parkland county

STATE OF THE ENVIRONMENT REPORT **2012**

Parkland County, Alberta
53109A HWY 779 T7Z 1R1
780-968-8888

Approved May 28, 2013

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

Figures:

Tables:

EXECUTIVE SUMMARY

Parkland County's inaugural State of the Environment Report provides an assessment of the condition of Parkland County's environment, the nature of the pressures upon it and responses to those pressures. Specifically, the Report assesses the State of Parkland County's air, land, groundwater, surface water, and biodiversity. Key findings are summarized below:

Parkland County's Air

Parkland County's air was assessed using the Province of Alberta's Air Quality Health Index (AQHI), and by comparing observed pollutant levels with Canada's National Ambient Air Quality Objectives (NAAQO). The AQHI employs a scale of 1 to 10 to describe the quality of outdoor air in Alberta with 1 indicating high quality air and 10 indicating heavily polluted air. Parkland County's combined AQHI average from 2008 to 2011 is 2.04. Regarding the NAAQO, Parkland County met air quality objectives for all measured pollutants between 2008 and 2011 except for ozone, which routinely exceeded the maximum limit.

Parkland County's Surface Water

Rivers were assessed by analyzing water quality and water flows. From 2000 to 2009, Pembina River flows remained within the normal flow range, but the North Saskatchewan River experienced below average flow levels in the summer and higher than average flow levels in the fall/winter/spring. River water quality for both rivers fluctuated between the two highest quality categories between 2002 and 2009. Parkland County's lakes were also assessed by analysing water quantity and quality. From 2001 to 2009, Lake Wabamun and Lake Isle's water levels were on average below normal levels. With regards to water quality, about 1/3 of the monitored lakes in Parkland County contained high quality water, 1/3 contained water of a moderate quality and 1/3 contained poor quality water.

Parkland County's Groundwater

Groundwater was assessed by analyzing groundwater levels in provincially managed test wells located throughout the County, and by analyzing water well density. From 1990 until 2010, groundwater levels fell by 0.8-2.5m in every test well in Parkland County. Also, in many areas of the County, water well densities are highest where the recommended extraction rates are lowest. If current trends persist, this could pose a long-term sustainability challenge for Parkland County.

Parkland County's Land

Parkland County's land was assessed by analyzing officially designated land uses and by assessing the County's waste generation and recycling data. Although a number of caveats apply to this section (see page 19 of this Report), out of

DISCLAIMER

Published June 2013

This report is based on information provided by Parkland County business units and external sources. Every effort has been made to ensure the integrity and accuracy of the data, information and details contained in this report.

Parkland County's total land base, 67.26% is dedicated to agriculture, 16.44% is dedicated for residences, 13.13% is dedicated to resource extraction, 1.95% is dedicated for parks, and 1.22% is dedicated to industry. Regarding waste and recycling, Parkland County disposed just under 240kg of solid waste per capita in 2011, and waste diversion rate (recycling) increased from 20% in 2010 to 25% in 2011 and 31% in 2012.

Parkland County's Biodiversity

Parkland County's biodiversity was assessed by analyzing the Status of Alberta Species and by assessing the presence of invasive species in the County. The Status of Alberta Species lists 17 endangered species, 12 threatened species and 18 species of concern. Regarding invasive species, 9 out of 46 species listed as Prohibited Noxious and 19 out of 29 species listed as Noxious were found in the County in 2012.

INTRODUCTION

The State of the Environment Report 2012 provides an overview of environmental trends in Parkland County. It is a report card of Parkland County's environment that seeks to assess the current state of the County's LAND, WATER, AIR, and BIODIVERSITY. Water is further divided into GROUNDWATER and SURFACE WATER. SURFACE WATER is further divided between RIVERS and LAKES. The Report is divided into sections according to these themes. Wherever possible, the themes are assessed using measureable data obtained from a variety of sources including the Province of Alberta. This Report represents a work in progress that will be continuously built upon over the years to provide residents, businesses and the wider community with a comprehensive long-term overview of the condition, the pressures, and the responses to the pressures facing Parkland County's natural environment.

(Photo Credit: Nancy Chow)

Indicators

This Report, like most State of the Environment Reports, employs indicators to assess the state of the County's environment. An indicator is a measurable thing, fact or tool that analyzes something specific to gain an understanding of something general. They are used to evaluate complex systems. For example, CO_2 emissions are an indicator of global warming. While there are numerous causes to global warming, scientific research has shown that there exists a direct link between increasing CO_2 emissions and increasing global average temperatures. Therefore, looking at global CO_2 emissions will provide an *indication* of human related effects on global temperatures. Similarly, looking at a river's water quality and flow (quantity) provides an *indication* of that river's overall health, and looking at airborne pollutant emissions provides an *indication* of air quality.

