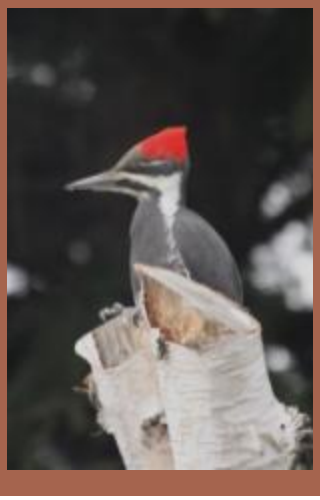
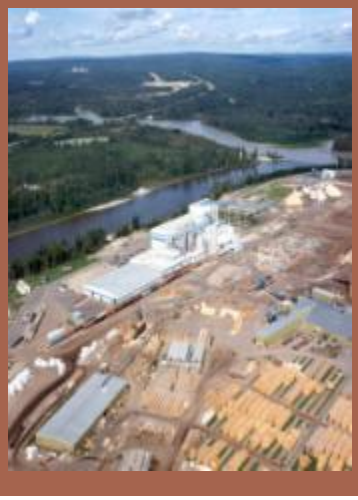
Alberta's Forest Sector Water CEP Plan:

A Journey towards Sustainable Water Management

2011





AFPA

ALBERTA FOREST PRODUCTS ASSOCIATION

About the Alberta Forest Products Association

Established in 1942, the Alberta Forest Products Association (AFPA) is a non-profit organization fully funded by its member companies. These companies manufacture wood products in Alberta including lumber, panelboard, pulp and paper, and secondary manufactured wood products.

The AFPA is a recipient of Alberta's prestigious Emerald Award recognizing environmental initiatives.

Alberta's forest products companies and the AFPA work together to develop public awareness of the industry and a greater understanding of the economic, environmental and social values of Alberta's forests. The AFPA provides member companies with service in the areas of Environment, Forestry, Health and Safety, Lumber Grading and Transportation as well as programs like FOREST*CARE* - the industry's program of continuous improvement. This program is based on the following principles:

1. Member companies will ensure that harvest levels do not exceed the capacity of the forest, that all harvested areas are reforested, and that harvest and reforestation methods foster a healthy new forest, supporting a diversity of species.
2. Member companies will manage their activities on forest lands for multiple uses and values, including timber growth and harvest, watershed protection, wildlife and aquatic habitat and recreational and aesthetic benefits.
3. Member companies will manage their forest and manufacturing operations in a manner that protects the environment, placing special emphasis on the quality of air, water, soil and habitat.
4. Member companies will operate in a manner that protects the health and safety of employees, contractors and the general public.
5. Member companies will be open and responsive to community views and questions regarding the industry.
6. Member companies will conduct operations to ensure that the renewable forest resource provides economic activity and employment now and in the future, while conserving other forest values.

For more information about the AFPA, call (780) 452-2841 or visit www.albertaforestproducts.ca.

Executive Summary

Water for Life, the province's strategy for water management released in 2003, identifies water conservation as a cornerstone for achieving the strategy's goals and outcomes. The Alberta Water Council has developed guidance on how the province's seven major water-using sectors, including Forestry, should develop water conservation, efficiency and productivity (CEP) plans.

Alberta's Forestry Sector has a long history of managing Alberta's forests in a sustainable manner. Wood fibre is a renewable resource that is used by the forest products industry in the manufacture of several goods including lumber, panelboard, pulp and paper and many specialty items. Within this sector, the pulp and paper industry is the only area requiring licenced water withdrawals. Hence the pulp and paper industry is the focus of this Forestry Sector water CEP plan.

Alberta's seven pulp and paper mills are all located in the Peace and Athabasca watersheds where they are licenced to withdraw less than 1% of annual river discharge. Pulp mills only withdraw water as it is needed and actual water use is even less than that licenced (~63%). Water not withdrawn remains in the river and continues to benefit aquatic health. Additionally, most of the water withdrawn (92%) is returned to the river. The pulp and paper industry is committed to a high standard of effluent quality. Water quality in these rivers is generally rated as good. Additionally, under federal and provincial regulations, mills are required to monitor the effect of emissions on the receiving water body.

Over the last decade, an investment of $5 billion in new capital expenditures and upgrades has contributed to a 5% decline in total water use in the pulp and paper industry. As well, these improvements contributed to an 8% improvement in productivity (measured as the number of cubic metres of water required to produce one dry metric tonne of pulp). While further reductions in water use may be technologically and economically challenging for this sector, improvements in productivity may continue to be made over the next decade, particularly where water use is tied to energy reduction initiatives.

As the champion of this plan, the Alberta Forest Products Association (AFPA) will continue to work with Alberta's pulp and paper mills to identify further opportunities for water CEP, drawing from provincial, national, and international experience. It is up to each mill to determine which opportunities are feasible, and when and how CEP initiatives might be undertaken.

Alberta's pulp and paper mills take a holistic approach to their environmental footprint and are continuously improving their energy consumption, emissions, water discharge quality and other environmental impacts. However, pulp and paper mills are not the only water users in the watershed. To address the cumulative effects of several users, Alberta mills, as well as meeting strict regulatory requirements, are working with partnerships to conduct additional research, monitoring, assessment and modelling exercises to ensure source waters and their associated aquatic ecosystems remain healthy. In turn, this work contributes to the achievement of *Water for Life* and its goals.

Acknowledgements

This plan could not have been produced without the cooperation and expertise of Alberta's pulp and paper mill operators. In particular, the AFPA thanks the following individuals for their contributions to the text and photos: Jennifer Fowler (Hinton Pulp), Brian Gilliland and Grant Bouree (Weyerhaeuser), Vince Martell (Slave Lake Pulp), Shaun McNamara (Al-Pac), Dan Moore (Alberta Newsprint Company), Keith Murray (Alberta Forest Products Association), Jeff Shipton (Millar Western), and Tom Tarpey and Ned Lorincz (Daishowa Marubeni). We also thank Troy Keller (2010 summer student) and Alberta Newsprint Company for building the water use database which in turn has informed this plan. We also acknowledge Petra Rowell for her work in editing and formatting this document.

Contents

1.0 Introduction

1.1 Water for Life

In 2003, the Government of Alberta released its *Water for Life* strategy, a policy to guide water management in the province. The strategy contained the following three goals and outcomes:

- Safe, secure drinking water supply
- Healthy aquatic ecosystems
- Reliable, quality water supplies for a sustainable economy

A key theme of *Water for Life* is water conservation, specifically, that *"Albertans will be leaders in conservation by using water efficiently and effectively"*. The strategy states that, *"fluctuating and unpredictable water supply in recent years has stressed the need to make some major shifts in how we use and allocate this renewable, but finite, resource."* One way to make a shift in how we use the water resource is to set and achieve a water conservation target. Thus, *Water for Life* sets a 30% conservation target that all licensed water-using sectors in Alberta will strive to achieve. This includes, but is not limited to, the following sectors:

- Oil and Gas and Oil Sands Mining
- Irrigation
- Forestry
- Urban Municipal
- Power Generation
- Downstream Petroleum Products
- Chemical Producers

1.2 Water Conservation, Efficiency and Productivity Planning

The *Water for Life* strategy also looks to partnerships to achieve its outcomes. In 2005, the Alberta Water Council (AWC), a multi-stakeholder consensus-based partnership, was asked by the Government of Alberta to examine the 30% water conservation target. The Council struck a Project Team that broadened the focus from water conservation to include water efficiency and productivity. The Team provided agreed-to definitions for these terms (see textbox next page).

The AWC Project Team also determined the desired outcomes to be achieved by water conservation, efficiency and productivity (CEP) and the principles to guide improvements in CEP as follows:

CEP Outcomes:

- Demand for water (surface and groundwater) is reduced.
- Water use productivity is increased.

- Resources are conserved to maintain healthy aquatic ecosystems.
- Water quality is maintained or enhanced.

CEP Principles:

- Fresh water is a finite and vulnerable resource, essential to sustain life, economic development and the environment.
- Water has an economic value in all its competing uses.
- Water has non-monetary values that enhance the quality of life.
- Sectors are accountable for what they control.
- Sectors have different opportunities for making progress in conservation, efficiency and productivity and are not necessarily comparable against other sectors.
- Sector plans will make every reasonable effort to protect and enhance aquatic ecosystems and meet ecosystem objectives.
- All stakeholders will work collaboratively, resolve differences through consensus processes, and support Best Management Practices.
- The Alberta Government will assure that goals for water conservation, efficiency and productivity are achieved.

Finally, the AWC encouraged all seven major water-using sectors to develop water CEP plans. In 2008, the Council provided advice on how CEP planning should be conducted and several sectors began the task of preparing sector-specific CEP plans.[1]

Water Conservation: Any beneficial reduction in water use, loss, or waste; Water management practices that improve the use of water resources to benefit people or the environment.

Water Efficiency: Accomplishment of a function, task, process, or result with the minimal amount of water feasible; an indicator of the relationship between the amount of water needed for a particular purpose and the quantity of water used or diverted.

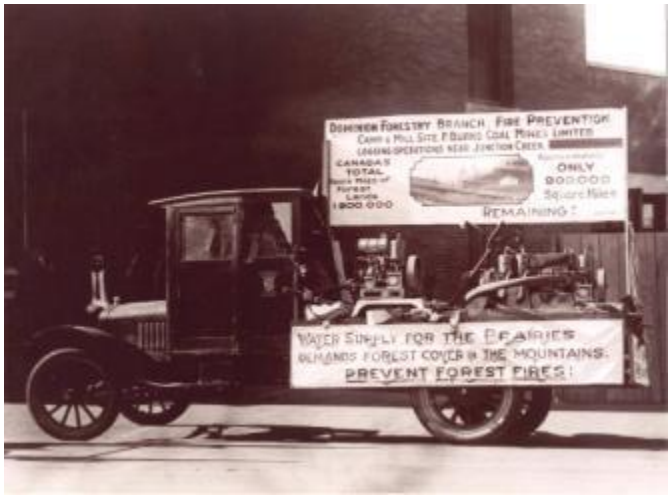
Water Productivity: The amount of water that is required to produce a unit of any good, service, or societal value.

[1] For more information on completed sector CEP plans, see the Alberta Water Council project page at http://www.albertawatercouncil.ca/Projects/WaterConservationEfficiencyandProductivity/.

