulation change
Advocacy
Investment
Cut spending
Today
2020
2030
2040
North-South axis development for all new neighbourhoods and housing developments
Require LEED Certification on all new homes
Require LEED Silver
Require Passivehaus/ Factor 9
Require energy efficiency standards for homes being resold on the market
Progressively tighten home resale standards
Create individual parcel assessment system
Work with SaskPower and SaskEnergy toward progressive per-capita progressive electricity and gas rates
Smart meters in Sask
SaskPower real-time pricing
Per-capita progressive and real-time pricing of electricity
PV achieve grid-parity
Rooftop investments rapidly spread to Regina (sunniest city in Canada)
City develops PV expertise on public buildings
City shares knowledge, advocates for PV, and provides expert on-site inspections
City informs residents about processes to install home power generation
City experiments with solar hot water heaters on public buildings
City shares knowledge and advocates for solar hot water heating
Ensure that 'efficiency mining' businesses are explicitly legal and meaningfully regulated at the municipal level
City informs residents about cost-effective energy saving measures
Consider economics of community-level anaerobic digesters
Implement where suitable
Transition public lights to LEDs with adaptive controls
Track improvements in lighting technology, upgrading city systems and regulations accordingly

9. Energy

Buildings are responsible for 36% of all energy use in the USA[67], while households consume 22.8% of all energy in Canada[68]. Government bodies around the world have recognized how important it is to cut down on our energy usage and emissions from our buildings. For instance, in Britain the government requires that all new buildings to be carbon neutral by 2016[69]. In order to accomplish this, the regulations involved will have to challenge the currently prevailing norms regarding energy and electricity issues in the housing industry. Both Regina's climate and its existing infrastructure contribute to the challenge of reducing home energy usage. We must find effective and efficient ways of continuing to face the frigid plains while relying progressively less on fossil fuels. Some of the best solutions are right below our feet (geothermal) and above our heads (solar, wind), and most importantly, within our reach. These types of solutions are described in this section along with some measures that the City of Regina and area of Rosemont can take today in order to cut down on energy and electricity usage attributed to the housing sector.

9.1 Home heating

In Saskatchewan, 85% of our space heating and 78% of our water heating is accomplished through the burning of natural gas.[70] Due to the significant expected increases in the long-term prices of natural gas, moving towards more effective energy usage is a practical necessity for Reginians. Additionally, this transition will play an important part in decarbonizing our economy, which is necessary to curb climate change.

Experience across North America and the world has shown that investments in energy efficiency show excellent returns, sometimes several times those of investing in energy production. Despite this, increased efficiency is often overlooked in considerations of energy policy. While energy waste is all around us, it is almost completely unseen by the average citizen. Low efficiency is only visible when it is extreme, such as palpably drafty homes. This section discusses some of the most cost-effective ways forward towards energy conservation in the housing sector, and what roles the City can reasonably play in improving the efficiency of the housing stock in Regina.

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67 Energy and the city: density, buildings and transport, Koen Steemers, Energy and Buildings, Vol 35, 2005.

68 Cansim 153-0032, Statistics Canada.

69 The Climate Challenge, Guy Dauncey, 2009: page 40.

70 Jana Havona et al., Ground Source Heat Pump Systems In Canada.

9.2 Home electricity

In 2011, 54% of Saskatchewan's electricity was generated by SaskPower's three coal-fired power plants. This has lead Saskatchewan to have the second most polluting electricity market in Canada at 840 grams of carbon per kWh - second only to Alberta[71]. In addition, Saskatchewan residents have one of the highest electricity rates in Canada due to this dependence on high-cost fossil fuels. However, this may be a blessing in disguise as higher rates make conservation and efficiency gains even more profitable. Furthermore, electricity rates are expected to rise in the short and medium term, as SaskPower predicts high costs and hard decisions in the next ten years, as 760MW of generating capacity will be approaching the end of its service life. Continuing growth in the mining and oil sector will place greater demand on the power grid, as will the growing residential and commercial consumption. In fact, the province estimates that 860MW of capacity will need to be added to the power grid over the next decade. Saskatchewan will need to install around 1620MW of generating capacity to address power facility retirements and increasing demand[72]. These are certainly exciting times on the supply side, and there will be a great opportunity to transfer a significant portion of the electrical grid towards more sustainable energy sources.

Saskatchewan homes use a lot of energy in the form of electricity. To give some context, Saskatchewan households use an average of about 8,464 kWh per year, for an average annual bill of around $1,129[73]. This is an important value to keep in mind as we move forward with assessing different types of electricity conservation measures and their payback time based on past consumption and prices.

9.2.1 Smart meters

This subsection will briefly discuss smart electricity meters. While the City will not likely have a direct role in implementing these meters, but it is important contextual information for any discussion of curbing electric power usage in the coming decades.

9.2.1.1 SaskPower implementation

Smart meters are electric power meters that can bill users based on time-of-day usage and also provide information back to home appliances regarding current energy prices. They are thus useful to

[71] Table 4 in Ground Source Heat Pump Systems in Canada: Economics and GHG Reduction Potential, 2007.
[72] Powering a Sustainable Energy Future: SaskPower's Electricity and Conservation Strategy for meeting Saskatchewan's Needs, April 2011.
[73] Saskpower 2010 Annual Report, Page 104.

both the utility and to the customer. This information allows the utility to keep production of electricity more precisely in line with demand and thus produce less excess electricity. Smart meters are a short term reality for SaskPower customers, since they are being rolled out starting in 2013 and finishing before 2015. They will provide new options to SaskPower (as discussed below in **Pricing Options**) and new convenience and information to customers. All meters will be installed and maintained by SaskPower, as is the standard for metering equipment. However, end users will be subject to small utility rate increases to cover the costs of the program. It is expected that the long-term savings from installing smart meters will greatly outweigh the costs with a payback period of 13 years. The program proposed by SaskPower involves installing 500,000 advanced meters costing $190 million dollars--or $380 dollars per meter[74].

9.2.1.2 Reduced consumer usage

Studies show that having more information helps to better inform decisions about energy use. The impact will vary from user to user, but overall it seems to lead to between 6.3% and 28% reductions in electricity usage due to the improved feedback[75].

The reason for this has to do with the fact that smart meters allow for real time monitoring and recording of household energy usage. This will allow consumers to make better decisions as to how they use certain appliances and see in real time the energy they are drawing and how much it is costing them. Additionally, smart meters have the power to communicate with network attached appliances, which helps to meet your needs while consuming power during off-peak times.[76] [77] [78]

9.2.1.3 Pricing options

With the introduction of Smart Meter technology in 2013, SaskPower will gain more flexibility in how it can price electricity. As electricity pricing currently stands, each user is charged an approximately $20 flat fee, plus a fixed rate per kWh consumed--10.61 ¢/kWh as of today. Instead, electrical rates could better reflect our goal of lower usage. There are a number of possible ways for SaskPower change billing to encourage conservation.

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74 SaskPower Advanced Metering.

75 Impact of adopting the time-of-use rate plans on the electricity cost in the Canadian residential sector, Ali M. Syed, Eleventh International IBPSA Conference.