Impetus for the Report

Parkland County has long held the environment as a priority, and the vast majority of its actions have reflected that philosophy. However, in the spirit of continuous improvement, in early 2011 Parkland County's Council felt that the time had come to streamline the County's approach to the environment, which until then involved a number of procedures, processes and formal and informal policies. So on May 24th 2011 Parkland County's Council re-iterated and cemented its commitment to the environment by adopting the Environmental Policy C-PD04 and the Environmental Procedure PD04-P1. These documents consolidated the existing approach into one policy and incorporated a number of additional responsibilities and actions that Council wanted administration to take. Among those additional responsibilities, Council directed administration to establish Parkland County's Environmental Advisory Committee and to create and publish this State of the Environment Report.

Role of Parkland County's Environmental Advisory Committee (EAC)

Parkland County's Environmental Advisory Committee held its first meeting on January 30th 2012 and has been involved in drafting this Report from the very beginning. The EAC decided on the scope of the Report (earth, air, water + biodiversity), chose the indicators, reviewed and made changes to the draft documents, and approved the final version which was presented to Council on **May 28th, 2013.**

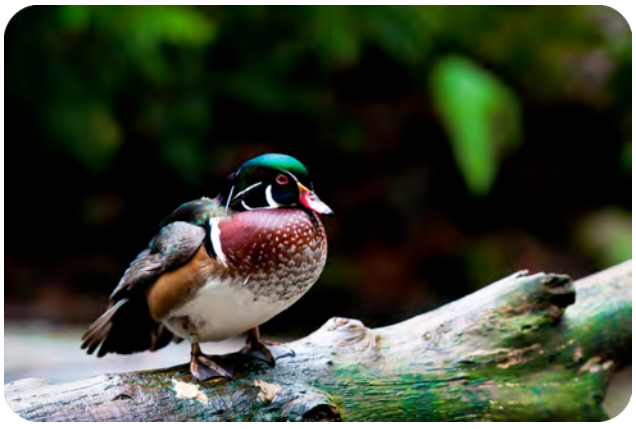
REPORT STRUCTURE

This report employs the following types of indicators to assess the State of Parkland County's environment:

- **Condition indicators** measure the current condition of an aspect of the natural environment at a given time. For example, the level of a substance in our air or water.
- **Pressure indicators** measure human-related activities that impact the environment, such as human-caused air emissions and wastewater effluent.
- **Response indicators** measure behavioral changes that help reduce pressures on the environment as a result of management actions, such as the percentage of waste diverted rom landfills through a recycling program.

Using the above information as a guide, this report is structured as follows:

Feature	Condition indicators	Pressure indicators	Response indicators
Air	✔		
Surface water - rivers	✔	✔	
Surface water – lakes	✔		
Groundwater	✔	✔	
Land	✔	✔	✔
Biodiversity	✔	✔	



(Photo Credit: Beth, Susan David)

(Photo Credit: Vago)

CONDITION OF PARKLAND COUNTY'S AIR

Condition Indicator: *Alberta's Air Quality Health Index*

The Air Quality Health Index (AQHI) is a provincially defined numerical value describing the quality of outdoor air in Alberta. The formula developed to calculate the AQHI is based on research conducted by Health Canada using health and air quality data collected in major cities across Canada, including Calgary and Edmonton.

The Alberta AQHI is based on the concentration of the following five major pollutants:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO2)
- Ozone (O3)
- Fine particulate matter (PM 2.5)
- Sulphur dioxide (SO2)

Hourly concentration measurements of these pollutants are used to calculate the Air Quality Health Index. This value is converted into four air quality categories:

FIGURE 1: ALBERTA AQHI[i]

The higher the AQHI number, the greater the health risk associated with exposure to the air.

The two communities in close proximity to Parkland County where ambient air quality is measured are Tomahawk and Genesee.

TABLE 1: AQHI ANNUAL AVERAGES[ii]

Year	Genesee	Tomahawk
2008	**1.9**	**2.2**
2009	**2.0**	**2.2**
2010	**1.9**	**2.2**
2011	**1.8**	**2.1**
2008-2002 avg.	**1.9**	**2.2**

Annual Average Levels of the Pollutants that Form the Alberta AQHI

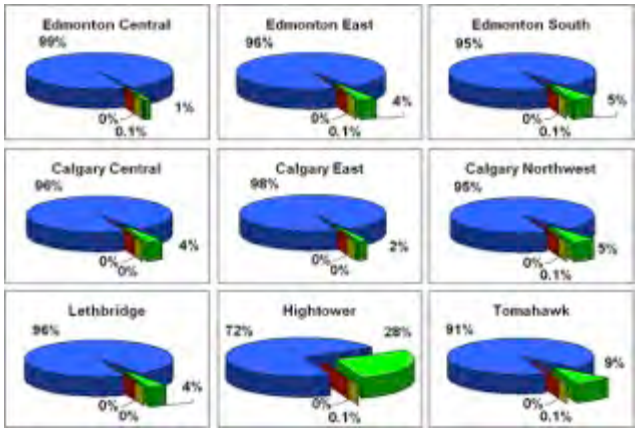
TABLE 2: ANNUAL AVERAGE POLLUTANT LEVELS[iii]

