LIQUID WASTE MANAGEMENT PLAN

STAGE 1 / 2 REPORT – FINAL DRAFT

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CONTENTS

APPENDICES

TABLES

FIGURES

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EXECUTIVE SUMMARY

Liquid Waste Management Plans (LWMPs) give local governments the authority, in accordance with Operating Certificates (OCs), to manage, collect and treat wastewater, and to return cleaned water to the environment. A LWMP aims to balance multiple factors including public, political, social, environmental, and financial. Lake Country's LWMP is anchored on partnering with the community and listening to interest groups to come up with a plan that identifies local challenges, and well thought out solutions, to address and enhance the management of liquid waste. While most of the infrastructure systems are in place and operating soundly, there is opportunity and motivation to improve local services by amplifying sustainability practices, being proactive to modern environmental management, being attentive to current and future customers, and finding cost-effective solutions that work over the long run.

The principal aim of Lake Country's LWMP is **to borrow water wisely and return it safely**. This aim reinforces the importance of long-term investments into high quality return water, regular lake health monitoring, dedicated interest in water reclamation, promoting water conservation, and enhancing stormwater management to reduce non-point source impacts to lake health.

Along with the principal aim, the 2022 LWMP was situated around three core drivers:

- **Safeguard the environment** → borrowing and returning water
- **Resilient services and infrastructure for a growing community** → wisely and safely
- **Meeting our Environmental Commitments** → delivering on key elements that improve liquid waste through regulations, initiatives, and policy

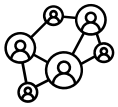
A LWMP identifies local issues and challenges related to liquid waste and develops custom, implementable solutions that aligns with feedback from the community. The technical analysis and engagement process to complete this Stage 1 and 2 report (combined) were extensive. Part of what aided the process to narrow down the challenges and to arrive at a suite of solutions were management principles. Principles help to instruct the working groups and the project team to focus on ideas and strategies that align with the broad intentions of liquid waste management in BC. A successful LWMP needs relevant and effective solutions that suit the local context and the actual conditions of liquid waste in Lake Country. The management principles are listed below:

- Seek to *right-size* new infrastructure to suit present and future needs.
- Consider levels of service and how they vary across wards and neighborhoods.
- Search out the best available technology for achieving the desired goals.
- Apply the user-pay /developer-pay principle in the assessment of costs.
- Recognize that stormwater runoff can contribute to pollution so it must be managed through water quality and quantity strategies, accordingly.
- Recognize the impact of climate change when developing options for existing or future processes.
- Ensure all efforts are made to facilitate public engagement and community support.
- Ensure that options are based on rigorous scientific principles.

Drivers, management principles, and the higher aim to borrow water wisely and return it safely provide the framework for this LWMP. Use of the framework was most apparent during important discussions with both the Advisory and Steering Committees. All participants wrestled with the key topics, their costs and policy impacts, to develop the path ahead through the exploration of three liquid waste management options.

Arriving at a preferred direction is a significant milestone. The central policy assessment in Section 5.5.6 outlines how public feedback, technical considerations, and political dialogue were channeled accordingly. The Stage 1 and 2 report outlines how the District of Lake Country determines its preferred direction while implementation details are spelled out in the next stage, Stage 3. The preferred direction is summarized below.

Completion of the **Phase 4 and 5 upgrades** to the wastewater treatment plant to ready the facility for 20+ years of growth and to meet new, stringent regulations for redundancy and returning cleaned water to the environment.



Implementation of the plan to **expand the centralized collection system** to areas outlined in the urban containment boundary of the Official Community Plan which will include pipe and lift station upgrades to accommodate customers within that boundary.

Positioning the District to explore a plan to **reclaim treated wastewater** through irrigation on select properties such as industry or parks or non-food farms along the outfall line route.

Continuance with the **biosolids program with a renewed agreement** and emphasis on partnering to restore the supply and demand imbalance for OgoGrow.

Expanding stormwater management to meet the principles of integrated stormwater management (a staple in the BC stormwater industry) with a strong focus on **non-point source pollution** and new infrastructure that renovates water quality prior to it meeting Wood, Kalamalka, or Okanagan Lakes.

Flexible / Adaptive return options (e.g., to-ground (secondary), lake (primary) and or reclaimed water (secondary, future)) to manage the multiple and often competing factors influencing the safe return of cleaned water back to the environment.

These elements of the LWMP will be discussed in more detail in in this report, then further confirmed in a follow up report in Stage 3, where cost-recovery for the $77M plan is designed appropriately. These costs reflect a conventional Class C estimate inclusive of 35% contingencies partially accounting for two years of extraordinary inflation. A cost-recovery and financial plan will be included in the Stage 3 plan where cost mitigation strategies will also be presented. Further, while this total budget does not include all the investments to complete a reclamation system, it does include adequate resources if Council decides to initiate the service and to commence design of a reclamation system. A detailed description of the preferred direction is provided at the end of Section 5.0 as part of the complete Stage 1 and 2 report, provided herein.

1.0 INTRODUCTION

Liquid Waste Management Plans (LWMPs) give local governments the authority, in accordance with Operating Certificates (OCs), to manage, collect, treat, and return cleaned water to the environment. The plan outlines the local challenges and includes well thought out solutions to address liquid waste, **including septic system management, the centralized sanitary sewer system, wastewater treatment, biosolids management, and stormwater.** The plan horizon is 20 years (typical) including a list of projects, programs, policies, and later, financial methods to achieve the chosen goals.

The District of Lake Country is currently managing its liquid waste through a Liquid Waste Management Plan (LWMP) that received Minister of Environment approval in 1998. Lake Country continues to manage its liquid waste through treatment by biological nutrient removal with discharge to ground. However, the plant is quickly running out of capacity including limitations to return cleaned water to ground and securing another return option will require regulatory approval.

Section 1.0 builds out the fundamentals of LWMPs including a focus on the context for Lake Country.

1.1 LWMP FUNDAMENTALS

The concept of LWMPs was introduced by the Ministry of Environment and Climate Change Strategy (BC ENV) in the early 1980's and formalized into the *Waste Management Amendment Act* of 1992 and later incorporated into the *Environmental Management Act* of 2004. The intent was to gradually replace waste discharge permits, to ensure that the return of treated liquid waste would conform to Ministry objectives, that utilities considered both long-term and short-term upgrades (e.g., over 20 years) when proposing treatment upgrades, and to ensure the public has input into the process.

A completed and approved LWMP has the endorsement of both the local government and the Minister of Environment. Since the process of developing a LWMP involves significant public input, the local government has the authority to implement the plan within a reasonable timeframe as funding becomes available, often without having to seek further elector assent for additional borrowing. Liquid Waste Management Plans are carried out in three distinct stages:

Stage 1: Identifies all issues and waste-management options.

Stage 2: Examines the options and associated costs in detail, evaluates the most promising options based on the three bottom lines (social, environmental, economic), and outlines a draft waste management plan based on the preferred approach.

Stage 3: Outlines the implementation schedules for the preferred approach including standards, commitments, and aspirations.

BC ENV accepted Lake Country's proposal to create a combined report from Stages 1 and 2 given the depth and breadth of study to date and the need to expediently confirm the plan direction.

1.2 STUDY AREA

The study area encompasses the municipal boundary of the District of Lake Country. But *how to study* the area needs a little more explanation:

- The centralized sewer system serves properties within the urban containment boundary and the LWMP will report out on expansion of the system to all others within the core developed area (developed, non-agricultural properties) and from infill growth, while staying within the urban containment boundary.
- Non-point source pollution is a District-wide, cumulative-effects challenge, largely stemming from dispersed sources with a particular focus on urban stormwater runoff. As the runoff moves, it picks up and carries away natural and human-made contaminants, depositing them into lakes, creeks, wetlands, and ground waters. Non-point source pollution relates to all properties, including those within and outside urban areas. (www.epa.gov/nps)
- Some of the District's liquid waste services include agreements with other service providers whereby operations occur on sites outside of the municipality e.g., management of biosolids at the regional compost facility which produces compost known as OgoGrow
- Okanagan Lake is part of a common basin to all communities up and down the Valley. Lake Country must be considerate to all actions that affect the environment.

The geographic study area is the entire District of Lake Country with a few focus areas depending on the topic, as outlined above.

Beyond where to study, it is important to also consider the study philosophy. It must be in tune with how to conserve water in a central basin and should encompass the range of issues for a LWMP. For this LWMP, the District is motivated by its inherent responsibility to **borrow water wisely and return it safely**. Achieving this aim is important now, and into the future as the community and its population grows. Table 1 summarizes growth projections for Lake Country including population changes in five year segments. These statistics come from the Official Community Plan, which governs how the community grows and how the District serves the community. Lake Country's Official Community Plan outlines how the community will grow responsibly including the extent, type, and goals of environmental services. While commonly centered on land use, the Official Community Plan iteratively wrestles with technical topics so that infrastructure needs and conditions inform planning, and vice versa. Later, the LWMP adds further details to how it will concurrently manage liquid waste. It is important to note that the population projections for the LWMP will extend to 2039, three years beyond the Official Community Plan given the sequencing of each report.

Table 1: Official Community Plan Population Projections

	Low (1.5%)	Medium (2.4%)	High (3.1%)
2022	14,129	14,898	15,520
2027	15,221	16,774	18,079
2032	16,398	18,886	21,060
2036	17,404	20,765	23,796

Providing a range of growth rates is useful when conducting scenario planning for a variety of local government topics. The medium growth rate is used for the LWMP as it offers a level of practicality that is sought after for infrastructure plans and because it matches the growth rate approved by Council in the Official Community Plan. Moreover, the medium growth rate of 2.4% is more reflective of the last 15 years of growth in Lake Country, and accounts for occasional years where there are spikes of growth e.g.,

5% to 6% or more, followed later by years of low growth, e.g., about 1%. These spikes of growth are apparent in the 2021 Census results which show an annual population increase of approximately 4.5% from 2016 to 2021. Overall, when projecting growth over 20 or more years as is done in a LWMP, it is appropriate to apply a blended long-term rate such as the 2.4%. As is noted in the OCP, a rate of 2.4%, "*may seem modest during this current period of high growth, these rates are relatively robust if sustained over an entire 20-year period.*" Overall, it is best practice that engineering studies follow the population projections from community plans, rather than set their own growth rates.

1.3 BACKGROUND

Lake Country was incorporated in 1995 and one of its first priorities was to establish a community sewer system in the core area. By 1998, only three years after setting out, Lake Country had its first approved Liquid Waste Management Plan and was set to commission the centralized sewer system and a highly regulated, provincially certified, treatment plant. Since the beginning, Lake Country has planned out thoughtful ways to expand the system to reach willing customers and reduce risk to the watershed, to modernize treatment, and to report back to the community and regulators that the hard work was paying off.

Fast forward to today, and after tens of millions of dollars of community wastewater investments, Lake Country has a leading-edge liquid waste management program. Programs developed incrementally, with intention and commitment to local environmental priorities. In all, the last 25 years of liquid waste management has come about by design and the next 20 years requires the same level of planning and intentionality. Before this plan charts forward, it is important to understand the roadmap to this LWMP including the background work for the current LWMP update, and the steps ahead following approval from the Minister. Figure 1 provides an abbreviated timeline of the historic, current, and future work related to liquid waste management in Lake Country.

Figure 1: Liquid Waste Management Timeline

Lake Country's LWMP is founded upon informing the community and working with interest groups to come up with a plan to enhance the management of liquid waste. While most of the system is in place and operating soundly, there is opportunity and motivation to improve the services. The cause for making improvements can be embodied by three drivers: **Safeguard the Environment, Resilient Services for a Growing Community, and Meeting our Environmental Commitments**. Each driver is outlined below with example commitments that bring to life the desired outcomes for a complete LWMP..

Safeguard the Environment

- ✓ Environmental Investments: We will build on our historic success in conserving the environment through liquid waste management services.
- ✓ Lake Health: We continue to monitor water quality and adapt in local ways to protect lake health.
- ✓ Low Footprint: We aim to design all projects to suit their present and future need and avoid over-sizing or under-sizing assets that may lead to premature renewal.
- ✓ Water as a Resource: We aim to borrow water wisely including water reclamation and to return it safely to the environment.

Resilient Services and Infrastructure for a Growing Community

- ✓ Collection System Expansion: We will connect existing customers in neighborhoods where there are aging, risky septic systems such as the Oyama Isthmus and East facing slopes in Winfield.
- ✓ Services for Growth and Development: We will grow from the core area and thoughtfully connect to new and diverse types of buildings that stem from our Official Community Plan and commit to grow sustainably, support local jobs, and meet housing needs.
- ✓ Capacity of our Infrastructure: We must upgrade our wastewater treatment plant including how we return cleaned water to the environment within 4 years.
- ✓ Affordability: We will fund the services we commit to and seek out residents' support for added costs.
- ✓ Technology and Advanced Systems: We continue to seek out technological advancements that provide opportunities to treat sewage effluent more effectively and to higher standards.

Meeting our Environmental Commitments

- ✓ Environmental Sustainability: We are obliged to support our Official Community Plan and meet goals for infrastructure, environment, and service delivery. These goals embedded within the OCP are summarized in Appendix E.
- ✓ Water Leadership: We want to implement water reuse solutions that address local, broad-based challenges in a way that encourages other communities in the Basin to follow suit.
- ✓ Regulatory Compliance: As it has for decades, we aim to meet or exceed what is mandated of us by environmental authorities e.g., Province of BC.

These drivers are also prevalent in the District's business plan framework which is discussed in the following section, and reviewed again later as a benchmark against the preferred direction.

1.4 ALIGNMENT WITH DISTRICT BUSINESS PLAN

Twenty-six years of governance history has positioned the District to provide various services to its residents that continue to evolve over time as needs and opportunities emerge. In 2020, Staff and Council developed a Business Plan to guide municipal decisions and services. Council's vision, mission and pillars of service provide a framework for all municipal endeavors. They are also generally instructive for the Liquid Waste Management Plan. The Business Plan framework is outlined below.

Lake Country, living the Okanagan way. Embracing our histories and nurturing our future.

To nurture a healthy natural environment, strong rural character and urban core, sustainable infrastructure, economic opportunities, an inclusive community with involved citizens, through respectful, transparent government, focused on balanced strategic decision-making.

- ✓ ENVIRONMENT: Maintaining a healthy and natural environment through responsible use, protection, and sustainable practices.
- ✓ INFRASTRUCTURE: Well maintained infrastructure and facilities that meet community needs and allow growth and development for prosperity.
- ✓ ECONOMY: Building a strong and vibrant community by attracting, supporting, and retaining businesses and residents.
- ✓ SOCIAL: Building social capital and engaging citizens and partners to improve the well-being and diversity of the community.
- ✓ GOVERNANCE: Fiscally sustainable government focused on strategic decision-making, transparency, and inclusiveness.

There are direct and indirect links between the business plan framework and the LWMP, such as:

- Lake Country's **history** of leadership in building out a centralized collection system and providing wastewater treatment services beyond the minimum requirements can also be the path to nurturing its **future.**
- Transparent government based on a **balanced view of perspectives** mirrors the provincial guidelines for liquid waste management and is embodied in Lake Country's engagement approach, particularly for this project.
- The environment and hard infrastructure **assets require attention**, investment, and ongoing evaluation to ensure that what is valued most is protected through cost-effective services.
- Implementing advanced liquid waste services are fundamental to a thriving economy and improved well-being throughout the community.

Overall, a liquid waste management plan requires consideration and integration with corporate business plans if it is to be effectively implemented. Throughout this document, including the key sections that frame up the preferred direction, there are consistent links between the framework above and the outcomes of this plan. This level of strategic alignment is deemed a best practice for leading organizations, including Lake Country.

1.5 PRIMARY TOPICS FOR LIQUID WASTE

The drivers for liquid waste management are *linked* with principles and issues of liquid waste. Those links are well known because of Lake Country's 25 years of experience with delivering related services but also because of the established management systems already in place. At this time, instead of asking *"where does the plan begin in managing liquid waste?"* it is better led into the process thinking about **"How can the plan take a solid system and make it better for the future?"** Getting better and putting the drivers into action to generate real strategies and solutions starts with knowing what should be improved. The primary topics for liquid waste are revisited in the list of issues section (Section 4.0) but they are presented here as they can be a useful lens when reading about the infrastructure and approaches already in place (Section 3.0). The list of primary topics includes:

1. **Limitations with in-ground disposal** for cleaned water return and the need for a more reliable, safe method for returning water to the environment

2. **Collection system expansion** and preparing residents, neighbourhoods, businesses, and new buildings for how and when the new pipes will be installed
3. **Upgrading the wastewater treatment plant** and the timing and rules for doing so
4. Understanding and **managing non-point source pollution**, with a focus on stormwater runoff including water quantity and flow management to suit the landscape and receiving environment
5. **Supply and demand for biosolids** and the OgoGrow partnership
6. The **balance of cost and funding** and meeting local environmental and regulatory goals and delivering affordable services
7. Integrating and adapting to the **impacts of climate change** on water quality, supply and demand, and reliable service delivery
8. Hearing from all interest groups during the process and **preserving strong relationships** with Lake Country's service partners

As evident from above, liquid waste is a broad topic that requires various elements and strategies for effective implementation. If it takes a lot to get LWMP's right, *why is the District updating its LWMP, now?* In short, Lake Country is doing this plan now:

- Because the wastewater treatment plant is at maximum capacity and any upgrades to accommodate future growth require authorization by BC ENV;
- Because plant flows have reached the limits of in-ground disposal and there must be safe, reliable alternative method(s) to return water to the environment;
- Because an update is needed about every 10 years and the province requested the update at this time.

Primary topics and drivers, including the reasons for undertaking the update now, provide a strong baseline for exploring the technical components that make up liquid waste services in Lake Country, as outlined in Section 2.0.

2.0 DEVELOPING THE LIQUID WASTE MANAGEMENT PLAN

2.1 OVERALL PLAN APPROACH

A LWMP must be feasible, and it must deliver on Ministry requirements. Feasibility comes in the form of local conditions, needs, and wants. For Lake Country, any proposed solutions must:

- Safeguard the environment
- Provide resilient, Council-supported services to a supportive community, and
- Meet the District's commitment for liquid waste and the environment.

The process outlined in Section 2.0, including the methods and tools for engagement, is instrumental for how to determine the social and financial expectations of the community. The technical solutions are guided by that context and must also adhere to regulatory requirements.

The combination of social, technical, and financial needs is presented in Section 5.0 where three options for updating the liquid waste management are evaluated through a social, financial and technical considerations. This approach to performance evaluation is common among other communities and is known to work well in assessing the proposed solutions given the goals of the project. Working through the big liquid waste questions with the community is a good place to begin, as outlined in Section 2.2.

2.2 ENGAGEMENT APPROACH

When any aspect of a waste management plan is developed or amended, the *Environmental Management Act* requires local governments to complete a comprehensive public review and consultation process. In accordance with guidelines from the Ministry, the public engagement process should incorporate the following principles:

- ✓ Public involvement should begin as early in the planning process as possible.
- ✓ Information should be openly shared among the public, the local government, and the advisory committee(s).
- ✓ Public responses should be given open consideration by the local government and, where appropriate, addressed in the planning process.
- ✓ The proceedings and results of activities, which are part of the public consultation process, should be documented and available for public scrutiny.
- ✓ There should be broad acceptance and a local sentiment for contributing to the implementation of the plan among residents.

This approach ensures the District's Plan aligns with public expectations, and that the thematic inputs from the community can be configured for decision making and sustainable service delivery. Putting these principles into action is outlined in Section 2.2.1.

2.2.1 COMMUNICATION AND ENGAGEMENT

Lake Country undertook the LWMP update to develop and implement a comprehensive communication and engagement process that meets, or exceeds, the engagement process mandated through the LWMP. Input gathered from the public, key stakeholders and neighbouring Indigenous peoples will be synthesized, summarized, and used to help inform the District's final Stage 3 report that will be submitted to the BC Ministry of Environment and Climate Change Strategy (ENV) for ministerial approval. The proposed approach to engagement is distributed, targeted, and synchronized across the community and leads to a robust picture of public and stakeholder sentiment for important liquid waste matters.

This Engagement Strategy was designed to be sensitive to the current needs for physical distancing in response to the ongoing COVID-19 pandemic. The project team worked collaboratively to adjust the Engagement Strategy and facilitate the engagement process virtually and worked within the guidelines of the Provincial Health Officer throughout the process.

Key to a successful update to the LWMP is adequate engagement where the public, key stakeholders, and Indigenous peoples are given opportunities to provide meaningful feedback at two key stages of the technical process. This strategy is guided by the best practices and principles of the International Association of Public Participation (IAP2), a globally recognized organization that aims to promote and improve the practice of public participation. This strategy was also guided by the District of Lake Country's Guiding Principles.

IAP2's Spectrum of Public Participation was designed to assist with the selection of the level of participation that defines an audience's role in any public participation process. The Spectrum shows differing levels of participation and depends on the goals, time frames, resources, and levels of concern in the decision to be made. As a rule of thumb, the higher the level of impact a decision will have for an audience, the higher the level at which they will want to be engaged. The five levels of public participation are identified in Figure 2.

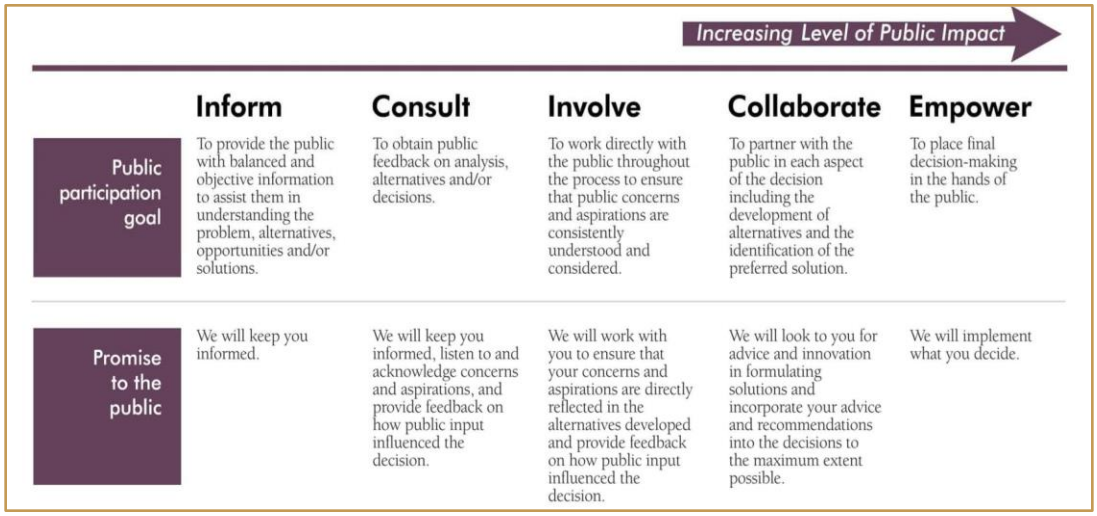


Figure 2: IAP2 Spectrum of Public Participation

Indigenous Engagement

Because of their strong connection to and reliance on the land and water, Lake Country understands that local Indigenous communities have a keen interest in understanding and participating in shaping the liquid waste management decisions the District will make. Today, there is a positive, respectful relationship with neighbouring Indigenous communities and Lake Country considers them to be partners in stewarding our common natural resources.

Engagement with Indigenous communities was implemented in a separate but parallel consultation initiative through a government-to-government process. Lake Country proactively reached out to all Indigenous organizations and/or communities whose traditional territory overlaps the project area (see current list in Appendix A). Pre-consultation with the Indigenous peoples began in February 2021 to enable Lake Country to hear directly from each Nation about interests/concerns they have with the project and how they would like to be kept informed and provide input throughout the process. Later, in the spring of 2022, Lake Country met with representatives of the Okanagan Indian Band to present and discuss the direction of the LWMP, the priorities to safeguard the environment, and the results of the Environmental Impact Study. Engagement between the two communities continues. Such as with Okanagan Indian Band, relationship building with some of the Indigenous communities began much earlier than the engagement process designed for the LWMP. Overall, engagement approaches and tools were designed to meet the unique needs of each Nation based on input received from them during pre-engagement (and throughout the engagement period).

Lake Country staff allocated resources to reach out and respond to each of the Nations according to their unique guidelines, cultural protocols, and needs. Where needed, there was a steady flow of information, administrative support, and technical expertise to assist interested Indigenous Communities and guide how to engage their community members as required (i.e., disseminating information to members, hosting community information sessions, etc.).

Engagement Objectives

Engagement methods and activities were guided by the Ministry's expectations coupled with the following local objectives:

- Tell the full story of Lake Country's commitment to maintain the highest standards in environmental management and Okanagan Lake water quality to provide context for the current LWMP work;
- Communicate the problem: e.g., the urgent need for infrastructure upgrades to meet the capacity required for Lake Country's growing population;
- Clarify the scope of work and the LWMP process; and
- Demonstrate how input is helping to shape the best solution and communicating how the design will incorporate public/stakeholder input moving forward.

Tools and methods for engagement included:

- Provide visually appealing and **easy to understand information** to ensure community members have a fulsome understanding of the process;
- **Use online public engagement platforms and social media**, as well as traditional methods to make it easy for everyone to get involved;
- **Build on** the direction and input gathered over **the past 20 years**;
- Ensure the technical team has informed input from most targeted audiences that enables the technical team to create a solution for liquid waste management that **reflects the concerns and aspirations of the community**;
- Ensure all targeted audiences clearly understand how their feedback has been used to inform key decisions by clearly communicating who the decision makers are and **how the input will be used**; and,
- **Provide a separate, parallel process** for Indigenous communities that respects and honours their consultation guidelines, cultural protocols, and unique needs.