2.0 Alberta's Forestry Sector

2.1 Alberta's Forests

Alberta's forests, found largely on crown (public) lands in the boreal Green Area or northern part of the province, and to a lesser degree along the foothills and in private woodlots, have long been recognized as an important resource with ecological, social and economic benefits. Ecological benefits include the goods and services, or functions, a forest provides such as wildlife habitat, watershed protection, carbon capture and storage, etc. Similarly, forests provide social benefits such as places for recreation and other cultural activities.



The Forestry Sector has a long history in Alberta.

The forest also provides a renewable source of fibre. Harvesting this fibre provides economic benefits to Albertans. Forestry is a major contributor to the province's economic diversity as the province's third largest sector (behind petroleum and agriculture). It generates $11 billion in direct and indirect revenue annually and employs 47,000 Albertans in 50 communities across the province.

"Sustainable Resource Development works to ensure forests remain vibrant in Alberta. Alberta supports a policy of sustainable forest management designed to provide ecological, economic, social and cultural opportunities for the benefit of present and future generations."

http://www.srd.alberta.ca/LandsForests/ForestManagement/Default.aspx

Alberta's crown-owned forests are managed for multiple-uses (such as oil and gas, forestry, recreation, wildlife, etc.) through the *Forests Act* and other legislation administered by Alberta Sustainable Resource Development (ASRD). Together, ASRD and forest companies operating under a lease (Forest Management Agreement, Timber Quota, or Timber Permit) manage forest and manufacturing operations in a sustainable manner that protects the quality of water, air, soil and wildlife habitat.

The Forestry Sector is made up of a number of diverse components including forest planning, forest fire protection, harvest, primary and secondary manufacturing, forest regeneration, forest research, etc. While all of these activities may occur around water, the only licensed water-users in the forestry sector are those engaged in the manufacturing of forest products, specifically pulp and paper.

2.2 Alberta's Forest Products Industry

Alberta's forests are harvested and manufactured into a variety of products by a diverse group of companies ranging in size from large multi-national corporations to small family-owned businesses. These companies produced forest products with a value of $4 billion in 2010. Products are used locally or shipped, largely to the United States, but also to Japan and the rest of the Pacific Rim.

In general, Alberta's forest products industry can be divided into five areas:

- Forest Management: a range of activities from resource planning to road building, to cutting, log hauling and reforestation.
- Dimensional lumber: sawmills generally produce standard sizes of lumber (solid wood).
- Panelboard: the production of Oriented Strandboard (OSB), Medium-density Fibreboard (MDF) and plywood.
- Pulp and Paper: the production of Kraft pulp, mechanical pulp and newsprint.
- Value-added (secondary manufacturing): the further processing of the products of primary manufacturing to increase their value.

The following sections look at these five areas in more detail:

2.2.1 Forest Management

Harvest involves the cutting and de-limbing of trees within a lease site before transporting these logs to Alberta's primary manufacturers (i.e. pulp and paper mills, panel board mills and sawmills). About one-percent of Alberta's forest is harvested each year using a variety of methods, including some that mimic natural disturbances like fire.

To ensure the sustainability of Alberta's forests, government policy does not allow timber harvesting to exceed the forest's ability to grow. The annual forest growth of all inventoried public lands in the province is estimated at 44.5 million cubic metres. The net Annual Allowable Cut (AAC) in the green zone is close to 23.1 million cubic metres. The principle species harvested for commercial purposes include white spruce, black spruce, lodgepole pine, trembling aspen and balsam poplar.

Forest growth is monitored to ensure annual harvest is sustainable.

Forest companies, operating under Forest Management Agreements and timber dispositions, are involved in Forest Management Planning, road construction, harvesting and reforestation. Forest Management Plans must have a public consultation component and must be approved by the Alberta Government before timber is harvested. Plans are continually revisited and revised in light of new research and on-the-ground results. In Alberta, it takes between 80 and 120 years to grow a tree. Forest products companies operate under a planning horizon that spans 200 years or more.

To ensure that our fiber supply is sustainable, reforestation has been legislated in Alberta for over 30 years. Forest companies plant approximately 75 million conifer seedlings in the province each year. These companies also undertake activities to help natural regeneration in deciduous species. Significant research is on-going to improve harvest and regeneration methods and to learn more about how forests function and remain healthy.

Additionally, to gain access to public and private fiber supplies, manage costs of complying with government regulations, and gain consumer confidence, many companies operate to provincial and national forest management standards. Standards, or codes of practice, may be developed for business processes, worker health and safety programs, transportation and infrastructure management, lumber grading, environmental impacts, and other aspects of operations. Similarly, certification programs, where a company is recognized (certified) once it has met a number of standards (usually involving a process of auditing and reporting), proves to

the public and regulators that the company is practicing due diligence and following good sustainability guidelines.

One example of a national standards program is the Canadian Standards Association *National Sustainable Forest Management standard* (CSA-Z809). This voluntary program was developed through an open and transparent multi-stakeholder consensus-based process and focuses on adaptive forest management with public participation, performance and system requirements. A certification program that many consumers are aware of is through the *Forest Stewardship Council*. In Alberta, several mills participate in the Government of Alberta's Enviro*Vista* program.[2] While there are many more examples of such programs, the AFPA recognizes that all standards and certification programs have value. The AFPA encourages forest companies to choose the system that best meets its needs, as defined by stakeholder demands, company culture and marketing requirements.

What is Forest*Care* Alberta?

Members of the AFPA created Forest*Care* in 1990, a program of continuous improvement in the province's forest products industry. Members who commit time, money and resources to meet, and in many cases, exceed program targets are proud to display the FOREST*CARE* trademark.

2.2.2 Dimensional Lumber

Once logs are harvested, they may be taken to a sawmill where they are de-barked, sawn, planed and dried into solid wood products of different dimensions for residential and commercial building projects. White spruce and lodgepole pine are the preferred species for lumber production and lumber is graded to ensure good quality. Alberta produced 2.8 billion board feet of lumber in 2010 valued at $740 million. Alberta product is largely exported to the United States although the industry is actively pursuing Asian markets.

Alberta's forest product companies are focusing on maximizing use of the entire log and reducing waste. Hence the by-products of lumber production may be utilized elsewhere. For example, woodchips are sent to pulp mills and sawdust can be sold as livestock bedding. Bark and shavings might be used as a fuel source for home heating or for co-generation facilities that provide electricity on-site or for sale to Alberta's power grid.

2.2.3 Panel Board

Flat panel wood products are used for wall and roof sheathing, sub-flooring, furniture and other building products. Total panelboard production in Alberta in 2010 was 1.1 billion square feet valued at $303.5 million. To develop panel board products, whole logs or wood waste might be used, depending on the facility. In Alberta, plywood is made from peeled conifer logs. The core

[2] For more information on these programs, see http://www.csa-international.org/product_areas/forest_products_marking/Default.asp?language=english ,http://www.fsccanada.org/certifiedforestsincanada.htm and http://environment.alberta.ca/01374.html.

of the log may be sawn into 2x4s and sold as fence posts or chipped. The remainder of the log is then used to create veneer sheets. These sheets are glued and pressed into various thicknesses and cut into various sizes. Waste products are sent to energy plants or to pulp mills as chips.

In more recent years, oriented strand board (OSB) products have become popular and are made mainly from deciduous species (some conifer chips may be used). These boards are made of long, thin strands of aspen or poplar bonded together under intense heat and pressure with a waterproof resin. As the name suggests, strands are "oriented" in different directions, adding to the structural stability and strength of the panel.

Similarly, medium density fiberboard (MDF) products are made from sawmill wastes (clean shavings and sawdust) that are combined with a synthetic resin. MDF boards are more pliant and durable, making them more attractive than traditional materials in the furniture industry.

2.2.4 Pulp and Paper

To make pulp and paper products, mills use both conifer and deciduous trees to produce wood chips, or they use byproducts from the sawmilling sector (chips, etc.). In 2010, Alberta produced total pulp and paper shipments of 1.5 million air-dried metric tonnes, valued at $1.3 billion.

Pulp Mills are regulated by both provincial and federal legislation and all mills have an environmental management system based on ISO 14000 principles.[3] Mills also participate in water and air quality monitoring and research in an effort to reduce waste, minimize water use, and improve effluent quality. The fiber supply of all seven pulp mills are certified to international CSA, SFI, or FSC Sustainable Forest Management Standards.[4] (Mill operations will be discussed in more detail in section four.)

2.2.5 Value-Added

The secondary manufacturing sector takes primary wood products and adds value by upgrading them. Examples include the manufacturing of wood pallets, shipping containers, cabinetry, wood doors and windows, hardwood flooring and laminated wood beams for large open structures and pre-fabricated houses, garages and other buildings. This industry has been expanding in recent years and companies will continue to look for opportunitities to expand the variety of wood products Alberta manufactures in the future.

[3] For more information on ISO 14000, see http://14000store.com/what-is-iso-14000.aspx.
[4] For more information on these sustainable forest management standards, see the following web links: http://www.csasfmforests.ca/; http://www.sfiprogram.org/; and http://www.fsccanada.org/default.htm.

Alberta also has the potential to expand its market via secondary manufacturing of its pulp products. One example of a new pulp product is nanocrystalline cellulose (NCC), a refined pulp product with the potential to be used in a variety of diverse applications such as automotive components, paints and building materials, plastics, packaging, health care products and energy extraction.

3.0 Water CEP Planning for Alberta's Pulp and Paper Industry

While the 'Forestry Sector' was identifed by the Alberta Water Council as one of seven major water-using sectors requiring the development of a CEP plan, water use varies significantly between different activities within this broad category. For example, harvesting activities do not generally involve the use of water and forest operations around water bodies are well regulated. Setback distances around lakes and streams ensure waterbodies are not disturbed by harvest activities or affected negatively by erosion that may impact aquatic ecosystem health. The forestry sector is also guided by regulations for stream-crossings, road-building, and other activities that may potentially impact the environment.

In general, mills that produce dimensional lumber, panelboard and value-added products also do not use a large amount of water in developing these products. What water they do require onsite is generally acquired through municipal licence-holders or small groundwater wells.

The pulp and paper industry is the only component of the forestry sector that withdraws significant amounts of water and who hold water allocation (withdrawal) licences. As the initial focus of a water conservation plan should capture the largest individual water users within a sector, the focus of the remainder of this plan is on the pulp and paper portion of the forest products industry.

3.1 The Case for a Pulp and Paper CEP Plan

Alberta's pulp and paper industry strongly supports maintaining the sustainability of the province's natural resources while also maintaining Alberta's global competitive position. Water is a natural resource that must be sustained for the social, economic and environmental benefits it provides including its use by the pulp and paper industry.