	NAAQO Maximum Acceptable Level (24h)	Genesee				Tomahawk			
		2008	2009	2010	2011	2008	2009	2010	2011
NO		0.00125	0.00079	0.00107	0.00065	0.00095	0.00089	0.00125	0.00062
NO_2	0.106 PPM	0.00397	0.003812	0.00449	0.00279	0.00466	0.00456	0.00537	0.00402
NO_X		0.00516	0.004787	0.00591	0.00347	0.00537	0.00525	0.00662	0.00468
O_3	0.025 PPM	0.02625	0.027916	0.02405	0.02749	0.03087	0.03187	0.02864	0.03444
SO_2	0.115 PPM	0.00121	0.001089	0.00093	0.00066	0.00077	0.00071	0.00072	0.0007
PM 2.5	120ug/m^3	4.096	4.021	5.61	3.529	3.81416	3.65649	4.87337	3.23144

The previous numbers indicate that pollutant concentrations remained below the federally set National Ambient Air Quality Objectives EXCEPT ground level ozone, which routinely exceeded the maximum NAAQO concentration objective set for this pollutant.

Exposure to ground level ozone can irritate, inflame and constrict proper lung function according to the EPA[iv]. In essence, the higher the exposure, the harder it is to breath. Sensitive groups include children, the elderly and people with lung diseases such as asthma, chronic bronchitis and emphysema, but healthy adults may also experience negative health effects.

FIGURE 2: ALBERTA AQHI ANNUAL SNAPSHOT 2009[v]



Although Tomahawk's annual average AQHI score was 2.2 for 2009, putting it in the Province's low risk category, air quality did vary between the low risk and moderate risk category throughout the year. For 91% of the time in 2009, air quality at Tomahawk was reported as "good", and 9% of the time it was reported as fair.

Photo Credit: Tete Jaune

Photo Credit: Brian Weatherley

CONDITION OF PARKLAND COUNTY'S SURFACE WATER: RIVERS

Condition Indicator: *Alberta River Flow Quantity Index*

The River Flow Quantity Index compares the water flow volumes that would naturally occur if the river were in a natural state with actual flow volumes recorded throughout the year. The River Flow Quantity Index does not necessarily describe the health of a river's ecosystem because a highly altered flow may still be able to support a healthy biodiversity. However, long term changes to a river's natural flow may cause it to evolve into an altered biological state with different animal and plant communities then would otherwise exist in the river.

There are two major rivers that fall within Parkland County's borders. The Pembina River is located on the western border of the County and flows to the northeast. The North Saskatchewan River is located on the southern border of the County and flows eastward towards Edmonton.

TABLE 3: ALBERTA RIVER FLOW QUANTITY INDEX[vi]

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pembina River ***Near Entwistle***	**Summer**										
	Fall, Winter, Spring										
North Saskatchewan ***At Edmonton***	**Summer**										
	Fall, Winter, Spring										

	Seasonal flow exceeded outside natural range		**Seasonal flow below normal natural**
	Seasonal flow above normal natural		**Seasonal flow much below normal natural**
	Seasonal flow within normal natural		**Seasonal flow diminished outside natural range**

From the previous data it can be seen that the Alberta River Flow Quantity Index for the Pembina River has remained within the normal flow range over the ten-year period. In contrast, the Alberta River Flow Quantity Index for the North Saskatchewan River has fluctuated significantly during this same period.

Condition Indicator: *Alberta River Flow Quantity Index*

The Alberta River Water Quality Index (ARWQI) is a Provincially defined and managed method to assess a river's biological and physical integrity while taking into consideration the types and amounts of chemical contaminants present in the river's water. It assigns one number to summarize a river's physical, biological and chemical health. Index values are calculated annually for specific sites across the Province based on data collected monthly or quarterly.

The Alberta River Water Quality Index incorporates and assesses the following variables when analyzing the health of a river:

- Metals (up to 22 variables measured quarterly);
- Nutrients (6 variables measured monthly);
- Bacteria (2 variables measured monthly); and
- Pesticides (17 variables measured 4 times during open-water season).

The Province of Alberta only produces the Alberta River Water Quality Index for 6 of the Province's

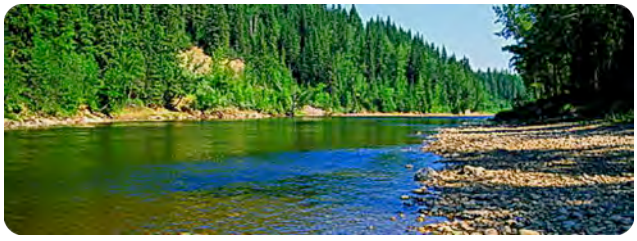
major rivers, so while there exists data for the North Saskatchewan River, ARWQI data does not exist for the Pembina River. However, the Province does monitor the Athabasca River – which the Pembina River flows into – and this data was used as a marker to assess the Pembina River's ARWQI.