76 LG Thinq linqs your smart appliances with WiFi and smartphone apps. Thomas Ricker, Engadget, 2011.

77 CES 2012: Smart appliances transform the home. Chris Lefkow, Jan 13th, 2012, Star Phoenix.

78 GE appliances to connect to smart grid via Tendril, Martin LaMonica. CNet News, 2009.

1. **A lower flat fee, a slightly higher rate per kWh.** Currently someone who uses less energy pays the same flat fee as an excessive user. An average user pays approximately $94.12 a month. A user with half that usage would see a bill of $56.70. While cutting their usage by 50%, they only see a 40% decrease in their bill. This effect becomes more and more vivid with smaller electric bills, since the flat fee represents a relatively larger portion of the cost. A smaller connection fee and higher rate per kWh would help close this gap and better reflect pure usage.
2. **Higher rates for higher usage.** A user could be charged one rate up to a fixed amount of usage, and pay a higher rate beyond that. Excessive users would see a higher margin cost for further usage, and a greater incentive to bring their usage closer to average. This sort of rate structure has seen significant success in Los Angeles, where they kept total water usage the same while adding a million people to the city.
3. **Time-of-use pricing.** Utilities see a higher marginal cost of electrical production at times of peak usage. Having a lower rate during hours of low usage and a higher rate during higher usage would help minimize utility production costs, since the market would naturally act to curb usage at the higher-price times. The extra power generated to meet peak demand is generated from less efficient (and therefore more expensive and polluting) natural gas peaking plants. In times of exceptional electrical demand (very hot or very cold days) power may have to be purchased from outside of the province, which is often expensive and inefficient, as energy loss in transmission increases with distance. There are already some provinces that are deploying this type of electricity pricing, with Ontario being the most prominent example[79]. What this does is encourage end users to shift their electrical loads such as dishwasher and clothes dryers to off-peak hours. With the development of the "Smart Appliances" described above, end-users will be able to automate some of their usage, allowing them to take advantage of low energy prices at off-peak times even if they themselves are not there in person to start an appliance. The time-of-use pricing system will result in lower emissions due to less peaking power plants which are inefficient, reduce generating costs and give SaskPower more time to replace aging production facilities.

[79] Ontario Time-of-Use Electricity Rates. Ontario Hydro.

9.3 Home energy and electricity solutions

This section will describe some of the different measures that can be taken by the City of Regina to cut back on electricity and energy at the residential level.

9.3.1 LED municipal lighting

Street lighting generally represents up to 13% of the electricity consumed in a municipality. In order to bring down this large cost, a number of cities have been converting to LED municipal lighting. Trail blazers like Los Angeles have shown that LEDs with adaptive controls can reduce electricity use by 50-70% in outdoor applications[80]. They are twice as efficient as standard street lights, have a lower operating cost, last many more years, and can be dimmed at dawn and dusk. Even with a higher upfront cost, LED streetlights are a strong investment, with a payback period of about seven years.

For example, Ann Arbor in Michigan State expects to save around $100,000 annually from 1000 lights, at a capital cost of $630,000 or $630 per light. Thus, their implementation has a payback period of around seven years. More aggressive plans have been realized in Los Angeles. LA plans to convert around 140,000 street lights to LEDs over a five year period. This project is expected to save the City around $10 million per year and show a payback period of seven years. Moreover, this payback period is expected to drop in the future as the cost of energy continues to rise across North America and the costs for LEDs and control systems continue to drop[81].

9.3.1.1 City involvement

The City of Regina could install these LED street lights in the area of Rosemont and use it as a pilot project. This pilot project would then be monitored and data would be gathered to perform an economic analysis of the project. The results would help guide the way forward and determine if similar measures should be implemented in other areas around the city.

Lighting technology will continue evolving, and it is in the City's best interest to keep an eye on emerging efficiencies. For example, the US Department of Energy recently held a competition to replace 60 watt incandescents with more efficient, long lived bulbs. The result was a number of screw-in compatible bulbs that use 83% less energy and maintain 97% of their brightness after 25,000 hours of operation (nearly 9 years, at 8 hours use per day)[82]. Given such remarkable results, it is worth

[80] http://www.lightsavers.ca/
[81] Municipal Policy Options Guide for Advanced Outdoor Lighting. Canadian Urban Institute, 2011.
[82] US DOE 60W Competition

watching to see what technology wins the competition to replace PAR 38 flood lights, which are much used by cities and citizens alike[83].

9.3.2 The business of efficiency

Companies like Transcend Equity (now owned by SCIEnergy) have created an innovative new way to exploit the opportunities offered by efficiency. They will 'buy' the energy bill for a given building for a period of several years, during which the owner of the building will pay them status-quo energy costs. They will then implement, at their own expense, energy efficiency improvements for the building. They implement such effective solutions that they are able to recoup what they paid for the bill and for the improvements during the several years that they own the bill. At the end of these years, the ownership of the bill and the improvements transfers to the building owner. This is a win-win situation because the owner of the building gains efficiency improvements in addition to being paid for the several year 'ownership' of the energy bill, while Transcend Equity makes money off of the difference between the status-quo energy costs and the true costs once they have improved the systems. For more information on Transcend Equity's approach, see their page on their system, which they call MESA.

9.3.2.1 City involvement

This approach seems to be an excellent way to apply expertise and capital to the efficiency problem with buildings. Since it is essentially zero risk for the building owner and a very high return on investment for the company, this approach is likely to be very commercially successful. The role for municipal government in this case would be to ensure that such projects are possible within City bylaws.

9.3.3 Solar systems

Solar energy systems have become an important tool in any motion towards sustainability. There are essentially two distinct solar energy systems: photovoltaic (PV) systems and solar thermal systems. PV systems produce electricity while solar thermal systems can heat water or the home itself.

9.3.3.1 Photovoltaic systems (PV)

Photovoltaic solar systems have been getting a lot of attention as of late. Experts believe that electricity from PV systems will play a dominant role in the long-term energy future of our society. Today, energy prices almost everywhere are on the rise, and solar panel costs have been falling at a

[83] US DOE PAR 38 Competition

very rapid pace in recent years. PV has already begun to offset expensive peaking generation in many hot, sunny places. It seems likely that in the next few years, PV will begin to play a significant role in power systems around the globe. On a household scale, the technology right now is on the brink of having an attractive payback period for people who want to take their electricity generation into their own hands.

Natural Resources Canada has developed a map that shows PV potential in kWh/kW (meaning, how much total energy you would produce in a year if you had a 1 kW system) for over 3500 Canadian municipalities[84]. This map shows that Regina is located in the best region for solar PV in all of Canada due to a high number of sunny hours in the year. In addition, the Canada Mortgage and Housing Corporation released a list which shows Regina being the sixth sunniest large city in the world[85]. These two sources point to Regina as being a prime candidate for PV and solar thermal systems. The maps and tables, provided by Canada Mortgage and Housing Corporation, present monthly and annual electricity generation per kilowatt of installed PV. It is evident that Canadian cities have really good solar potential compared to the rest of the world. In fact, our least sunny location, St. John's for instance, has more solar potential than cities in Germany and Japan which are the world's leading countries in solar electricity generation.

The PV system can be designed and incorporated in a number of ways. The types of PV panels and installation method are determined by the end user's needs, their budget, and a home energy assessment. Older homes are harder to retrofit with PV or solar thermal systems; however, new homes can be developed such that they are solar ready.

The solar home can either be off-grid or grid connected. Given our goal of bettering Regina, we will discuss grid connected homes. Connected homes can take advantage of incentives, which will be explained further below, but must also adhere to SaskPower's guidelines regarding grid connection.

9.3.3.2 Solar thermal

Solar thermal systems are growing more popular throughout North America due to their shorter payback period and smaller up-front cost. Generally, solar hot water systems cost around $5-8 thousand and can reduce a household's hot water bill by 33-75% depending on usage[86].

[84] Natural Resources Canada, PV Potential and Insolation
[85] Photovoltaic PV systems, Canada Mortgage and Housing Corporation
[86] PV vs. Solar Water Heating: Simple Solar Payback.

9.3.3.3 Costs associated with solar systems

One of the biggest challenges of implementing PV and solar thermal systems are upfront costs. While personal PV systems are still rather expensive, they are rapidly coming down in price while electricity prices are simultaneously on the rise. As these prices drop, payback periods shorten and home PV installations become better investments, leading some to wait just a little longer for a lower price. At the utility scale--meaning large scale PV systems in the MW range--grid parity is expected to occur in Canada as soon as 2015, or when the cost of a PV module hits $2 per watt[87]. With PV expected to hit grid parity by 2015, the city will see an increasing rate of PV installations up to and through this time.