Further to the above, Appendix A includes a detailed schedule and summary inputs for all communications and engagement activities in the LWMP. However, in short, the engagement program is summarized below based on the three phases and a multitude of tools and methods.

Table 2: Engagement Program Summary

Communication and Engagement Phases	Examples of Tools and Methods
• **Phase 1 Engagement – March to July 2021** *Goal: Introduce LWMP Update, Communicate Stage I/II List of Potential Options and Gather Input on Best Solution* • **Phase 2 Engagement – September to November** *Goal: Propose the LWMP Update, Communicate the Preferred Direction and Gather Input on Schedules and Finances*	• Two Committees: Steering and Advisory • Regular Council briefings (up to 6 in 2021) • Online Q&A relevant to LMWP concerns • Community engagement site letstalk.lakecountry.bc.ca including whiteboard video • Email subscribers list • Mini articles online: *Fact Friday* • Information and media releases; social media activity • Mail outs and notices to the public • Virtual community, public and workshop meetings • Survey #1 and #2 • What we heard report • LWMP Report (Stage 1/ 2) and Stage 3 Report (Implementation)

Beyond stating *what was done (appendix materials)*, there is a keen interest in the LWMP to connect any proposed solutions to *what was heard*. The conversation and input of the community is essential to meeting the objectives of the engagement plan and instrumental to the obligation of the local government when completing the LWMP. Summary highlights from the engagement process are outlined later in this report. Section 3.0 begins the important reporting task of outlining liquid waste management systems: the core areas for updating in the 2022 LWMP.

3.0 LIQUID WASTE OVERVIEW: COLLECTION, TREATMENT, CLEANED WATER RETURN & STORMWATER

To help provide structure and guidance around the inputs requiring consideration in a LWMP, the process has been broken down into five technical focus areas:

1. Collection
2. Treatment
3. Returning Cleaned Water to the Environment
4. Biosolids, and
5. Stormwater

Understanding the role, relationship and needs of each of these focus areas in liquid waste management is paramount for effective service delivery and to safeguard the environment. Therefore, the purpose of this section is to build a foundational understanding of the role for each of them. A management plan requires a detailed look at the systems in Lake Country to describe the issues, the rules, the objectives, and their needs.

3.1 COLLECTION

The collection section concentrates on the conveyance of liquid waste from:

- Properties connected to the centralized treatment system and future development areas,
- Properties that utilize private septic systems, and,
- Properties serviced by one of two District satellite treatment plants.

Before each of these collection types are explored in detail, an overview of the entire system is provided below.

3.1.1 LAKE COUNTRY COLLECTION INFRASTRUCTURE: STATUS AND NEEDS

System Overview

Lake Country's sanitary sewer collection system consists of over 75 km of sanitary pipes and 15 lift (pump) stations equipped with standby power (either portable or permanent). This infrastructure services roughly 3,500 units (single detached dwelling unit equivalent) and transports an annual average of 1,700 to 1,800 m^3/d of untreated water to the wastewater plant for treatment.

The number of connections and the average flows tend to rise a little bit each year as new customers emerge. Figure 3 is a schematic of the major types of collection systems in Lake Country.

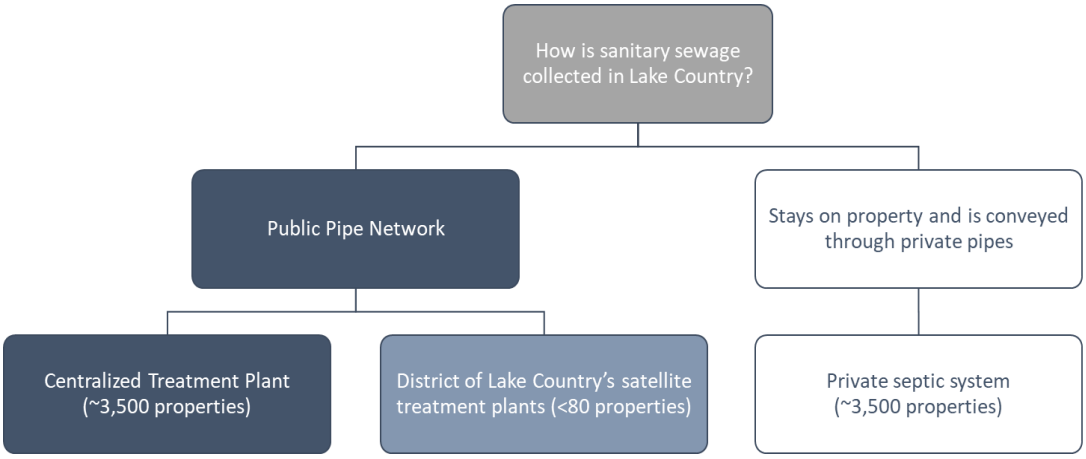


Figure 3: Collection System Type (Overview)

Centralized Collection System

A centralized collection system is a series of sewer pipes that collects sanitary flows from residential, commercial, industrial, and/or institutional uses and conveys them to a single wastewater treatment plant. The intent is that the liquid entering the collection system originates solely from wastewater, which has relatively low flows but high concentrations of treatable substances. These substances include essential nutrients needed to maintain a healthy wastewater treatment plant.

The flow (hydraulic loading) into the collection system defines the size requirements of the infrastructure. The amount of flow is quantified by:

- The number of connections (users).
- The average discharge resulting from all the connections.
- The extraneous inputs to the system.

Extraneous inputs, such as stormwater and *inflow and infiltration*, can make their way into sanitary collection systems through any of the following avenues:

i. Combined storm and sanitary sewer systems (which are not present in Lake Country)
ii. Pumping - stormwater is pumped from the stormwater system to the sanitary system to mitigate the limitations of stormwater infrastructure,
iii. Inflow - rainwater enters the sanitary system through improper plumbing (i.e. outside house drain connections, holes in manhole covers, etc.)
iv. Infiltration – rainwater enters the sanitary system often through pipe defects such as cracks

These extraneous flows can present challenges, such as increasing demand on the wastewater treatment plant and a reduction in the concentration of nutrients in the untreated water which has a significant impact on the treatment process. The role of nutrients in the wastewater treatment process is discussed furthered in Section 3.2.

Overall, the centralized system plays a critical role in protecting lake and ecosystem health. After decades of study in the Okanagan in particular, it is well known that centralized collection systems in core areas can better protect the watershed in comparison to properties serviced by ageing septic systems. This is most notably the case in higher density neighbourhoods whose groundwater and soil are typically inadequate to handle the cumulative impacts from septic system flows from many

properties. When expansion of the centralized system targets areas designed for growth, this helps the community achieve development goals set out in the Official Community Plan while also protecting the environment and the characteristics and identity of local neighbourhoods (e.g., where sewer trunks are not extended).

Managing Flows: Present-Day and 20-Year Projections

Flows in the system that arrive at the plant vary somewhat throughout the day with the least flows occurring at night. Certain periods of the year cause higher flows to occur, such as during the summer when tourism is strong, but another important season is the spring when snowmelt and precipitation combine to generate higher flows to the plant despite low levels of inflow and infiltration. The latter issue of peak flows, stemming from inflow and infiltration is important but presently a very low concern in Lake Country relative to other communities in BC. Overall, managing flows during wet weather helps to maintain normal system function and prevent premature capacity upgrades. Lake Country's inflow and infiltration is less than the maximum requirement set in the *Environmental Management Act* which regulates that the Average Maximum Daily Flow must be less than 2 times the Average Dry Weather Flow. A number of factors contribute to low inflow and infiltration in the District including the newness and good condition of infrastructure, District-led initiatives such as regulations preventing combined sewers and direct inflow connections (i.e. roof leads), and the ongoing inflow and infiltration Control Program which monitors sanitary system flows to identify, track and resolve the erroneous flows. Recent success in managing extraneous flows suggests the District should carry on as-is.

Approximately half of Lake Country's total population of 13,000 residents receives service from the centralized sewer system and the wastewater treatment plant. The share of the population on the that system continues to rise as new developments connect and as homes relying on aging and failing septic systems connect to the centralized network as well. Growth projections include an additional 5,030 units to be added to the centralized system in the next 20 years. This is equivalent to approximately 12,575 people (note: equivalent population is higher than actual population growth because it accounts for flows that arise from businesses and institutions), spread across 3 major growth areas in the District:

i. **Core growth areas:** locations supporting new growth and development in the District.
ii. **Retrofit areas:** locations with aging and failing septic systems being brought onto the centralized collection system, which are prioritized based on discussion regarding these questions:
    - Which properties pose the greatest risk to environmental health?
    - How must the centralized system expand to accommodate ongoing development?
    - How collection system expansion aligns with the downstream capacity of the treatment plant and the method for returning cleaned water to the environment?
    - What are the opportunities to capitalize on economies of scale to lower costs of expansion?
iii. **Expanded development areas:** locations near the existing collection systems where expansion will support governing planning objectives such as densification.
    - McCoubrey Plateau – has not yet been intensively developed but future plans include urban-level development such as residential, single, duplex and multi-family housing. The Official Community Plan has goals to establish this neighbourhood as a comprehensive residential neighbourhood with a mixture of urban land uses and densities.

- Glenmore Industrial – the Official Community Plan outlines plans to redevelop this area from gravel extraction to light industrial uses with new and current business opportunities. An additional 5.55 ha of industrial activity can be expected in this area in the next 20-years.

Table 3 summarizes growth projections for these areas over the next 20-years which are also mapped in Figure 4. Figure 5 illustrates the Urban Containment Boundary, which aligns very closely with the growth projections.

Table 3: Summary of Growth Projections (Development Units)

Development Type	2020-2024	2025-2029	2030-2039	Total
Core Development Area	1,310	940	1,280	3,530
Retrofit Areas	0	700	0	700
Expanded Development Areas	0	250	550	800
Total	**1,310**	**1,890**	**1,830**	**5,030**

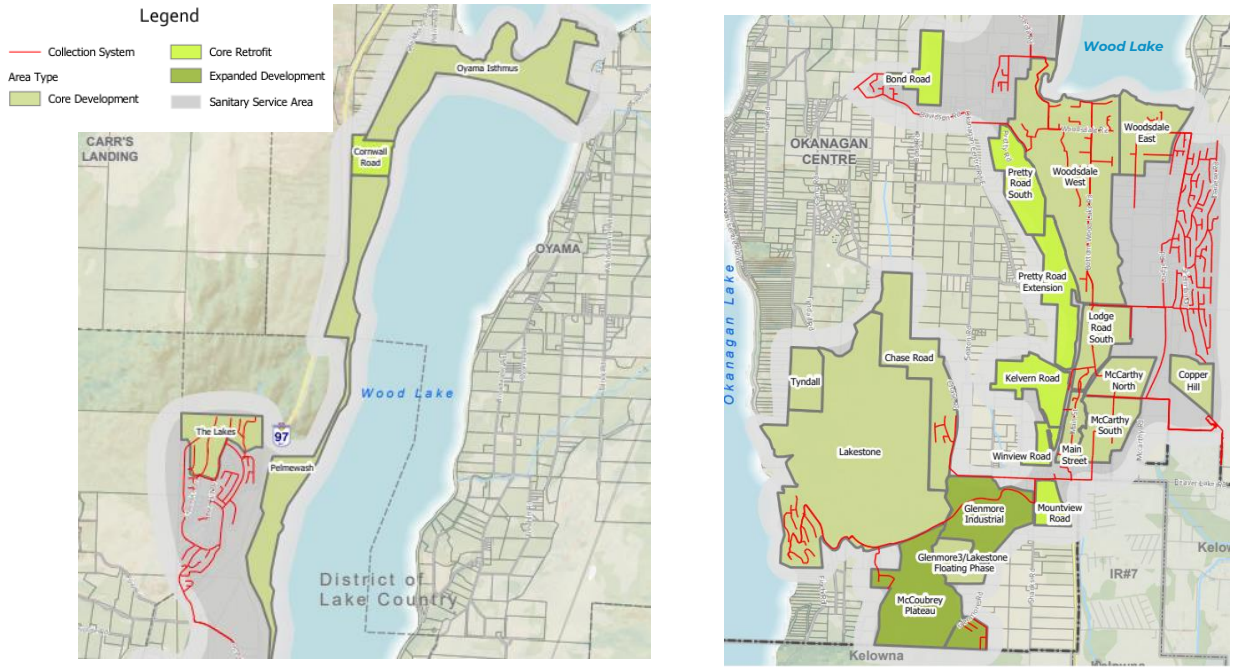


Figure 4: Sewer Area Boundaries

In addition to spatial growth projections in the two figures above, it is important for the reader to consult the District's Zoning Bylaw (includes amendments to 2021) which further reinforces the proposed sewer servicing direction, in that, there are no proposed areas of significant urban density outside of where sewer pipes and laterals will be.

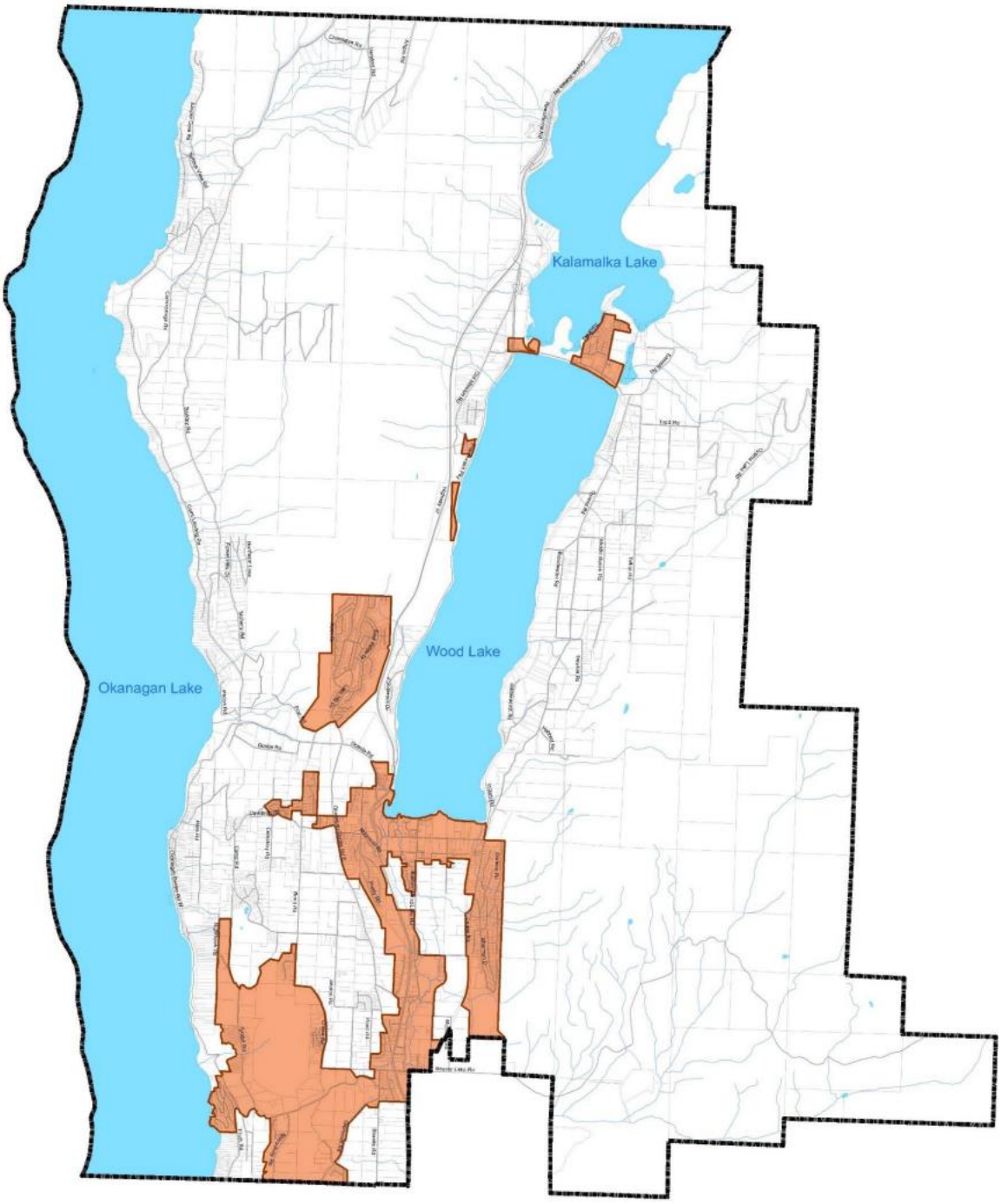


Figure 5: Urban Containment Boundary

The growth projections in Table 3 can be combined with historical loading to the wastewater treatment plant to estimate flows for a 20-year design horizon. A twenty-year design horizon is preferred for multiple reasons:

- Projecting the needs of a community beyond 20 years is difficult and often inaccurate.
- Facilities constructed for the future may not be useful for several years, with the result that facilities and equipment may lie unused for many years.
- Equipment becomes obsolete with time.

- Most mechanical equipment has a lifetime of approximately 20 years.
- 20 years lines up with the projections in the Official Community Plan.

Table 4 outlines the 20-year flow projections to be used throughout this plan.

Table 4: Twenty (20) - Year Flow Projections

Flow Scenario	Current	10-year Design Horizon	20-year Design Horizon
Annual Average Flow[1]	1,690 m^3/day	3,460 m^3/day[7]	4,460 m^3/day[7]
Maximum Month Flow[2]	1,950 m^3/day	3,720 m^3/day[7]	4,720 m^3/day[7]
Average Dry Weather Flow[3]	1,640 m^3/day	3,350 m^3/day[8]	4,330 m^3/day[8]
Maximum Day Flow[4]	2,180 m^3/day	3,950 m^3/day[7]	4,950 m^3/day[7]
Peak Instantaneous Flow[5]	3,456 m^3/day[6] (40 L/s)	8,640 m^3/day (100 L/s)	11,150 m^3/day (129 L/s)

(1) Average daily flow to plant during 2018 calendar year

(2) Daily average during highest volume month in 2018 (May due to precipitation and high groundwater levels, typically occurs in July/August)
(3) Used average daily value of September, October, and November months as assumed dry period
(4) Peak flow day during 2018 calendar year. Value reflects flooding event and is not typical
(5) Peak flow into Lodge Road lift station (modelled value for 10 and 20 year design horizons)
(6) Existing peak flow into Lodge Road lift station estimated at 39 L/s. Existing peak pumping rate is 40 L/s
(7) Current value plus projected average dry weather flow and inflow/infiltration for design horizon
(8) *Current value plus projected average dry weather flow only for design horizon*

The link between rising flows and growth in the community is readily apparent. Determining where and when sewer expansion occurs however is based on several guiding criteria including:

i. Lake health
ii. Customer affordability and timing of system renewal
iii. Development/infill
iv. Utility cost of service
v. Capacity of the treatment plant (staging)
vi. Risk management e.g., failing systems, aging infrastructure, soils, environment
vii. Proximity to existing collection infrastructure

A number of these criteria were key topics of discussion on sewer service expansion (to unserviced areas) during the public engagement process in 2017 for the Official Community Plan update, which was partly based on background analysis from Lake Country's draft Stage 2 LWMP report from January 2011. That report assessed 11 neighborhoods through a Kepner-Tregoe analysis including these criteria:

- Proximity to existing sewer (indicates cost feasibility)
- Number of new connections (indicates pace of progress)
- Estimated Cost (with number of connections, indicates cost feasibility)
- Environmental concerns (known, stated, or implied)
- Health Concerns (known, stated or implied)
- Desire by residents for service (indicates implementation and financing feasibility)
- Neighborhood age (indicates risk to environmental and health concerns)
- Potential for developer cost-offsets (indicates cost feasibility)

The results of the Kepner-Tregoe analysis were fed into the 2017 OCP through public workshops where Lake Country residents conveyed their thoughts, through survey and dialogue, regarding sewer service expansion to areas not yet connected to the centralized system. The discussions framed the sentiment of the community for both support or opposition, and for or against, sewer extensions. The detailed discussion led to the sewer area boundaries in Figure 4 and several policies (discussed in Appendix C) adopted in the Official Community Plan that have formal, Council approval and together guided the expansion schedule in Tables 3 and 4 of the 2022 LWMP. The neighborhoods selected then remain priority today based on the criteria of past analysis include Mountain, Bond, Pretty Road North, Pretty Road South, KelVern, Winview, and Oyama. These six neighbourhoods, plus the La Cresta area, were subsequently studied in 2015 including field assessments to determine the level of risk from inadequate on-site, private septic systems. Through a combination of hydrogeological modeling and surface water sampling, the study concluded that extending the wastewater system to these areas is required to reduce nutrient loading in downgradient surface waters, including Vernon Creek, a fish bearing stream (excerpts from the study are appended – Appendix C).

The timing of adding new customers has an impact on capacity at the plant. Figure 6 illustrates the rise in flows against the limitations of the infiltration system (which is the current method for returning cleaned water to the environment).

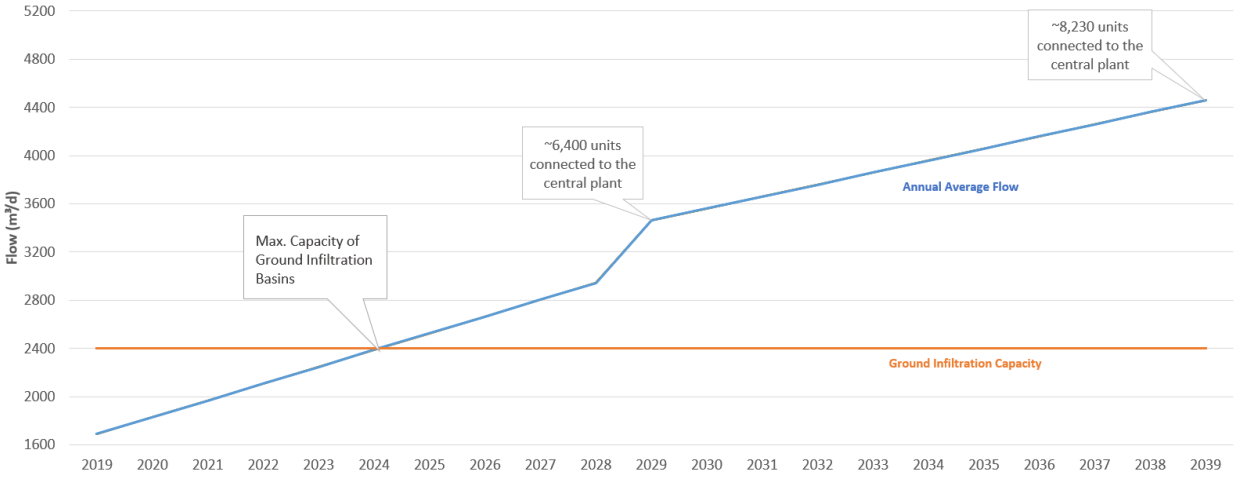


Figure 6: Growth of Flows and Limitations of Infiltration Capacity

With modest capacity enhancements, the infiltration capacity is estimated at 2,400 m^3/day which will be eclipsed by flows in the central sewer system by 2024 or 2025. These and other bottlenecks for handling growing flows in wastewater is often due to the size of collection pipes, capacity of treatment plants, and the limits of infrastructure for returning cleaned water back to the environment.

While reaching a ground-infiltration rate of 2,400 m^3/day has been reported in the past as feasible with modest improvements, the present-day capacity of the ground infiltration system is 2,000 m^3/day. Adjacent developments to the wastewater treatment plant and recent experiences by operations staff with the infiltration galleries strongly suggests that adding more flows to the ground is not feasible. At 2,000 m^3/day infiltration abilities, the takeaway from Figure 6 is that flows from new customers will exceed the capacity of the plant to treat wastewater for its return to the environment. These two topics are explored in detail throughout Sections 3, 4 and 5 of this report.

There must be management and control systems so that flows in the centralized system do not exceed what the pipes can convey. To date, the collection system has been operating well with no concerns of flooding or lift station surcharges/overflows. However, to accommodate future flows there must be capacity upgrades throughout the collection system. A recent study included hydraulic analysis to assess capacity for both current and 20-year flow projections to help outline needs for upgrades and enhancements. Results from the hydraulic analysis are summarized in Table 5 including a description of necessary projects and a phasing schedule. The total costs to complete these upgrades was estimated in that report at approximately $5.9 million. A detailed cost estimate for these works is included in Appendix B. Recent cost escalation warrants a larger contingency and a revised total estimate of the works at $8.9M. Further cost estimating will occur as design exercises unfold.