Ensuring water supplies are sustainable reduces the risk of water scarcity and provides an atmosphere of certainty to Alberta mill

"**Recycling**" is using the same water over again within one process or series of processes by the same user.

"**Reuse**" means using water for one purpose, then moving it to another use, possibly by another sector, with or without some form of treatment prior to reuse.

operators. Although they are located in watersheds where water-shortages are currently not an issue, Alberta operators are continuously searching for methods to reduce, reuse or recycle water. Over the past decade, Alberta mills have spent $5 billion in new capital expenditures and upgrades in order to create some of the most efficient and environmentally-friendly plants in the world.

Water and energy conservation are often closely linked. Facilities operate "Just in Time "water treatment plants (clarifiers and sand filters) and all water used in the pulp manufacturing process undergoes some degree of treatment and/or heating which is a significant cost to the manufacturing facility. In many cases, one of the important benefits of conserving water is the concomitant reduction in energy use.

CEP planning also aligns with this industry's goal to be a world leader in technology and stewardship initiatives. Developing a water CEP plan, and using technology to achieve it, will demonstrate the pulp and paper industry's commitment to *Water for Life* goals. Working with other water-users through the *Water for Life* partnerships, this industry will also contribute to ensuring the water resource, and the aquatic ecosystem it is associated with, remains healthy and sustained for all Albertans, now and in the future.

3.2 Plan Leaders and Champions

The Alberta Forest Products Association (AFPA) is championing this Forestry Sector Water CEP plan. As such, the AFPA, with input from both members and non-members, will draft the plan and encourage its adoption and implementation. The AFPA also commits to seeking input on this plan from its stakeholders, including existing Public Advisory Committees (PACs) as well as those organizations with a mandate for water policy (Alberta Water Council) and watershed assessment and planning in the area of Alberta's pulp and paper mills (the Athabasca Watershed Council, Lesser Slave Watershed Council and the Mighty Peace Watershed Alliance).

The seven pulp and paper facilities currently operating in Alberta have an excellent CEP track record, having made significant gains in water conservation, efficiency and productivity over the past decade (2000 – 2009).[5] These companies will continue to take a leadership role in implementing CEP opportunities over the next decade (2011 – 2020).

[5] Note that because good data is available for this period, the year 2000 has been established as the base year for measuring water CEP in the forestry sector.

3.3 Goals and Vision of a Water CEP Plan

2020 Vision: *Alberta's pulp and paper mills are world leaders in water-use reduction technologies and process operations, have further reduced their water consumption and improved their efficiency and productivity. As stewards of Alberta's water resources, they are actively working with partnerships to ensure aquatic ecosystems are healthy.*

Specifically, plan goals include the following:

- To keep water withdrawals and returns from Alberta's seven pulp and paper mills at current (2009) or improved levels;
- To utilize research and technology to improve productivity by a further 5% over the next decade; and
- To continue to work with partnerships to improve water quality and to ensure aquatic ecosystems are healthy.

The vision and goals of this plan will be achieved through the continued adoption and implementation of best available technology economically available (BATEA) and best management practices (BMPs) by Alberta's pulp and paper mills. The uptake of BATEA and BMPs has already led to a 5% reduction in water use and an 8% increase in productivity over the last decade. Further investigation of investment opportunitities in new technologies may lead to future reductions in water consumption.

Alberta mills will also continue to improve water CEP performance and aquatic ecosystem health in the watersheds in which they operate through their participation in partnerships, research initiatives and education.

3.4 Plan Contribution to *Water for Life*

This Forestry Sector CEP plan supports the principles of the *Water for Life* strategy. Water for Life includes a principle that *"Albertans must become leaders at using water more effectively and efficiently, and will use and reuse water wisely and responsibly."* By implementing BATEA and BMPs, Alberta's pulp and paper industry has and will continue to contribute to this *Water for Life* principle.

Additionally, this plan will contribute to the *Water for Life* goals as follows: A *safe and secure drinking water supply* and *reliable supplies for the economy* will be maintained through informed and intelligent water usage by this industry. (Several Alberta mills work with their local municipalities to share intake and treatment infrastructure to ensure all local needs are met.)

Additionally, continuously improved treatment processes for the quality and quantity of effluent discharged into Alberta watersheds will ensure *healthy aquatic ecosystems* and source supplies for downstream users.

And finally, *Water for Life* includes outcomes such that:

- All sectors are demonstrating best management practices and improving efficiency and productivity associated with water use (2007 – 2010); and
- Water is managed and allocated to support sustainable economic development and the strategic priorities of the province (2010 – 2014).

The forest products industry will contribute to achieving these *Water for Life* outcomes by:

- Being recognized as world leaders in water use reduction technologies and process controls through the implementation of BATEA and BMPs; and
- Being recognized as stewards of the water resources in Alberta by participating in partnership initiatives for research, monitoring and assessing aquatic ecosystem health.

3.5 Relevant Policies, Legislation, and Planning Initiatives

Aside from *Water for Life*, there are several other policies, acts and planning initiatives that may impact the pulp and paper industry's use of water in the province. As mentioned previously, forest management in Alberta is administered under the *Forests Act*. Forest Management Plans must be approved by the Government of Alberta before harvest can occur. These plans may set out conditions where, when and how harvest will occur, setback distances from waterbodies, etc.

Other provincial acts, such as the *Water Act* and *Environmental Protection and Enhancement Act* specifically impact pulp and paper operations such as water withdrawals and emissions. All mills must meet a suite of conditions before they can receive an Operating Approval from Alberta Environment: conditions vary by mill. Additionally, pulp and paper mills must comply with federal legislation including the *Fisheries Act, Canadian Environmental Protection Act* and *Navigable Waters Protection Act*. Several regulations, such as the federal *Pulp and Paper Effluent Regulations,* also affect operations.

Pulp and paper mills are required by law to participate in the federal environmental effects monitoring program. They also voluntarily participate in a number of research, monitoring and assessment programs (see more on these programs in section 6.1).

To assist the province with the management of cumulative effects on Alberta's forests, the Forestry Sector must also be aware of other users and activities on the landscape. Thus, this sector has a long history of participating in government and multi-stakeholder processes for developing integrated land use plans, including the regional planning currently taking place under the *Land Use Framework*.

Under *Water for Life*, Watershed Planning and Advisory Councils (WPACs) are tasked with undertaking watershed assessment and planning in each of the province's major basins. These activities focus on maintaining or improving the water quality, water supply and aquatic health of each basin. A pulp and paper CEP plan can contribute to a watershed plan. Hence the forestry sector is represented on the board and technical teams of several WPACs.

Alberta's seven pulp and paper mills are located in the area of three WPACs. The Athabasca Watershed Council is currently in the process of completing Phase 2 of a State of the Watershed Report. A watershed management plan for the Athabasca watershed will be developed at a future date. Similarly, the Lesser Slave Watershed Council has completed a state of the watershed report. The Mighty Peace Watershed Alliance has only recently formed.

For more information about these and other Watershed Planning and Advisory Councils, see:

Athabasca Watershed Council
http://athabascawatershedcouncil.org/

Lesser Slave Watershed Council
www.lswc.ca

Mighty Peace Watershed Alliance
www.mightypeacewatershedalliance.org

Water for Life WPAC page
http://www.waterforlife.alberta.ca/01261.html

3.6 Barriers to CEP Planning

There are several technological and economic challenges to further CEP gains in the Forestry Sector. Alberta's pulp and paper mills already operate with the best available technology and have already made significant improvements in water CEP over the past decade. Further improvements will become increasingly difficult from a technological perspective. From an economic perspective, the forest industry is subject to market demand for its product. In turn, demand affects economies of scale and how much water is used in production. Alberta's forestry sector, already facing shrinking capital investment, must also maintain its economic competiveness with other jurisdictions.

Additionally, pulp and paper mills are focused on reducing their overall environmental footprint and sometimes water reduction may negatively impact other media or result in increased energy consumption. For example, at Hinton Pulp, water reduction efforts are starting to conflict with effluent pond temperature requirements. The conservation of warm water sources has the best

energy benefits and is usually the focus of water reduction strategies. This means the resulting effluent to the ponds is cooler; this can cause problems with lower pond temperatures and reductions in treatment efficiencies in the winter. While the pulp and paper industry continues to evolve and reinvent itself during these challenging economic times, they will not do so at the risk of creating additional environmental impacts, nor will they compromise their environmental performance to achieve voluntary water reduction targets. Hence, operations must consider many aspects, and not look at water use in isolation of other environmental priorities.

Similarly, government initiatives must not be at cross-purposes. Green house gas regulation in Alberta has provided an opportunity to mitigate operational and project costs through GHG reduction projects. In the pulp sector, GHG reduction is closely linked to water use. However, in some cases, GHG reduction projects may result in slight increases in water use. Hence a lack of harmonization between government initiatives may derail potential CEP opportunities.

Finally, if the operator doesn't need the water (because they have instituted reduction/ recycling/ reuse programs), they don't withdraw it and this portion of their licence remains in the river where it contributes to the aquatic ecosystem. However, the pulp and paper industry is only one user of the water resource. In fact, after combining forestry with other industrial uses (chemical plants, fertilizer plants, manufacturing, mining, coal mining, hydroelectricity and other industrial activities), this sector only accounts for 3% of water allocations in the province.[6] The forest sector cannot control the impact of other users, industrial and municipal development, and the cumulative impacts of water withdrawals on the watershed. Only by working with other users, through partnerships like the Alberta Water Council and Watershed Planning and Advisory Councils, can Alberta mills mitigate this risk to some degree.

3.7 Plan Scope

This CEP plan is applicable to all the pulp and paper mills currently operating in Alberta, including both members and non-members of the AFPA. At this time, all of these mills are located in central and northern Alberta in the Athabasca, Lesser Slave and Peace watersheds where water supply is currently not a large issue.

[6] For more on water use in Alberta, see *Reliable, Quality Supplies for a Sustainable Economy: current and future water use in Alberta* at http://www.assembly.ab.ca/lao/library/egovdocs/2007/alen/164708.pdf.

4.0 Current Pulp and Paper Industry Water Use Profile

4.1 Alberta's Pulp and Paper Mills

Currently, Alberta has seven pulp and paper mills (Table 1). All of these facilities rely on a surface water source. Five are allocated water out of the Athabasca watershed including the mainstem, as well as the McLeod and Lesser Slave tributaries. The remaining two facilitates are allocated water out of the Peace watershed mainstem and its tributary, the Wapiti River.