As of March 2012, the price for PV sits around $2.29 per watt[88] - $0.29 from the 2 dollar market noted above for PV to reach parity with fossil fuels. The module cost represents around 35-40% of the total costs to install a home solar energy system[88]. Therefore, the cost of a system fully installed is around $6.5 per watt. At this price, a 2 kW system will cost around 13 thousand dollars to install. With Regina being one of the best cities in the world suited for solar PV--determined by Natural Resources Canada[89]--the 2KW system can provide 2722 kWh. To give some context, an average home will use around 8,464 kWh per year with an average bill of around $1,129. Therefore, these estimates conclude that such a system can pay itself off in just over 12 years without any subsidies. One should also keep in mind that this payback period is based on fixed electricity prices--and this will hardly prove to be the case as we move into the future. In fact, SaskPower has indicated that the cost per kWh in Saskatchewan is expected to increase by 5% every year[90] which only makes the economics of solar more attractive.

9.3.3.4 Subsidies available for solar systems

There are a few subsidies available through SaskPower that help with the costs of implementing these solar based systems. The first one is the Small Power Producers Program.[91] The SPP program accommodates customers who plan to install a system likely to generate more electricity than they will need in a year. They can either sell the total generated power or only the excess power generated to SaskPower at a price of 9.609 ¢/kWh. The second option through SaskPower is called the Net Metering

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87 The Climate Challenge, Guy Dauncey, 2009: page 46
88 SolarBuzz, Solar Market Research and Analysis
89 Natural Resources Canada. Photovoltaic potential and solar resources maps of Canada.
90 SaskPower in email correspondence.
91 SaskPower: Small Power Producers Program

Program.[92] This program allows customers to 'bank' excess power produced in some months for use during less sunny times. The program that one chooses will depend on their specific situation and needs.

Since PV modules tend to be warrantied for 20-25 years, and come with life expectancies exceeding 40 years, it appears that investments in PV today are a good choice. In addition, people who invest in this sort of system are cutting down on their personal environmental footprint and protecting themselves against the progressively higher energy costs expected in the near and long-term future.

City involvement

With all of the different types of programs available for residential consumers, it makes it hard for them to know what the best program is for their specific scenario. In fact, a lot of people are unaware that these programs are even a reality and forgo the option of producing their own electricity. We propose that the City create a program where they reach out to people in the Rosemont area (and city for that matter) and inform them of the different options available to help make solar systems a reality. In addition, they will help interested parties file their forms to get rebates through the incentive routes mentioned above. By doing so, Rosemont citizens will be more aware of the process involved with a solar install and will come to the realization that it is economical and quite stress free with experts available to help and provide on-site solar assessments and support.

The on-site solar assessments and PV installations will be performed by PV technicians and other private parties that specialize in this service. These assessments will consider roof pitch, shade, ease of installation, etc. A low cost and honest assessment is crucial for ensuring that good investments are made in home generated electricity, increasing the value of the community.

9.3.4 Heat pumps

A heat pump is a device that in winter will take heat from the ground and circulate it through a home but also pump heat into the ground during the summer. This works because the temperature at a given depth stays the same regardless of the time of year. Ground heat pumps are an attractive option for mitigating rising energy costs, where ground conditions permit. Heat pumps are most cost effective when installed during home construction, so it is important to make new homeowners and home-builders aware of the benefits.

In 2003, NRCan[93] conducted a geothermal analysis in seven locations across Canada. This analysis determined that a heat pump in Winnipeg will have a simple payback period around 8-9 years.

[92] SaskPower Net Metering Program

If a system exchanges heat with a body of water rather than earth, the payback period shortens to about 5 years. Electricity rates and natural gas prices in Saskatchewan are notably higher than in Manitoba. Electricity is more than double (10.61 cents/kWh) and natural gas 65% higher (14.53 cents/cu m) in Saskatchewan. Payback periods will therefore be shorter in Saskatchewan, but will still be dependent on the specifics of the installation.

9.3.4.1 Subsidies available for heat pump systems

There are incentives offered through SaskPower for residential heat pump installs. The program is called the Geothermal and Self-Generated Renewable Power Loan Program. [94] By participating in this program, residential customers will be able to improve the economics of installing a heat pump system in their homes.

9.3.4.2 City involvement

The City will be involved in implementing heat pump technology in a similar way listed above for solar systems. We propose that the City create a program where they are reaching out to people in the Rosemont area and informing them of the different subsidies available to make heat pump technology a reality. Much like the solar system program, they will provide support in helping interested parties complete and submit required documentation to implement residential heat pump systems. This will help alleviate some of the stress and answer some of the legal questions involved in the process.

9.3.5 Home energy saving measures

There are some simple home energy saving measures that everyone can take to cut down on their personal carbon footprint while also saving money. The table below shows some difference measures and their expected savings. The numbers are just a rough estimate and will vary as commodity prices fluctuate. In addition to some of the measures suggested below, users can utilize the numerous energy efficient financing tools online to better identify potential energy saving measures one can take given their specific situation[95] [96]. Using tools such as these will quickly show that an end user can invest around 4,000 dollars and essentially save $600 dollars per year. This equates to a payback period of around 7 years.

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[93] Heating Energy Cost Comparison: Heat Pump and Electric Heating Systems
[94] SaskPower: Geothermal Program
[95] ASE Energy Efficient Financing
[96] Home Energy Saver

9.3.5.1 City involvement

The City could develop a pamphlet that lays out the different measures that residents can take to save on electricity and energy. One to two individuals would be responsible for disseminating the information. The program could be a joint venture with SaskPower and SaskEnergy. The costs involved to develop and administer a program such as this are expected to be quite small with reasonable payoffs. Some of the measures that would be included in the pamphlet are shown in the table below. The average Canadian's carbon footprint is around 11 tonnes of C02 per year. Including information like this in the pamphlet will give the reader some reference when they are trying to understand the impact that each individual measure listed will have in decreasing their overall personal carbon footprint. Table drawn from The Climate Challenge, Guy Dauncey, 2009: page 84.

Measure	**tonnes C02 saved per year**	**$ saved per year**
Turn down the water heater thermostat from 60C to 49C	0.097	12
Wash clothes in cold water	0.148	18
Wrap the water heating in an insulating jacket; insulate hot water pipes	0.143	18
Install water-saving shower heads and faucet aerators	0.218	27
Install program-able thermostats in your main rooms, set to 20C daytime, 13-14C night; wear a sweater to stay warm	0.161	29
Seal large air-leaks; caulk and water-strip/draft-proof around windows, doors, baseboards, attic hatches and power switches	0.862	104
Add extra insulation in the attic (R-30)	0.763	91
Add extra insulation in the basement	0.338	45

Add extra insulation in the walls	0.216	26
Upgrade to high performance windows	0.971	51
Add thin plastic film to the windows in winter	0.188	22
Seal and insulate your heating ducts, and get your furnace tuned	0.544	59
Raise your cooling thermostat to 26C	0.154	19
Tune up your air-conditioning unit	0.59	7
Add an attic radiant barrier	0.57	7
Paint your roof white	0.214	26
Total	5.076 tonnes	$561.00

9.3.6 Biogas/biomass facilities

There are currently communities around the world that are installing anaerobic digesters and using them to create electricity from food waste. Household digesters are not yet cost effective, although they would be able to provide about 13% of a households annual natural gas needs.

9.3.6.1 City involvement

As natural gas prices rise, we suggest taking a look at community level digesters. A full feasibility analysis would need to be conducted to determine the payback period for such a system, the size of system, the amount of energy that could be created by a system using organic waste, etc.

9.3.7 Home buying/selling standards

To further accelerate the adoption of energy saving measures in the city of Regina and region of Rosemont, the City could require that homes are brought up to a specific energy savings code when they are sold. The costs associated with this would either be rolled into the cost of the new owner's mortgage or would be borne by the seller (making their home fit for the market). For instance,

requiring new home-owners to implement energy upgrades whenever a new home is sold is being practised in San Francisco[97].