TABLE 4: ALBERTA RIVER QUALITY INDEX[vii]

	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
North Saskatchewan **Upstream of Edmonton (Devon)**	**90**	**98**	**97**	**98**	**97**	**88**	**98**	**93**	**93**	**99**
Athabasca River **at Athabasca**	**97**	**99**	**93**	**97**	**90**	**97**	**100**	**91**	**94**	**96**

96-100		Guidelines almost always met; "Best" Quality. (Excellent)
81-95		Guidelines occasionally exceeded, but usually by small amounts; threat to quality is minimal. (Good)
66-80		Guidelines sometimes exceeded by moderate amounts; quality occasionally departs from desirable levels. (Fair)
46-65		Guidelines often exceeded, sometimes by large amounts; quality is threatened, often departing from desirable levels. (Marginal)
0-45		Guidelines almost always exceeded by large amounts; quality is significantly impaired and is well below desirable levels. "Worst" Quality. (Poor)

PRESSURES FACING PARKLAND COUNTY'S SURFACE WATER: RIVERS



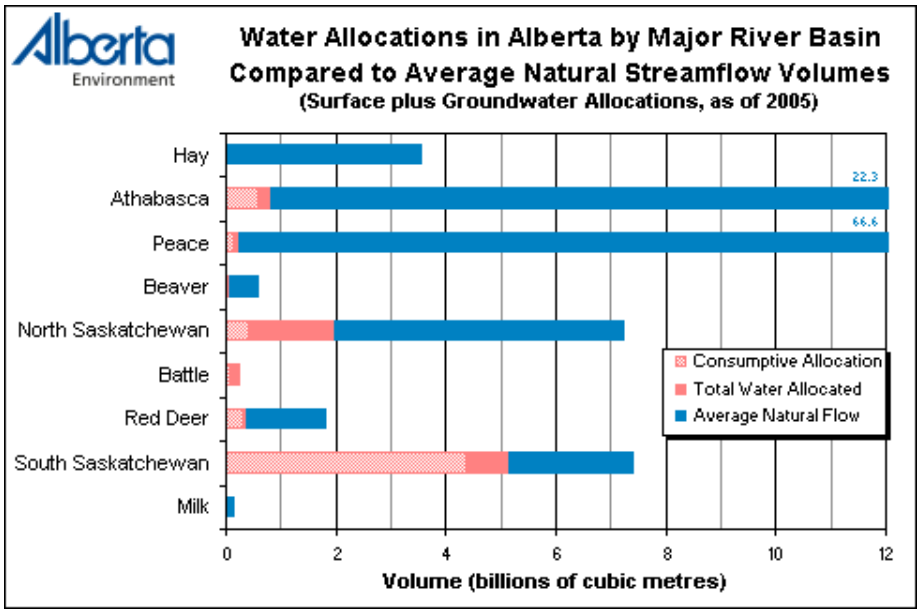
Pressure Indicator: *Water Allocations Compared to Natural Flows*

The Water Allocations Compared to Natural Flows (WACNF) indicator compares a watercourse's natural flow with the amount of water that people and companies have been allowed by the Province to take out of the watercourse. These uses include, but are not limited to: household water, agriculture, irrigation, and commercial and industrial processes. The amount of allocated water does not necessarily equal the amount of water that is withdrawn from the watercourse because the water allocations may not be fully used, and many users put the water they use back into the watercourse after use. The WACNF is calculated using two methods. The first method looks at water volumes – It compares the volume of water that would naturally flow through the watercourse with the volume of water that people have been allowed to use. The second method uses a percentage-based comparison to find out what percentage of the watercourse's natural flow has been allocated for human use.

(Photo Credit: Greta Jokubauskaite)