Alberta's pulp and paper industry utilizes two different types of mills:

- Mechanical Mills produce pulp by utilizing an energy intensive method of production called refining, which takes wood chips and grinds them down into pulp.
- Kraft mills produce pulp using chemicals to break down the wood into its cellulose component (for more on these processes, see Appendix 1).

Water in a mill may be used for several purposes including:

- As a non-contact coolant used to cool pulp that has been heated;
- As a mixer during the pulp-making process;
- As a carrier for transporting the pulp through the process;
- For steam generation where steam is used for process heating and electricity generation (steam is also used to soften wood chips in order to decrease energy and chemical requirements and to heat the pulp process to improve dewatering and debris removal);
- For diluting chemicals and pulp; and
- For cleaning (washing) the final pulp product.

Alberta Newsprint Company's wastewater treatment system near Whitecourt, Alberta.

Table 1. Alberta's 7 pulp and paper mills and the licensed amount of water they can withdraw annually.

Facility	Mill Type	River/Basin	Annual Diversion (acre feet)	Annual Diversion (cubic meters)
Alberta Pacific Forest Industries Inc. (Boyle)	Kraft	Athabasca	29,500	36,388,000
Alberta Newsprint Company (Whitecourt)	Mechanical	Athabasca	12,000	14,801,783
Daishowa-Marubeni International Ltd. (Peace River)	Kraft	Peace	30,000	37,004,456
Hinton Pulp (A division of West Fraser Mills Ltd.)	Kraft	Athabasca	68,400	84,370,155
Millar Western Forest Products Ltd (Whitecourt)	Mechanical	McLeod/Athabasca	7,702	9,500,278
Slave Lake Pulp (A wholly owned subsidiary of West Fraser Mills Ltd.)	Mechanical	Lesser Slave /Athabasca	5,100	6,290,758
Weyerhaeuser Company Limited (Grande Prairie Operations)	Kraft	Wapiti/Peace	33,000	40,704,902
		Total	**185,702**	**229,060,332**

Generally, mills have their own infrastructure for withdrawing and treating source/waste water before and after it is utilized. These systems are efficient, with very little loss through leakage or evaporation. That is, for every cubic meter (m^3) withdrawn at the river, a m^3 is delivered to the mill for use in processing. Mills have approximately four hours of water storage capacity and do not require larger storage. So, if water is not needed, it is not withdrawn and remains in the ecosystem; water conserved means water is left in the rivers to contribute to river flow and water quality.

However, recognizing they are not the only users of the source and that efficiencies may be gained, several mills share water infrastructure with their local municipalities as follows:

- Hinton Pulp provides both potable water treatment and waste water treatment for the Town of Hinton. In addition to treating the town's waste water, they also accept sewage from septic tanks in the Yellowhead region.
- Millar Western has partnered with the Town of Whitecourt to upgrade and share a water intake structure for all diverted water.
- Weyerhaeuser has a partnership with Aquatera, to monitor aquatic health on the Wapiti River, source water for the City of Grande Prairie.
- AL-PAC provides drinking water to local residents that store their water in cisterns. Farmers can also get water for spraying.

4.2 Baseline Water Use

Each pulp and paper facility in Alberta operates under a water licence which dictates the allowable maximum withdrawal, quantity and rate. As seen in Table 1 above, the total annual licensed water diversion by Alberta's pulp and paper mills is 229,060,332 m^3 or 151,349,974 m^3 from the Athabasca watershed (less than 1% of average annual discharge) and 77,709,358 m^3 from the Peace watershed (less than 0.1% of average annual discharge).

However, a facility may not require all the water it is allowed to withdraw. Actual water usage is somewhat less than licensed volumes (Figure 1). In fact, the average daily water intake of these seven mills has decreased approximately 5% over the ten year period between 2000 (57,199 m^3) and 2009 (54,083m^3) (Figure 2) due to improvements each mill has made to their production process.

Additionally, once it is used and treated, a large proportion of withdrawn water is returned to the river. Currently, 92% of the water withdrawn by these seven mills is returned to the watershed from which it was taken. The remaining 8% is sent out as steam/water vapour (back into the water cycle) or with the product.

Alberta Newsprint is the only paper mill in Alberta. By the time it has gone through the former, press sections, dryers and calendar stack, newsprint will be about 8% water.

Thus the amount of water consumed in the making of pulp and paper products is much smaller than the amount withdrawn (Table 2 below). All withdrawals and returns are metered and each facility is responsible for reporting monthly water use volumes, returns and percent efficiency to Alberta Environment.

Millar Western's mill site at Whitecourt.

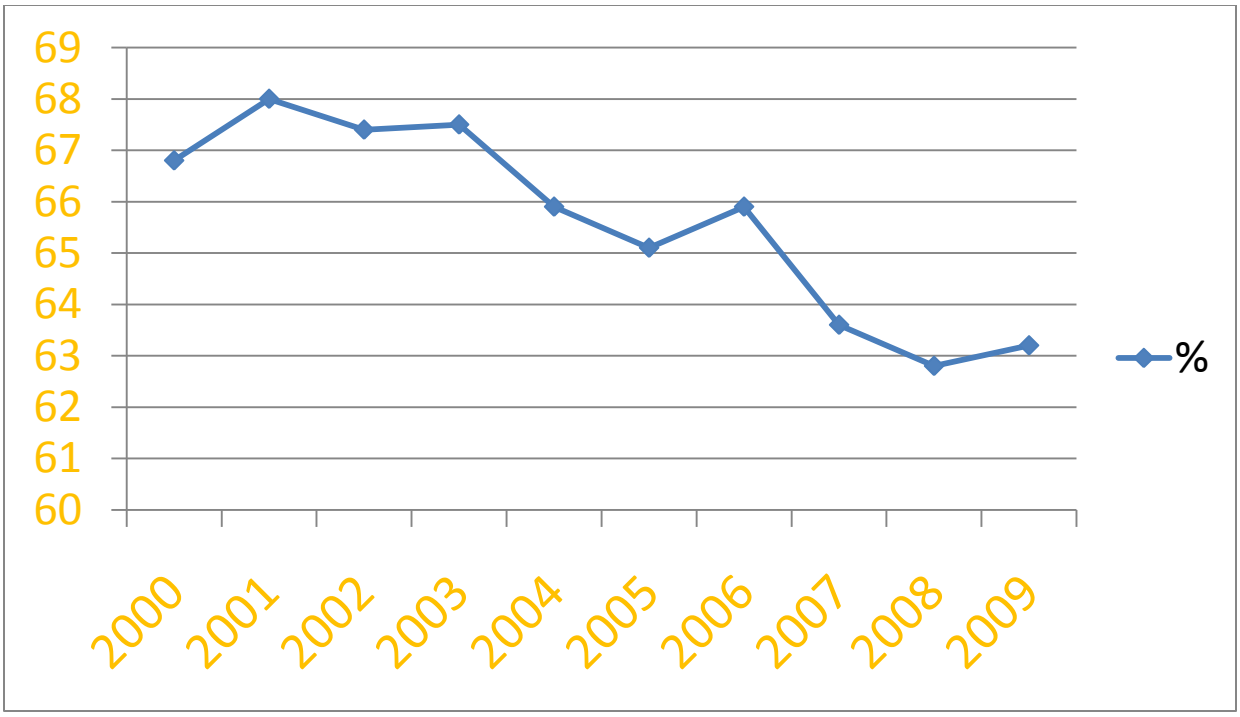


Figure 1. Actual Water Diverted as a Percent of Licensed Volume from 2000 to 2009 (All Mills).

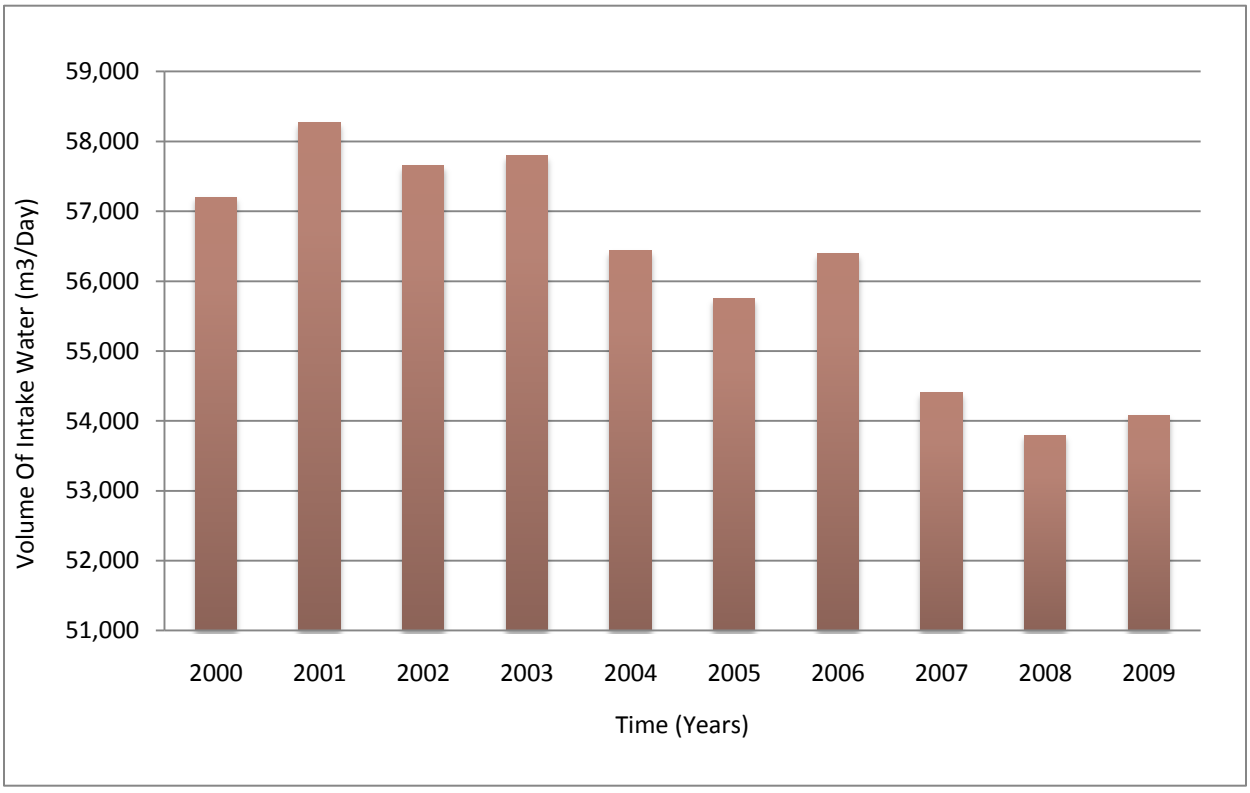


Figure 2. Average Daily Intake Water from all Pulp and Paper Mills in Alberta, 2000 – 2009.