In Germany, the government is spending 1.5 billion Euros to upgrade all the pre-1978 housing stock to the Passivhaus Standard by 2025[1]. These Passivhaus designs use 95% less energy than average buildings and there are already 6,000 of them in operation throughout Germany! Passivhaus is a stringent standard, but one that has been repeatedly met by developers, even in harsh climates.

Regina in fact has a house that is built roughly to Passivhaus standards, the Factor 9 prototype house[98]. The Factor 9 design incorporates both energy and water saving features, resulting in a 50% reduction in water usage and 88% reduction in energy usage[99]. So while the Passivhaus design is a little more efficient, both are leaps and bounds ahead of the status quo and provide very reasonable payback periods[100]. It is worth noting that the exceptional water saving features of the Factor 9 house were allowed only as an experiment, and that Regina City regulations regarding grey water would have to be changed to allow further Factor 9 style homes. Remarkably, these energy savings were achieved without generating any of its own electricity. Last but not least, the house was designed to have low maintenance costs.

9.3.7.1 City involvement

The area of Rosemont can act as a pilot for Canada to implement a similar type of program as Germany is undertaking with their Passivhaus program, though to avoid regional disparities, such a program would be applied to the entire city. Additionally, the City should require that all homes sold and bought in the city be brought up to specific standards--similar to the program currently taking place in San Francisco[101]. The specific standard chosen should be tailored to the specifics of the climate and current housing stock in Rosemont. Beginning with a relatively easy standard like Energy Star, the goal would be to transition as quickly as possible towards achievement of standards on the level of Passivhaus or Factor 9.

9.3.8 New building standards

Minimum building standards tend to become de-facto maximum building standards, meaning that the most efficient new buildings tend to only differ slightly from average new buildings. Average

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97 The Climate Challenge, Guy Dauncey, 2009: page 88

98 Saskatchewan Research Council, Moving Towards Sustainability in House Energy Use, The Factor 9 Home: A New Prairie Approach

99 Home Energy: The Magazine of Home Performance, Monitoring Results for the Factor 9 home

100 Canada Mortgage and Housing Corporation, Innovative Buildings: Factor 9 Home.

101 Residential Energy and Water Conservation Requirements. City of San Francisco.

buildings tend to be designed to only barely meet the standard as a cost-saving measure. In a traditional 20th century marketplace, this meant that the more energy efficient building, which costs more up-front but has lower total costs, has a significant disadvantage because the markets were not very responsive to energy efficiency. This is very likely to change in the coming decades with the long-term trends in energy prices becoming apparent to more of the population. However, the City can make a huge difference in the long-term economic viability of living in Regina by taking proactive steps to prepare the housing market for the changes to come.

9.3.8.1 City involvement

Regina could require all newly constructed buildings to adhere to a more stringent, more sustainable standard. A common and easily achievable North American standard is LEED certification. These buildings are only a few percent more expensive up-front than traditional ones, and even with the currently low energy prices they have payback periods on the order of 10-15 years. With rising energy costs, the economics of efficient homes and commercial buildings will become even clearer.

Regina should require LEED certification of new homes by ~2018, LEED Silver by ~2026, and a standard equivalent to the Passivhaus (or to the Factor 9 prototype mentioned above) by ~2034, with an eye towards a net-zero standard around 2050. These are very affordable steps forward, representing increases in up-front costs of a few percent each, and perhaps ten percent total. It is worth stressing that these buildings have *lower* total lifetime costs than traditional ones because their energy needs are vastly reduced. The detailed analysis of this proposal is beyond the scope of this document, since it would require careful analysis by various City departments before deployment. Our preliminary analysis of this proposal in terms of both traditional and energy economics indicate that it is a practical path forward for the City.

9.3.9 Neighbourhood standards

The sustainable neighbourhood design concept is rapidly spreading throughout the world. The basic design considerations for a sustainable neighbourhood are discussed throughout this document, so they will not be explored in detail here. This section will only discuss one aspect of sustainable neighbourhood design since it is not mentioned elsewhere in this document.

All neighbourhoods should be designed to maximize the length of streets that are oriented along an east-west axis, maximizing the number of homes that are built to be primarily north-south facing. North-south facing homes have much more roof surface area that is oriented in such a way as to be useful for the eventual addition of solar hot water or electricity systems. Additionally, north-south

facing homes can take full advantage of passive solar heating through windows that face either the street or their back yards. It is relatively rare for a Regina house to have even one significant window on the sides of the house which do not face the largest sections of the lot.

For these reasons, the prevailing form of development throughout most of Rosemont is suboptimal. Most homes are east-west facing, make very little use of passive solar heating, and have minimal solar energy potential. It is very difficult to change the axis of neighbourhoods once they are established, so it is crucial that all neighbourhoods being constructed in Regina in the future are forced to maximize the long-term solar potential of the neighbourhood. Neighbourhood developers currently do not feel significant economic pressure to build neighbourhoods designed for effective long-term occupancy and efficiency. It is thus the City's role to stipulate conditions of development upon these developers to maximize the long-term well-being of Regina residents.

9.3.10 Case studies/examples that we can leverage

There are some great examples of communities around the world that are doing amazing things from an energy efficiency point of view. Some examples are shown below. These examples could be studied in further detail to see what sort of measures could be taken from them and applied to the Rosemont context.

9.3.10.1 Findhorn, Scotland

In Findhorn, Scotland; there are Ecohouses and technically an Ecovillage. They have the lowest recorded ecological footprint for any permanent community in the developed world. The reasons have to do with building design, locally growing their own food, wind turbines, community sharing of resources and very low car usage at 6% of the UK national average[102]. The City of Regina could look at this community in detail and see exactly what sort of measures would easily apply in the Rosemont neighbourhood. This would be done by doing an in depth analysis of the area and looking deeper into the way that it functions.

9.3.10.2 Gussing, Austria

The second example of a sustainable community is in the town of Gussing, Austria. Here, they generate 95% of their heat, electricity and fuel from sawdust, maize, waste cooking oil and other materials spread out across multiple project types. When performing a feasibility study for Rosemont to roll out a similar type of community, many variables would have to be considered before one could

[102] Findhorn Ecovillage

determine the feasibility of such a project. This community in Gussing would hopefully be of some help where they could lend support as to what and what has not worked for them.

9.3.10.3 Stockholm, Sweden

The third example involves an area in the city of Stockholm, Sweden called Hammarby Sjostad. In this area, there are 11,000 apartments that will be heated with recovered heat from the local sewage treatment plant[103]. In addition, re-sorted wastes will be combusted to create energy. There is another city in Sweden called Kristianstad where cars and buses run on biogas that is generated from the 100,000 tonnes a year of sewage mix. Not only does biogas generation happen in Europe, but it also takes place in the USA as well. In King County, Washington, there are 1000 homes that are powered by fuel cells that obtain their hydrogen from sewage. There are currently no communities in Canada that deploy these types of project involving sewage conversion into biogas, but there are some in studies being conducted. For instance, in Victoria the sewage contains enough energy to power 200 buses, 5000 cars, heat 3500 homes, and provide electricity for 2500 homes; the potential exists but there needs to be a thorough feasibility study conducted in order to determine whether or not Regina can benefit from any of these types of projects. In doing so, existing projects would be studied and analyzed to help determine the validity of such a sewage/biogas based project in Regina.

9.3.10.4 Drake Landing, Alberta

The fourth example of a community that can be leveraged when developing Rosemont is the Geo-Solar Drake Landing community in Alberta[104]. This is a community of 52 homes and is the largest subdivision of R-2000 single family homes in Canada. This results in each home being 30% more efficient than conventionally built homes. The community receives 90% of its space heating needs by solar thermal energy. This is accomplished by storing the energy in a Seasonal Thermal Store that can be tapped into when heating space requirements increase in the winter months. This community results in a reduction approximately 5 tonnes of greenhouse gas emission per home in a year. To give some perspective, Canada's GHG equivalent emissions per-capita in 2009 were 20.5 tonnes. So a reduction of 5 tonnes per home in a year is a significant amount. Further analysis needs to be conducted on the Drake Landing community to determine what sort of measures could be rolled out in the Rosemont Area[105].