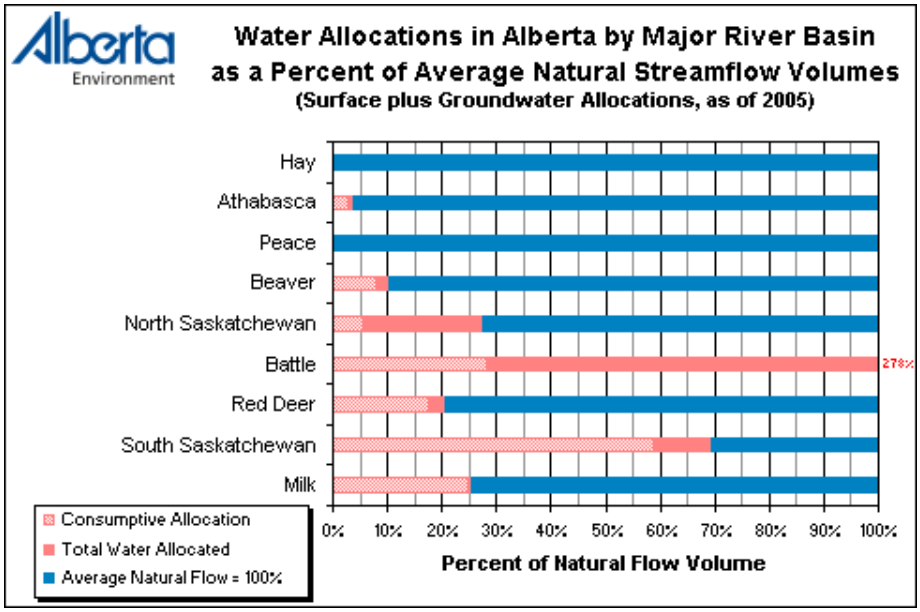
(Photo Credit: Neil Waugh)

FIGURE 3: WATER ALLOCATIONS: VOLUME-BASED METHOD[viii]



This graph shows that the North Saskatchewan River experiences the second highest diversion rate by volume of Alberta's major rivers.

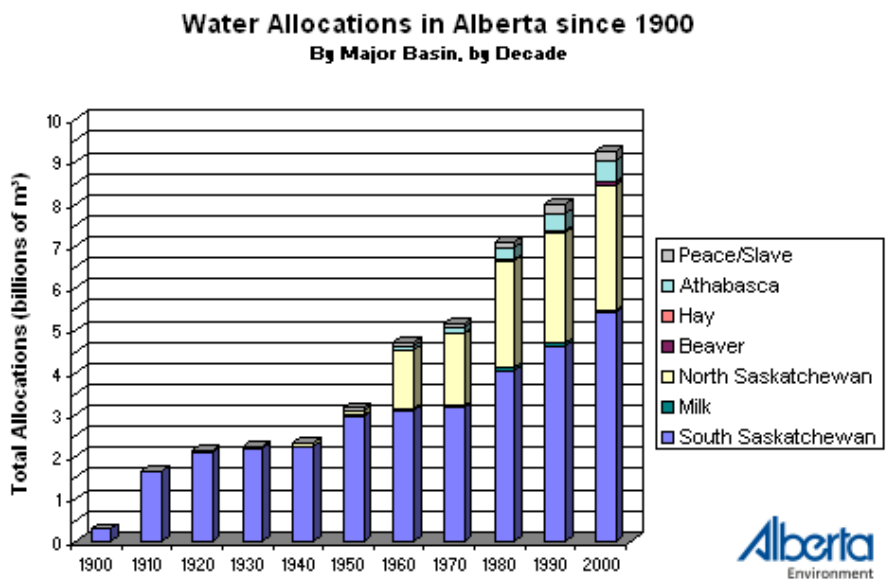
FIGURE 4: WATER ALLOCATIONS: PERCENTAGE-BASED METHOD[ix]



This graph shows that the North Saskatchewan River experiences the third highest diversion rate by percentage of Alberta's major rivers.

The graph below shows the historical trends in water allocations in Alberta since 1900:

FIGURE 5: WATER ALLOCATIONS IN ALBERTA SINCE 1900[x]



This graph shows that the North Saskatchewan River experiences the second highest diversion rate by volume of Alberta's major rivers.

As of 2005, nearly 2 billion cubic meters were allocated from the North Saskatchewan River for human use, representing just under 30% of the river's annual flow. From 1900 until the early 1950s the volume of water allocated from the North Saskatchewan was very minor. However, since the 1960s the amount of water that has been allocated from the North Saskatchewan has increased markedly, consistent with what has been observed in the rest of the Province.

CONDITION OF PARKLAND COUNTY'S SURFACE WATER: LAKES

Condition Indicator: *Status of Alberta Lake Levels*

The Status of Alberta Lake Levels assesses the water levels in 27 of Alberta's lakes. Although lake levels do fluctuate naturally because of variations in weather, the Province accounts for this by comparing the water levels it records at a lake throughout the year with the historical trends for that lake. The lake's current water levels are then assigned a grade depending on how they stack up to historical data. The Status of Alberta Lake Levels does not necessarily describe the health of a lake's ecosystem because a highly altered water level may still be able to support a healthy biodiversity. However, it adds a level of detail that assists with the interpretation of related observed changes in water quality, biodiversity, and recreational opportunities as lake levels change over time.

Two out of the 27 lakes that the Government of Alberta monitors are located in Parkland County: Lake Wabamun and Lake Isle.