Table 2. Actual Water Use

Combination of all 7 mills:

- Average Volume Diverted (2009) for all Mills: 54,083.4 m^3/Day
- Average Discharge Volume (2009) for all Mills: 49,573.9 m^3/Day
- Average amount of consumed water (2009) for all Mills: 4,510.0 m^3/Day

Mechanical Mills (3):

- Average Volume Diverted (2009) for Mechanical Mills: 15,307.5 m3/Day
- Average Discharge Volume (2009) for Mechanical Mills: 13,803.5 m3/Day
- Average amount of consumed water (2009) for Mechanical Mills: 1,504 m3/Day

Kraft Mills (4):

- Average Volume Diverted (2009) for Kraft Mills: 83,165.3 m3/Day
- Average Discharge Volume (2009) for Kraft Mills: 76,401.6 m3/Day
- Average amount of consumed water (2009) for Kraft Mills: 6,763.7 m3/Day

4.3 Productivity

While understanding the amount of water used is an important aspect of CEP planning, knowing how well the water is used and what a unit of water produces, is also key. Pulp sector productivity (intensity) can be portrayed as the number of cubic meters of water required to produce one air-dry tonne of pulp. The pulp and paper industry has improved productivity over

the past decade. In 2000, 60.8 m^3 of water was required to produce one tonne of pulp. By 2009, this figure was at 55.7 m^3 - an 8.4% improvement (Figure 3).

Productivity is, however, affected by economies of scale. In 2005, an older machine/production line was taken off line at Hinton, resulting in less product the following year (2006) without a corresponding decrease in water use (no new facilities have been added to Alberta's pulp and paper industry over the past decade). Different areas of water use can also impact productivity figures. Water use reductions have been made in areas where water is specifically used for pulp production however water use for cooling purposes is the same or slightly higher.

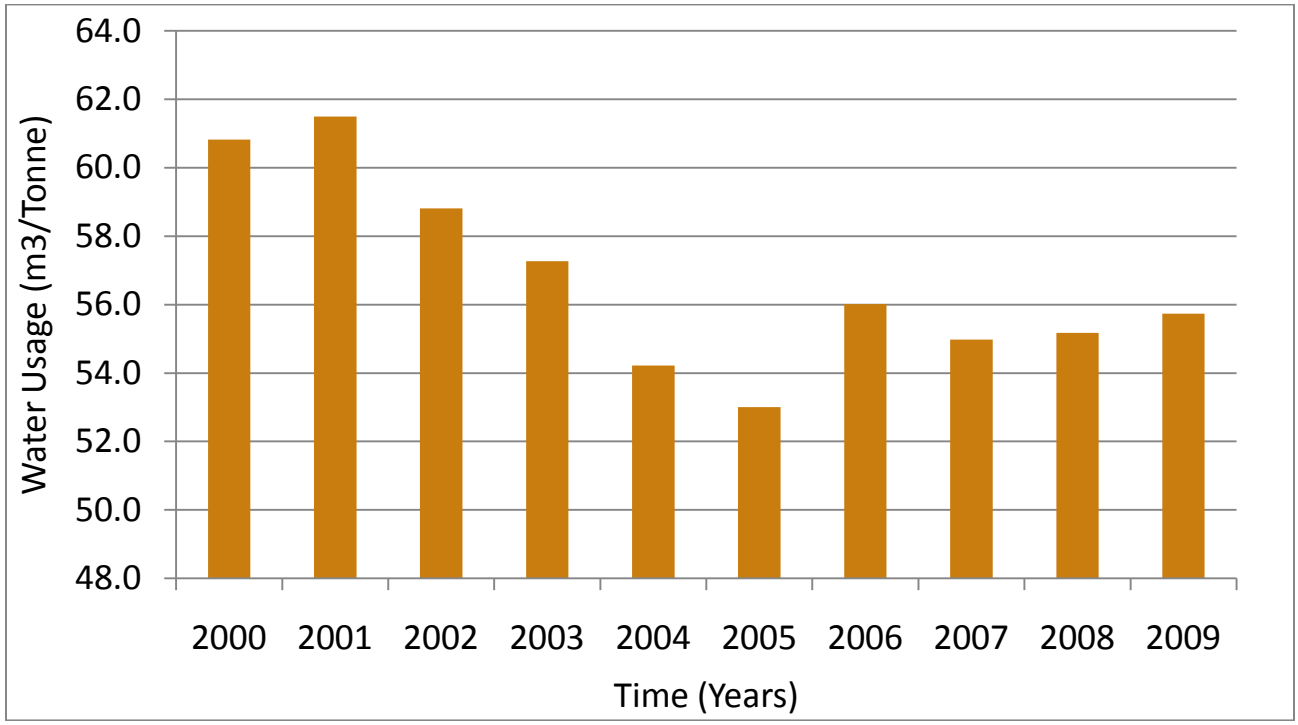


Figure 3. Average Pulp Sector Productivity / Intensity (m^3/tonne) for all Pulp and Paper Mills in Alberta.

Productivity can also be compared between the two pulping processes. Between 2000 and 2009, Alberta's kraft mills have reduced water use per one tonne of pulp production form 74.1 m^3 to 68.7 m^3 or 7.3% (Figure 4). Similarly, water usage by mechanical mills has declined from 29.6 m^3 to 23.8 m^3 or 19.6% during the same time period (Figure 5).

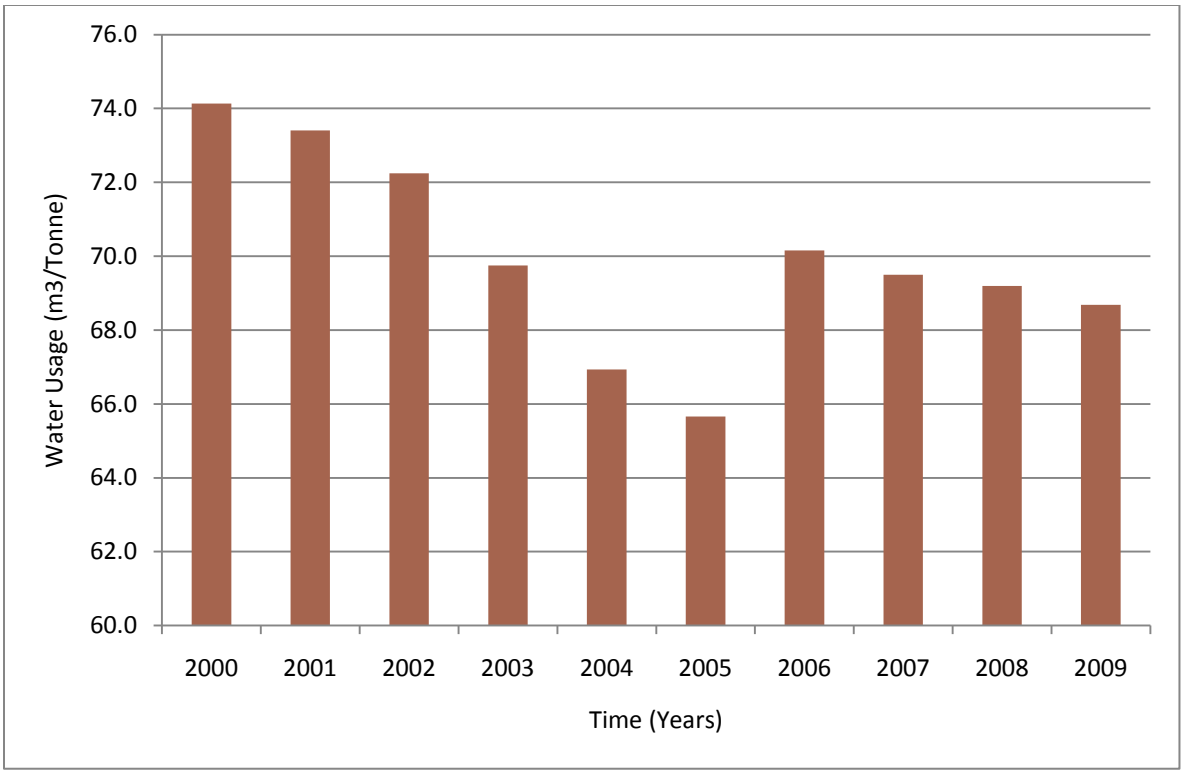


Figure 4. Average Water Usage in Kraft Pulp Mills in Alberta.

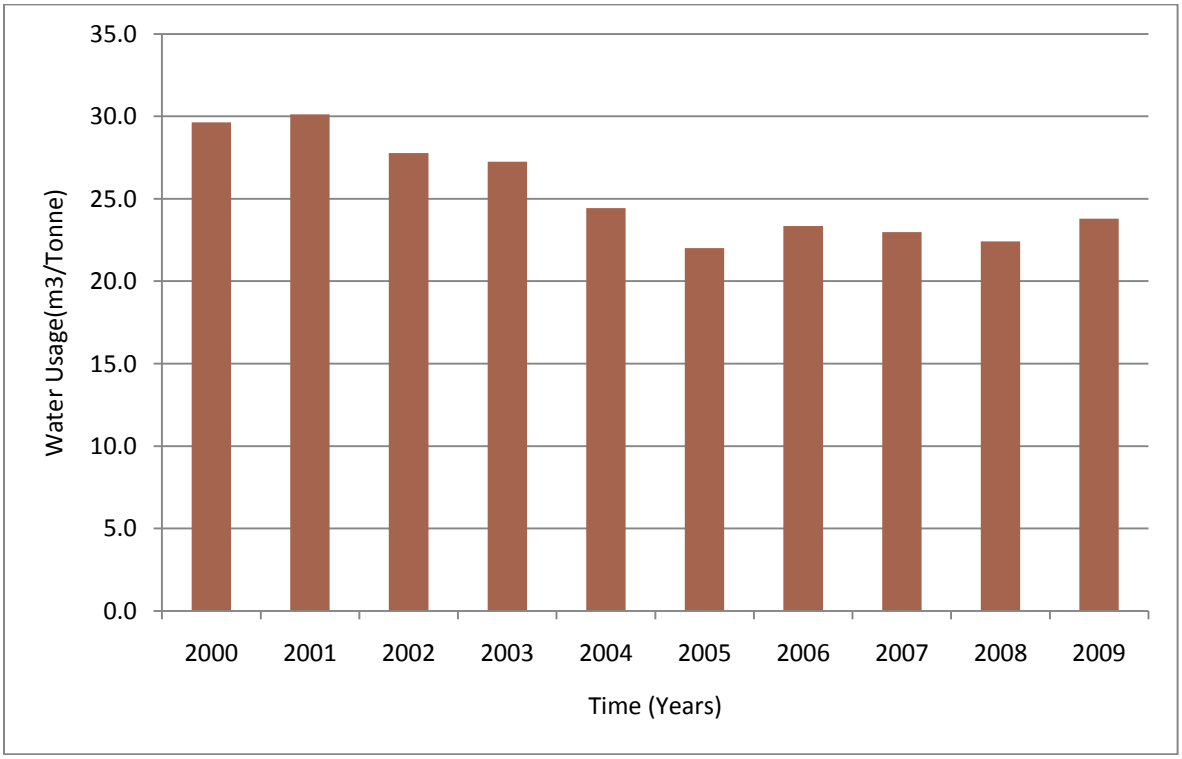


Figure 5. Average Water Usage in Mechanical Pulp and Paper Mills in Alberta.