Table 5: Project Phasing

Year	Project	Potential Development Units [1]	Residual Capacity (L/s)	Notes
2020	Clement Lift Station	262	2	Upgrade pump capacity, refurbish piping
2022	Lodge Road Forcemain	786	11 [2]	Partial twin with 250mm, Lodge Road to McCarthy Road
	Lodge Road Lift Station (Stage 2)		1 - 10 [3]	Add third pump (3 @ 60hp) and upgrade electrical
2027	McCarthy Lift Station	2,444	n/a [5]	New lift station at end of roadway to collect flows from south of McCarthy Road.
	McCarthy Road Gravity Sewer		n/a [5]	New 300mm sewer along roadway from Bottom Wood Lake Road to station. Cap existing main north of road
2029	Seymour Lift Station	3,200	17 [5]	Upgrade pump capacity
	Seymour Forcemain		6 [5]	Upsize forcemain to 200mm from LS to Lodge Road. Note that it may be possible to utilize higher head pumps at the Seymour Lift Station to defer the need for upgrading the forcemain. For the purposes of this report, the forcemain upgrade has been allowed for to ensure the cost estimates provide the District with flexibility for the Seymour Lift Station upgrade.
	Clement Forcemain		54	New forcemain to Seymour catchment
2030	Jensen Road Gravity Sewer	3,383	21	Upsize 200mm to 300mm to accommodate future peak flows
	Lodge Road Gravity Sewer		40	Upsize 300mm to 450mm to accommodate future peak flows

(1) Maximum # of units that can be developed before project needs to be constructed

(2) Pressure constraint of existing forcemain limits flow to 50 L/s. Residual = 50-39 = 11 L/s

(3) Flow monitoring required to more accurately gauge peak flows into station

(4) Seymour upgrades must be constructed prior to development in Oyama

(5) Brand new service area and/or project

The implementation schedule, including funding plan, for the LWMP will include the upgrades outlined in Table 5. Overall, this section on managing flows outlined the needs, challenges, and infrastructure bottlenecks for present-day and 20-year flow projections. A key ingredient for this liquid waste management plan is to itemize the upgrades to facilitate the projected growth and to schedule the works in a way that achieve the goals of the community.

Collection System: Flow Management - <u>Volume Reductions/Water Conservation</u>

Indoor water consumption levels have direct impacts on wastewater flows and can be influenced significantly through water conservation plans and the promotion of sustainable water practices. Lake Country's *Water Conservation Initiative Study* is focused on reducing 2008 water demand levels by 25% by 2030 to align with targets set in the *Water Master Plan* (2012). While a significant portion of Lake Country's water consumption is used outdoors, the initiative recognizes the direct links between indoor consumption and strains on the wastewater collection and treatment system. As such, reductions in domestic indoor consumption remains a primary focus by way of the implementation of universal water meters to increase water conservation in all demand areas. Other initiatives are focused on education and public outreach and the potential for a tiered water rate to promote and reinforce the need to conserve water during peak periods. Figure 6 below shows water demand projections in Lake Country up to 2030 and incudes the targets set in the *Water Master Plan* as well the *Living Water Smart* provincial targets. By continuing on this trajectory, the District positions themselves well to reach their conservation target and simultaneously reduce strains on the sewer system.

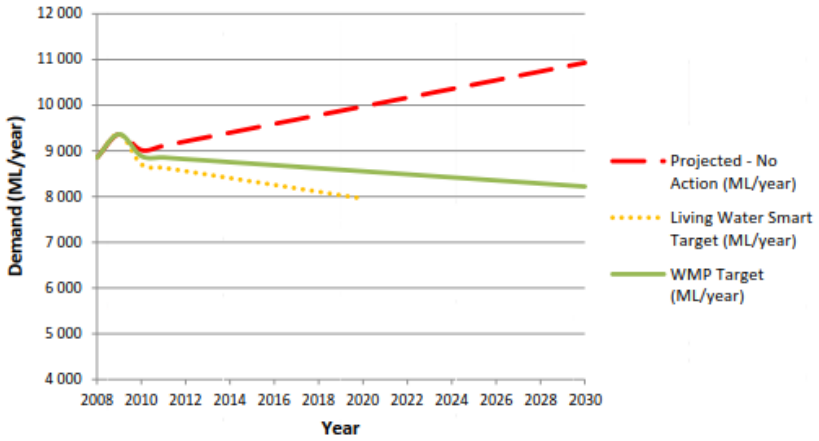


Figure 7: Water Demand Projections to 2030

Collection System: Flow Management - <u>Source Control</u>

Source controls are actions that are designed to limit the entry of harmful substances to the sanitary sewer and storm drainage systems. These substances are controlled because they threaten system operations and infrastructure as well as public and environmental health. Source controls work at the source, meaning where surface runoff or sanitary sewer originates, or at the tie-in of improper service connections, and can also take form of regulations for non-domestic discharges, among others. Currently, Lake Country employs several regulatory measures such the *Sanitary Sewer Regulation and Rate Bylaw* and the *Stormwater Management Bylaw* which each outline a series of prohibited substances from entering the sanitary and drainage systems, respectively. Moreover, the *Sanitary Sewer Regulation and Rate Bylaw* defines specific requirements for industrial and commercial sewer connections, expansions or changes which require approval from the District Engineer. When these regulations are coupled with ongoing water quality monitoring, the District can adapt and respond to changing source control needs by initiating targeted education outreaches or through Bylaw amendments when necessary. Lake Country will continue to address source controls as it has.

3.1.2 ONSITE RETURN SYSTEMS

In-Ground Septic Systems

Large parts of the District of Lake Country, including areas that cover about half of the population, use private septic fields to manage their wastewater. In most circumstances, these small systems function as intended and work well. Where they are working well and the risks to environment are manageable, then the use of septic fields can and should continue.

In select areas and with some types of systems, there can be challenges which contribute to liquid waste management. The challenges in these cases typically relate to improper design, lack of system management, maintenance, and oversight, or too many in-ground systems in a small area. Figure 8 illustrates a common septic system design which includes a septic tank and a drainage field.

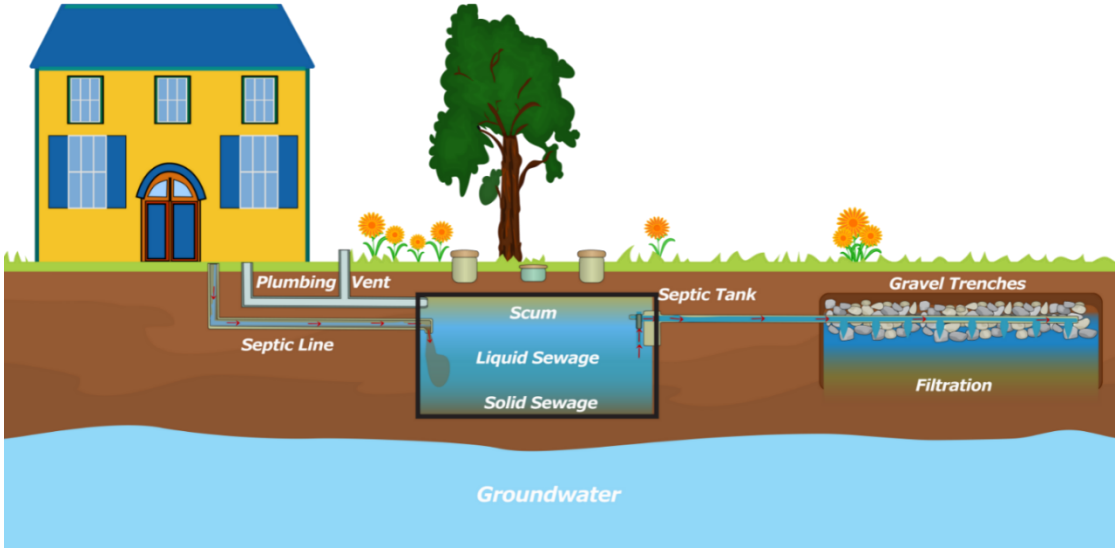


Figure 8: Common Septic System Schematic

Buildings without proper functioning septic systems are a barrier to Lake Country's aim *to borrow water wisely and return it safely.* To collectively safeguard the environment, private septic systems must be operated and maintained according to best practices, thereby reducing their risk to public and environmental health. A local report authored by BC ENV emphasizes the relationship between septic systems and water quality, specifically regarding phosphorus concentrations,

"*Reduction of phosphorus from septic tanks and agricultural sources would appear, from the analysis to date, to offer the most promise* [to meet water quality objectives] *in the near future".* (Phosphorus In The Okanagan Valley Lakes Sources, Water Quality Objectives And Control Possibilities, Ministry of Environment, 2005).

The LWMP can outline incremental tactics to improve septic system management primarily through education. There are thousands of septic systems in Lake Country including in Okanagan Centre, Carr's Landing, and the east slopes of Winfield. Most are not a concern. However, those systems which exhibit the following characteristics can pose risks to the environment and require homeowner diligence:

- Properties with small lots and older septic systems;
- Sites with a high groundwater table;
- Systems operating near a water body; and,

- Areas where soil conditions or other environmental features may be sensitive to cleaned water return.

All septic systems need ongoing maintenance and proper management within the District. However, Lake Country's role in septic system management is small when considering the regulations and authorities for septic systems including the role of the homeowner and responsibilities of the Province.

Septic Systems Regulations and Agency-Based Programs

Private sewer systems are regulated by two primary statutes in BC. There are no private *community sewer systems* (i.e., those with multiple connections who share a common facility) of concern in Lake Country but if there were, these would be regulated by the *Municipal Wastewater Regulation* (BC Reg. 87/2012 under the *Environmental Management Act*) or the *Sewerage System Regulation*. The *Municipal Wastewater Regulation* regulates the return of cleaned water from sewerage systems with discharges that are equal to or exceed maximum daily flows of 22,700 litres (22.7 cubic metres). Flow levels that are this high typically require multiple dwelling units including strata lots, which means the *Municipal Wastewater Regulation* is primarily intended for community system regulations.

The remainder of private systems fall under the *Sewerage System Regulation* (BC Reg. 209/2010, under the *Public Health Act*) which regulates:

- The construction and maintenance of holding tanks; sewerage systems that serve single family residences or duplexes;
- A combination of sewerage systems that service different buildings on a single parcel of land; structures that serve one or more parcels on strata lots or on a shared interest of land; and
- Sewerage systems or combinations of systems with a combined design daily domestic sewage flow of less than 22,700 litres (22.7 cubic metres).

The issue of improperly managed private septic systems falls under the *Sewerage System Regulation*. Construction, operation, and maintenance of private onsite systems through the regulation are the responsibility of authorized persons or homeowners, with supervision from authorized persons. There are currently no obvious regulatory mechanisms to provide assurance to Lake Country that private onsite systems are performing as designed and are not presenting unacceptable risks to public or environmental health. Systems regulated by the *Sewerage System Regulation* are filed with the Interior Health Authority, and Lake Country has limited information on the age, condition, and performance of these systems. Any reported issues with a private system are sent to Interior Health and actioned accordingly by them.

Also, the Okanagan Basin Water Board has initiated multiple programs, including the Sewage Facilities Assistance Grant, to support local governments and homeowners and other groups to steward a co-operative approach to managing septic systems through funding and policy initiatives in the Valley. Millions of dollars in grants to local government have been distributed to communities to support policies for lot-size minimums for new subdivisions that will use onsite septic systems, to support the infrastructure costs related to retrofits, and to enable upgrades to lower nutrients in surface waters.

While the Province carries the role of approvals and oversight for system effectiveness, and the Okanagan Basin Water Board helps to fund sustainable collection system and septic system practices, it is ultimately **a requirement of property owners** – the principal operators of their onsite wastewater treatment facility – to undertake the necessary education, maintenance, and financial steps to ensure its long-term effective use. In that way, Lake Country may continue to provide a complementary role to educate, offer tools and incentives, and promote compliance of septic systems. Stage 3 will explore District supported programs to encourage proper maintenance from local property owners.

3.1.3 PRIVATE SEPTIC SYSTEMS: STATUS AND NEEDS

Most residents in Lake Country would soundly agree that high-quality treated water is required to ensure the environment is protected, however, there can be a significant gap between homeowner knowledge and or financial and technical resources to manage their individual treatment systems. Maintaining a septic system to the required standards is an important responsibility. Septic system programs by local governments tend to be incremental in nature and focus on education and awareness followed later with some degree of policy and or standards through development permitting. Overall, the best practice is to take a risk-based approach so that the highest priority properties achieve the earliest, most advanced management to safeguard the environment. The LWMP ought to include highlights from the following best practices, common to leading organizations in Canada who steward the environment through effective septic system management. Two of these are listed here, which are deemed relevant to Lake Country.

1. Best Practice: **Focus education programs** that promote expected levels of maintenance and inspections for private systems. Additional tactics to improve education and awareness-building include:
    - Coordinate with the Regional District of Central Okanagan to share materials, notices, and inspection or enforcement programs.
    - Consider local certifications or informal designations that celebrate those homeowners who take proactive steps to ensure their system is managed according to the regulations
    - Develop marketing tools to clarify to homeowners that they are the principal operators of their onsite wastewater treatment system, and they are obliged to self-educate, coordinate inspections, conduct maintenance, and secure adequate funds for the renewal and long-term replacement of their unit.

2. Best Practice: **Refine regulatory tools** that encourage proper design and construction of private systems.
    - Continue to require all newly created lots to be serviced with an on-site sewer system to be a minimum of one hectare in size. Homesite severances comply with the Agricultural Land Commission Act are exempt from this policy *(as stated in the Official Community Plan)*.
    - Continue to require all development on existing lots that cannot connect to the community sewer system and are located within 100 metres of any water body to be serviced with a Type 3 on-site sewerage system *(as stated in the Official Community Plan)*.
    - Continue to prohibit the creation of new privately-run (community-sized) sewage treatment facilities *(as stated in the Official Community Plan)*.
    - Explore the requirement to refer the status or condition of some private septic systems, based on an inspection, to Interior Health Authority as part of the Building Permit process and tie an approved permit to a properly designed and functioning system. In extraordinary cases, this referral may cause the homeowner to complete a total upgrade of their septic system or require elevated treatment measures (Type 2 or Type 3) as required. The extent and cost of the upgrade is highly contingent upon the environmental conditions of the site and area.

While monitoring septic areas has been common in other communities, conventional monitoring programs have proved less than effective given their costs, large areas, and accuracy limitations. Similarly, any monitoring may be the responsibility of other agencies and above all, need not precede action of homeowners to effectively manage their systems. The practices above and other programming for septic systems are rolled into the preferred direction of the LWMP, outlined in Section 5.6.

3.1.4 SATELLITE SYSTEMS

Properties in Lake Country not connected to the centralized treatment plant or private septic systems are likely connected to one of three District owned satellite treatment plants. These two systems are in Carr's Landing and Oyama.

Carr's Landing

The two plants at Carr's Landing use septic treatment systems and return cleaned water to ground. System #1 services less than 30 properties along Carr's Landing Road near Nuyens Park, whereas System #2 services approximately 15 properties off Carr's Landing Road slightly south of Gable Beach Park. The opportunity to expand capacity at either of these locations does not seem feasible.

While both systems continue to operate as designed, recent monitoring demonstrates that biochemical oxygen demand (BOD) levels are higher than usual. The concern here is less around the adequacy of the treatment facility, but rather the type of liquid waste entering the system. These BOD levels motivate the need for continued monitoring and education to local system users on what is permitted to go down the drains. Because this is an operational concern, addressing higher levels of BOD in Carr's Landing is not included within the LWMP update.

Oyama

The Oyama satellite treatment plant is in the Trask Road area of Oyama and services less than 30 properties. This small community plant provides secondary treatment before returning cleaned water to ground through an infiltration gallery. If needed during an emergency situation, flows from this plant can be pumped and hauled via truck to the centralized treatment plant, therefore eliminating the need for process redundancy. Since its construction circa 2005, the plant has been operating efficiently with no known issues and should continue to be monitored until the core system expands to pick up the service area and nearby properties.

3.2 WASTEWATER TREATMENT AT THE CENTRALIZED PLANT

3.2.1 WASTEATER TREATMENT OVERVIEW

The substances found in domestic wastewater are typically consistent from community to community with few exceptions. While these substances are often regarded as contaminants or pollutants, many of them are nutrients/food essential for maintaining a healthy microbiological population within a wastewater treatment plant. Therefore, a balance of nutrients must be maintained throughout the system that satisfies the needs for plant operation while meeting regulatory requirements for cleaned water return. Key substances that a wastewater plant is commonly engineered to treat are summarized in Table 6.

Table 6: Commonly Treated Liquid Waste Substances

Targeted Substance	Description	Concentration in Medium Strength Wastewater
Biochemical Oxygen Demand (BOD_5)	• Measures how much oxygen is consumed by micro-organisms under controlled conditions over a 5-day testing period • This is the most commonly used parameter to quantify the organic strength of wastewater	200 mg/L
Total Suspended Solids (TSS)	• A mix of settleable and unsettleable particles suspended in a wastewater column • Solids removal is a key element of the treatment plant's operational efficiency	195 mg/L
Nitrogen	• Typically found in wastewater in the form of ammonia, largely produced in urine • Ammonia can be toxic to aquatic life and can impact algal growth, as can nitrates (biologically converted ammonia)	20 mg/L
Phosphorus	• In excess, phosphorus can cause excessive algal growth and concerns for aquatic life • Biological treatment or chemical dosing are primary forms of treatment	5.6 mg/L
Faecal Coliforms	• This group of bacteria is associated with the guts of mammals, and can be used to indicate potential contamination or the presence of other health concerning micro-organisms (e.g. polio virus) • Treatment is achieved through disinfection, typically by either chlorination or ultra-violet (UV) light.	10^4 to 10^6

Source for Concentrations: (Metcalf and Eddy, 2014)

Treatment requirements are dependent on the quality of untreated water arriving at the plant and the desired quality of cleaned water. The level of treatment is assessed in terms of the need to protect public health and the receiving environment and is typically determined through the regulatory quality requirements and the completion of Environmental Impact Study.

A treatment facility can have up to four levels of wastewater treatment.

Preliminary treatment includes screening large objects and removing heavy solids such as sand or gravel from the incoming liquid waste which can damage or interfere with subsequent treatment steps.

Primary treatment removes materials from the wastewater by means of settling. The primary treatment processes remove 30 to 50% of BOD_5 and TSS.

Secondary treatment relies on biological processes to oxidize the organic matter. Essentially, the process supports a community of micro-organisms that use the organic matter in the wastewater as a food source. Secondary treatment provides a removal efficiency of about 85% for carbonaceous biochemical oxygen demand ($CBOD_5$) and TSS. The standard in Canada is that all domestic wastewater treatment plants should treat to a minimum of a secondary standard.

Tertiary or advanced treatment refers to methods and processes that provide a higher level of treatment compared to secondary treatment. These systems are numerous and varied and may include nutrient removal processes and disinfection.

3.2.2 LAKE COUNTRY TREATMENT INFRASTRUCTURE: STATUS AND NEEDS

The District of Lake Country operates an advanced biological nutrient removal, centralized wastewater treatment plant which serves approximately 50% of its population via the centralized collection system. In addition to serving parts of the community connected to the sanitary sewer collection system, the centralized wastewater treatment plant also includes a trucked waste facility, which receives septage from properties of the Central Okanagan region. This septage is the semi-solid waste that is pumped from septic tanks. An overview of the plant's components are highlighted in Figure 9.

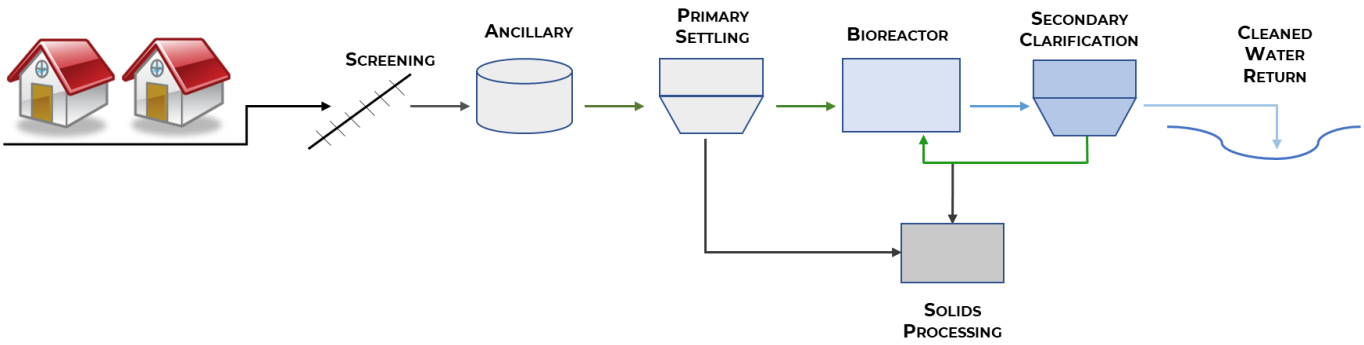


Figure 9: Components of the District of Lake Country's Centralized Treatment Plant

The functions of the components are summarized here:

Screening and Ancillary: remove plastics, odours, and inorganic substances such as sand and small rocks (preliminary treatment)

Primary Clarifier: settling the solids out of wastewater (preliminary treatment)

Bioreactor and Secondary Clarification: maximizing nutrient removal through biological communities and settling out solids to renovate flows into cleaned water

Solids Processing: dewatering solids for use in composting

An important element of this LWMP is to expand the plant to meet future flows from growth, and to enhance treatment systems to renovate water even further to meet the requirements of the receiving environment (beyond in-ground e.g., the current practice). The District of Lake Country has a history of providing extraordinary liquid waste treatment since the late 1990's that surpasses the minimum regulatory requirements. Lake Country's decision to build a biological nutrient removal plant 20 years ago largely contributes to the centralized system's complexity and ability to provide advanced treatment. The biological nutrient removal system provides high quality cleaned water for BOD and TSS, in addition to nitrogen and phosphorus removal. This is the same type of technology found in other treatment plants across the Okanagan Valley returning cleaned water directly to Okanagan Lake. Except for filtration and disinfection, today's treatment processes meet the same treatment and quality outputs as these other municipalities in the Valley. Many of these outputs and requirements are discussed in the following section.

3.2.3 LAKE COUNTRY TREATMENT INFRASTRUCTURE: REGIONAL SEPTAGE HANDLING

Lake Country sits at the north end of the Central Okanagan, but it plays an important role for the entire region. Septage pump outs from septic systems all over the region are collected from private properties and hauled to Lake Country's plant for processing. The materials are concentrated wastewater, much greater in solidity and impact than typical domestic flows, which must be managed and considered in long term plans. Approximately 15 million liters of septage is received at the plant annually, or 2.4% of the total flows. The effect of pump outs from hundreds of homes in the region is significantly more than the same number of regular homes connected to the centralized system. Yet, Lake Country has been able to manage the service well, through several key practices:

- Equipment that receives the septage are intertwined with the rest of the plant components which allows for one plant process, creating a simplified operational approach
- The service is designed and monitored like a partnership, where the District works collaboratively with the Central Okanagan Regional District
- Fees and funding are directly tied to known and measured impacts at the plant so that the costs of receiving the septage are borne by those who use it
- Modern asset management is undertaken to ensure the longevity and sustainability of the practice, whereby reports and assessments are completed cooperatively between both parties
- The operation has more than 10 years of practical, successful experience where troubleshooting (though rare) has established communication channels and a pattern of effective solutions.

Given the reliability and success of the program to date, this liquid waste management plan will propose to maintain the status quo for septage handling. Upgrades at the plant will incorporate the septage program in its design to allow for its continuance. No additional or separated costs for septage will be outlined in this plan, though they are expected as part of the service discussion between Lake Country and the Central Okanagan Regional District.

3.2.4 LAKE COUNTRY TREATMENT INFRASTRUCTURE: REGULATORY OVERVIEW

The *Municipal Wastewater Regulation* is the default regulation in BC for the management of domestic wastewater treatment, cleaned water return and reclaimed water use. The *Municipal Wastewater Regulation* was published in April 2012, and replaced the *Municipal Sewage Regulation*, which was initiated in 1999. The *Municipal Wastewater Regulation* covers cleaned water quality requirements for return to surface waters, ground, and reclaimed water use, along with treatment system redundancy requirements. Each of these requirement-areas is explored further, below.

Cleaned Water Quality Requirements

The quality requirements for cleaned water return are defined and compared in Table 7 for Class A cleaned water (i.e., returned to-ground) and the criteria dictated by Okanagan Lake, should this be the preferred return location. These are considered default requirements that must be confirmed through an Environmental Impact Study, which may indicate quality criteria should be more, or less, stringent than the qualities summarized in Table 7. When multiple return locations are included in a liquid waste strategy with different quality criteria, it is common for communities to treat to the most stringent requirements. There are also additional requirements that must be considered in the case of water reclamation, which are defined herein.

Table 7: Cleaned Water Quality Requirements

Parameter	Quality Requirement (Class A Cleaned Water)	Okanagan Lake
Flow Criteria	N/A	Effluent discharge rate > 50 m^3/d with a lake surface area ≥ 100 hectares.
$CBOD_5$	≤ 10 mg/L	≤ 10 mg/L
TSS	≤ 10 mg/L	≤ 10 mg/L
Faecal Coliforms	≤ 2.2 MPN/100 mL (median) ≤ 14 MPN/100 mL (maximum)	≤ 50/100 mL prior to return
Turbidity	≤ 2 NTU (average) ≤ 5 NTU (maximum)	N/A
Ammonia	N/A	Safe for fish health
Nitrogen	≤ 10 mg/L as nitrate ≤ 20 mg/L as total nitrogen	≤ 10 mg/L[1]
Total Phosphorus	N/A	≤ 0.25 mg/L, annual average
pH	N/A	6 - 9

When releasing to a lake, the *Municipal Wastewater Regulation* also indicates that the edge of the *initial dilution zone* must be located at least 300 m away from recreational areas, domestic or agricultural water intakes, and any sensitive area requiring protection, as directed by the BC ENV. For reference, the *initial dilution zone* is a defined area around a point of discharge where mixing between the effluent and receiving environment occurs. Some degradation in water quality is expected within that zone but it is confined accordingly.