TABLE 5: STATUS OF ALBERTA LAKE LEVELS[xi]

	Status of Annual Lake Levels								
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Lake Isle	**Normal**	**Below Normal**	**Much Below Normal**	**Normal**	**Below Normal**	**Below Normal**	**Above Normal**	**Much Below Normal**	**Much Below Normal**
Lake Wabamun	**Much Below Normal**	**Much Below Normal**	**Much Below Normal**	**Much Below Normal**	**Normal**	**Normal**	**Above Normal**	**Normal**	**Normal**

Condition Indicator: *Lake Water Trophic Status*

Lake Water Trophic Status is a key indicator of a lake's overall biological health. The trophic status is a measure of a lake's biological productivity, which in this case means the potential that the lake has to grow plant and algae material. Generally speaking, the abundance of aquatic plants and algae is directly related to the concentration of nutrients contained in the lake water, with a higher concentration of nutrients bringing about a larger plant and algae population, and a smaller nutrient concentration bringing about a smaller plant and algae population. The relative size of the plant and algae population in a lake is important for the health of the fish living in the lake, because the more plant and algae material is present in the water, the more it absorbs the oxygen in the water that fish need to survive. In fact so much oxygen can be taken up by the plant and algae community in a lake that most if not all the lake's fish population can die off. These events are known as fish kills. Key nutrients of concern are phosphorous and nitrogen.

In the Province of Alberta, Lake Water Trophic Status is determined by analyzing the concentration of chlorophyll-a in the water. The logic behind this is that since chlorophyll-a is a unique by-product of plant and algae activity, higher the concentrations of chlorophyll-a found in a lake's water imply more plant and algae activity, which in turn implies higher nutrient levels and lower oxygen levels in the water. The reverse is also true – lower concentrations of chlorophyll-a imply less plant and algae activity, which implies lower nutrient levels and higher oxygen levels. Although many variables impact the relationship between chlorophyll-a, nutrient levels and oxygen levels, the above-described relationships are widely accepted by the scientific community.

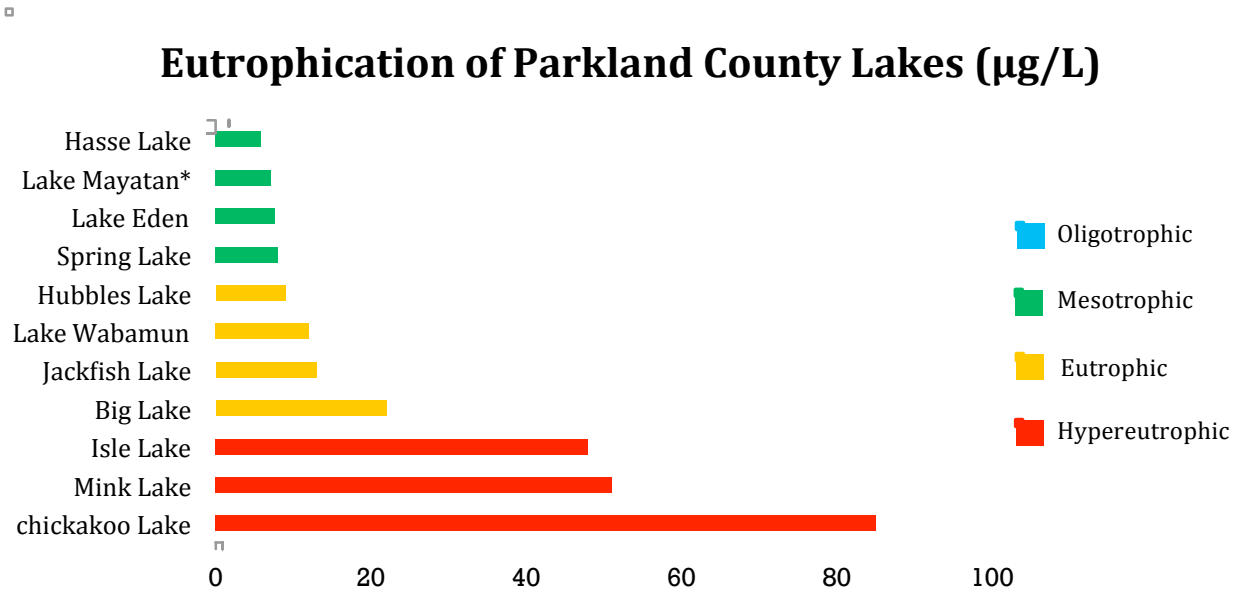
The Province of Alberta employs the internationally recognized categorization system to classify lakes based on their trophic status. Lakes are classified in 1 of 4 categories based on the observed concentrations of chlorophyll-a. The table below describes each category.