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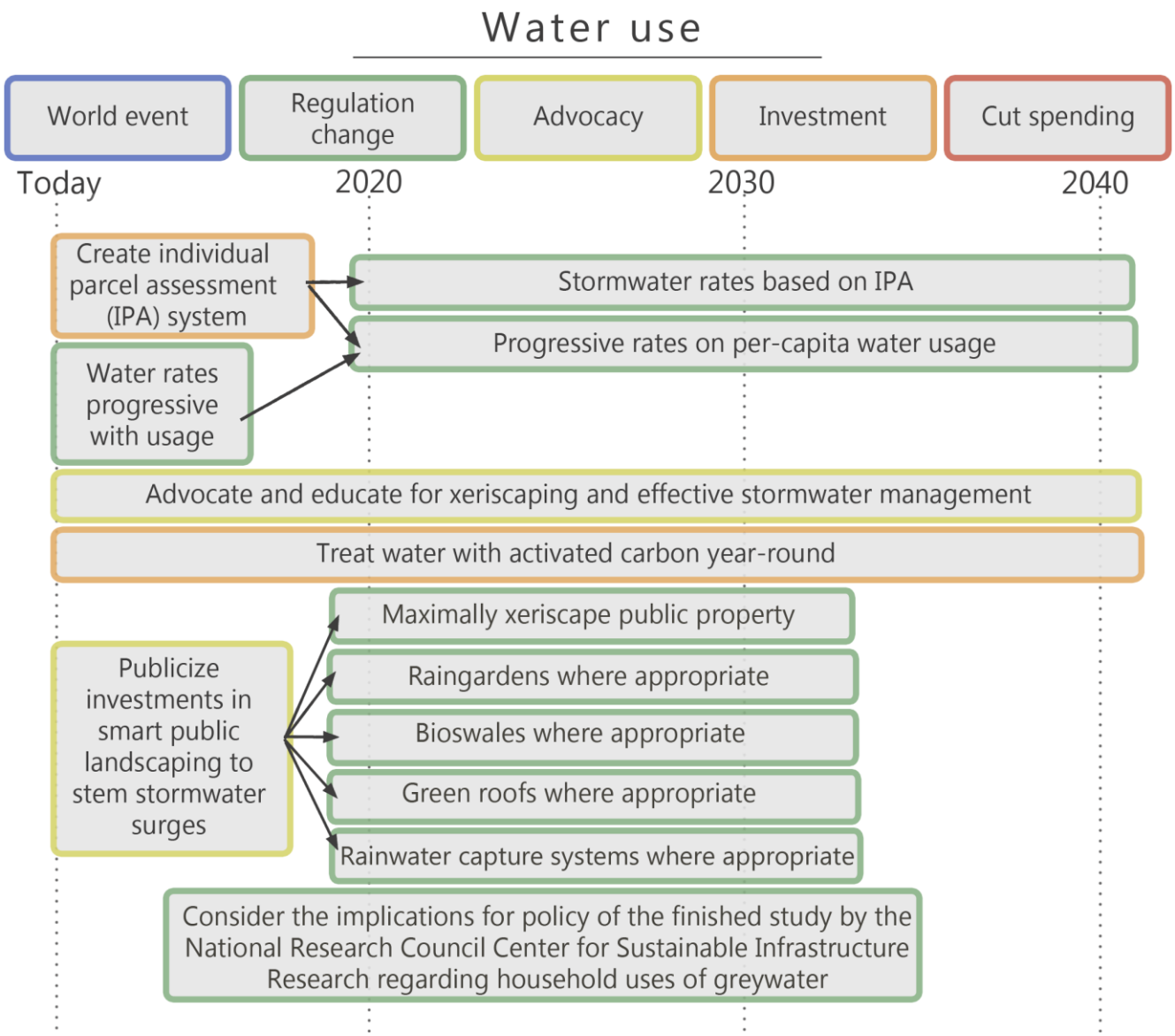
103 The Climate Challenge, Guy Dauncey, 2009: page 55

104 Drake Landing Solar Community

105 Science Applications International Corporation, Energy Report Summary 2011, January 9th 2011.



10. Water Management

10.1 Water sources

Regina receives the vast majority of its water supply via dual pipeline from Buffalo Pound. Due to expected increases in demand the pipeline has recently been doubled. Further expansions could be delayed or even canceled through more efficient water usage and conservation, as well through better use of our rain resource.

Granular activated carbon bonds with organic compounds, thus removing them from the water supply. Studies have shown that this is an effective method of removing tested-for endocrine disruptors. Currently Regina's water supply is treated with granular activated carbon but not with the intent of eliminating endocrine disruptors, but to reduce foul odours and tastes. To this end water is only treated with activated carbon from May through December, when active biological processes produce foul tasting organic compounds[106].

We recommend using activated carbon year round to reduce endocrine disruptor levels in the water. Additionally, we recommend that testing of pesticide levels in the water supply be conducted more often, since currently testing is done only once per year.

10.2 Water usage and trends

Regina's water usage was reduced between 1988 and 2007 due to the implementation of a Water Conservation Program. We credit this program with the relatively small increase in water use since 1990[106]. The transition to improved, monthly metering means that citizens pay for what water they use. As discussed in the land use section, we recommend the adoption of a progressive rate structure based on usage to incentivize water conservation.

10.2.1 Xeriscaping

The Water Conservation Program also included some efforts to investigate xeriscaping, due to its positive environmental impact, minimal water consumption, and minimal required maintenance. We recommend that xeriscaping be adopted as much as possible by the City for use in parks and boulevards.

Also, the City should actively share its experience with Regina xeriscaping with the populace, as there are many people who would rather not have to spend as much money and time taking care of their lawns as they currently do. The City currently maintains a high-quality guide on the subject, which is certainly a step in the right direction. Through civic engagement, and promotion of this knowledge, residents can learn that they have the freedom to changes their landscaping towards a more attractive and water-efficient ground cover. It is important that people learn that there are many options and 'looks' that can be achieved, ranging from desert/gravel to lush carpet.

106 Buffalo Pound Water Administration Board, 2010 Annual Report.

10.3 Stormwater

As mentioned briefly in the introduction, it is expected that Regina's winter precipitation will increase during the next few decades. This effect will exacerbate some of the problems Regina currently has with spring flooding. Much of Rosemont is within the floodway fringe of Wascana Creek, necessitating that the residents of this area pay special attention to the possibility of flooding.

Stormwater management is a large and growing expense for the City. The Regina Development Policy Plan states that,

> "*Since 1991, the estimates of servicing capacity for underground utilities have decreased in the northwest and southeast sectors. This is due to unanticipated infiltration of storm water, through drainage tiles around houses, into the domestic sewer system.*"

They go on to say,

> "*It is expected that, with revisions to building standards to reduce this infiltration for new houses, service capacity will be sufficient to complete existing neighbourhoods, commence a new neighbourhood in the southwest, and with a wastewater detention facility to reduce peak demand, allow new neighbourhoods in the southeast. In conjunction with expected infill development, completion of these existing neighbourhoods will cover new housing needs to 235,000 population.*"

The result of this is that,

> "*Beyond this stage of development, **a new wastewater collection trunk would be needed to expand capacity for development** in the southwest and southeast sectors to accommodate an overall city population beyond 300,000. An engineering review will be required to determine options for servicing beyond this time frame, and should consider a range of transportation and other planning factors.*" [Emphasis added] [107]

We cannot generally change how much rain occurs during a storm (though cloud seeding research continues elsewhere in the world), but we can design systems that mitigate how stormwater runoff hits the system. There are a number of useful and cost-effective techniques and technologies for reducing the volume of stormwater flow, and thus reducing the probability of overflow events. Techniques of this sort are collectively known as Sustainable Urban Drainage Systems (SUDS).