Redundancy Requirements

The *Municipal Wastewater Regulation* stipulates that a qualified professional must determine, based on an Environmental Impact Study, which reliability category applies to a wastewater facility. For each reliability category, Part 3 of the *Municipal Wastewater Regulation* stipulates redundancy design requirements for major unit processes. Redundancy adds flexibility to the plant and better allows for shutdowns for maintenance or repairs. Redundancy can also reduce the risk of insufficient cleaned water quality from leaving the treatment plant.

There are three reliability categories defined in the *Municipal Wastewater Regulation*:

1. **Category 1** facilities are those for which short term effluent degradation could cause permanent or unacceptable damage to the receiving environment.
2. **Category 2** facilities are those for which permanent or unacceptable damage to the receiving environment would not be caused by short term effluent degradation but would be caused by long term degradation.
3. **Category 3** facilities are those that do not fall into Category 1 or 2.

Based on available information, it is assumed that potential options for returning cleaned water back to the environment will fall into the reliability categories outlined in Table 8.

[1] 6 mg/L is the stated requirement by the *Municipal Wastewater Regulation*, however, operational certificates list 10 mg/L to accommodate winter conditions and plant treatment levels

Table 8: Predicted Reliability Categories for Identified Discharge Options

Discharge Option	Reliability Category
Continued discharge to ground, with or without pumping groundwater	Reliability Category II
Discharge to Okanagan Lake	Reliability Category I

Reclaimed Water Requirements

Reclaimed water systems use cleaned water from wastewater treatment plants as their source to offset the demand of potable water. Reclamation emerges in the LWMP because of the local interest in reclaimed water. Vernon's spray irrigation program began more than 40 years ago,

The *Municipal Wastewater Regulation* indicates four quality requirement categories for water reclamation, based on the risk to public health and/or the environment, with higher quality requirements in cases where the risk is greater. The risk categories and quality criteria are summarized in Table 9 and range from the highest risk category (Indirect Potable Use) to the lowest risk category (Lower Exposure Potential).

Table 9: Quality Criteria – Reclaimed Water Categories

Parameter	Quality Requirement			
	Indirect Potable Use	Greater Exposure Potential	Moderate Exposure Potential	Lower Exposure Potential
$CBOD_5$	≤ 5 mg/L	≤ 10 mg/L	≤ 25 mg/L	≤ 45 mg/L
TSS	< 5 mg/L	≤ 10 mg/L	≤ 25 mg/L	≤ 45 mg/L
Turbidity	≤ 1 NTU	≤ 2 NTU (average); ≤ 5 NTU (maximum)	Not applicable	Not applicable
Faecal Coliforms	< 1 CFU/100 mL or < 2.2 MPN/100 mL (as median of 5 consecutive samples)	< 1 CFU/100 mL or < 2.2 MPN/100 mL (as median of 5 consecutive samples); Maximum of 14 CFU/100 mL	100 CFU/100 mL (as median of 5 consecutive samples); Maximum of 400 CFU/100 mL	200 CFU/100 mL (as median of 5 consecutive samples); Maximum of 1,000 CFU/100 mL
pH	Site specific	6.5 to 9	6.5 to 9	6.5 to 9

These parameters are highly instructive as to the water quality needs to meet a given use. The summary below better explains how to put the scientific parameters into practice e.g., into the field.

Indirect Potable Use is the highest standard of reclaimed water identified in the *Municipal Wastewater Regulation*, as the end use is seen as being of greatest risk. The Indirect Potable Use risk category would apply to reclaimed water which is being used to replenish a potable water source for broad applications (though still not for drinking purposes).

Greater Exposure Potential is the second highest standard of reclaimed water identified in the *Municipal Wastewater Regulation* and is defined as a use where public contact with the reclaimed

water is likely, or where there is a risk to the receiving environment. In addition to the quality requirements outlined in Table 9, this category of reclaimed water also requires treatment to remove viruses.

Moderate Exposure Potential is the third highest standard of reclaimed water identified in the *Municipal Wastewater Regulation* and is defined as a use where public contact with the reclaimed water is likely to be minimal, or where public access to the reclaimed water is restricted and the users are educated as to the risks associated with reclaimed water. The risk to the receiving environment is also considered to be moderate, because of the intended use. In addition to the quality requirements outlined in Table 9, there may be additional quality requirements, monitoring and access restrictions, depending on the use of the reclaimed water.

Lower Exposure Potential is the lowest standard of reclaimed water identified in the *Municipal Wastewater Regulation* and is defined as a use where public access is restricted, and users are unlikely to encounter the reclaimed water. The uses are intended to be commercial or industrial in nature and the users must be educated with respect to the risks associated with reclaimed water. With respect to the receiving environment, there must be a low risk. In addition to the above quality requirements, as with the moderate exposure risk, worker contact should be minimised, with additional disinfection being required to ensure a maximum faecal coliform concentration of 14/100 mL in cases where frequent worker contact is expected.

For all three exposure categories (Greater, Moderate and Lower), the *Municipal Wastewater Regulation* indicates that a total residual chlorine concentration of 0.5 mg/L is to be maintained at the point of use unless there are risks to fauna/flora or if it can be proven that adequate disinfection was achieved before distribution.

Although the BC ENV has jurisdiction over the *Municipal Wastewater Regulation*, the local health authority must be notified of the intent to use reclaimed water, as there is a provision in the *Municipal Wastewater Regulation* for the local health authority to authorise (or not) the use of reclaimed water.

The Reclaimed Water Guideline was published in 2013 (BC Ministry of Environment, 2013). The intent of this guideline is to serve as a key reference and guidance document for the use of reclaimed water in BC. The guideline covers several aspects of reclaimed water use, including potential uses and tools.

Treatment Quality Summary

Table 10 provides a comparison of the present-day treatment quality at the Lake Country plant against the requirements for plants returning cleaned water to Okanagan Lake, and other surface waters with less stringent quality requirements. The results of this comparison demonstrate that Lake Country competes with top quality treatment plants in the Valley. Any treatment technologies used by these municipalities and the District are among the top treatment processes that balance practicality and costs. Additional steps to enhance the treatment process (and output quality) includes the implementation of disinfection and filtration equipment and the replacement, duplication, and upgrades of system components to satisfy capacity, quality, condition, and redundancy requirements.

Table 10: Treatment Requirements for Various Return Environments

Parameter	Lake Country	Plants Returning to Okanagan Lake	Typical Plant in BC
$CBOD_5$	10 mg/L max	10 mg/L max	45 mg/L max
TSS	20 mg/L max	10 mg/L max	45 mg/L max
Ammonia	Full ammonia removal	Full ammonia removal	Treatment not usually required
Nitrate	Full nitrate removal	Full nitrate removal	Treatment not usually required
Phosphorus	0.25 mg/L total P	0.25 mg/L as total P	If needed, 1 mg/L total P max
Faecal Coliforms	Currently not required as discharge to ground	50/100 mL before discharge	If needed, 200/100 mL at the edge of the initial dilution zone – i.e. about 100 m away in the receiving environment, after release and dilution

3.2.5 PHASE 4 AND PHASE 5 UPGRADES: CAPACITY AND COMPLIANCE

Lake Country's treatment equipment has recently been assessed based on capacity (20-year design horizon), condition, cleaned water return quality requirements, operational concerns, and degree of redundancy required for each reliability category by the *Municipal Wastewater Regulation*. Table 11 outlines the equipment processes that will need to be replaced, duplicated, or upgraded based on the assessment and consultation with District of Lake Country operations. The prospect of returning cleaned water to Okanagan Lake is incorporated in this table, given the limitations of the present method of in-ground disposal.

Table 11: Equipment Processes to be Replaced, Duplicated, or Upgraded based on 20-Year Design Horizon

Item	Upgrade Rationale			
	Regulatory-Based Redundancy	Age/Condition	Capacity	Effluent Quality
Replace Influent Sewage Screen		☑		
Construct Additional Primary Clarifiers	☑		☑	
Replace Original BNR Mixers + Pumps		☑		
Construct Additional BNR Trains	☑		☑	
Construct Additional Secondary Clarifier	☑		☑	
Add Tertiary Filtration				☑
Add Disinfection				☑
Replace DAF Unit		☑	☑	

Item	Upgrade Rationale			
	Regulatory-Based Redundancy	Age/Condition	Capacity	Effluent Quality
Upgrade Dewatered Solids Storage		☑		
Replace Septage Rock Trap		☑		
Equalize Flows			☑	

The outcomes of this analysis demonstrate that regardless of the return location (i.e., ground, surface water, etc.) a series of treatment processes must be upgraded, replaced and/or duplicated to satisfy regulatory requirements and continue the protection of public and environmental health. An in-depth description of each component's needs can be found in the 2020 *Treatment Upgrades – Centralized Plant,* appended to this report. Of particular interest are two large (relative to current plant size) capital projects proposed to occur sequentially beginning in 2021 (Phase 4) and completed in 2025 (Phase 5).

These two projects accomplish two important objectives:

- Produce cleaned water that will be compliant with the water quality requirements for return to Okanagan lake, which is evaluated herein as the preferred return location for the long-term,
- Update treatment processes and equipment to meet modern regulations for redundancy

Table 12 itemizes the upgrades for each component as part of Phase 4 and Phase 5. Phase 4 works were initiated in 2021 and were centered on increasing capacity for future flows from growth, increasing redundancy to meet modern regulations. Phase 5 is centered on meeting water quality requirements to return cleaned water to the environment via an outfall to Okanagan Lake. The baseline components of the Phase 4 and Phase 5 upgrades are summarized in Section 5.4.

Table 12: Phase 4 and Phase 5 Upgrades

Phase 4 Upgrades	
i. Biological Nutrient Reactor 3 (expand capacity)	ii. Sewage headworks screen (upgrade)
iii. Secondary Clarifier 2 (redundancy)	iv. Septage rock trap (replacement)
v. Filters & Tertiary Treatment (water quality)	vi. Dewatered sludge bin enclosure (replacement)
vii. Environmental studies & permitting	viii. Existing Biological Nutrient Reactor Replacements
ix. Contingency	
Phase 5 Upgrades	
a) Pipeline and Outfall (design and construction)	b) UV (water quality)
c) Primary Clarifier 2 (redundancy + capacity)	d) DAF (capacity)
e) Primary Clarifier 3 (redundancy + capacity)	f) Equalization (capacity)
g) Biological Nutrient Reactor 4 (redundancy + capacity)	

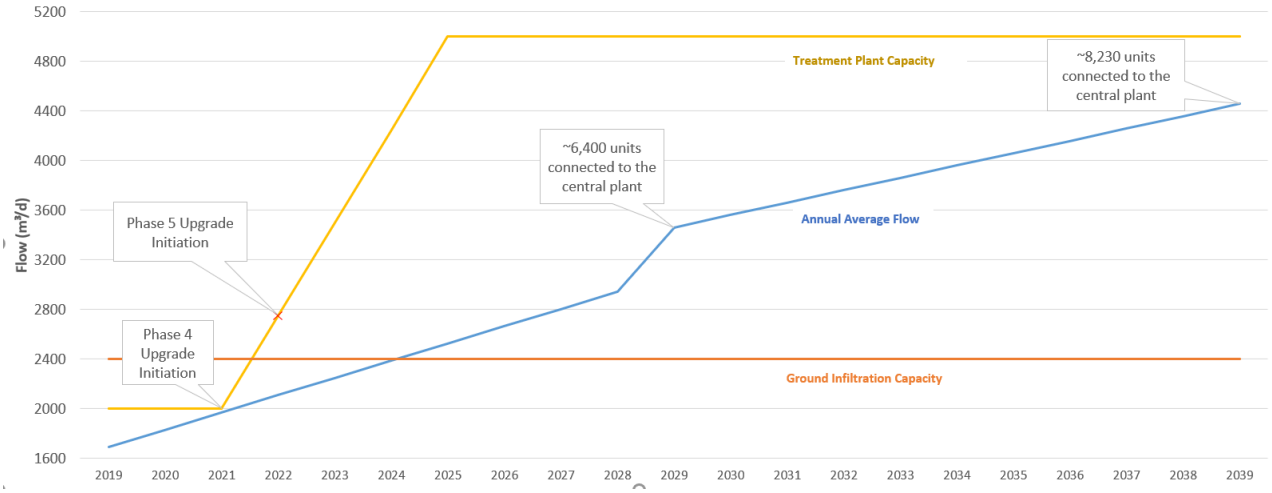


Figure 10: Growth of Flows and Limitations of Ground Infiltration and Treatment Plant Capacity

Figure 10 is a modified version of Figure 6 (previously, above), now including the capacity of the wastewater treatment plant through both the Phase 4 and Phase 5 upgrades (yellow line).

Past studies pointed to the need and feasibility to add one more infiltration gallery. However, recent challenges with the galleries suggest that more flows could lead to less reliable infiltration rates thereby raising the risk of spillover. Plans for Phase 4 and 5 do not include adding infiltration galleries, however the additional redundancy and greater effluent quality will serve to maximize the capacity of the existing galleries.

Project funding is briefly described in Section 5.6 and will be expanded upon in the Stage 3 report.

3.3 RETURN WATER

Municipal sanitary sewer systems collect liquid waste flows, treat it to meet the prescribed standard, then take select steps to safely return the treated water back to the environment.

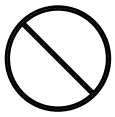
3.3.1 LAKE COUNTRY RETURN WATER INFRASTRUCTURE: STATUS AND NEEDS

Current Practice

Lake Country's method for returning cleaned water back to the environment includes specialized galleries (look like geometric ponds) which overlie engineered and natural materials where the flows infiltrate into the soil. Ground-return is a fairly common practice in small communities, but this method tends to hit a threshold for growing communities where some or all the approach becomes inadequate due to soil limitations and space constraints (larger plants require a lot more land).

That threshold is known in Lake Country and is quickly approaching due in part to the following limitations of in-ground return at the site:

Limitation 1: Pre-determined Capacity of the Soil: *Mother Nature* leaves a unique footprint at every site. The layers of rock, sand, topsoil, and mixed layers generate a maximum rate of infiltration. Lake Country monitors this rate continuously and has decades of data to aid in projecting when the flow from the plant exceeds the capacity of the soil.



Limitation 2: Blind-Off: When microbiological colonies and other sediments set up on the surfaces in between the soil grains, this reduces the size of the space between them, constraining flows. The blind-off occurs at depth making restoration very challenging.

Limitation 3: Activities on Neighboring Properties: The plant is situated off Beaver Lake Road, adjacent to active, mixed-use properties. As the land and soils surrounding the plant site are disturbed, there are impacts to underlying soil conditions, which typically do not neatly conform to property lines. New buildings, deep excavations, converting natural soils to impervious surfaces, and underground pipe works all play a moderate but cumulative role in shaping the carrying capacity of the soil.

The existing infiltration system is reaching capacity as today's flow rates, at select times, exceed the limits of what the soil can receive. As the centralized collection system grows, the increasing flows of cleaned water will quickly exceed the soil's capacity on a regular basis. There is no desire to add in-ground capacity beyond 2,000 m^3/d and recent excavation works at neighbouring properties that have altered soil conditions signaling that the galleries are at their maximum rate.

Adding hydraulic pumps to enhance infiltration is another option that has been considered to maximize in-ground return, to prevent elevated water tables, and to promote temporary sub-surface storage in times of drought or between seasons. In this scenario, the pumped groundwater must be directed to a safe return location. Because of the difficulty controlling substances entering the groundwater from other sources (e.g., runoff), this presents a risk of pumping excessive organic matter (not from the cleaned water) and/or nutrients (i.e., nitrates) from the groundwater to the final return location. Returning extracted water to a surface source, such as Vernon Creek, has been ruled out due to the potential water quality risks. However, the use of groundwater extraction as part of a reclaimed water system should be pursued further as part of future feasibility studies for a non-potable irrigation supply system using cleaned water.

Overall, the combination of gradual blind-off in the pores, increasing flows from new customers, nearing the pre-determined capacity of the soil, and the surrounding threats to soil capacity make ground disposal an interim, but not complete option, for returning cleaned water to the environment. An alternative method for returning flows must be confirmed in this LWMP as the treatment plant is upgraded to accommodate flows, starting in 2024/25.

Alternatives

Safely returning water to the environment requires careful study, which Lake Country has extensively conducted over the last 8 years. The alternatives for expanding return water capacity are outlined here.

- **Direct Return to a Water Body:** Studies have considered the environmental health of numerous surface waters and their risk and ability to safely accommodate the return of Lake Country's cleaned water. Surface waters explored through this analysis include:
    - *Wood Lake, Duck (Ellison) Lake, Vernon Creek:* The BC ENV stipulated these three options as non-viable due to existing concerns around lake/creek health.
    - *Okanagan Lake: A*ll other major communities in the Okanagan return their treated water to Okanagan Lake (or a direct tributary) by researching the receiving environment and selecting locations that can safely accommodate flows. Decades of data in and around the existing outfalls (e.g., Kelowna, Summerland, West Kelowna) offer a glimpse into the sustainability of this practice and underscores the robustness that comes with continuous monitoring. Like any other community, if water quality trends in the environment warrant higher levels of treatment, then a plan would be

made to enhance treatment processes further, and the equipment added in due course.

- **Additional In-Ground Sites:** Studies confirm that the current site is preferred and that there are no other feasible alternatives, to the North/South or East/West of the current plant or viable options for expansion. The rated capacity of the galleries today is 2,000 m^3/d, which is considered the long-term sustainable rate for the site given current conditions. These restrictions are the outcome of the combined in-ground return limitations presented above.
- **Collaborative/Partnership Approach:** One approach explored in 2019/2020 considered maintaining current operations, maximizing in-ground return, and sending remaining, untreated liquid waste overflows (> 2,000 m^3/d) to the City of Kelowna for treatment and return, to Okanagan Lake. Relative to the other options being explored, the upfront costs to establish a partnership with the City of Kelowna and build the necessary infrastructure as a long-term treatment solution was unfeasible. However, there is potential for the City to provide some temporary relief to the District by receiving treated flows on an interim basis until Phase 4 and 5 upgrades are complete. The interim nature of this approach is backed by Kelowna's short-term spare capacity while growth occurs from the Duck Lake Industrial Park area through to the City's treatment plant. Overall, some consideration to partnering with a public utility for operations, ownership and maintenance has been considered but this does not yield alternative locations for cleaned water return to Okanagan Lake.
- **Reclaimed Water:** A handful of communities in BC employ reclaimed water often in the form of irrigation for agriculture. While it is rare that reclaimed water is their primary method to return cleaned water to the watershed, all communities have a suitable back-up to the reclamation system, typically in the form of an outfall back to a large water body. In the northern part of the province, industrial uses for water reclamation focusing primarily on the supply of water for oil/gas exploration are more common. A handful of communities work with living environmental systems e.g., wetlands to return water to the environment, but their popularity is low for a variety of reasons. Overall, reclaimed water requires a suitable land base (the water must be beneficially reclaimed), willing customers, and an additional infrastructure to store, monitor and convey the supply to the users. Yet, if reclaimed water users cease or decrease their demands, the reuse approach must also be accompanied by a long-term reliable method to return water to the environment such as an outfall to a lake. Vernon, one of the handful of communities in BC who employs reclaimed water for most of its flows, relies on its outfall to Okanagan Lake from time to time, and measures water quality as it occurs. Their approach has more than four decades of history but is challenged at times to find adequate customers (demand) to meet their annual volume of reclaimed water (supply).

The transition to a lake outfall with or without reclaimed water will involve new, more stringent requirements for safely returning water to the environment. With respect to setting new requirements for water quality, an Environmental Impact Study allows a qualified professional to assess conditions and recommend water quality standards for any flows returned to receiving environment (e.g., Okanagan Lake).

3.3.2 ENVIRONMENTAL IMPACT STUDY: OVERVIEW

An Environmental Impact Study is an important and required component to assess the environmental risks and benefits associated with any proposed location to return cleaned water. In the case of a LWMP, an Environmental Impact Study is used to determine the level of impact a receiving environment may experience from the return of cleaned water to mainstem lakes. An Environmental

Impact Study that indicates no undue harm on the environment would be pivotal for moving forward with three initiatives: continuous treatment of the community's domestic wastewater, system expansion into neighborhoods relying on aging in-ground disposal systems and the acceptance of septage from the general area into the LWMP.

Okanagan Lake is being considered amongst the short list of options for the safe return of cleaned water back to the environment. To determine if Okanagan Lake is a suitable return location, an Environmental Impact Study was initiated in Summer 2020 to assess baseline environmental conditions and anticipated impacts at preferred outfall locations, situated along Finch Road, as shown in Figure 11. While multiple locations of an outfall are depicted on the map below, they are all situated within one general area which encompassed the study.

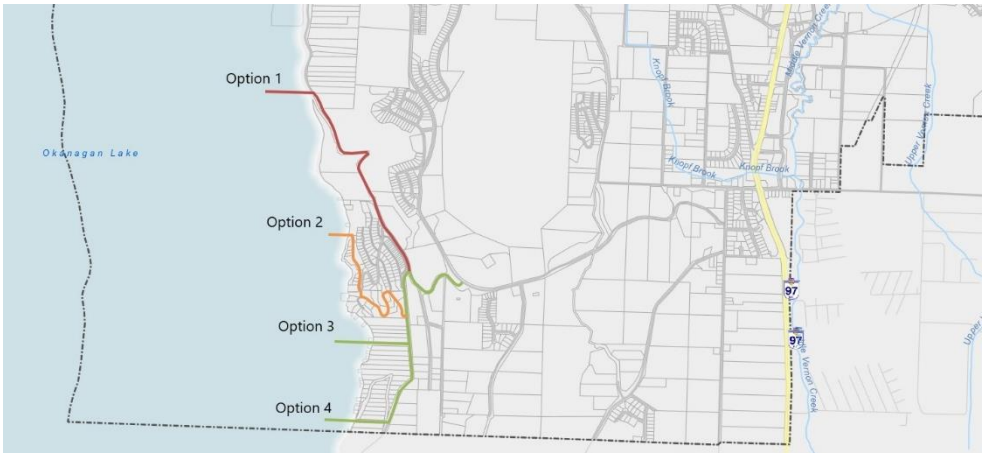


Figure 11: Area of Study for the Outfall

The components of the Environmental Impact Study are multi-fold and include:

- Assessing the risks associated with the proposed outfall locations and associated infrastructure.
- Characterizing the receiving environment including seasonal hydrological conditions, locations of sensitive areas, etc.
- Characterizing the pre-discharge environmental baseline conditions including benthic community data, minimum available dilution, water quality parameters, etc.
- Assessing the environmental impact of returning cleaned water to Okanagan Lake.
- Evaluating the cumulative effects on Okanagan Lake including water and sediment quality, and environment and human health.

To support these components, the Environmental Impact Study includes monitoring of the following items, primarily monthly from September 2020 till December 2021:

- Bathymetry of the outfall region (completed August 2020)
- Thermistor line (hourly)
- Water currents mapping
- Dissolved oxygen, temperature, and conductivity profiles
- Water chemistry at various depths, including nutrients, bacteria, total and dissolved metals and other parameters of interest (pH, chloride, hardness)
- Algae samples at various depths
- Sediment cores (single test)

- Survey of potential outfall pipeline route and aquatic macrophytes (completed January 2021) by remotely operated vehicle

A detailed summary of the monitoring program including parameters and scheduling are provided in Appendix D-1 (Environmental Impact Study for Return to Okanagan Lake Update) and Appendix D-2 (Environmental Impact Study – Updated Terms of Reference)

The investigation of current tributary inputs and other community discharges into Okanagan Lake indicate that any inputs from the District of Lake Country will be low in volume compared to these other sources. Additionally, the quality of the cleaned water produced by the District of Lake Country will be equivalent to that produced by other communities directly discharging to Okanagan Lake such as Kelowna, the Regional District of Central Okanagan and Summerland.

The results from the EIS support the continued consideration of Okanagan Lake as a viable option for the safe return of cleaned water to the environment.

3.3.3 RESULTS OF THE ENVIRONMENTAL IMPACT STUDY

The Environmental Impact Study included a robust monitoring program which generated significant data including bathymetry, remotely operated vehicle (underwater route inspections) results, and multiple water quality parameters collected monthly. Ongoing monitoring will deepen the breadth of data already provided and may yield both: a) assurance that return to Okanagan Lake is a suitable long-term option and b) whether to augment treatment methods down the road.

Overall, the Environmental Impact Study identifies that cleaned water return to a deep outfall in the proposed location (study area off Finch Road) is an appropriate low-risk installation and this method of return can be deemed a safe way to return water to the environment.

3.3.4 CONCEPTUAL REVIEW OF WATER RECLAMATION

Water reclamation is about using the water as a resource more directly such as distributing the cleaned water return across various properties, typically via irrigation systems. There are opportunities for industrial reuse, such as potable water substitution for concrete, manufacturing, construction, or oil and gas activities, as a complement to a slightly more common method of direct use on farms or large fields.

Lake Country is a mixed-urban community with large areas of land dedicated to both suburban and agricultural land uses. Parks and sports fields are coveted reclamation locations too given the desire for green, well-maintained fields throughout the summer (though exposure of treated effluent to public areas will warrant higher water quality requirements, education, signage, and specialized scheduling). Farms situated near to the wastewater treatment plant, or the outfall return line, create an opportunity for reclamation so long as customers emerge who demand the water. It is important to note that BC regulations require a municipality to have a 100% redundant method to safely return water to the environment other than its water reuse system.