TABLE 6: LEVEL OF EUTROPHICATION AND LAKE CHARACTERISTICS

Level of Eutrophication	**Chlorophyll-a Concentration µg/L**	**General Lake Characteristics**
Oligotrophic	**<2.5µg/L**	**Low phosphorous, low plant mass, clear water, oxygen rich water**
Mesotrophic	**2.5 - 8µg/L**	**Moderate phosphorous, moderate plant mass, moderate water clarity, moderate oxygen levels**
Eutrophic	**8 - 25µg/L**	**Higher phosphorous, higher plant mass & intermittent algal blooms, lower water clarity, lower oxygen levels**
Hypereutrophic	**>25µg/L**	**Very high phosphorous, highest plant mass & common algal blooms, lowest water clarity, oxygen depletion**

The figure below summarizes the level of eutrophication for Parkland County lakes that were regularly monitored by Alberta Environment in 2011.

FIGURE 6: EUTROPHICATION OF PARKLAND COUNTY LAKES IN 2011[xii]



The tables below show a longer-term perspective on the level of eutrophication observed in Parkland County's major lakes.

TABLE 7: EUTROPHICATION OF PARKLAND COUNTY LAKES 1996-2009[xiii]

	Big Lake West Basin		Isle Lake		Jackfish Lake		Wabamun Lake – East Basin	
Year	Average Phosphorous Total –TP (µg/L)	Average Chlorophyll Total –A (µg/L)	Average Phosphorous Total –TP (µg/L)	Average Chlorophyll Total –A (µg/L)	Average Phosphorous Total –TP (µg/L)	Average Chlorophyll Total –A (µg/L)	Average Phosphorous Total –TP (µg/L)	Average Chlorophyll Total –A (µg/L)
1996					**32.9**	**15**		
1997	**100.7**	**20**	**140.3**	**45**				
1998	**80.9**	**23**	**366.8**	**67**				
1999								
2000							**27.7**	**7**
2001							**32.4**	**10**
2002							**28.1**	**7**
2003							**29.1**	**9**
2004							**30.4**	**9**
2005							**28**	**10**
2006							**21.2**	**10**
2007					**22.3**	**12**	**24.7**	**13**
2008							**21**	**8**
2009								

TABLE 8: EUTROPHICATION OF PARKLAND COUNTY LAKES 1996-2009[xiv]

	Wabamun Lake – Main Basin		Wabamun Lake – Moonlight Bay		Wabamun Lake - West Basin	
Year	Average Phosphorous Total –TP (µg/L)	Average Chlorophyll Total –A (µg/L)	Average Phosphorous Total –TP (µg/L)	Average Chlorophyll Total –A (µg/L)	Average Phosphorous Total –TP (µg/L)	Average Chlorophyll Total –A (µg/L)
1996	**34.1**	**11**	**30.2**	**3**		
1997	**35.9**	**14**				
1998	**36.3**	**13**				
1999					**27.7**	**8**
2000			**33.2**	**6**	**28.2**	**8**
2001			**25.9**	**2**	**30.3**	**11**
2002			**31.1**	**5**	**28.8**	**9**
2003					**31.8**	**12**
2004					**35.8**	**14**
2005					**32.5**	**14**
2006					**21.5**	**12**
2007					**31.5**	**12**
2008					**23.5**	**12**
2009						

CONDITION OF PARKLAND COUNTY'S GROUNDWATER

Condition Indicator: *Groundwater Levels*

Groundwater is an essential resource for the majority of Parkland County's residents, with 76% of respondents obtaining their potable water from drilled wells according to Parkland County's Environmental Advisory Committee Environment Survey 2012. With such a heavy reliance on groundwater for residential living, it is important to understand the abundance and quality of the resource, so that it may be properly managed to ensure a safe, reliable and healthy water supply for current and future generations.

Groundwater levels are an important indicator of aquifer health and resilience.

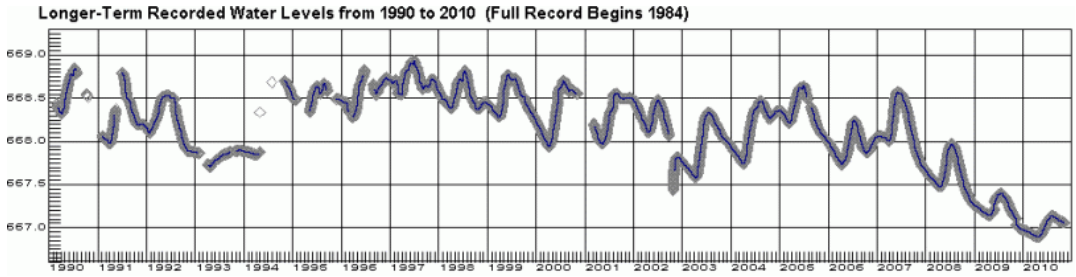
Although some variations in groundwater levels are caused by natural processes, such as weather changes, winter freezing and spring thawing, most healthy aquifers are able to maintain their ability to produce water.