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[107] Regina Development Plan, City of Regina Planning and Sustainability Department, 2011.

10.3.1 Raingardens

Raingardens are areas of vegetation designed to aid in speedy water absorption into the ground. They are extremely effective at reducing the total load on stormwater system. A particularly successful implementation was in Seattle' Street Edge Alternatives project, where the resulting measured storm water runoff from the street was reduced by 99%. Extensive studies are available of the effectiveness and low cost of raingardens.

Raingardens help water infiltrate the local groundwater at a gradual rate, and also significantly filter the water during its passage. Scientific studies have shown that raingardens are very successful filters for stormwater that ends up in groundwater.

10.3.2 Bioswales

Bioswales perform a similar role on the neighbourhood level. They are gently sloping, heavily vegetated beds designed to move stormwater from one location to another, slowing its passage and filtering it as it goes. They may be advantageous in over raingardens because they can provide an economy of scale and also integrate into local public spaces. However, they do often require a change in land use on the neighbourhood scale.

In Regina, they are already being planned near the University[108], and they were also recommended in the Regina Business Park Study in March 2012[109]. Regina already has at least one bioswale installation, at the south end of Garnet Street, next to the creek. Opportunities in Rosemont may include: along NW Blvd between Connaught and McIntosh as well as along the rail track at the northern edge of the neighbourhood. They can also be used in any park, though it is important to keep safety in mind. Their marshy depth would have to be kept low so that there wouldn't be a significant danger of kids falling into them. Ideally we would want to keep the danger level at or below that of the very large, muddy puddles that can form in Regina parks after large rainfalls.

10.3.3 Green roofs

While green roofs tend to be significantly more expensive per unit area than the above two techniques, they can still be useful in the urban setting. For example, in areas that lack any foliage such as downtown, building owners may make the change to green roofs if they have an economic incentive to do so. The next major section of this chapter discusses one way that such an incentive could be created.

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108 University of Regina, Campus Master Plan Draft Document.

109 Regina Business Park Study, City of Regina, MacNaughton Hermson Britton Clarkson Planning Limited March 2012.

10.3.4 Rainwater capture

Rainwater capture systems can be used to store rainwater for later uses, such as flushing toilets and providing water for lawns and gardens. Any gains made in rainwater capture and use have the added benefit of displacing some of the use of the cities limited high-quality clean water supply. This will be discussed in much greater detail in the greywater section later in this chapter.

10.3.5 Biologically active stormwater management ponds

A 2007 study by the National Research Council looked at conventional vs biologically active storm runoff ponds in Regina. The results showed that using a constructed wetland improves water quality of stored storm runoff before it is discharged into streams and groundwater. This is in comparison to older ponds which were designed to impound water for a shorter period of time, and with no intentional biological elements[110].

10.4 Necessary incentives

Since stormwater drainage and water usage are distributed in nature, centralized solutions are by their very nature difficult and relatively inefficient. It is much better to deal with stormwater at its point of origin rather than attempting to solve the problem centrally with expensive infrastructure. Well-planned prevention efforts will be many times as cost-effective as any end-of-pipe solution.

The hard question is how to incentivize such activities. One possible approach is to assess a properties stormwater fee based on how much stormwater is likely to be generated from their lot, given its size and composition. We will now discuss this idea in some detail.

10.4.1 Individual parcel assessments

The original inspiration for this section was this article about green development in Germany. Apparently a very significant incentive for individual stormwater management can be created by charging for stormwater management based on the total load expected from a parcel of land. The City would benefit from this approach because it will have less stormwater to deal with. The more rain gardens and green roofs we have in the city, the less stormwater our system needs to handle.

A change in this direction will require the establishment of a system of individual parcel assessments (IPAs), as discussed earlier in the land use section. Depending on the inspection

[110] A comprehensive water quality monitoring in urban stormwater detention ponds. National Research Council of Canada, 2007.

techniques and timeline decided on, it may make sense for the plan to be phased in for different areas of the city at different times.

Since generally permission of the property owners is required for inspection, an incentive for people to arrange inspection times with the City would be to set the 'uninspected' rate near the high end of the expected spectrum for stormwater management costs. Thus, residents will have an incentive to seek out an inspection date and time, and to be cooperative with inspections. A long-term incentive system would need to combat the problem of inspections going out of date. Perhaps after a few years the inspection goes out of date and the cost changes back to the 'uninspected' rate, again incentivizing cooperation.

For example, a house is inspected and assessed at X m^3 of stormwater drainage per year. The X m^3 value will be valid for 5 years. After 5 years it is assumed that the conditions will have changed and a new assessment will be required. To encourage the resident to submit to assessment, every year after the reassessment date the assessed value should automatically appreciate by 20%. Thus if the resident refuses to have their property assessed they will pay higher and higher rates until the property is assessed, at which point the value will be set to the new assessed value, where it will remain for the next five years.

Alternately, the inspection could be done from off property, from aerial photos of Regina and current property tax information. Additional features which would drastically reduce the stormwater flow from a property, such as a new green roof or well-placed rain garden, may need to be inspected in-person by a City expert.

Current (2008) Regina prices are $7.83 per month for storm drainage. With higher and lower rates being derived from this assumed average, it is clear that the economic incentive towards stormwater management is not likely to be large on an individual level. However, if the IPA technique were coupled with effective outreach and informational resources on how to reduce your storm water contributions, even an incentive of several dollars a month could be enough to drastically change the future of Regina's storm water system.

Lastly, it is worth mentioning that detailed information about the impervious surfaces present in a neighbourhood could be incredibly useful for watershed management as well as stormwater infrastructure planning. This data has value far beyond its practical application to stormwater management fees[17].

10.5 Greywater

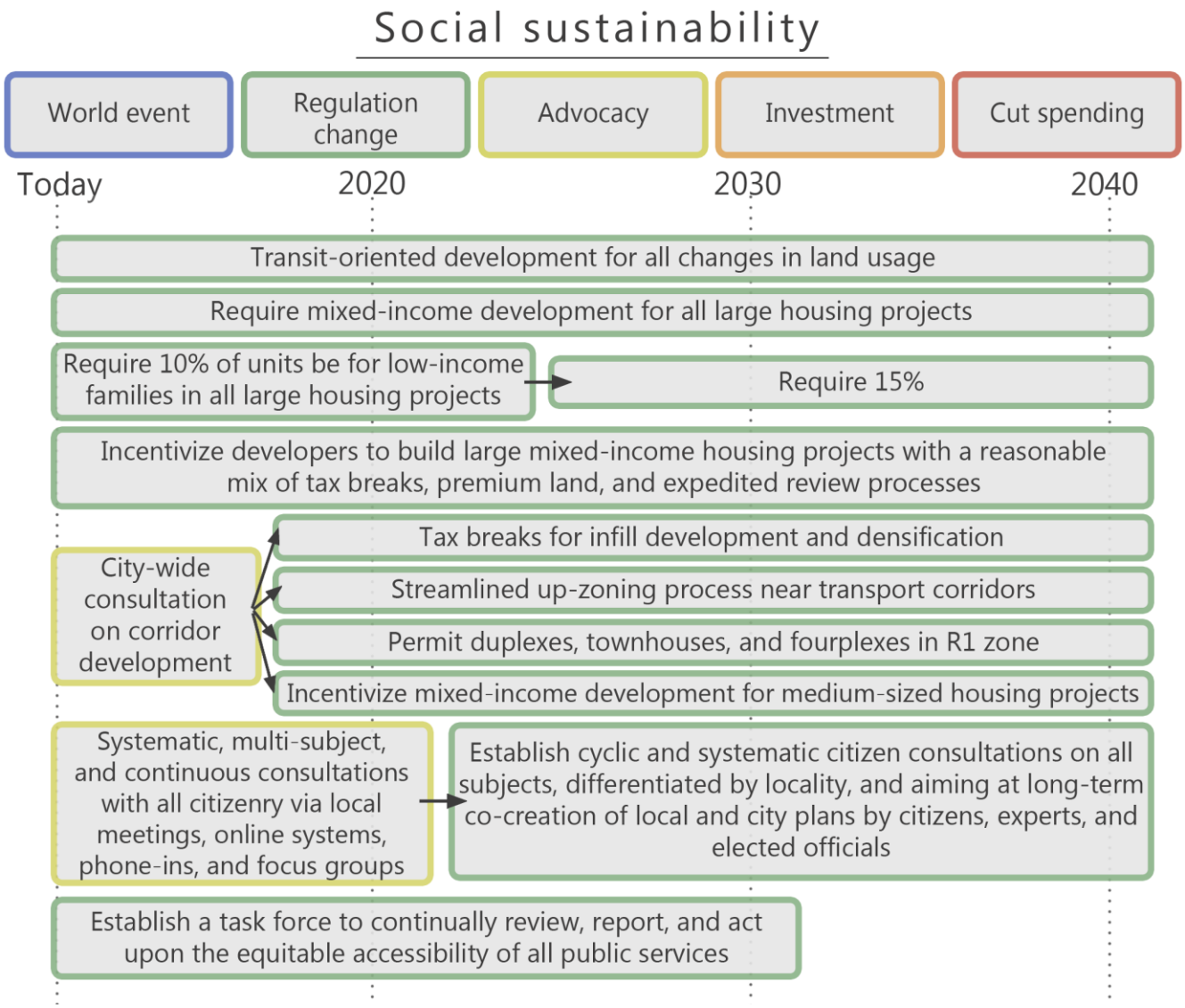
The National Research Council Centre for Sustainable Infrastructure Research (NRC-CSIR) in Regina has been undertaking investigations as to the possible use of greywater for sub-potable uses, such as toilet flushing, irrigation, and laundry. Starting in 2007, they began research to determine the optimal time to remove storm water from ponds, and how much treatment would be required for various sub-potable uses[111]. The City of Regina should be ready to take under advisement the results of this study, since it is generally believed that as much as 50% of in-house water usage could be substituted or partially substituted with rain water.