Scale of Water Reclamation

Water reclamation on farmland requires detailed consideration to multiple factors, such as: the type of irrigation system of the land holder, their crop, the soil requirements, and the weather. Years with above normal precipitation or years where smoke clouds out the sun can warrant lower demands. Farms with drip irrigation systems, a best practice for potable water users, tend to use 50% less (or more) than traditional overhead spray guns. Overall, any water reclamation system requires detailed appreciation

of the customers and their needs as their demand characteristics fluctuate, while the supply (from cleaned water) remains relatively fixed based on the flows from the centralized system.

In 2021, the average daily flow to the plant is about 1,900 m^3/day, or about 700,000 m^3/year (700 megaliters). For the average crop in the Okanagan in an average year, the irrigation demand is estimated between 0.6m to 0.7m per year (of depth). Although these estimates are highly preliminary, securing up to 990 hectares of land, or nearly 2,500 acres, would provide for reclamation of nearly all wastewater flows. This is a very large area of farmland that would require a network of pipes and systems, but it has been accomplished in select communities. As the total annual flows increase with time and new customers, the total land base would expect to rise with it.

When considering feasibility of substituting reclaimed water for irrigation, it is important to note that most potential customers in Lake Country already have a suitable, cost-effective potable water option from the local water utility. A feasibility plan to reclaim water must focus on customer needs and interests, weigh the economic considerations, and would require a comprehensive outline of the present and future potential areas for a reclamation system.

Figure 12 illustrates the lands between the wastewater treatment plant and the proposed outfall location (EIS study area) in Okanagan Lake. The dashed line illustrates the general route to convey treated water to the lake, but more study is planned on the preferred route to get from the plant to the outfall location. Various sized farmlands and a few parks surround the proposed outfall line. Land areas have not been estimated for these sites primarily because that estimate is only one factor of many to assess feasibility.

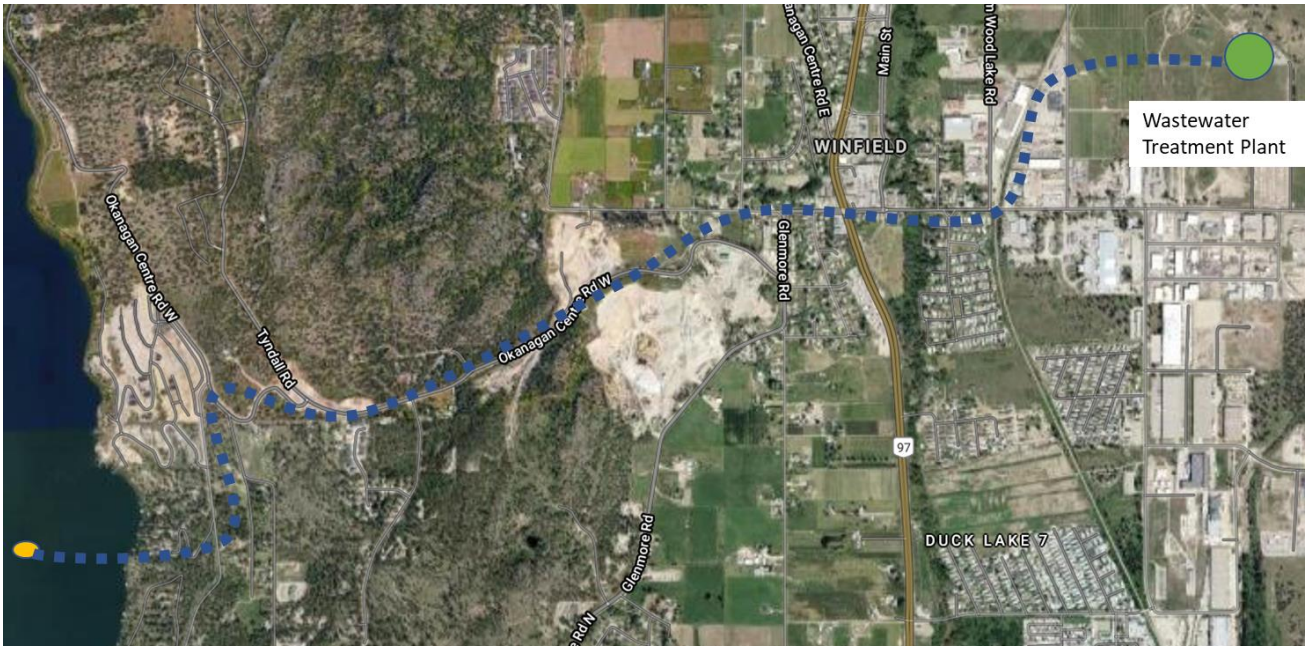


Figure 12: Potential Conveyance Route and Outfall Location

If water reclamation is a preferred method of return, then a detailed assessment including engagement with future customers will instruct how and where to situate future infrastructure. It is critical to prove feasibility and long-term water demand security before investing tens of millions of dollars in new pipes to connect to unconfirmed properties.

Discussion of the Potential for Water Reclamation

Lake Country's need for a suitable, long-term method to return cleaned water to the environment via deep lake outfall does provide for the opportunity to introduce water reclamation. Properties located along or near to the outfall route who meet the regulations and guidelines could become customers to a water reclamation system. At this time, it would be important to consider the following approaches which guide how to effectively establish a reclamation system and its customers:

- Pursue District-owned parks and or school-hosted sports fields as a priority customer
- Expect, initially, to reclaim a minor portion of the treated flows in the summer creating an on-demand reuse system, rather than expending the effort to treat and store throughout the off season (a full-year approach may be pursued if the number of customers and their irrigation needs match the annual supply volume).
    - Note: discharging to ground (current system) and pumping from ground to the reclamation system could provide some reservoir relief, however this should be evaluated through a regulatory and water sustainability lens.
- Confirm customer interest prior to putting pipes in the ground
- Price reclaimed water so that there are incentives to use it over potable water (unless policy leads to the requirement e.g., Bylaw, that some customers must use reclaimed water)
- Pursue clusters of customers where a dense suite of pipes can be utilized by multiple properties
- Seek out non-irrigation customers, such as industry (including within City of Kelowna lands), to capture better water revenues (industrial water rates are often much higher than agricultural) and to complement other reclamation opportunities
- Engage golf courses and commercial irrigation uses such as nurseries and landscape suppliers which tend to cover smaller land areas but still require large volumes of cleaned water
- Confirm approval from the Ministry for any reuse including adequate environmental study to confirm that reclamation is indeed beneficial and safe for the properties and the overall watershed
- Utilize policies and bylaws to mandate water reclamation in rare instances and rely more on the economics of water supply and demand to create lasting benefit to user and the utility

There is potential for most of these approaches in Lake Country. It will be critical to conduct the appropriate planning so that any investments in water reclamation yield an appropriate return on that investment.

3.3.5 EMERGING SUBSTANCES OF POTENTIAL CONCERN

The accompanying Environmental Impact Study (Appendix D-1) discusses a range of parameters, with a focus on substances that are relatively simple to monitor. Traditionally, the focus on pollutants and substances which could cause a concern to public health and the environment has been based on substances which could coat fisheries substrates (e.g. suspended solids), impact dissolved oxygen concentrations (e.g. biochemical oxygen demand), cause nutrient enrichment (e.g. nitrogen and phosphorus) and cause illness or disease (e.g. enteric pathogens). These substances are typically found in elevated concentrations in domestic wastewater and are relatively easy to treat by standard wastewater treatment processes. In addition, the negative impacts to human health or the environment are typically as a result of the high concentrations, with the risks being substantially decreased after treatment.

Over the years, there have been significant achievements for standard wastewater treatment processes to address these traditional pollutants. This has contributed to the shift in focus to

more subtle contaminants which are, in comparison, found in low concentrations, are challenging to treat and can still have the potential to cause adverse impacts despite being present in ultra-low amounts. These are loosely named "emerging substances of potential concern" and consist of a wide range of different substances which are ever increasing in number through progress which is made in research and understanding.

The vastness of this subject can start to be understood by considering one family of these emerging substances of potential concern. Per- and polyfluoroalkyl substances (PFAS) are a range of chemicals that are found in a vast number of products, including stain repellents, adhesives, paints, fire-fighting foams, food packaging, personal care products, non-stick cookware, etc. They are extremely stable compounds and can persist and accumulate both in the human body and the environment. These substances have the potential to cause impacts to human health and the environment. More than 6,300 different PFAS have been documented, and this list continues to grow. This is just one example and does not consider intermediate products that are produced during treatment/biodegradation.

Analysis for emerging substances of potential concern is challenging, given the wide range of substances which would be included in the search, coupled with the fact that these substances are often present in very low concentrations. Management of these substances for any community, regardless of that community being as small as the District of Lake Country, is overwhelming.

With the magnitude of emerging substances of potential concern and with the issues being world-wide, the approach for management has been global rather than local. In addition, as this is still an emerging subject, activities tend to be research-based rather than implementation-based. The approach continues to be consistent across the globe – to develop a better understanding on the origins of these substances, the potential effects to human health and the environment, to develop appropriate and repeatable testing and analytical protocols, and to understand if there are treatment options and, if so, are these treatment options reasonable both from the practical and financial point of view.

Many of these substances are difficult to treat. Therefore, while treatment may be considered, the approach of banning and replacing with alternatives, or education on appropriate disposal are all more preferred options. This approach is more reasonable and aims to eliminate the presence of these substances in our water systems via the sanitary sewer system. In Canada, the Federal government has led direction on the management of substances. For example, the use of the endocrine disrupting substance nonylphenol and the use of microbeads in cosmetic/cleaning products have both been banned while alternatives are regularly looked into and supported by industry, academia and regulators. Education is the focus for pharmaceuticals, with disposal though pharmacy programs rather than the sanitary sewer system.

Analysis is also challenging due to the variable nature of the different substances, their presence in low concentrations and the ability to access routine sampling at a reasonable cost through commercial laboratories. As much of the information on these substances is emerging, analysis can still be focused within research institutes and specialised research laboratories.

To summarize, the subject of emerging substances of potential concern is not one which is just limited to a local government level. This is a complex issue and is being dealt with on a global level, with direction being led by senior levels of government. Many of these substances require

direction to be set globally or, at the very least, nationally. As our understanding of this subject is still evolving, much of the information available is currently being produced at the research-level. In addition, there are a vast number of substances that fall into the category of being of potential concern. This results in highly complex situations at the local level with respect to monitoring, treatment, and analytical approaches with a lack of clear guidance for municipalities.

Still, Lake Country intends to take a supportive roll to this topic by committing to consistent contributions to the Okanagan Lake Collaborative Monitoring Program. This includes support for the Ministry of Environment and Climate Change Strategy in monitoring for select emerging contaminants of potential concern at locations and at a cost to be determined in the future. Later, if the regulations are to change, Lake Country remains committed to meeting or exceeding any requirements for cleaned water quality as its return to the environment, including any proven and necessary works to treat emerging substances of concern.

3.4 BIOSOLIDS

Waste solids are produced as part of the wastewater treatment plant process and may be called sludge or biosolids. Sludge is defined as the remaining organic solids which results from treating liquid wastes. Lake Country, in part through the OgoGrow service arrangement, is committed to producing *biosolids,* which render the materials safe for reuse. The management of sludge and biosolids/biosolids products is regulated by the *Organic Matter Recycling Regulation*.

3.4.1 LAKE COUNTRY BIOSOLIDS INFRASTRUCTURE: STATUS AND NEEDS

The excess solids produced at the centralized wastewater treatment plant are dewatered mechanically and then trucked to the Kelowna-Vernon composting facility where OgoGrow, a Class A compost is produced. The waste solids are fermented prior to dewatering, which is a process that both acts to reduce vector attraction and produce VFAs for biological phosphorus treatment. In addition to serving parts of the community that are connected to the sanitary sewer collection system, the centralized wastewater treatment plant also includes a trucked waste facility, which receives septage from the Central Okanagan region. On receipt, the solid portion is separated from the liquid portion by mechanical dewatering (centrifuge) and trucked along with the rest of solids to the OgoGrow facility. The liquid portion is blended with the incoming domestic wastewater from the community collection system and is treated at the centralized wastewater treatment plant, prior to discharge to ground.

Once at the Kelowna-Vernon facility, the dewatered solids are blended with wood waste and other incoming dewatered excess solids. The Kelowna-Vernon facility operates under the Organic Matter Recycling Regulation, and the District is required to sample their dewatered solids, as directed by Kelowna-Vernon. The Class A compost produced is used throughout the region to enhance plant growth as a soil supplement.

Throughout 2020, just over 2,000 dry tonnes of material were hauled from all participating communities to the OgoGrow facility. Most of the material received at the site comes from the City of Kelowna and Vernon. While the OgoGrow program has had generally strong uptake over its lifespan, there are emerging concerns about the supply and demand imbalance and that more customers and land areas are needed to keep pace with the amount that is generated. Periodically, excess material has been diverted to landfill sites and land application projects, in

accordance with landfill operational authorisations and Land Application Plans under the Organic Matter Recycling Regulation. In these cases, the District continues to be a provider of the material and is not the holder of the authorisation for the landfill operation/closure plan or the Land Application Plan. As such, the District acts under the direction of the authorisation holder in aspects such as quality testing.

Lake Country's primary aim with biosolids is to secure a long-term agreement with the owner-operators of OgoGrow and to support the supply-demand balancing required for effective reuse of the materials.

3.5 STORMWATER

The management of liquid waste is an integrated exercise that is often influenced by other major utility works and land use planning. For this reason, stormwater management is a key consideration in any liquid waste management plan and commonly shares overlapping synergies focused on public health and environmental protection.

3.5.1 LAKE COUNTRY STORMWATER INFRASTRUCTURE: STATUS AND NEEDS

Stormwater management in Lake Country is an opportunity to protect water quality from non-point source pollutants, lessen impacts to property damage due to runoff, reduce soil erosion and protect public safety. For these reasons, Lake Country continues to make investments and build systems and policies that protect these at-risk areas from uncontrolled stormwater and focus efforts around managing where stormwater flows, and its quality.

Stormwater Management: Hydraulics

Lake Country has two major drainage basins with runoff going to either Okanagan Lake or Wood and Kalamalka Lake. Areas contributing flows to Okanagan Lake contain a mixture of urban and rural development with agricultural lands and undeveloped areas, where significant runoff events are rare but are a concern due to potential damages to private property and municipal infrastructure. Alternatively, the Wood and Kalamalka Lake catchment is made up of several sub-basins, some experiencing extreme runoff events due to heavy and rapid snow melt and face long-term threats of even greater runoff due to pine beetle deforestation and wildfires. Other sub-basins in the catchment are urbanized, include a major provincial highway, experience rural residential development, contain agricultural land, and account for some undeveloped areas. Here, the stormwater impacts are diverse and range from surface water ponding to groundwater challenges and deficient infrastructure.

The diversity of runoff characteristics and behaviour in Lake Country means a one size fits-all solution is not applicable. In some areas it makes sense to sink as much stormwater as possible into the ground, while other areas require diversion to more accommodating landscapes e.g., when bedrock is encountered or areas not traditionally ready to accept in-ground flows e.g., grassland hillsides. For this reason, it is important for both the District and private property owners to understand how stormwater flows on their property and how to best direct it without causing undue consequences to neighbouring properties and infrastructure.

Stormwater Management: Quality

When stormwater flows along the surfaces of our communities, it can pick up a range of contaminants from fertilizers to the oils found on roads and other paved surfaces. These pollutants can be carried by stormwater runoff and eventually make their way into local watercourses and lakes. This is why source control measures become a popular practice in municipal policy to protect the health of the public and environment.

Figure 13: Okanagan Lake

There has been significant interest in enhancing lake health in the Okanagan for a variety of reasons including recent algal blooms, flooding, including sudden, large freshets and higher-than-normal lake levels, historic water quality challenges stemming from septic systems, and many other issues that originate within and well outside of our local government boundaries. While the locations of the source can vary, research has landed on the causes and these are well founded in Okanagan literature, namely:

1. **Fertilized Landscaping** and/or Agriculture, along shoreline areas. Where agriculture fertilization is required, it should be intercepted with planted native riparian vegetation and should not exceed the needs or capacity of the land and crops.
2. **Runoff from high intensity agricultural lands.** Site specific runoff controls (e.g., at high-capacity dairy-oriented farms) coupled with natural or engineered treatment systems to enhance water quality.
3. **Failing septic systems** near shorelines and adjacent streams or aquifers. Where onsite treatment systems are required near the shoreline, the level of treatment should be high (e.g., Type 2 or 3) and the discharge field should be located outside of the flood zone (among other design considerations).
4. **Wetland restoration** or additional wetlands with treatment to intercept stormwater prior to discharge into mainstem lakes.
5. **Riparian area management** and approvals including modern tactics for subdivision, development, and local drainage bylaws. Riparian crossings require special attention to address water quality and water quantity.
6. **Wake erosion,** especially specialized power boats that disturb lakebed sediments and release nutrients to a water depth of 8m, or more.

Agricultural issues tend be complicated issues that require a diverse suite of practices and tools, along with collaboration among various senior government ministries and related agencies to resolve. Enforcement of the Agricultural Environmental Management Code is critical too. In cases of water quality concern from agriculture, Lake Country will have limited powers, but they are often driven to advocate for new approaches to enhance water quality among a range of parties. Wake erosion has some similarities to agricultural runoff, because the District is largely unable to affect change unless other communities take a cooperative stance and contribute to solutions. Whereas riparian area

management has more depth and breadth of tools in Lake Country, each other source of non-point source pollution will require policy development and strategy to affect change. The LWMP ought to initiate these concepts.

Master Drainage Plan

In response to various stormwater management challenges, Lake Country undertook a Master Drainage Plan (the Plan) in 2015 to create an inventory of existing drainage works, identify associated issues and challenges, and suggest strategies to help manage run-off in a cost effective and environmentally sound way. The goals of the Plan are to:

1. Add to the inventory of drainage infrastructure systems and map them with geographic information systems.
2. Identify natural drainage areas (current and historic) for an improved understanding of how water flows through public and private property.
3. Document existing and potential drainage problems and identify tentative solutions for future action steps.
4. Identify and record existing groundwater problem areas and review stormwater management strategies with respect to ground disposal e.g., infiltration infrastructure, compared to use of other options.
5. Minimize environmental and water quality impacts, and where practical, enhance the environment and water quality.
6. Identify options for improved policies, procedures, and bylaws to protect public and private property and the environment from negative impacts of surface water and groundwater.

The plan lists several actions taken as part of the study to support the goals listed above, as well as a suite of future actions and recommendations to help continue to manage stormwater in a cost-effective manner that reduces public, private and environmental risks. Future actions and recommendations of the Plan include:

- Establishing bylaws and policies to address drainage problems and promote the re-establishment of historical drainage courses.
- Identify impacts from climate change and develop strategies to address problem areas.
- Identify potential impacts from pine beetle infestation deforestation and wildfires to develop strategies to address problem areas.
- Perform assessments to identify manmade hazards such as major watermains, sanitary sewers and force mains, and storm conveyance structures and determine potential impacts from failure.
- Create a financial strategy to address outstanding problems and priorities and set out a framework for addressing potential problem areas.
- Integrating the stormwater management plans into the LWMP update.

Other ways stormwater is managed in Lake Country is through the District's Subdivision and Development Servicing Bylaw, and Stormwater Management Bylaw which outline construction specifications for storm drainage systems, and requirements to protect and maintain drainage infrastructure, respectively. These bylaws in combination with the Official Community Plan require development to manage stormwater by accommodating drainage on site and contributing funds for necessary stormwater systems and upgrades where needed. These policies help to protect pre-development drainage conditions and manage changes in hydrology due to development.

Select recommendations from the Master Drainage Plan, particularly those with a focus on water quality protection, are summarized in this LWMP. A few additional strategies and requirements are also included to make even further progress with respect to non-point source management and water quality objectives.

3.6 SYSTEMS CONDITIONS SUMMARY

Section 3.0 outlines the conditions, challenges, and needs for short-term and long-term liquid waste management in Lake Country across the five core technical topic areas. By creating a broad understanding of what is at stake and what needs more attention, the report can transition towards future systems and the investments required to achieve the values and principles of the project. Section 4.0 corrals the context of Section 3.0 plus the present-day conditions for liquid waste to establish the list of issues (a key outcome of the Stage 1 and 2 report). Technical options for liquid waste management arise from the list of issues so that the investments proposed have direct links to where we aim to get better. These options underwent public feedback and thorough evaluations so that their performance can be assessed relative to each other and positioned for decision making. Feedback from the outreach and engagement is presented in Section 5.0.

The plan concludes with engagement results and technical summaries to establish the plan direction. This combination of technical rigour and listening to the public for their interests in a vision for the service is the hallmark of a completed LWMP.

4.0 LIQUID WASTE ISSUES

Lake Country has a 25-year history with liquid waste management and has achieved important milestones, such as: expanding the centralized system, continuing use of ground infiltration galleries, incremental improvements to stormwater management, and treating wastewater to a very high standard, like other communities in the Okanagan that return cleaned water to Okanagan Lake.

The 2022 liquid waste management plan accepts the local history and aims to expand the levels of service and outcomes to even greater standards. Getting better at liquid waste management requires strict attention to the issues and concerns being faced. Section 4.0 is a critical piece to the Stage 1 and 2 report because it is the basis for problem solving, and in turn, establishing plan direction.

4.1 CONSOLIDATED LIST OF ISSUES

The list of liquid waste issues emerges from a thorough process lasting many years (both inside and external to the LWMP) with ongoing observation and inquiry, and a desire by Lake Country to improve service delivery. Part of the local story includes the long list of technical reports commissioned by Lake Country to deepen the understanding of concerns, challenges, and solutions for liquid waste management. Each historic report is available to the public on the District's website.

The need for changes to the current liquid waste treatment and return process largely comes from impacts of adding new customers and expanding the centralized system. However, several considerations and legislative requirements must be satisfied, consulted, and approved of before moving ahead with alterations to the system. These factors add new needs for liquid waste management and ultimately steer the final LWMP.

Lately, via this LWMP, the District has worked with the community to round out the list of issues to incorporate the perspectives and ideas from residents so that the list of issues is inclusive of both technical and public views.

The challenges and their associated levels of significance in liquid waste management planning are summarized in this section. This list of primary topics is presented here as it was in Section 1.0 for quick reference. A more complete list of issues and challenges is provided in Appendix E.

Table 13: Short-List of Heightened Issues for Liquid Waste Management in Lake Country

Issue	Need
Limitations with in-ground capacity to return cleaned water	• Implement a more reliable, safe method for long-term return of cleaned water to the environment • Decide on whether to maintain some level of in-ground return to limit direct release to the lake
Costs and scheduling of collection system expansion and preparing residents, neighborhoods, businesses, and new buildings for how and when the new pipes will be installed	• Confirm that Lake Country will continue with the locations and sequencing of sewer retrofit and core area expansions as outlined in Official Community Plan • Implement funding strategy including grant applications to cover program costs
Long-term compliance at the wastewater treatment plant	• Upgrade existing units to extend their life in a cost-effective manner • Implement Phase 4 and Phase 5 with approval from BC ENV • Ongoing compliance with District's Operating Certificate and other environmental requirements
Understanding and managing non-point source pollution, primarily through stormwater management	• Enhance stormwater management techniques to meet current and future responsibilities to safeguard water resources
The uncertainty and imbalance of supply and demand for biosolids	• Secure a long-term agreement with the owner-operators of the OgoGrow program • Contribute resources (time, people, small funds) to improve the supply-demand issues
Meeting the balance of costs and funding to achieve the LWMP and deliver reliable, cost-effective services	• Create and follow a detailed implementation plan including financing and metrics for assessing performance
Challenges with balancing risk and funding to maintain service delivery targets	• Regularly review and update asset management plans including priority-setting frameworks for capital upgrades and adopting specialized policy as needed (keep with current practices)
Climate change and its impact on water quality, water supply and demand, and reliable service delivery	• Integrate climate change adaptations throughout all areas of this plan • Monitor conditions regularly and prepare the public and elected officials for costly adaptations as they emerge
Managing both, the extraordinary work to collect, treat and return liquid waste, and listening to the needs and interests of stakeholders.	• Hearing from all interest groups during the process and preserving strong relationships with our service partners • Consideration to a liquid waste advisory panel who supports ongoing implementation of the Plan

These primary issues cover a broad range of topics that must be managed in the LWMP. In some cases, an issue may be a very tangible one, like an asset that needs to be larger. In those instances, the LWMP will need to define a **project** for resolution. For other topics or issues, the challenges may relate to the behaviors and practices of the utility, the public, and users of the liquid waste systems. In these instances, the municipalities employ **programs** whereby there is a list of activities and outcomes in mind with a corresponding list of resources to ensure they can be accomplished. In other areas, the issue is rather absolute, and we need to draw a line for what is acceptable and allow the projects and practices to follow suit. In these cases, we define **policy** areas, rules, or regulations. The implementation of policies tends to be low cost for the LWMP itself but can have cost impacts to other parties as they interact with the new requirements. Distinguishing needs into projects, programs and policy help direct actions for these issues which are specified in greater detail for each of the issues identified in the comprehensive list of issues that is appended.

The list of issues can appear large. But many of these issues are not new and Lake Country has decades of experience and 20+ years of positive results in dealing with nearly all of them. As per the LWMP guidelines set out by BC ENV, presenting the issues transparently affords all audiences to weigh on specific topics which contributes to the problem-solving process. This open planning process with the public serves to open multiple avenues for participation but also depicts the breadth of the issues.