5.0 CEP Planning for Alberta's Pulp and Paper Industry

5.1 Water Supply and Demand Considerations

The forest resource in Alberta is currently fully allocated and no significant expansion of the traditional pulp and paper sector is anticipated in the next decade. Development of new technologies around nano cellulosic fibers may result in more efficient use of current wood supply and development of a new suite of forest-based products. There are no expected water supply considerations (i.e. no expected need for expansion of current water licenced volumes) for pulp and paper mills in Alberta.

Specific to the business planning and activity-level of each individual mill, water demand may vary from day to day. Daily withdrawal limits (i.e. rate of withdrawals) may be defined in a mill's water licence. Facilities located on low flow water courses may experience seasonal supply problems in the case of extended drought conditions. Contingency plans are in place to mitigate operations during such low-flow periods. Climatic variation and long-term trends may exacerbate such droughts or otherwise affect the timing of flows.

Likewise, the cumulative impact of several users may impact source waters. While Alberta's water allocation system is currently governed by the first-in-time, first-in-right priority system, it is mutually beneficial for all water users of a local source to work together through WPACs and other partnerships to ensure the water resource is sustainable for all.

5.2 Overview of Opportunities for CEP

Over the past decade, all of Alberta's pulp and paper mills have identifed and implemented projects for improving water CEP (For a list of these projects, see Appendix 2). By undertaking these improvements, the pulp and paper industry has been able to achieve the results discussed above. This sector also freely shares project information between facilities. The AFPA Environmental Group meets four to five times a year to ensure Alberta's pulp and paper industry remains competitive and leaders in reducing their environmental impact.

Over the next decade, all of Alberta's pulp and paper mills will continue to identify and pursue opportunities to improve CEP. In general, CEP opportunities for this sector fall under the following categories:

- Reduce intake (annual daily demand) by:
    - Increasing recycling and reuse of water/wastewater within a mill's operation.
- Improve efficiency by:
    - Improving leak detection and repair programs.

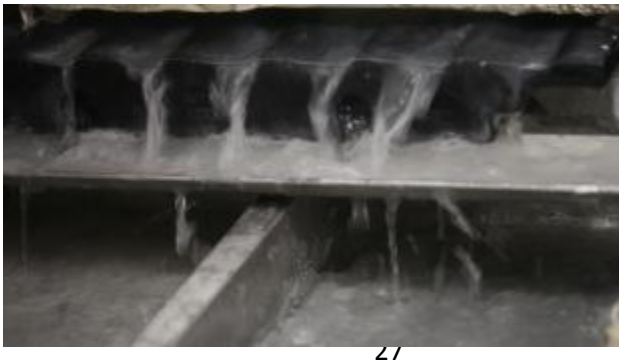
    - Installing new, more water efficient equipment.
- Improve productivity by:
    - Increasing productivity of output per water unit.
- Improve knowledge of CEP by:
    - Supporting the work of research organizations to investigate methods to improve CEP.
    - Looking at the work of other jurisdictions.

While each mill will make use of the opportunities that best meets its own business plan, it is useful to know what the range of options are. Hence, the AFPA has undertaken an initiative to document CEP projects, both in Alberta and elsewhere. Examples of a number of such projects, implemented or to be implemented in the near future by Alberta mills, are described in Table 3 below.

When reviewing the list of potential CEP projects it may undertake, it is useful for a mill to have a set of criteria to help determine which projects will help it meet its goals. Criteria for choosing a CEP project might include the following:

The proposed project:

- Will make a significant reduction in the amount of water withdrawn for use or result in a measurable improvement in efficiency or productivity;
- Is technologically feasible in the next decade;
- Is economical: anticipated expenditures are less than savings in capital and operating costs;
- Can be implemented within the next business planning cycle without significantly impacting output;
- Does not harm the aquatic health of receiving waters or benefits such waters; and
- Demonstrates that Alberta pulp and paper mills are world-leaders in water-use reduction technologies and process operations and are good stewards of Alberta's water resource.



Several mills have implemented water conservation projects focused on collecting process or "whitewater" used in creating pulp and recycling it or using it in other parts of the mill.

Table 3. Examples of Projects implemented or to be implemented by Alberta mills.

Mill	Project: Timeline	Purpose / Description	Impact on Water CEP	Cost
Alberta Newsprint Company	Dispersed air floatation: started up in March 2011. Still optimizing system.	To remove wood extractives (pitch) from paper machine dewatering loop while selectively retaining wood fines. This project is an important component for ANC in the future as is allows for the utilization of mountain pine beetle affected pine. Extractive free stream can be reused on paper machine and in other mill processes.	Water savings up to 3,500 L/ min.	$2.1 million. Joint project with FP Innovations with funding support from NRCan and Bio-solutions.
	Dissolved air floatation: started in 2007.	A non-selective process of cleaning water from paper machine dewatering loop. Fines and extractives are both removed from this process. Cleaned water can then be used on paper machine showers.	Water savings up to 2,500 L/min.	$350,000
	Lime dilution using sludge press Filtrate: expected start-up Fall 2011.	Utilization of stream normally sewered to dilute lime which is used for effluent system pH control. Lime is currently made down using fresh water.	Water savings up to 350L/min.	$15,000
Al-Pac	Do filtrate recycle to Dn showers: start-up following May 2011 shutdown.	Piping changes to allow Do filtrate to be recycled to Dn showers, reducing our hot water consumption.	~50 L/s of mill hot water while at full rates. Or ~2.2 m^3/tonne	
	Renewable Power Export Expansion Project: March 2012.	Capturing vented steam to generate electricity.	135,000 t/year (2004-2009 average) 0.22 m^3/tonne	
DMI Ltd. (Peace River)	Down Flow Lo-Solids Cooking: 2003	Increased mill production rate using same amount of water.	Productivity improvement. Decreased water usage by 3 m^3/Adt	$3.2 Million
	Upgraded Back Pressure Turbo Generator: 2006	Increased steam efficiency of existing Back Pressure Turbo Generator to both remove medium pressure extraction bottleneck and to produce additional green power (40MW to 45 MW).	Reduced venting of steam by 84,000 t/y or 0.18 m^3/Adt	$1.9 Million
	Mill Energy Usage Improvement: 2007	Reduced steam used to supply mill hot water. Added warm water supply equipment to displace cold water use in key heat exchange equipment and add heat exchange surface area to reduce steam used to produce hot water.	Energy efficiency improvements & Increased reuse of warm water by 3 m^3/min.	$2.1 Million
	Replace Surface Condenser: 2014	Replace existing surface condenser to improve mill evaporative capacity, reduce chemical use, reduce kiln fuel use, improve energy efficiency and reduce water use.	Energy improvements & decrease in water use.	

Mill	Project: Timeline	Purpose / Description	Impact on Water CEP	Cost
Hinton Pulp	Bleach Washing Water Conservation and Energy Improvements (2004)	This project included the install of recycle piping, flow controls and Uniflow (high capacity) shower bars on each bleach washing stage at Hinton Pulp. This allows greater washing and recycle capacity; and control of the bleach plan operations. Additional benefits included reductions in chemical use, environmental impact of bleach effluents and final pulp dirt contamination.	The displacement of fresh hot water and strategic dosage of recycled filtrates reduces hot water heater and mixer heating steam demands significantly.	
	Contaminated Condensate Use in Brownstock Washing (2003)	The shower heads on two washers were modified which allowed contaminated condensate from #3 evaporators to supply flow to the lower shower bars while warm water supplies the upper shower bars. The result is an increased condensate use to the washers without adversely affecting carryover of chemical oxygen demand (COD) to the bleach plant. The project resulted in a reduction in pond flows and Biological Oxygen Demand (BOD) loading.	The estimated water reduction in water throughput to the brownstock heaters is 600 GPM.	
Millar Western	Bioenergy Project - Whitecourt	Utilizing whitewater to generate biogas using an anaerobic hybrid digester to pre-treat waste water in advance of existing aerobic treatment system, generating power and steam. Recovered organic material will be converted to a biogas that will be cleaned of H_2S, and then used to fuel reciprocating engines, to generate green electricity. Has side benefits of decreased water usage and improved effluent quality. Converts waste to clean, renewable power, for use at the pulp mill. Harnesses waste heat from power production, to further reduce consumption of energy generated by non-renewable fossil fuels Cuts direct and indirect greenhouse- gas emissions by almost 47,000 tonnes, or the equivalent of 79% of current mill emissions. Reduce the production of solid biomass waste, or sludge, and the environmental impacts associated with its transportation and application to farm fields as a soil enhancer, by 50%.	Water savings is approx 700,000 m^3/yr. Reduces fresh water usage by 10%. Reduces organic content in final effluent discharges to the Athabasca River by 65%.	$32 million

Mill	Project: Timeline	Purpose / Description	Impact on Water CEP	Cost
Slave Lake Pulp	New P1 Tower and Recovery Tank (2001-2004)	Installed a new P1 tower which helped utilize water and improve efficiencies. A water recovery tank was installed to assist with water capture off of our 3rd stage of washing.	Improved water use efficiency and reuse.	
	Reuse of cooling water (2008)	Recovered a portion of our excess cooling water that was being sent to effluent from cooling our 3 - 1500 HP blower motors. This water is now being reused in the process.	Increased water capture and reuse.	
	Bio-Methanation with power generation (Future project)	Implementing a bio-methanation project with power generation. This will provide water recovery opportunities from recovery of cooling water back to the process into hot water make-up; less water required for cooling 3 blowers (anticipated to drop to two); and water reduction also anticipated as polymer make down requirements for sludge dewatering will be reduced.		
Weyer-haeuser Grande Prairie	Water Use Reduction Projects over the past 10 years	Over the past 10 years, Weyerhaeuser has implemented a number of process improvement and water use reduction projects; 1. Use of evaporator condensates in bleach plant 2. H&V water returned to fire well reservoir 3. Upgraded cooling tower return line 4. Converted empty stock chest to warm water tank 5. Kiln trunnion and pre-coat filter water reclaim 6. Other process improvements	6,000 m^3day	
	New Evaporator Project and Cooling Tower	A new state-of-the-art, 7-effect, high-solids evaporator set is being built at the mill. Along with the cooling tower, the project will reduce overall mill water usage by 10% to 15%	7,500 $m^{3/}$day	$75million

5.3 Implementation Schedule

While review, selection and implementation of water CEP projects is solely at the discretion of Alberta's pulp and paper mills, at least 14 CEP projects are already planned for the near future (see Appendix 3). In addition, the AFPA, through its presentations, publications, research partnerships and other activities, will continue to identify world class CEP improvements and encourage its members to implement such measures over the next decade.