10.6 Wastewater

The City is currently budgeting $150 million towards upgrading the wastewater treatment system[112]. Since wastewater costs are currently charged on the amount of water bought from the system, the changes suggested above to the rate system for water usage would apply here as well. As discussed earlier, progressive rates would be a significant incentive against overuse.

[111] Urban stormwater runoff-waste product or resource? National Research Council Centre for Sustainable Infrastructure Research.

[112] Design Regina, Regina Water, Wastewater and Storm Water Topic Sheet.



11. Social Sustainability

Social sustainability focuses on the creation of community and civic engagement within the population. A socially sustainable community is one in which people know their neighbours, and have the capacity to work together to solve problems within the community. Principally, this is achieved by creating an environment where people have the possibility of interacting. The stereotypical small town is an example of a socially sustainable community, some place where everybody knows your name, and you regularly meet people in the post office, grocery store, watering hole, or corner gas station.

In contrast, a socially unsustainable neighbourhood is one where people rarely interact with their neighbourhoods, sometimes referred to as bedroom communities, as people return to their home for sleep and then leave again. These communities lack local amenities, forcing residents to drive long distances for recreation and services. In doing so, they eliminate the majority of the serendipitous encounters that form a social community.

11.1 Facilitating the creation of community

Community, like any organism, needs the right environment in which to thrive. Fortunately humans are uniquely adept at creating effective social environments. Healthy communities foster interaction, communication and inclusivity.

11.1.1 Interaction

Without interactions, people will have no means of meeting each other and no opportunity to foster relationships. To create interaction, neighbourhoods should contain both residential and local commercial areas, allowing people to walk or bike to nearby amenities. Development of this sort is a strong causal factor in the creation of very social communities because residents are much more likely to meet and interact with one another.

For this type of development to be successful there needs to be a sufficient population density to support local businesses. In 1971 the average household in Rosemont had approximately 3.2 residents, today there are only 2.3 residents per household. The decrease in population density threatens the viability of local business and could turn Rosemont into a bedroom community. This is also evidenced by widespread fears among residents of Rosemont that the major local grocery store (Extra Foods) will close.

The first objective with regards to density is not to increase it to unprecedented levels but simply to return it to historic norms. Because people have smaller families now than in the past, it may not be possible to increase the number of people living in a single unit. To achieve desired densities, it will be necessary to build additional housing units. Given the maturity of the area, densification will need to occur in both horizontally and vertically. As discussed in more detail in the land usage section, large lots are opportunities for semi-detached and secondary suite development, but development of low-rise apartment buildings is likely to be very effective in south-eastern Rosemont due to the age of the homes there.

11.1.2 Communication

Communication is about providing residents with the ability to gather and organize, to share ideas and concerns. Historically this has happened in churches and schools, which is why most community activities have centred around these two institutions. Schools are vitally important to the creation of community as they are the primary venues in which children interact, and school activities also often serve as opportunities for parents to meet and interact. Schools provide an excellent starting point for the development of community life, but they do still exclude most adults, especially those who do not have children. The City could play a helpful role in the creation of local communities in a number of ways, including fostering civic engagement by launching of inclusive public consultations about local governance issues.

11.1.3 Inclusivity

Inclusivity is the most important part of creating a sustainable community. Without it, the community will not be able to incorporate new residents, and as existing members drift away, the community as a social being will eventually die. Schools are again the primary source of inclusivity, because children are least likely to hold deep-seated prejudice towards strangers and because all kids are required to go to school. Kids are also some of the least mobile members of society, so if the bonds they form in school are to be translated into the community, those communities must be accessible by active transport. Local school populations benefit from additional social cohesion and locality in their operations and after-school programs. These factors again hearken back to the importance of high population density.

Extending inclusivity from the school into the broader community is currently achieved through the social events (plays, performances, sports events, banquets, etc.) that the schools host. The inclusivity of the community can be enhanced by having the schools perform actions in the community such as artistically imprinting public space (painting fire hydrants, wall murals, fences, etc.), the establishment and care of local landscaping, and the extensive use of learning environments outside of the classroom. Taken together, actions such as these will help knit together adult livelihoods and institutions with the integrating community of the school.

11.1.4 Scale

Communities operate at a human scale and are therefore inherently small, consisting of at most a few thousand people. Beyond this number, familiarity with other members of the community becomes increasingly difficult. Without self-reinforcing familiarity, the community will fragment into

smaller community groups, or dissolve into a collection of isolated individuals. It is important to try to scale the size of neighbourhoods so that they are optimally sized to form cohesive communities. This will help maximize civic engagement and, most importantly, quality of life.

11.2 Action items

11.2.1 Consultation

To improve the resilience, engagement, and social health of communities within Regina, the City should undertake systematic and lengthy local consultations with residents, focusing on simultaneously engaging as broad a spectrum of residential subcultures as possible. To this end, the consultations should employ multiple mediums, including Internet and mobile communications, phone-ins, local meetings, and focus groups. These consultations should evolve into a cyclic system of citizen consultations on all subjects, differentiated by locality, and aiming at long-term co-creation of local and city plans by citizens, experts, and elected officials.

11.2.2 Mixed-income development

To foster greater social mobility and to reduce the socially exclusionary nature of expensive regions of the city, all major housing developments should be mixed-income, providing a minimum of 10% of all housing units that are oriented towards low-income residents. Low-income units are generally designed to house a higher number of residents per unit area. Thus the density of low-income development is generally at a level significantly above the average for suburban Regina.

The City should be actively involved in the process of planning the land use changes that lead to this development, allowing it to easily streamline the process for developers. If added incentives are needed, developers can be attracted and retained with a combination of:

a. high-quality plots of land,
b. temporary tax breaks, and
c. expedited review processes with the City.