4.2 CLIMATE CHANGE IMPACTS AND CONSIDERATIONS

Climate change creates an array of challenges and issues across the Okanagan (and elsewhere) including wildfire, drought, flooding, and various pressures on aquatic habitats and ecosystems. Projections for climate change suggest that conditions will worsen over time. A recent report by the Central Okanagan Regional District, *Climate Projections for the Okanagan Region (February 2020)*, point to three times as many days above 30°C by the latter half of this century as well as longer, warmer growing seasons (among other conditions). The impacts of these projections on liquid waste management vary but generally include those in Table 14.

Table 14: Challenges and Management Themes for Climate Change and Liquid Waste

Challenge	Management Theme
Storm and precipitation variability, including more rainfall events throughout the year (except for summer) plus greater intensity and more frequent large-scale events	**Stormwater Runoff**
Earlier runoff and shifting seasons which can strain reservoirs and create more demand for irrigation, especially if additional growing seasons are added	**Reclaimed water**
Warmer lake temperatures and changing water quality conditions	**Treatment standards** **Lake Health**
Greater drought and flood potential	**Ecosystem strain** **Nutrient loading to Lakes** **Use of in-ground storage for reclamation**
Changing watershed conditions from changing ecosystems	**Ecosystem health**
Expanded infrastructure to adapt to various conditions	**Service sustainability** **Additional funding**

These issues can become critical at any time and are best addressed through proactive measures. It is important to initiate some climate change adaptation tactics within the liquid waste management plan, and to regularly review the effectiveness of any programs to ensure that the LWMP is a constructive tool in Lake Country's quest to adapt to a changing climate. Those elements of the LWMP that contribute directly or significantly to adapting to climate change are referenced in Section 5.6 which outlines the preferred direction.

4.3 TRANSITION TO DEVELOPING SOLUTIONS

The presentation of the long list of issues is a milestone in the process. From here, the LWMP transitions to solutions and developing ideas and opportunities for how to address the issues. The principles, drivers, and best practices for managing the environment emerge as helpful guides from here.

5.0 LWMP SOLUTIONS

A long list of issues and ideas is part of what guides any plan to manage liquid waste. This section itemizes and evaluates the solutions that emerged from past studies and through the recent engagement process. It is important to identify criteria and principles when generating lists of solutions. Sections 5.1 and 5.2 focus on common liquid waste management principles and strategic criteria which can be used to both generate and evaluate the accompanying long list of solution ideas.

5.1 LWMP – MANAGEMENT PRINCIPLES

The LWMP is guided by social, environmental, and economic factors. In addition to meeting regulations, the LWMP also articulates the community's vision for dealing with liquid waste and protecting the environment. Some common management principles for the LWMP include:

- Seek to *right-size* new infrastructure to suit present and future needs.
- Consider levels of service and how they vary across wards and neighborhoods.
- Search out the best available technology for achieving the desired goals.
- Apply the user-pay /developer-pay principle in the assessment of costs.
- Recognize that stormwater runoff can contribute to pollution and manage both water quality and quantity accordingly.
- Recognize the impact of climate change and greenhouse gas emissions when developing options for existing or future processes.
- Ensure all efforts are made to facilitate public engagement and community support.
- Ensure that options are based on rigorous scientific principles.

5.2 LIST OF IDEAS AND OPPORTUNITIES

The list of issues was generated early into the process, and each topic matured as the engagement process unfolded. Generating ideas starts with the issues and often can be traced back to three sources:

- **The public and other stakeholders** who provided their input throughout the process,
- **Staff and Council** who are intimately familiar with the assets and systems and regularly listen to and respond to residents of Lake Country,
- **Other municipal partners** or other communities who can share ways (both proven and unproven) to handle liquid issues and the best practices to consider when creating plan direction and effectively implementing it.

The type of idea depends on the issue it is trying to solve, and many liquid waste challenges require an array of solutions including projects, new standards, regulations, policies, and/or programs to address them effectively. While long lists of issues can seem too large to tackle, the act of creating the list is a widely accepted practice to stimulate creative thinking and to allow for more inclusive engagement. Table 15 itemizes the preliminary ideas gathered through the plan process.

Table 15: Liquid Waste Management: Long-List (unfiltered) of Ideas

Collection System	• Provide more education, incentives and or regulations for septic system maintenance • Instead of Official Community Plan schedules, expand collection system to all properties except agriculture • Pursue carbon neutral sanitary sewer operations	• Pursue heat recovery or energy capture for sale or reclamation by large users • Instead of serving new customers as they emerge, stop all new development • Transition to composting toilets in some or all areas
Treatment Plant	• Instead of treating all 20-year flows, send all flows to Kelowna • Instead of treating all 20-year flows, send only the flows above 2,000 m^3/day to optimize the current plant • Exit the service of receiving trucked waste	• Create a partnership/agreement with another public utility to run the plant • Make significant investments in water quality monitoring • Use reverse osmosis and eliminate all particles of concern from wastewater • Use natural areas to treat liquid waste. • Add a publicly owned sani-dump
Return Water	• Return all flows (100%) to Okanagan Lake in a safe manner • Return all flows (100%) to an alternative surface water i.e., not Okanagan Lake • Continue ground return, incrementally add-on water re-use, and send remaining flows (only) to Okanagan Lake	• Find new ground return lands • Treat to potable standard and pursue 100% reclamation • Consider potable substitution (partial reclamation) for flushing toilets, residential lawn watering and industrial uses • Pursue reclaimed water program with irrigation and parks as prime customers
Biosolids Reuse	• Mandate safe use of OgoGrow at all publicly owned lands • Create Lake Country's own composting program including new customers • Explore gasification and energy development e.g., convert biosolids to heat/power	• Sell dried biosolids to industry for energy development • Buy upper watershed lands and study how to integrate OgoGrow into source protection planning and wildfire control • Create long-term agreement with regional or private service partners
Stormwater	• Direct worst runoff to sanitary treatment plant • Add more natural areas as interface between built and sensitive environments • Add more materials to the list of regulated/banned substances	• Slow it, spread it, sink it, including landscaping standards and rain barrels • Increase road sweeping and add more best practice technologies e.g., oil-grit separators • Find and evaluate the health of all storm outfalls

Linking ideas and issues to create the preferred direction is an important part of the planning process. Not all ideas or opportunities can be implemented on their own, and there is a large degree of interconnectedness among the solutions. For example, a water reclamation system triggers certain upgrades to the treatment plant to meet the water quality standards for a given use. This interconnectedness is handled in three main ways:

1. **Assessing the feasibility** of any option (e.g., reclamation, Okanagan Lake, Wood Lake etc.)
2. **Reviewing for relevancy** e.g., whether the core needs for liquid waste (collection, treatment, return, biosolids, and stormwater) are impacted and require attention
3. **Projecting the effectiveness** of the proposed options over 20 years through evaluation based on local values.

The remainder of Section 5.0 is applies these concepts – connections and feasibility between technical parts, meeting core needs, and performance evaluation - to arrive at the preferred direction for Lake Country's LWMP.

5.3 FEASIBILITY SCAN FOR OPTIONS DEVELOPMENT

A feasibility scan uses a few critical lenses to eliminate low-prospect ideas from further consideration. For liquid waste management, we consider the drivers and history in Lake Country and settle on three specific feasibility criteria:

1. Not supported by District's Obligations e.g., regulations, Official Community Plan, or legal. This means, if selected, there would be undue conflict with one of the previously made commitments.
2. Previously studied and deemed presently infeasible. This means, Lake Country understands the root of the idea and sees some merit in it; yet, it has been explored (locally or elsewhere) and found to be not worth pursuing.
3. Ideas that are not Best Practice among other municipalities but may be future consideration. This means, that this idea hasn't caught on elsewhere and while it appears noteworthy, it is not ready to be implemented, but the District should keep an eye on how effective it is over time.

The ideas that remain from Table 15 are put forward for further evaluation in Section 5.4, while those that have been eliminated are listed below.

Table 16: Eliminated Liquid Waste Management Ideas

Criteria	Explanation for Why the Idea was not Pursued
Not supported by Lake Country's Local Obligations e.g., regulations, Official Community Plan or legal	• **Expand collection system to all properties except agriculture.** *This concept is not an example of Smart Growth and would lead to uncontrolled sprawl and loss of character (as studied and proven in multiple other communities in BC), it does not comply with the urban containment boundary as identified in the Official Community Plan, and it would create extraordinarily high sanitary utility costs because long pipes are installed between sparsely populated areas (high cost to low customer ratios).* • **Stop development.** *This concept does not meet community plan goals, would have legal consequences for existing zoning policies, would prevent much needed housing stock for current and future residents, and may ultimately increase sanitary and housing costs for all.* • **Mandate safe use of OgoGrow at all publicly owned lands**. *This concept would create competing priorities on public lands, such as specialised turf fields that cannot accommodate extra organic cover, or urban-waterside properties which aim to manage erosion and sedimentation, and many other public sites that are not suitable for large soil transfers. However*

Criteria	Explanation for Why the Idea was not Pursued
	expanded use of OgoGrow in select spaces on public land can be considered as part of a regional supply/demand study. • **Create Lake Country's own composting program and customers.** *This concept conflicts with Lake Country's commitment to the OgoGrow program and would also increase the costs of service because the economics of going at this alone are not favorable (solo composting service has been studied and tried in BC before and is known to not work due to poor economics).*
Previously studied and deemed infeasible at this time.	• **Pursue heat recovery or district energy opportunities in the industrial area.** *Proposed upgrades to the treatment plant will already include heat recovery from the clarification processes to warm the filtration building. However, broadscale heat recovery for external customers only works cost-effectively when there are many, close and new developments in need of energy retrofitting. The gradual development conditions on Beaver Lake Road, the small size of the plant, and the distance to distribute the energy are not conducive to stand-alone, district energy.* • **Pursue carbon neutral sanitary sewer operations**. *This concept-in-full is difficult to achieve, however, carbon reduction programs are already underway through fleet electrification and building upgrades at the District of Lake Country. Also, Lake Country has already made multiple* commitments *to reduce carbon emissions including signing onto the Climate Action Charter (BC) meaning all emissions are tallied and offsets or reductions are carried out. While not an explicit outcome of this plan, Lake Country is on a path to achieve this over the long-term.* • **Send all flows to Kelowna**. *This concept has low support by the public given the strong local* sentiment *to maintain authority over decisions and operations of the wastewater system. Also, the preliminary costs and capacity charges expressed by Kelowna make this financially unfeasible.* • **Use reverse osmosis and eliminate all particles of concern**. *This concept has been studied elsewhere and is cost-and-energy prohibitive, especially without the regulations that require it.* • **Return all flows (100%) to an alternative surface water location** that is not Okanagan Lake. *This concept has been studied extensively for all local water courses e.g., Wood Lake, Middle Vernon Creek, others, and Okanagan Lake is the only viable surface water option available at this time in the area.* • **Consider potable substitution (partial reuse)** for flushing toilets, residential lawn watering and industrial uses. *This concept has been explored in many other jurisdictions and is not feasible on a retrofit basis because it is very expensive to create a third utility (non-potable purple pipes) and disruptive to people's homes and costly to their plumbing systems. Water reclamation is being considered but not domestically.* • **Sell dried biosolids to industry for energy development.** *This concept has been* considered *and feasibility is presently low because there is no known, local recipient, and the cost to render the biosolids dry enough to aid in*

Criteria	Explanation for Why the Idea was not Pursued
	energy production often outweighs the benefits (especially at low energy prices). • **Explore gasification and energy development e.g., convert biosolids to heat/power.** *This concept, at this time, consumes too much energy and costs to prepare the biosolids to become fuel (e.g., studies in the Capital Region). Energy pricing may change in the future which can improve the business case for biosolids-to-energy development*.
Ideas not Considered Best Practice.	• **Transition to composting toilets in some or all areas.** *This concept has low merit on a broad basis because public feedback is consistent that most residents want the convenience and cost-certainty of a utility and are broadly speaking much less interested in the effort entailed in private, individual collection and treatment facilities.* • **Treat to potable standard and pursue 100% reuse.** *This concept presents regulatory and cost issues; however, this may be more popular decades into the future. Water reclamation is part of the plan, but not to 100% levels.* • **Buy upper watershed lands and study how to integrate OgoGrow into source protection planning and wildfire control.** *This concept is overly narrow as presented and needs to be considered more holistically as part of a source supply master plan.* • **Direct worst runoff to sanitary treatment plant.** *This concept was tried decades ago elsewhere however the intense runoff flows are excessive and expensive and better addressed at the source or in a distributed manner. In addition, runoff of concern is not concentrated near the plant, creating extraordinarily high piping costs.* • **Use natural areas to treat liquid waste.** *This concept can work for stormwater and is being pursued modestly in the stormwater section, but it is not practical for wastewater treatment at this scale and location.*

The process to engage and develop the LWMP has multiple benefits. One benefit is evident in this section where the long list of ideas can be consulted time again as conditions change. A service solution that is partially infeasible today may become fully feasible in 10 or 20 years. Lake Country staff can continue to refer to this report as it implements the preferred direction. Table 17 outlines the remaining ideas listed above.

Table 17: Remaining Liquid Waste Management Ideas

Collection System	• Implement the core area expansion program • Continue with asset management practice and service sustainability principles (relates to the other 4 topic areas too) • Education incentives and or regulations for septic system maintenance
Treatment Plant	• Upgrade the plant to meet regulatory and capacity requirements • Independently monitor lake health • Invest in monitoring technologies and partnerships • Add a publicly owned sani-dump
Return Water	• Return some or all flows (100%) to Okanagan Lake in a safe manner • Find new ground return lands • Pursue a reclaimed water program with agri-irrigation and parks as initial customers
Biosolids Reuse	• Create long-term agreement with regional or private service partners • Support alternative strategies to improve the balance of supply and demand of biosolids
Stormwater	• Include non-point source pollution strategies to upcoming stormwater master plans e.g., add more natural areas as interface between built and sensitive environments; add more materials to the list of regulated/banned substances • Promote private property stormwater best management practices • Increase road sweeping and add many more best practice technologies e.g., oil-grit separators • Find and evaluate hazards at all storm outfalls

Being an update to the LWMP (rather than a wholly new approach), most of these ideas will form part of the preferred direction. Like the ideas that passed the feasibility scan, there are two primary capital projects already underway at the treatment plant: Phase 4 and Phase 5 upgrades. Those are explored further, below.

5.4 BASELINE COMPONENTS: PHASE 4 AND 5 UPGRADES

Inherent to all of the options and solution combinations is the need to be compliant to modern regulations, to develop a plant that can achieve water quality targets for the receiving location (Okanagan Lake) and has the capacity to accommodate current and future customers of the sanitary sewer utility.

Part of a complete liquid waste management plan includes the linkages between issues, solutions, costs and revenues. While the latter is primarily addressed in Stage 3, this section outlines the baseline costs for Phase 4 and 5 upgrades from the *Sanitary Sewer Plan* (2020). They are presented here so that all additional ideas and solutions proposed in the preferred direction can be shown in addition to the baseline costs. In this case, Table 18 is a modified version of Table 12, this time with itemized costs that are presented in 2022 dollars, and a change in scheduling of the environmental studies from Phase 5 into Phase 4. These cost estimates are suitable for option evaluation but may undergo some refinement in both Stage 3 and during implementation.

Table 18: Baseline Costs for Phase 4 and Phase 5

Description	Proposed Capacity	BC ENV Approval Required?	Total Cost
Phase 4 Upgrades			
Biological Nutrient Reactor 3 (expand capacity)	Total installed capacity = 3.75 MLD However, to meet redundancy requirements for Reliability Category 1 facility, max treatment capacity = 3.3 MLD	Yes	$ 3,900,000
Secondary Clarifier 2 (redundancy)	Total installed capacity = 19.8 MLD However, to meet redundancy requirements for Reliability Category 1 facility, max treatment capacity = 13.2 MLD	Yes	$ 2,450,000
Filters & Tertiary Treatment Building (water quality)	4.95 MLD	Yes	$ 5,350,000
Sewage headworks screen (replacement)	No Change	No	$ 660,000
Geo-technical – wastewater treatment plant	n/a	No	$ 50,000
MWR Registration/OC Amendment	n/a	Yes	$ 65,000
Septage rock trap (replacement)	No Change	No	$ 300,000
Dewatered sludge bin enclosure (replacement)	No Change	No	$ 200,000
Existing Biological Nutrient Reactor Replacements (replacement)	No Change	Yes	$ 570,000
Environmental studies & permitting	n/a	Yes	$ 260,000
Subtotal Phase 4 Upgrades			**$ 13,805,000**
Phase 5 Upgrades			
Pipeline and Outfall (design, geotechnical and construction)	6.0 MLD	Yes	$ 9,500,000
Primary Clarifier 2 (redundancy + capacity)	4.0 MLD	Yes	$ 1,425,000
Primary Clarifier 3 (redundancy + capacity)	6.0 MLD	Yes	$ 1,000,000
Biological Nutrient Reactor 4 (redundancy + capacity)	5.0 MLD	Yes	$ 3,350,000
UV (water quality)	4.95 MLD	Yes	$ 1,950,000

Description	Proposed Capacity	BC ENV Approval Required?	Total Cost
DAF (capacity)	175 m^3/day	Yes	$ 2,050,000
Equalization (capacity)	1,000 m^3	No	$ 1,700,000
Subtotal Phase 5 Upgrades incl. Outfall-Pipeline			**$ 20,975,000**
Total			**$ 34,780,000**

5.5 SOLUTION OPTIONS

Using the common liquid waste management principles and strategic criteria outlined above, a series of solution options can be generated. Each option is a solution set that embodies a range of feasible, liquid waste initiatives and solutions. In all cases, the options build on infrastructure and services already in place but go further to address the issues and concerns projected over the next 20 years. Most of the options have common programs and technical options; however, there are differences among the options which creates the need to *decide* in this plan. The primary choice in this LWMP centers on how cleaned water is returned to the environment and the degree of independence or partnership involved in implementing the service(s).

The options emerged through the plan process including commentary from the public, stakeholders, interest groups and the two committees. Each of the three options outlines the number of initiatives, the type of solutions, the sequence of implementation, the extent of the works, and their costing. The evaluation of the options is premised on key criteria, outlined below. Yet any assessment should be based upon the core needs driving a solution so that there is a clear link between liquid waste management needs and the proposed option.

5.5.1 OPTION ONE: BASE OPTION

This option involves a new pipe that sends cleaned water safely back to the environment via Okanagan Lake. Once the plant is upgraded to accommodate the flows from new customers for the next 20 years (via Phase 4 and Phase 5 upgrades), the in-ground return facilities would be used, when necessary, as a flexible/back-up return location. This plant upgrade is scheduled to begin in 2022 and will be followed with the necessary enhancements to satisfy quality requirements associated with return to Okanagan Lake such as process redundancy, filtration, and disinfection.

The Environmental Impact Study on Okanagan Lake required as part of the approval process identifies that the outfall study area is a safe, low risk means to return cleaned water to the environment. Subsequent design exercises after adoption of the Stage 3 report will ascertain the specific route of the outfall pipe for release into the study area. Later, regular, ongoing monitoring will be required to ensure that treatment levels are safe for the receiving environment, at the start, and for the long run.

The new outfall pipe will be sized to accommodate 100% of flows and will wind along local roads past factories, fields, and farms where cleaned water could be reused in the future for irrigation if there is local customer interest. In this scenario, the District takes a reactive approach to water reuse which is initiated by customer demand, some time in the future. As for partnerships, Lake Country would remain part of the regional trucked waste program and contribute its sludge or biosolids to the OgoGrow program.

Option 1 Summary

Benefits	Drawbacks
• Safe, long-term method for cleaned water return • Most cost effective • Reliably supports collection system expansion • Potential to provide reclaimed water (e.g., opportunity to mitigate drought risks)	• Water reuse would be limited to select lands based on the willingness of potential customers and the treatment ability of the plant • Some loss of investment in existing in-ground disposal works • Does not appeal to resident concern for Lake outfall

5.5.2 OPTION TWO: HYBRID RETURN LOCATIONS

This option also involves a new pipe that sends cleaned water safely back to the environment via Okanagan Lake, with some additional works beyond the *Base Option*. Like Option 1, the pipe would be sized to handle all flows for more than 20 years and follow the same route where flows re-enter the environment into the EIS study area. Option 2 differs from the Option 1 because it continues to use in-ground return as the primary method for returning water back to the environment up to 2,000m^3/d. This approach would remain in place for as long as the in-ground facilities properly function, which is estimated to be many years. Option 2 would include additional pipes to prepare for water reclamation in preferred locations with either moderate or greater exposure potential such as sports fields and pastures and commercially processed agricultural crops (not for direct human consumption). Water reclamation opportunities in this case would be proactively led by the District and would be a small complement to sustainable resource management. The additional infrastructure required to pursue water reclamation will result in higher costs in comparison to Option 1. In other words, under most circumstances, Option 2 would prioritize in ground disposal for as much flow as possible (up to 2,000m^3/d), find new customers for water reclamation and generally send what remains to Okanagan Lake. In Option 2, the plant is also upgraded to accommodate the flows from new customers for the next 20 years and to suit requirements for return to Okanagan Lake which requires the most stringent standards of the three potential return locations in this option (i.e., to-ground, reuse, and Okanagan Lake). Like Option 1, permission to return cleaned water in this hybrid approach also comes from BC ENV and would be partly based on:

1. The Environmental Impact Study on Okanagan Lake where findings conclude that the risks of returning cleaned water here are low, and the Lake can handle these flows.
2. The quality of cleaned water and its reuse application (i.e., irrigation vs. potable use). The local health authority can also have a stake in approving water reuse applications.

As for partnerships, Lake Country would remain part of the regional trucked waste program, contribute its sludge or biosolids to the OgoGrow program, and establish a quasi-utility (future) with select properties (customers) for water reuse.

Option 2: Hybrid Return Locations

Benefits	Drawbacks
• Safe, long-term method for return water • Partially diverts flows from going to the lake by continuing in-ground return and investing into reuse • Potential to provide reclaimed water service contributes to sustainable water practices and opportunity to mitigate drought risks.	• Likely the most expensive, long-term option • Requires ongoing maintenance and associated costs to operate three return systems (in-ground, water reuse, Lake). • Some limitations on how/where water can be reused

5.5.3 OPTION THREE: PUBLIC UTILITY PARTNERSHIP

This option involves a new, direct partnership with another public utility such as the Regional District of Central Okanagan (RDCO) or the City of Vernon or Kelowna to run liquid waste services in Lake Country. This approach would give the service partner most of the operational responsibilities, including treatment operations, decision making for maintenance, and management around where flows go. This option could look like several different solutions, some of which have been highlighted below:

a) A public utility takes over Lake Country's existing plant and new capital projects outlined above would be the same as Option 1 or 2;
b) A public utility combines liquid waste flows from Lake Country and other surrounding municipalities (e.g., Kelowna, etc.) and:
    i. Uses Lake County's plant for treatment
    ii. Sends flows elsewhere (e.g., Kelowna) for treatment

The number of unknowns in this option make it impractical to provide a realistic cost estimate. The task here is to better understand the community's support/opposition to shift the responsibilities of liquid waste management from the District to another public utility.

Option 3: Public Utility Partnership

Benefits	Drawbacks
• Typically provides access to larger technical teams and/or equipment. • Potential long-term cost savings should a regional approach be adopted.	• Time consuming to establish partnerships and agreements which may conflict with the urgency of upgrading the plant • Foregoes local authority in some areas • Requires strong collaboration between District departments (i.e., Planning, Engineering, etc.) and the public utility

5.5.4 COST SUMMARIES FOR THE THREE OPTIONS

Costs for the options are an important element in the feedback and analysis phases of Stage 1 and 2. Each of the three options was presented in detail to the public and the committees, including their cost estimates. While not design-ready costs, these are costs that are suitable for comparative performance and for making decisions over the 20-year horizon. Later, Stage 3 will include slightly more robust costing on the preferred option to confirm the overall approach to implementation.

Cost summaries are presented in tabular form based on 2021 dollars and inclusive of contingencies and design costs common to conventional Class C cost estimates. Financing or borrowing costs are not presented here as these will be confirmed in the Stage 3 report once the final direction is approved by Council and forwarded to the Ministry. Table 19 outlines the cost elements, and the description of the investment for Option 1.

Table 19: Cost Estimate for Option 1

Cost Element	Investment Description	Cost
Biosolids	Create and sign a medium to long-term agreement with the owner-operators of the OgoGrow program for continued receipt of biosolids from the plant; this agreement may be done concurrently to confirm Lake Country's continued receipt of regional trucked waste. Costs estimated to be $0.1M over 20 years. Contribute a small share of the funds for this investment area into regular program updates (about every 5 years) that restore the balance of supply and demand for reuse of OgoGrow, including confirming the role of Lake Country and its lands or residents in making that so. Costs estimated to be $0.1M.	$0.2 M
Stormwater	Transition from drainage plans *to integrated stormwater management plans* including water quality monitoring throughout the District at specialized locations. Develop a non-point source pollution plan for lake and stream health outside of what is not readily addressed in the integrated stormwater plan (above). Costs estimated to be $1.0M. Invest in new stormwater treatment works including natural and engineered areas that enhance water quality at various streams and outfalls to safeguard lake health $1.0M. Update bylaws and education resources given the local interest by the public to do the right thing once it becomes known and clear to them. Costs estimated to be $0.1M (over 20 years).	$2.0 M
Collection System	Continue with expansion of the centralized system as outlined in the Official Community Plan by upgrading key utility works such as pump stations, force mains, and trunks (led by utility). See Table 5.	$8.9 M
Sewer Retrofit	Continue with expansion of the centralized system as outlined in the Official Community Plan through retrofit areas (led largely through specific area service charges and offset in part through grants, if successful). Estimated by Urban Systems and District Staff as prepared and presented under separate cover.	$30.0 M
Outfall Line	Permitting, design, and installation of a pipe that conveys highly treated return water from the wastewater treatment plant to the outfall location in Okanagan Lake. See Table 17.	$9.8 M

Cost Element	Investment Description	Cost
Treatment Upgrades	Phase 4 and Phase 5 upgrades (with the outfall excluded and presented above, separately). See Table 18.	$25.0 M
	Total	**$75.9 M**

Option 1 can be expanded in the future to build out a reclamation system for water reuse and the ground infiltration approach can be used as a back up method. This is not the initial position of the option, however.