One of the actions outlined in *Water for Life* is the establishment of an on-going monitoring program to ensure all sectors are achieving water conservation and productivity objectives. The AFPA will continue to encourage its members to report on their water use (i.e., through sector initiatives and/or Alberta Environment's electronic water use reporting system). Additionally, each mill has a Public Advisory Committee (PACs) representing the public in the area in which they operate. Through their involvement with PACs, WPACs, and the AWC, the forest products industry will continue to report to its stakeholders and partnerships.

Performance measures enable water users to measure improvements to track performance within their own company from year to year. For Alberta's pulp and paper industry, the performance measurement will be *"Water use for individual facilities compared to baseline year of 2000".* The Pulp and Paper industry will know this CEP plan is achieving success when:

- Rivers are healthy.
- Effluent quality is maintained or improved.
- Water diversions are decreased.
- Water intensity (m^3 / tonne) is reduced.

Evaluation will enable continual adaptive management to emerging issues such as climate change, potential water shortages, ecosystem deterioration, new forms of pollution and new policies developed to address emerging issues. Specifically, the AFPA, as champion of this plan, will carry out the following implementation, monitoring and reporting actions:

AFPA Action	Timeline
1. Following AFPA Board approval, post this CEP Plan on the AFPA website as a public document.	Early 2012
2. Continue to compile and share a list of CEP opportunities and updating project lists by encouraging all mills, research partners, etc. to provide information on further examples of CEP projects, their suitability, benefits, costs, etc.	Ongoing.
3. Working with a research partner, undertake a literature search of sample CEP projects from other jurisdictions that would be beneficial to Alberta's pulp and paper industry.	2012
4. Working with its partners, conduct a literature search to compare/benchmark Alberta water CEP statistics with other pulp and paper facilities with similar regulations and effluent treatment in Canada first, and worldwide second.	2012
5. Continue to track which projects have been implemented by mills in Alberta and where possible, the results of that implementation in relation to water CEP statistics.	Ongoing.

6. Continue to track water CEP data as has been done for the period 2000-2009 and reviewing CEP performance and water use on a regular basis.	Ongoing.
7. Working with its partners, further investigate water use in the remaining forest products industry (lumber mills, panel board, etc).	2013
8. Report on the above to stakeholders, the Alberta Water Council, etc. every two years or as otherwise recommended by the AWC CEP project team.	Ongoing.

6.0 Other Forestry Sector Water Initiatives

Sectors can use water more efficiently or increase productivity as well as reduce total demand, but these improvements in efficiency or productivity do not necessarily lead to healthy (or healthier) aquatic ecosystems. Ideally, improving conservation, efficiency and productivity will also create environmental benefits by protecting or enhancing aquatic ecosystems and helping to achieve this *Water for Life* goal.

The Forest Products Industry has been engaged in initiatives to better understand aquatic ecosystem health since the 1960s when North Western Pulp and Power, Alberta's first FMA holder, partnered with the provincial Fish and Wildlife Division to carry out the Tri-Creeks project. This study lasted more than 20 years and produced several papers on the effects of harvest on fish and other aquatic components and how such effects can be mitigated through the use of riparian buffers and other beneficial management practices. Today, the Forest Sector continues to be engaged in several initiatives to understand and protect aquatic ecosystem health. A few of these are detailed below:

6.1 Environmental Effects Monitoring and Management

As stated previously, approximately 92% of the water used by pulp and paper mills in Alberta is discharged to the waterbody that it came from. Before it is returned, however, water must be treated to ensure it does not have unacceptable levels of nutrients like nitrogen and phosphorus, which can negatively affect aquatic environments.

Mills have developed a suite of best management practices to address nutrient management. In general, all water on a mill site, including runoff water, goes through an extensive treatment process. This includes settling out solids, cooling the water down and using microscopic organisms to consume organic materials in the effluent.

Getting Creative with Waste!

Biological solids from Alberta's mechanical mills are being used for several beneficial purposes. Direct spreading of these biosolids on agricultural and forest lands has had a positive impact on vegetation growth rates. Biosolids can also be composted and used in greenhouse potting soils. Additionally, composted biosolids can be used to remediate hydrocarbon contaminated soils on oil well sites.

Additionally, all mills discharging water to aquatic environments must participate in the federal *Environmental Effects Monitoring Program* (EEM) to assess any effects potentially caused by their effluent. These programs usually involve sampling water quality parameters, like dissolved oxygen and temperature, as well as fish and benthic invertebrate populations, downstream of discharge sites.

Recently, Environment Canada has led an effort to create a summary of all the EEM studies as well as provincial water quality data in existence for the Athabasca River. Results to date have shown the only common effect amongst the mills on this river system is a mild nutrient enrichment downstream from the diffusers at near and\or far field locations. The effects show an increase in the benthic community population however not in the diversity of the community.

Several mills also work with the provincial government to collect and model data. Modeling for dissolved oxygen, a requirement of all aquatic life, has helped to determine acceptable limits for the management of biological oxygen demand (BOD) in the Athabasca River. BOD limits are written into the operating approval for each mill, which must have a BOD management plan. Continued BOD monitoring, also a requirement of licence approvals, ensures BOD discharges are below levels which could impact winter dissolved oxygen. A working group is also looking at how low dissolved oxygen levels might be mitigated using effluent aeration, oxygen infusion, etc.

"We have been working with Alberta Environment to understand and mitigate impacts. For example, the mills were part of the discussion that led to the reduction in BOD limits: a clear demonstration that the mills are willing to ante up to help protect the resource."
Dan Moore, Alberta Newsprint Company

Similar work is ongoing to determine other performance-based limits for Sediment Oxygen Demand, Total Suspended Solids (TSS) and other nutrients. This focus on nutrient monitoring and management ensures Alberta's mills have some of the lowest levels of effluent discharge of any pulp mills in the world.

6.2 Cumulative Effects Modelling

Consistent with the *Water for Life* strategy, the forest products industry recognizes the importance of taking a watershed approach to managing the cumulative impacts of growth and development in Alberta's watersheds. Pulp and paper mills are only one player operating in these areas and their impacts must be considered in context of other activities, including point and non-point emissions, on the landscape around them. Hence several mills are not only involved in their own emissions monitoring and management, they also participate in broader initiatives like the Forest Watershed and Riparian Disturbance (FORWARD) project.

Since 2001, the FORWARD Project has collected data on weather, soils, wetlands, vegetation, streamflow and water quality from first- through fourth-order watersheds on the Boreal Plain of north-central Alberta. Key chemical and physical relationships were established between the watershed and surface waters using models adapted to address small watershed processes.

In 2003, a companion project was initiated on the Boreal Shield of northwestern Ontario. In 2006, the Ontario-based and Alberta-based FORWARD initiatives were amalgamated as FORWARD II. The objectives of FORWARD II were to: (1) collect pertinent hydrometric, stream biochemistry, soils, vegetation and bio-indicator data; (2) adapt existing hydrological and water quality simulation models to predict watershed disturbance impacts, particularly nutrient exports; (3) incorporate these models into decision support tools for the project's industrial partners, and; (4) establish these decision support tools as standard practice within watershed-based landscape management.

FORWARD is a collaborative research project directed through Lakehead University with academic partners at the universities of Alberta and Saskatchewan and industrial partners in Ontario and Alberta. Currently, partners are working on a proposal for FORWARD III. This project would continue to focus on natural and man-made landscape disturbance, broadening from forestry to include agriculture, municipal growth and other activities from point and non-point sources potentially affecting water quality in the Athabasca River.

Researchers sample fish populations on the Athabasca River.

6.3 Other Research

The AFPA and several of its members are supporters of the Alberta Foothills Research Institute (AFRI). This non-profit corporation is conducting applied research in sustainable forest management. This initiative creates an opportunity for Alberta to take a leadership role as a node of the Circum-boreal Forest Network. The Foothills Research Institute also focuses on climate change impacts and adaptation and on the hydrological impacts of mountain pine beetle infestations.[7]

Together with academic and funding agencies across Canada, AFRI has continued its support of FORWARD, mentioned above. AFRI is also involved with the large-scale *Ecosystem Management by Emulating Natural Disturbance* (EMEND) project in north-western Alberta.[8]

[7] For more on the AFRI, see http://foothillsresearchinstitute.ca/pages/home/.
[8] For more about the EMEND project, seehttp://www.emend.rr.ualberta.ca/.

7.0 Participation and Accountability

Participation of pulp and paper industry members in this water CEP plan is voluntary and the AFPA has no means of assigning accountability to its members. However, this sector has been making voluntary water use reductions a major focus in the past decade in order to meet stakeholder expectations as well as to offset rising energy costs. This focus is expected to continue in the coming decade.

8.0 Conclusion

"As this sector adapts to the production of hi-tech, hi-value materials from carbon fibers, we will strive to lessen our impacts on the receiving environment. Watch our Journey!

Keith Murray, Alberta Forest Products Association

The CEP team and the Alberta Water Council should be commended in their efforts to create a process by which water conservation, efficiency and productivity can be achieved. The Forestry Sector is committed to making this process work through identifying its major water users (the pulp and paper industry) and supporting the implementation of CEP opportunities at each facility.

While each facility will identify and prioritize its own opportunities and timing for water CEP initiatives, it has been recognized that reducing water use is analogous to sustainable forestry practises – the facilities need the resource in order to survive – so protection and preservation of the resource is part of every mill's business plan.