11.2.3 Equity

In order to ensure that equity is conscientiously pursued throughout municipal government, the City should establish a permanent task force to continually review, report, and act toward achieving the equitable accessibility of all public services. This approach is vastly preferable to broad overarching mandates towards equity, since this approach explicitly makes it someone’s job to investigate these concerns, report on them, and take action where action is necessitated.

The creation of a permanent equity office in local government would be intended to ensure that residents with equity complaints will have well-informed and well-connected experts who can help them make their voices heard. Such an equity office would not be able to address all concerns (including serious legal ones), but their creation and empowerment would be a significant step towards the deep ingraining of equity concerns into all operations of government. Eventually, it is possible that such an office would be so successful that they would 'work themselves out of a job' by changing the culture of City governance so completely that they are no longer necessary. This is a bright and appealing vision of local government, and certainly one that is worth working towards.

12. Acknowledgements

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13. Appendix A: Phase 1 of Rosemont transport

It may be helpful to refer back to the map in the earlier section on Zoning Rosemont for comparison with these notes.

13.1 Bike lanes for Rosemont

1. Bike lane on the whole length of Sweeney Street in the NW corner of Rosemont. At the north end of the street, the lane continues over the tracks (over a new at-grade crossing designed only for pedestrians, bikes, etc.). It connects at the south end to Ritter Ave.
2. Ritter Ave, starting at Dorothy (in the west), will have a lane or parallel path on its way east until it hits the frontage road just to the west of McCarthy Blvd. It then turns south and continues until it can cross over McCarthy on 4th Avenue.
3. Bike lane down 4th Avenue all the way east out of Rosemont.
4. Starting out near the bridge on McCarthy, the paths between Brunskill Place and the creek will connect with a bike lane in the alley just east of McCarthy Blvd. The path's route is initially

straight north, following the existing alleyway north past 4th and Mikkelson turning North West, eventually reaching the north end of this residential area, where it turns due east. It goes east until it hits the top of Campbell St.

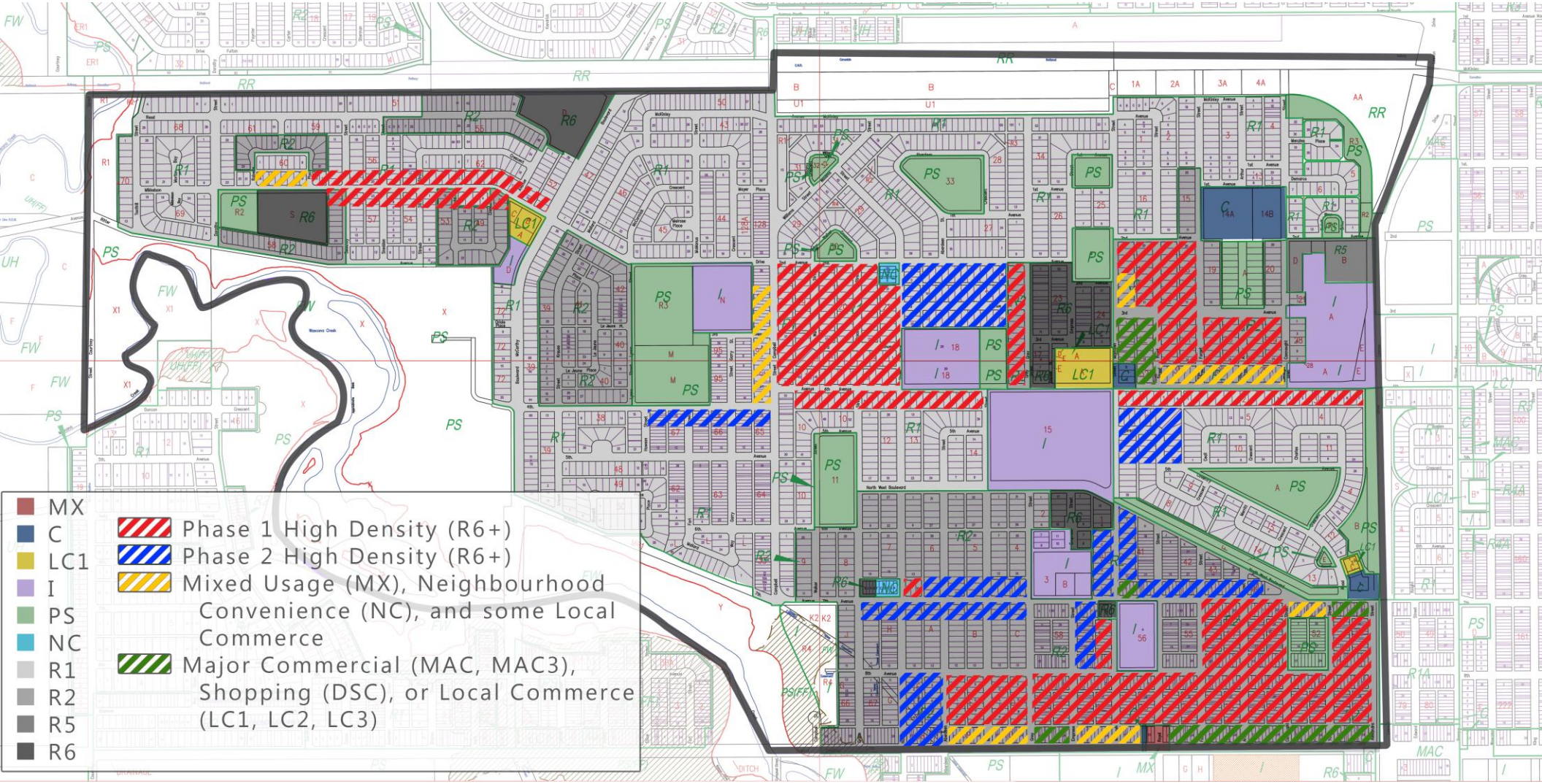
5. Campbell Street will have a bike lane. On the north end, the city should negotiate an agreement with CN, so that the path can continue north of Campbell. Many people use this crossing unofficially in that capacity already, and it is one of the only north-south crossings possible on the east end of Rosemont. The Campbell street lane goes south all the way until it meets up with AE Wilson Park by the creek.
6. Starting in AE Wilson Park, the 7th Ave. bike lane will go east all the way out of Rosemont.
7. Starting in the middle of Rosemont, (at Rosemont Park), a bike lane will go east on "NW Boulevard", then slants south-east, eventually meeting up with the 7th avenue lane.
8. Starting on the slanted part of NW Boulevard, on Royal St., this path goes straight south out of Rosemont.
9. Lastly, the parts of McIntosh that are north of NW Boulevard have a bike lane.

13.2 Intermodal hubs

1. Beside the extra foods on 4th and McIntosh there will be a multimodal station. The city should work with Extra Foods to implement bike racks on or near the east side of their building.
2. Just west of Campbell, on Mikkelson (2nd Ave), at the front of St Francis Community School.
3. On the west end of Mikkeson, near its corner with Dorothy Street, is a park with a bus shelter there already.
4. Front of Martin collegiate, on NW Boulevard.
5. Howson and 4th Avenue, on the park (south end of St Francis Park).
6. South end of Grace Street, on Dewdney. (Note that there is a bike path coming up from the creek area that comes up to Dewdney, exactly where there is an existing bus stop).
7. East of Royal St., on Dewdney, in front of the Lutheran church, and quite near Luther College.

Appendix B: Detailed zoning of Rosemont

The zoning map on the following page illustrates our proposed zoning goals (discussed our earlier section on Zoning Rosemont) over top of the zoning maps used by the City. This view of our zoning plans may be helpful for individuals who are trained in understanding zoning schematics. Additionally, a much higher-resolution version of this image is available online, accessible through this link.


MX
C
LC1
I
PS
NC
R1
R2
R5
R6
Phase 1 High Density (R6+)
Phase 2 High Density (R6+)
Mixed Usage (MX), Neighbourhood Convenience (NC), and some Local Commerce
Major Commercial (MAC, MAC3), Shopping (DSC), or Local Commerce (LC1, LC2, LC3)