Option 2 includes all elements of Option 1 plus $13.8M in further investments for water reuse. The additional costs reflect a preliminary concept for water reuse including a small booster station, regulating valves, new pipes, and service connections for 10 to 20 lots situated between the wastewater treatment plant and the area around Chase Road and Okanagan Centre Road (west). It is important to note that building the infrastructure is one thing but securing long-term customers who will reliably use the water is critical to the programs' success. Table 20 summarizes the costs for Option 2.

Table 20: Cost Estimate for Option 2

Cost Element	Investment Description	Cost
Option 1 (all elements)	Biosolids, stormwater management, collection system, outfall line, and treatment plant upgrades	$75.9M
Reuse Systems	Infrastructure to extend supply from the pressurized outfall line to select properties	$13.8M
	Total	$89.7M

Option 1 and Option 2 differ primarily through the upfront investments to create a water reclamation system.

Option 3 does not differ between reuse or not, but instead, puts the decision-making lens on partnerships and responsibilities. If Lake Country were to partner with another utility, there would be many more questions concerning how to implement that approach. But a formal partnership can realistically be done and has been done in other communities in BC. At a policy level however, it is important to wrestle with whether the community (e.g., residents and businesses) is interested to forego some authorities for liquid waste. The costs for Option 3 really do vary on the willingness to enter into a new service agreement. For now, those costs are considered moot, or more clearly stated, can be $75.9M (like Option 1) or $89.7M (like Option 2) or anywhere in between. But determining local interest in this approach is best tested through engagement and community feedback. The summary results of that feedback are outlined in the next section.

5.5.5 FEEDBACK HIGHLIGHTS FROM THE ENGAGEMENT PROCESS

The first phase of the communication and engagement process (for the Stage 1 and 2 report) sought to inform and engage the public, key stakeholders, and Indigenous communities to create a Liquid Waste Management Plan that accurately reflects their interests, concerns, and desires. Between March and July 2021, engagement was conducted through:

- Launching an information and awareness campaign through informative post cards, project update emails, weekly informative project brochures, FAQ sheets and background materials;

- Developing the main project website to host engagement tools such as the survey and Q/A tool;
- Establishing the Advisory Committee to represent public and technical interests; and
- Hosting meetings with the interested First Nation communities.

Throughout the course of this engagement, several main themes emerged. The Advisory Committee expressed the importance of balancing growth and costs when developing liquid waste infrastructure. In addition, they expressed interest in solution options that support innovation and environmental sustainability (e.g., water reuse). These themes were echoed in the public survey, as comments highlighted concerns for the environment, support for prioritizing water reuse, and a desire for reasonable spending and financial management. The public was also clear in their support for maintaining full control over the District's liquid waste management process. These bullets further characterize the feedback heard to date:

- Strong desire for **return water** to Okanagan Lake **that is safe** e.g., compliant and monitored
- Mixed views on whether to **pursue lowest cost** or to spend more to **create reuse systems,**
- A rising demand from property owners to **retrofit other neighborhoods** and expand the core area further
- Some elevated concerns around **growth** and how developers will **share the costs** of new works and capacity
- Residents with septic systems are generally aware of their responsibilities to maintain them
- Expressed desire for enhanced **stormwater management** specifically to **improve lake water quality** e.g., Wood, Okanagan, Vernon Creek
- Modest interest, but certainly *no push*, for a public utility partnership where Lake Country secedes its treatment duties to another agency or community.

This LWMP benefits from the feedback noted above in that the expressions are understandable and generally, they are actionable. How to organize these considerations to decide on the preferred direction is outlined in the next section.

5.5.6 CENTRAL POLICY ASSESSMENT TO SET PLAN DIRECTION

A central policy assessment corrals the core topics of this project and includes public feedback and regulatory considerations to funnel the range of choices towards the preferred direction. For a liquid waste management plan, this section is where the public feedback, technical studies, and plan requirements come together.

The central policy assessment was conducted collaboratively with the Steering Committee (Mayor and Council) in June 2021. Many of the same questions that public and interested stakeholders have been dealing with are the same ones that will require Council direction. The meeting with the Steering Committee became an important milestone in the Stage 1 and 2 process. Questions framed the policy discussion, including:

- What is the local level of interest in a **reclaimed water service** (reuse, infrastructure, economics, benefits)? How can we link the direction for liquid waste to the needs and ideas for potable water planning?

- What is the level of **support to build and pay for new capacity** in liquid waste systems to service growth (with development covering their share)?
- How much **local control** should there be in wastewater treatment and cleaned water return? What is the local interest in exporting some responsibilities to a partner?
- What is the **culture of environmental stewardship** that we want in Lake Country? Should we continue the local tradition of doing more than is required of us for the Okanagan Basin?

When coupled with feedback from the engagement process, the policy discussion led to key insights for direction:

i. That local **autonomy and ownership of wastewater treatment** responsibilities is currently **more important** than any potential medium-term benefits of a public utility partnership. Option 3 received mild public support and low political support. Future LWMPs in Lake Country should continue to wrestle with this topic however it should not be pursued further in this plan.

ii. That the **core investment areas** of collection system expansion, stormwater management, biosolids program continuance, and treatment upgrades to meet modern regulations should be adopted in the LWMP given their **direct alignment with the public interest**.

iii. That **developers ought to pay their fair share** and that the District should revisit its development cost charges (DCC's) and factor those into long-term financing so as to avoid overburdening existing customers with the cost of new growth. The LWMP direction should include a commitment to updating DCC's.

iv. That Lake Country should continue to exceed the minimum requirements for wastewater treatment and cleaned water return to safeguard the environment, much like it has since its first LWMP in 1996. The principal aim of the LWMP, to *borrow it wisely and return it safely*, reinforces the importance of long-term investments into high quality return water, regular lake health monitoring, dedicated interest in water reclamation, promoting water conservation, and enhancing stormwater management to reduce non-point source impacts to lake health. **Each of these concepts, and their funding, will be part of the preferred direction.**

v. That **preserving lake health is perhaps the highest priority** and while most audiences including both committees understand the need for an outfall to deep water in Okanagan Lake, that this should be used alongside other re-entry tactics over the long-term such as to ground (as is current, for as long as feasible) and through reclamation (at select properties).

vi. That **there is local interest in reusing water** and the question of expanding a water reclamation system is more about *when*, than it is about *if*. The LWMP should develop an incremental plan to prove out feasibility for partial reuse and confirm how it will set up a system including infrastructure, customers, operations, and policy. Drivers for water reclamation are:
    a. To offset potable supply needs to mitigate the demands that are expected from longer, warmer summers and droughts, something rather evident in 2021
    b. To minimize the amount of water returned directly to the lake.

vii. That **Option 1 and 2 provided helpful bookends** in the process to reveal public and political interest in either approach, but that a **blended version** of the two options inclusive of adaptive and flexible return water regime i.e., use of the outfall primarily, with infiltration to ground where feasible, and later, reclaimed water, comprise a blended approach for liquid waste management and cleaned water return in Lake Country.

5.6 PREFERRED DIRECTION ARISING FROM STAGE 1 AND 2

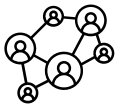
A liquid waste management plan aims to balance multiple accounts including public, political, social, environmental, and financial. Stage 1 and 2 is successful when there is a preferred direction that aligns with technical needs and drivers for the plan, and it is based strongly on the feedback from the community and its service partners.

The preferred direction outlines the core investments into liquid waste management for Lake Country over the next 20 years. Later, after further engagement with BC ENV, the committees, and other community groups, the Stage 3 report will be prepared to outline a detailed implementation plan. More details on the Stage 3 scope of work are discussed in Section 5.6.4. That said, the preferred direction from the Stage 1 and 2 report will become binding and the success of the plan will be measured against Lake Country's ability to deliver what is proposed here.

5.6.1 PREFERRED DIRECTION SUMMARY

Lake Country's 2022 LWMP will continue the local tradition of exceeding its minimum requirements to manage liquid waste and to safeguard public health and the environment. With strong consideration to feedback received to date from the committees and the public, the preferred direction will include:

Completion of the **Phase 4 and 5 upgrades** to the wastewater treatment plant to ready the facility for 20+ years of growth and to meet new, stringent regulations for redundancy and returning cleaned water to the environment.



Implementation of the plan to **expand the centralized collection system** to areas outlined in the urban containment boundary of the Official Community Plan and will include pipe and lift station upgrades to accommodate customers within that boundary.

Positioning the District to explore a plan to **reclaim treated wastewater** through irrigation on select properties such as industry or parks and non-food farms along the outfall line route.

Continuance with the **biosolids program with a renewed agreement** and emphasis on partnering to restore the supply and demand imbalance for OgoGrow.

Expanding stormwater management to meet the principles of integrated stormwater management (a staple in the BC stormwater industry) with a strong focus on **non-point source pollution** and new infrastructure that renovates water quality prior to it meeting Wood, Kalamalka, or Okanagan Lakes.

Flexible / Adaptive return options (e.g., to-ground, lake and or reclaimed water) to manage the multiple and often competing factors influencing the safe return of cleaned water back to the environment.

Today's rate of infiltration likely represents the peak return rate of cleaned water into the ground. Moreso, the rated capacity of the soils appears to be declining, permanently. For example, flood risks from the galleries have risen and each spring District staff undertake significant efforts to manage infiltration during high flows. At times, the galleries are unable to process the flows they used to accommodate, leading District staff to use unplanned soak away strips or temporary pits to buttress what the galleries can not. Expectedly, diminishing capacity of the galleries will lead to greater reliance

over time on the outfall and or reclamation opportunities. So, the limitations of the galleries trigger a modified *cleaned water return regime* that must include and promote **return flexibility** to suit several known factors. Initially, while the galleries undergo repairs, the District will operate the outfall as its primary method to return cleaned water. Later, as infiltration galleries are restored, they may become a highly supportive complementary method, perhaps approaching their peak infiltration rate of 2,000 m^3/day. Later, as a reclamation system builds out, a share of the cleaned water may be returned to customers and land holders who benefit from the non-potable supplies for spray irrigation (or similar). While the District will aim for some degree of consistency from year to year, there must be flexibility to manage multiple competing factors that may arise from time to time, such as:

- Groundwater quality near the plant and neighboring farmers wells
- Treated effluent quality at different times of the year and the desire to safeguard the Lake
- Algae considerations in either Okanagan lake or Wood Lake
- Demand for reclaimed water
- Maintenance or renewal of infiltration galleries
- Droughts and the need to support replenishment of Okanagan Lake and to capitalize on alternative drought-resilient sources such as groundwater
- Sub-surface storage for irrigation water for the pending growing season
- Pipe/outfall maintenance and providing an alternative disposal method during those periods
- Other.

A flexible and adaptive return-water regime, with Okanagan Lake as the primary receiving environment, affords Lake Country a notable level of redundancy when contemplating risks and opportunities for water stewardship. Though in-ground return and spray irrigation options are not able to offset the entire flow projections for the next 20 years, the proposed approach will allow for the District to choose the best return location given local conditions.

Table 21 outlines cleaned water return conditions over the next 20 years, separated into 5-year increments.

Table 21: Twenty-Year Cleaned Water Return Conditions – Adaptive Flows

	All flows in MLD			
Era	**Maximum Month Flows**	**Ground**	**Outfall**	**Reclamation**
2021 to 2025	1,950 to 2,800	Up to 2,000/2,800*	0	0
2026** to 2030	2,800 to 3,750	0 to 2,000	800 to 3,750	0
2031 to 2035	3,750 to 4,250	0 to 2,000	1,750 to 4,250	>=0
2036 to 2040	4,250 to 4,720	0 to 2,000	2,250 to 4,720	>=0

*fully treated flows in excess of the capacity of the basins will be directed on an interim measure to City of Kelowna sanitary sewer collection system until Phase 4 and Phase 5 are complete.
** Phase 4 and Phase 5 are scheduled to be complete in 2026

Each year in its annual wastewater report submitted to BC ENV, the District would provide a projection for flows to the outfall for the upcoming year. In 2026 or earlier, the District will present to the Ministry a comprehensive feasibility study to conclude the direction for a water reclamation system where the percent of reclamation each year, if functionally pursued, would be factored into the annual reports. The aim of the overall management approach is to maximize the infrastructure, remain compliant, and continue the practice of water stewardship by directing water to suit the range of water factors listed above.

Key elements for implementation of the LWMP will be unpacked in more detail, with Class C costs, in the next section. Later, in Stage 3, the plan components will be finalized and converted to an implementation schedule.

5.6.2 PLAN COMPONENTS AND INVESTMENT AREAS

Table 22 expands on the preferred direction by outlining key activities, outcomes, and investment areas for each major topic. These costs reflect 2022 dollars and represent a conventional Class C cost estimate where contingencies are estimated at 35%. Due to ongoing and extraordinary price escalation at the time of writing this report, the existing figures also reflect a moderate-to-high inflation level of 5% for the first 2 years, returning to predictable inflation levels thereafter. Typical to most master plans, these figures must be regularly updated to suit actual price conditions. Revenue strategies provided in the Stage 3 report outline options for how the District can mitigate and cover rising costs through implementation.

Table 22: Summary of Plan Components and Investments

Plan Component	Investment Description	Cost
Biosolids		
	• Create and sign a medium to long-term agreement with the owner-operators of the OgoGrow program for continued receipt of biosolids from the plant; this agreement may be done concurrently to confirm Lake Country's continued receipt of regional trucked waste. Costs estimated at $0.1M over 20 years • Contribute a small share of the funds for this investment area into regular program updates (about every 5 years) that restore the balance of supply and demand for reuse of OgoGrow, including confirming the role of Lake Country and its lands or residents in making that so. Costs estimated at $0.1M over 20 years.	$0.2 M
Stormwater		
	• Transition from drainage plans to integrated stormwater management plans including water quality monitoring throughout the District at specialized locations • Develop a non-point source pollution plan for lake and stream health outside of what is not readily addressed in the integrated stormwater plan (above) $1.0M • Invest in new stormwater treatment works including natural and engineered areas that enhance water quality at various streams and outfalls to safeguard lake health $1.0M • Update bylaws and education resources given the local interest by the public to do the right thing once it becomes known and clear to them. Costs estimated at $0.1M over 20 years.	$2.1 M
Collection System		
	• Continue with expansion of the centralized system as outlined in the Official Community Plan and the Sanitary Sewer Plan through upgrades at key utility works such as pump stations, force mains, and trunks (led by utility) (Table 5) • Continue to evolve septic system management practices and employ new tools to promote and or warrant property owners to fulfill their responsibilities as owners and operators of their on-site wastewater treatment facilities. Costs estimated at $0.1M over 20 years.	$9.0 M
Sewer Retrofit		
	• Continue with expansion of the centralized system as outlined in the Official Community Plan through retrofit areas (led largely through specific area service charges and offset in part through grants, if successful). • Continue to plan to connect new customers from sewer retrofit areas upon successful commissioning of Phase 5 of the plant upgrade.	$30.0 M
Outfall Line		
	• Initiate the permitting, design, and installation of a pipe that conveys highly treated return water from the wastewater treatment plant to the outfall location in Okanagan Lake for all	$10.4 M

Plan Component	Investment Description	Cost
	flows not reclaimed by future reuse customers, or not returned to ground. Costs projected at $9.8 M • Part of the outfall line project is to establish a monitoring program that meets and exceeds provincial requirements for water quality monitoring so that Lake Country has ample time and rationale for additional treatment upgrades in the future, if warranted. Costs estimated at $0.6M, likely spent in years 1-10.	
Treatment Upgrades		
	• Phase 4 and Phase 5 upgrades (with the outfall excluded and presented above, separately). Costs estimated at $25.0M. • Maintain the in-ground capacity at 2,000 m^3/day so that returning clean water to ground remains a reliable method for returning cleaned water to the environment. • Study the cost-benefit of a public sani-dump. Costs estimated at < $0.1M. • Continue with the regional septage receiving service and amend that service as needs arise. • Continue with annual financial contributions to the Okanagan Lake Collaborative Monitoring program and support future costs associated with studying emerging substances of concern.	$25.1 M
Reuse Systems (System Set Up and Feasibility)		
	• Initiate feasibility plans for a water reclamation system. Include a stringent review of available lands (public and private), an assessment of customers and their needs and willingness to pay, consideration to benefits of a reclamation system to the potable water system, and preliminary design exercise for future infrastructure to extend reclaimed water from the pressurized outfall line to select properties. • Construction of any reuse facilities should occur after completion of the feasibility plan and some time after Phase 5 is fully commissioned. Given the capital cost outlay from now until 2027, the timing for introducing new infrastructure may be near 2030 or when this plan is updated and or upon the receipt of senior government funding to support new infrastructure.	$0.3M
	Total	**$77.1M**

A key part of Stage 3 will be reviewing the cost recovery tools available to the District and to design a funding strategy that lines up with cost-share responsibilities and the timing of available funds.

Brief Scan of Funding Tools for Implementation of the LWMP

Municipalities can evaluate and choose from a variety of funding tools to suit their needs and stakeholders. Below is a brief list of common tools that will be reviewed in more detail in Stage 3. It's important to note that cost-sharing with developers and local area service financing relates to over 50% of the total costs, putting a little less pressure (but still some) on utility rates. Four funding categories are outlined below.

Core funding sources: these tools support a user-pays approach in which customers using the service pay their fair share.

- Development cost charges
- Utility rates
- Local service area charges

Complementary funding sources: these are existing, general funding mechanisms collected by the District which are distributed to various community indicatives to support a range of municipal services

- Parcel tax
- Environmental levy

Potential funding sources: funding through this mechanism can be sporadic and commonly relies on an application and approval process meaning funds are not always guaranteed.

- Grants

Financing: This requires a borrowing bylaw to be established with approval from Council.

- Municipal Finance Authority (MFA) long-term borrowing
- Lake Country is presently undertaking an alternative approval process whereby the District would borrow funds to complete Phase 4 works. Only if 10% of residents petition against the proposal would the District be left to find other ways to pay for the project.
- Lake Country was successful through the alternate approval process in Fall 2021 where it can now borrow up to $8.85M through a borrowing Bylaw with servicing costs covered by development charges.

These funding tools will be assessed more completely in Stage 3.

5.6.3 ALIGNMENT OF THE PREFERRED DIRECTION WITH STUDY DRIVERS

Any management plan requires fulsome consideration to the origin and basic needs of the project. Lake Country's 20-year history with liquid waste and its desire to continue to improve upon the current system weighs strongly on the next 20 years. There are distinct motivations currently as well, including for the environment, for service delivery, and for meeting local commitments. Table 23 outlines how the preferred direction delivers on the plan drivers.

Table 23: Brief Review of the Preferred Direction Against Plan Drivers

Safeguard the Environment	
Environmental Investments: We will build on our historic success in conserving the environment through liquid waste management services.	Through the forward-looking investments into water reclamation and the incremental transformation of stormwater services
Lake Health: We continue to monitor water quality and adapt in local ways to protect lake health.	Through stormwater, the outfall line and via the next Operating Certificate
Low Footprint: We aim to design all projects to suit their present and future need and avoid over-sizing or under-sizing assets that may lead to premature renewal.	Through feasibility planning for any new works and designing all new infrastructure to maximize what we already have, and only add new when we must
Water as a Resource: We aim to borrow water wisely including reuse and return it safely to the environment.	Through continued water conservation measures and a long-term commitment to returning compliant, safe water to the lake and all other return options
Resilient Services for a Growing Community	
Collection System Expansion: We want to connect existing customers in neighborhoods where there are aging, risky septic systems such as the Oyama Isthmus and East facing slopes in Winfield.	Through continued implementation of the sewer boundary extensions outlined in the Official Community Plan
Services for Growth and Development: We will thoughtfully connect to new, various types of	Through continued implementation of the sewer boundary extensions outlined in the Official

buildings that stem from our Official Community Plan *and commit to grow sustainably.*	Community Plan, and via regular updates to local development cost charge updates
Capacity of our Infrastructure: We must upgrade our wastewater treatment plant including how we return water to the environment within 5 years.	Through Phase 4 and Phase 5 upgrades
Technology and Cost-Effectiveness: We seek out technological advancements provide opportunities to treat sewage effluent more effectively and to higher standards.	Through Phase 4 and Phase 5 upgrades
Meeting our Commitments	
Affordability: We will fund the services we commit to and seek out residents' support for added costs.	Through the Stage 3 implementation plan where timing and funding sources will ensure the LWMP lives up to this commitment
Sustainability: We are obliged to support our Community Plan and meet goals for infrastructure, environment, and service delivery.	Through multiple initiatives outlined above
Regulatory Compliance: As it has for decades, we aim to meet or exceed what is mandated of us by environmental authorities e.g., Province of BC.	Through ongoing diligence in service delivery and via commitment to the investments in this plan

5.6.4 LIQUID WASTE MANAGEMENT: ADAPTING TO CLIMATE CHANGE AND CONSERVING WATER

Communities rely on water for most of their daily lives. Liquid waste management represents our obligation (and opportunity) to renovate water up to high quality standards so that what we return to the environment is safe. The preferred direction for Lake Country's LWMP includes various commitments to manage liquid waste in strategic ways that shows adaptation to climate change and the need to conserve water.

The content originally presented in Table 14 is presented again (as Table 24) with the specific actions of the LWMP to adapt to a changing climate and to conserve water.

Table 24: Challenges and Management Commitments for Climate Change and Liquid Waste

Challenge	Management Commitment
Storm and precipitation variability, including more rainfall events throughout the year (except for summer) plus greater intensity and more frequent large-scale events	• Implement integrated stormwater management which will include updates to local design storms to suit future climate conditions; plan for system upgrades accordingly
Earlier runoff and shifting seasons which can strain reservoirs and create more demand for irrigation, especially if additional growing seasons are added	• Implement the feasibility analysis and customer evaluation for water reclamation • Pursue engineering work to confirm groundwater storage and withdrawal in the areas down gradient of the infiltration basins at the WWTP for reclamation

Challenge	Management Commitment
Warmer lake temperatures and changing water quality conditions	• Continue to contribute – and increase contributions as needed – toward the Okanagan Lake Collaborative Monitoring Program
Greater drought and flood potential	• Create and implement the non-point source pollution reduction plan as part of the stormwater stream of this LWMP • Study how to capitalize on in-ground storage for reclamation • Update the District's water conservation plan (committed to outside of the LWMP but referenced here) • Continue with integrated stormwater management planning
Changing watershed conditions from changing ecosystems	• Implement water quality monitoring as part of the stormwater management theme
Expanded infrastructure to adapt to various conditions	• Continue to plan for climate adaptation and conservation within the District's infrastructure master plans; finance accordingly.

It is important to note that the key outcome of the Stage 1 and 2 report is to land on the preferred direction. From here, further engagement with BC ENV, stakeholders, and Council will occur prior to completing the Stage 3 report, where implementation and accountable actions are the desired outcome.

Implementation is a very important element to the success of Lake Country's LWMP. Stage 3 is the next phase of the project where the preferred direction and other tools are designed to ensure Lake Country's 2022 LWMP is set up for successful implementation.

Next steps in the process are simple but important.

- To present the Stage 1 and 2 report to both committees and make it available for review by members of the Community.
- To submit the Stage 1 and 2 report to BC ENV for their review and comment prior to finalizing the preferred direction, an accomplishment confirmed by Council.
- To proceed to Stage 3 upon completion of a round of engagement on this report, on general concurrence by BC ENV, and formal adoption by Council of this Stage 1 and 2 report.

5.6.5 STAGE 3 DESCRIPTION OF SCOPE OF WORK

The three-stage framework for completing LWMPs allow local governments in BC to travel through an orderly process where ideas are evaluated, and preferred commitments are implemented. Stage 3 receives the direction that stems from Stage 2 and outlines the resources – human, financial, social, political, regulatory, and technical – to deliver on the goals, objectives, and strategies of the plan. Public consultation continues while analysis and reporting focus on the needs and measures to successfully implement the plan as it is scheduled in the approved document. Once complete, Lake Country's Council intends to endorse the Stage 3 report which creates a formal level of local assurance in the plan outcomes.

It is common to signal the transition from Stage 2 to Stage 3 by describing the next scope of work. The list of activities below represents the Stage 3 actions to complete the District's LWMP.