Additional Resources

Handbook of Water Use and Conservation – Homes Landscapes Businesses Industries Farms. Amy Vickers. Waterplow Press, Amherst, Ma. 2001. 446 pp. (for conservation and efficiency definitions);

Principles of Water Use Efficiency, in *Principles of Water Use Efficiency*. Donald M. Tate. On-line: http://www.cepis.ops-oms.org/muwww/fulltext/repind48/principles/principles.html

Alberta Pulp and Paper Mills:

Alberta Pacific Forest Industries Inc.
http://www.alpac.ca/index.cfm?id=pulpmill_overview

Alberta Newsprint Company
http://www.albertanewsprint.com/profile/information.htm

Daishowa-Marubeni International Ltd.
http://www.dmi.ca/

Hinton Pulp (A division of West Fraser Mills Ltd.)
http://www.westfraser.com/

Millar Western Forest Products Ltd
http://www.millarwestern.com/

Slave Lake Pulp a wholly owned subsidiary of West Fraser Mills Ltd
http://www.westfraser.com/

Weyerhaeuser Company Limited (Grande Prairie Operations)
http://www.weyerhaeuser.com/Businesses/CelluloseFibers/GrandePrairie

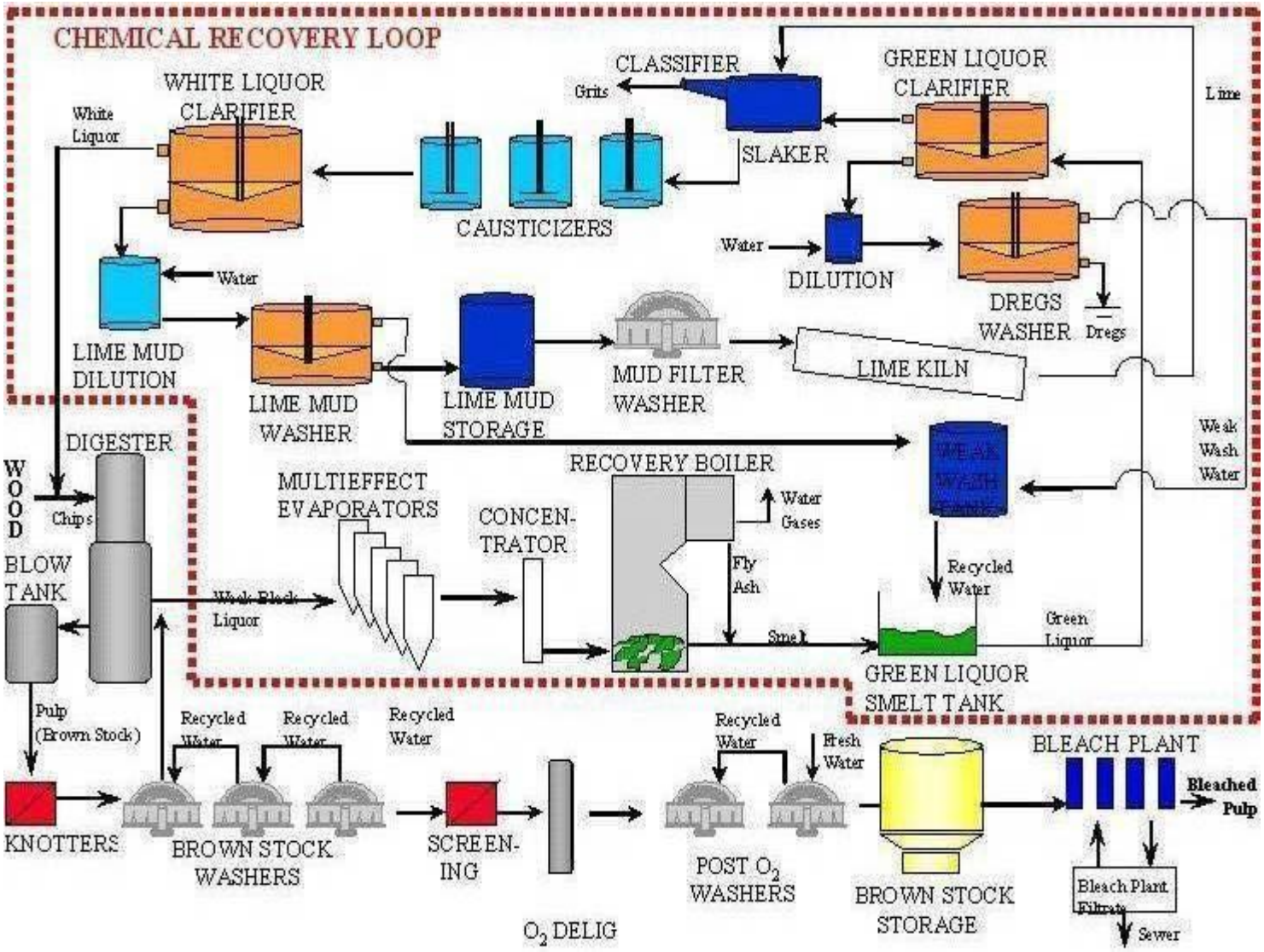
Appendices

Appendix 1 – The Pulping Process

Pulp manufacturing consists of one or two basic steps, depending on whether the final product requires white pulp. There are two general classes of pulp processes:

Mechanical Pulping: Mechanical Pulping produces a high pulp yield of 85-95%. The process uses fewer chemicals but is extremely energy intensive. The breaking down of the wood into fibres is accomplished by passing wood chips between one rotating (rotor) and one stationary (stator) metal disc. This produces a pulp often referred to as refiner mechanical pulp. Heat can also be used to produce thermo-mechanical pulp (TMP). One advantage of refiner mechanical pulping is the opportunity to process sawmill residues which could normally not be utilized in a grinder designed to process logs. Mechanical pulping in its pure form is a reasonably simple and cheap operation although rising energy costs threaten this method. It is used for products such as Newsprint and some printing grades. It can also be mixed with chemical pulps to produce a mixture of properties. Semi-chemical pulping, a mixture of the chemical pulping and mechanical pulping process which softens chips before refiner treatment, is more flexible and has gained popularity over the pure refiner mechanical pulping process. Mechanical pulp has low strength compared to chemical pulps. Its high yield gives it an advantage, although there is a huge cost in energy using this method. Mechanical pulp provides good printability, but changes colour on exposure to light as can be seen in old newspapers.

Chemical Pulping: A combination of chemicals, heat and pressure breaks down the lignin so that it can be washed away from the cellulose fibers. Once the lignin has been dissolved and the wood chips have been converted to pulp, the pulp is washed to separate it from the "black liquor"; a mix of spent pulping chemicals, degraded lignin by-products and extractive compounds. The chemical recovery process is an integral part of the kraft pulping process. Water is removed from the black liquor in a series of evaporators and the concentrated black liquor is sent to a recovery boiler. The organic wood residue in the black liquor has significant energy content and is burned near the top of the recovery boiler to produce steam for mill operations. At the base of the recovery boiler, the used pulping chemicals accumulate in a molten, lava-like smelt. After further chemical treatment and processing at the mill, these chemicals are reused in the pulping process. Through this internal recycling process, most chemical recovery systems recover about 99% of the pulping chemicals. Modern kraft mills are generally self sufficient in their use of energy due to their ability to burn wood by-products. The water from the evaporators is usually clean enough to be used in other parts of the mill. Kraft pulping methods typically convert 65% of the wood used in the process into pulp. For white paper products, the pulp undergoes additional chemical bleaching, to remove additional lignin and/or brighten the pulp.


CHEMICAL RECOVERY LOOP
CLASSIFIER
Grits
GREEN LIQUOR CLARIFIER
Lime
WHITE LIQUOR CLARIFIER
White Liquor
SLAKER
CAUSTICIZERS
Water
DILUTION
DREGS WASHER
Dregs
Water
LIME MUD DILUTION
LIME MUD WASHER
LIME MUD STORAGE
MUD FILTER WASHER
LIME KILN
DIGESTER
WOOD
Chips
MULTIEFFECT EVAPORATORS
CONCEN-TRATOR
RECOVERY BOILER
Water Gases
Fly Ash
Weak Wash Water
Recycled Water
BLOW TANK
Weak Black Liquor
Smelt
Green Liquor
GREEN LIQUOR SMELT TANK
Pulp (Brown Stock)
Recycled Water
Recycled Water
Recycled Water
Recycled Water
Fresh Water
BLEACH PLANT
Bleached Pulp
KNOTTERS
BROWN STOCK WASHERS
SCREEN-ING
POST O_2 WASHERS
BROWN STOCK STORAGE
Bleach Plant Filtrate
Sewer
O_2 DELIG

Appendix 2 – Past Sector Projects (Since 2000) that have Contributed to Water Use Reductions

1. Cooling tower construction and year-round utilization.
2. Maximizing water flow to the cooling tower.
3. Providing daily focus on water supply, consumption and recycling opportunities.
4. Increased utilization of evaporator condensates in the fiber line.
5. Reuse of steam stripped condensates on brownstock washers.
6. Reuse of filtrates from the Clo_2 generator in the bleach plant.
7. Condensate use in brownstock to replace hot water on showers.
8. Increased / improved recycle use in bleach plant for showers and standpipe dilution.
9. Retire No. 1 pulp machine and woodroom operations.
10. Brownstock washer improvements.
11. Upgrade of 60A/B MC pumps to obtain higher consistency to bleach hi-d storage vessel.
12. Upgrade bleach/brown washer shower bars for improved washing.
13. Process changes in bleach plant to improve washing.
14. Digester cook modifications to reduce COD to brownstock.
15. Use of process water for sludge press shower.
16. Heat exchanger optimization project.
17. Installation of self contained seal water units.

Appendix 3 – Future Planned Sector Projects that will Contribute to Water Use Reductions in the next Decade

1. Cooling tower expansion.
2. Recovery of cooling water streams that are currently sewered.
3. Recycle / recovery of non-contact cooling water.
4. Upgrade or replace evaporators.
5. D_o filtrate recycle.
6. Renewable power export expansion.
7. Purchase and install pressure diffusion washer to improve washing and reduce BOD loading.
8. Increase temperature of warm water to demins.
9. Upgrade remaining fiber line MC pumps to increase consistency, reduce hot water consumption and increase chemical efficiency.
10. Water reduction program for No. 2 stock preparation area.
11. Reclaim warm water sewered to clear water bypass.
12. Downflo-lo solids cooking in the digester to reduce loading on brownstock and increase solids to evaporator train.
13. Reclaim #2 evaps 5^{th} stage contaminated condensate.
14. Reclaim machine room vacuum pump water.