1. **Communications and Engagement**
    - Update the project website to include the revised (final) Stage 1 and 2 report and refine project schedules from today to proposed completion date
    - Continue with online staff availability for questions and answers, which was an effective form of engagement in Stage 1 and 2
    - Re-engage with the Advisory Committee in regard to implementation schedules and cost-recovery tactics
    - Present to Council outlining next steps for Stage 3
    - Continue consultation efforts with area-wide indigenous communities including community-to-community engagement with Okanagan Indian Band
    - Host a virtual (potentially in-person) event to discuss plan implementation, financial strategies and the schedule of projects and programs over the next 20 years

2. **Refine Implementation Plan**
    - Reflects the majority of effort in this stage, whereby all investment areas and commitments in the Stage 1 /2 report are scheduled and detailed for proper execution over the plan horizon; efforts will be directed to:
        - Project sequencing and milestone dates for Phase 4 and 5 upgrades to the wastewater treatment plant including planning, design and construction of the outfall line
        - Outlining basic cash flow considerations to show the accrual of funds and the expenditures required to complete the work
        - Confirm dates and costs (preliminary scheduling) for completion of major collection system capital
        - Refine the detailed description of septic system management programs for definition, launch and review about every 5 years
        - Propose the strategy to secure a long-term agreement for OgoGrow and refine the role of Lake Country in that arrangement and its local interest to see it succeed
            - This will include a description of the biosolids management responsibilities of the district versus those of the service provider (OgoGrow)
        - Outline a high-level implementation framework for integrated stormwater management and the accompanying milestones
        - Provide a basic description of the scope for a future feasibility study for water reclamation with a focus on agricultural and park lands
        - Provide a list of activities and outcomes that will signal the long-term sustainability of the two satellite plants at Carr's Landing and Oyama

3. **Conduct financial analysis** and confirm the cost-recovery toolkit and schedules to pay for the 20-year plan. Financial analysis will consider use of and impacts to: utility rates, development cost charges, specified area charges, borrowing needs, and any other sources of funding including grants and or inter-community partnerships. Estimates for impacts to different user groups will be provided as well e.g., residential, industrial, institutional.

4. **Review pertinent regulations that enable implementation** including assessment of existing operating certificates and recommendations to amend these documents to suit the plan e.g., timing of change, nature of new terms, etc.

5. **Develop the terms for ongoing advisory support** for the LWMP over the plan horizon and into the next plan update. The approach for advisory support is likely to include the use of a public committee or standing committee of Council and or other engagement means at the disposal of the municipality through its regular engagement operations. The terms and structure of the

advisory body will be detailed upon completion, and reflection of the communication and engagement process to close Stages 2 and 3 and proposed to ENV for discussion at that time.

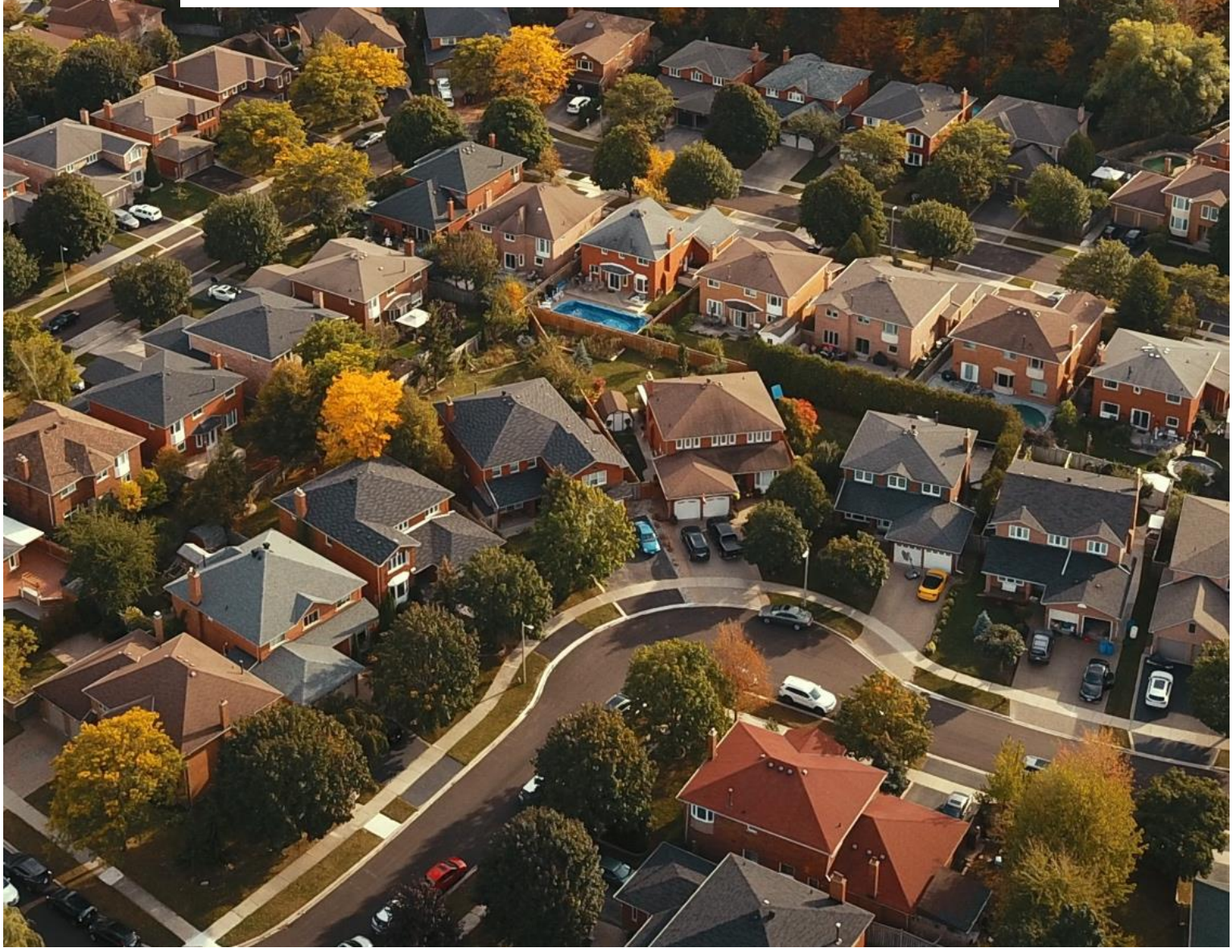
6. **Finalise reporting**, post to website and submit to Ministry of Environment, followed by endorsement of Lake Country Council in Winter 2022/23.

Stage 3 work will be initiated upon submission of this report to the Ministry, given the time pressures to advance the over-capacity plant to accommodate customers poised to connect in due course.

---Closure---

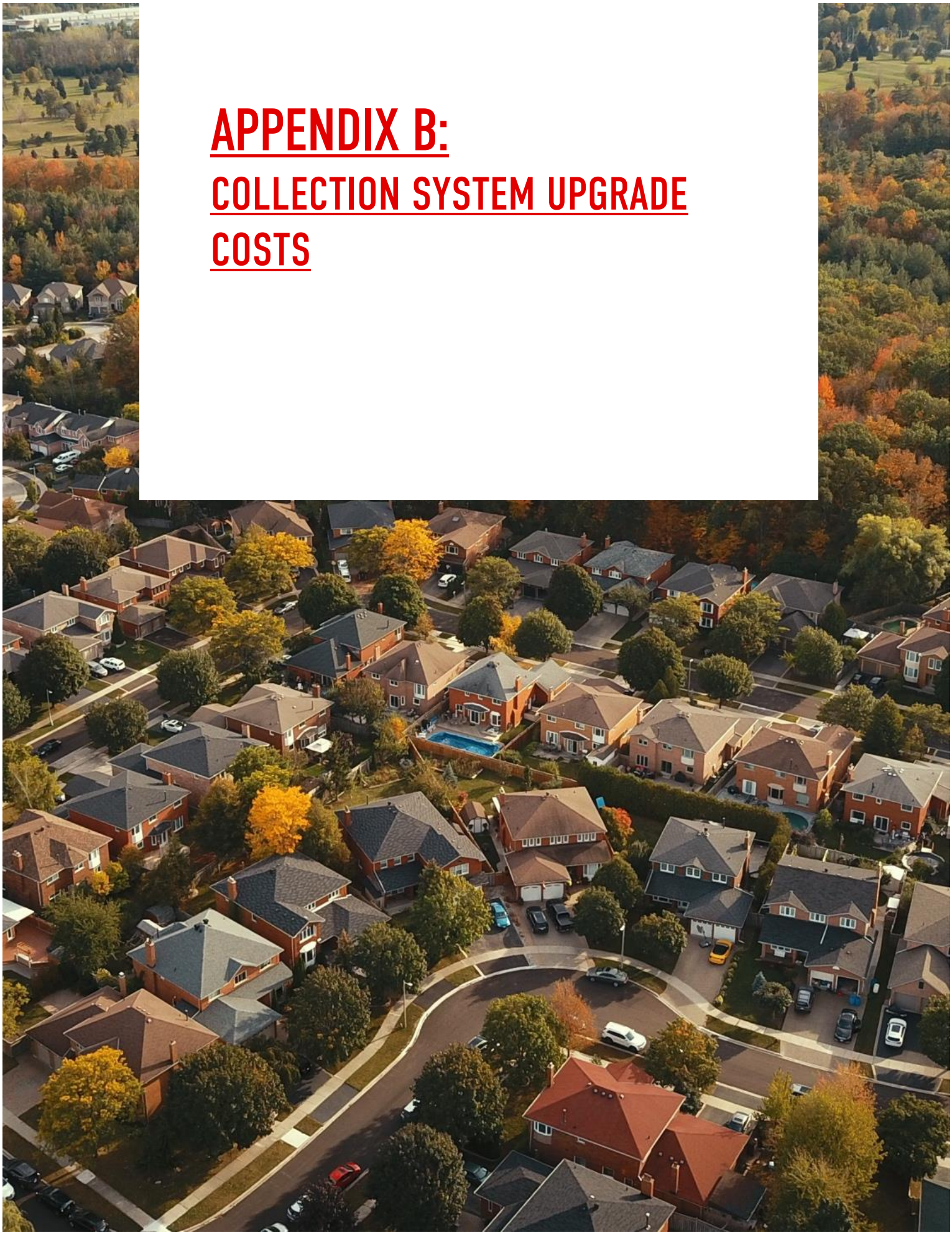
APPENDIX A:

COMMUNICATION AND ENGAGEMENT SUMMARY



APPENDIX B:

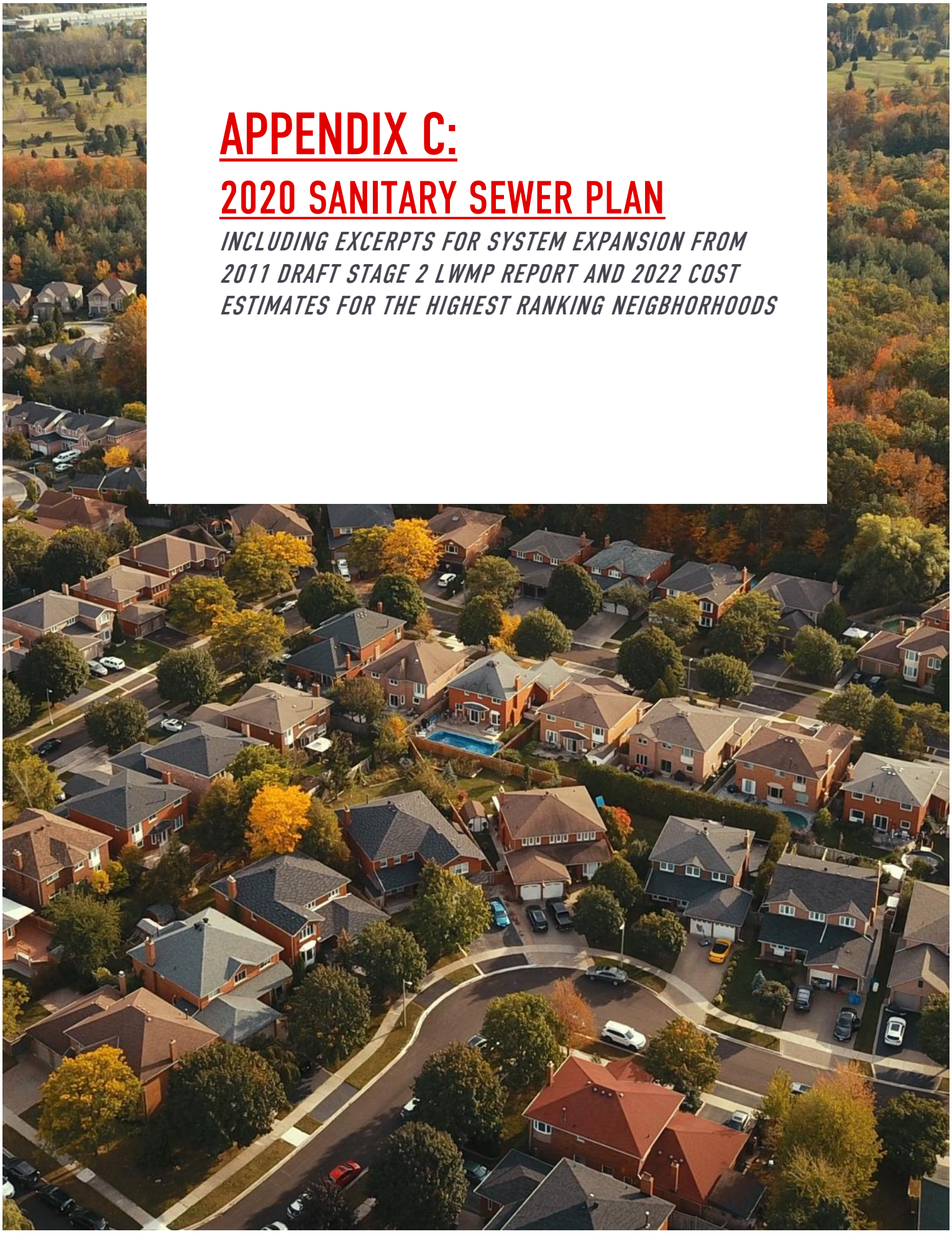
COLLECTION SYSTEM UPGRADE COSTS



APPENDIX C:

2020 SANITARY SEWER PLAN

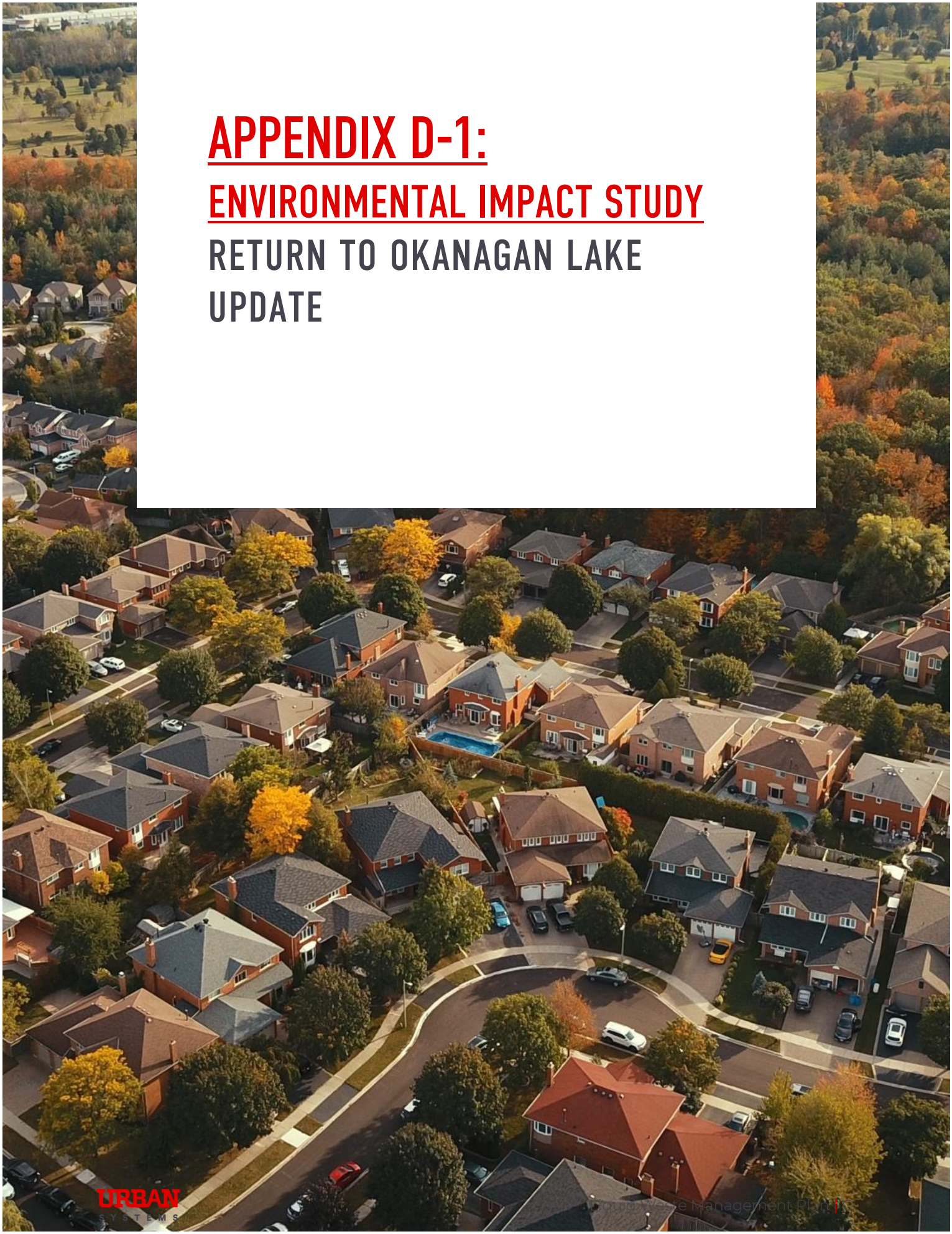
INCLUDING EXCERPTS FOR SYSTEM EXPANSION FROM 2011 DRAFT STAGE 2 LWMP REPORT AND 2022 COST ESTIMATES FOR THE HIGHEST RANKING NEIGBHORHOODS



APPENDIX D-1:

ENVIRONMENTAL IMPACT STUDY

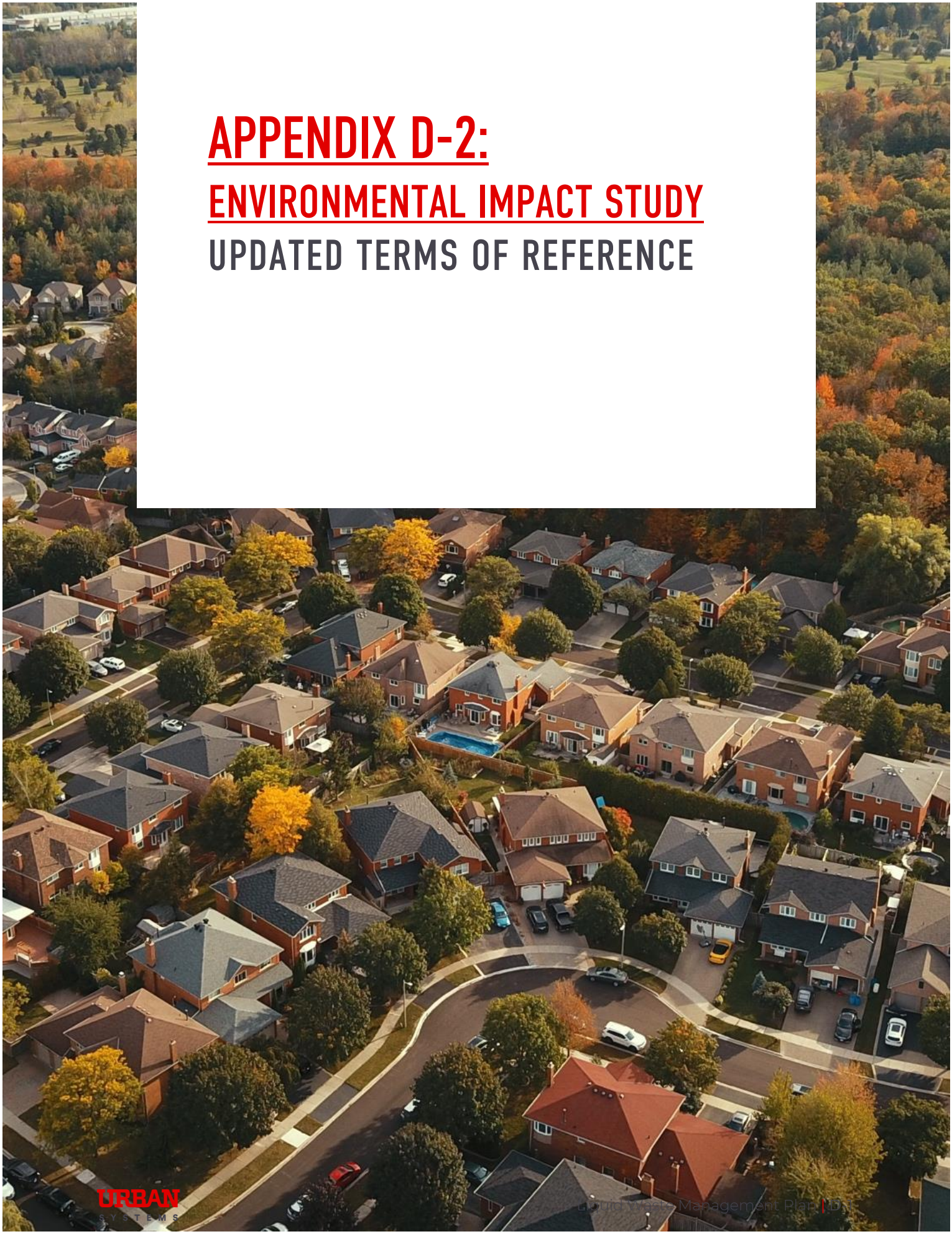
RETURN TO OKANAGAN LAKE UPDATE



APPENDIX D-2:

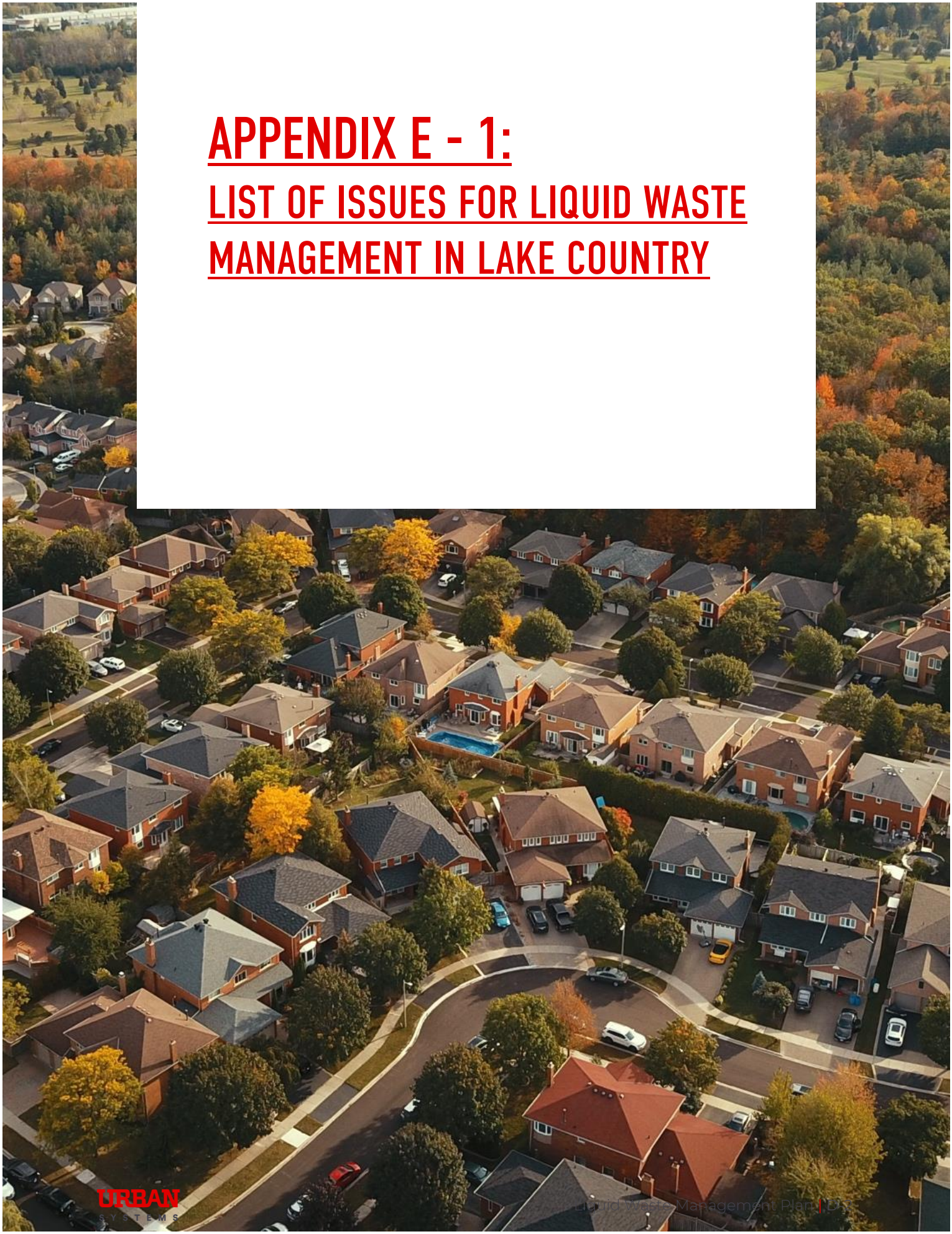
ENVIRONMENTAL IMPACT STUDY

UPDATED TERMS OF REFERENCE



APPENDIX E - 1:

LIST OF ISSUES FOR LIQUID WASTE MANAGEMENT IN LAKE COUNTRY



APPENDIX E - 2:

POLICY REFERENCES FROM OCP