With healthy aquifers, the amount of water that is being drawn out (if any) is being put back into the aquifer by natural processes at the same or faster rate and the aquifer is able to sustain the current rate of water withdrawal.

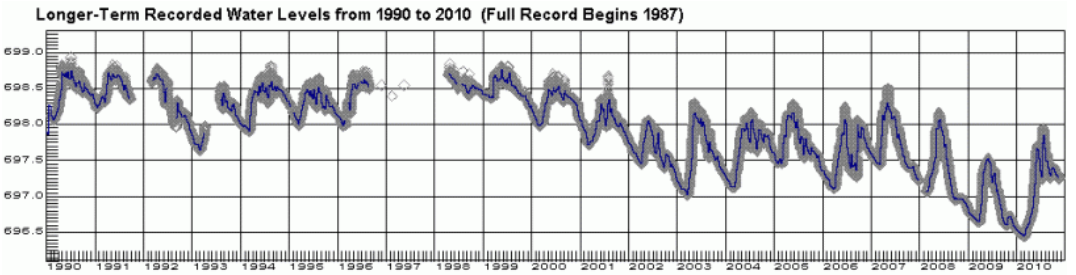
However, a systematically declining groundwater level may indicate that the water is being drawn out faster than natural processes are able to replace it and that the aquifer may not be able to sustain the current rate of water withdrawal in the long term.

The Groundwater Observation Well Network (GOWN) is a provincially managed network of over 250 wells located throughout Alberta that are used to monitor groundwater levels. About 160 of those wells are used to monitor groundwater quality as well. Parkland County hosts 7 GOWN observation wells within its borders. The following tables summarize the groundwater levels for the 7 County wells.

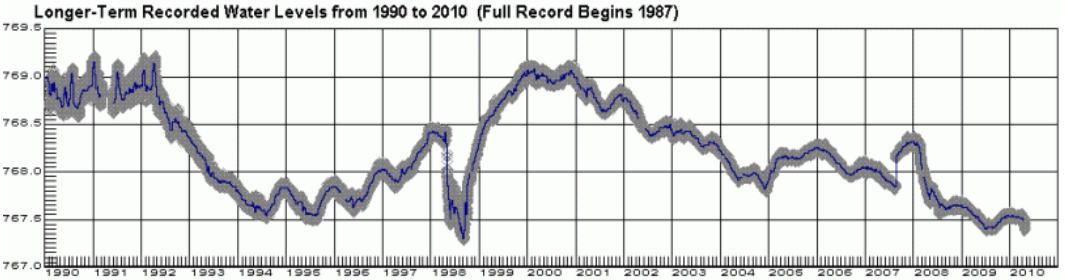
FIGURE 7: GROUNDWATER LEVELS[xv]



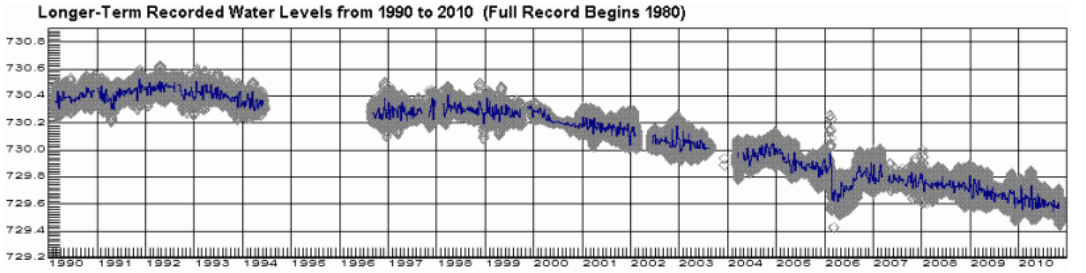
Wagner Well # 172
Depth: 15.5m
Aquifer Name: Surficial
Type: Confined



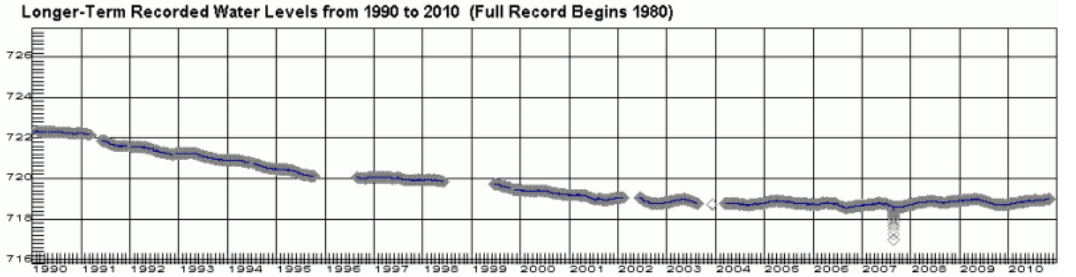
Botanic Garden Well # 162
Depth: 10.7m
Aquifer Name: Surficial
Type: Unconfined



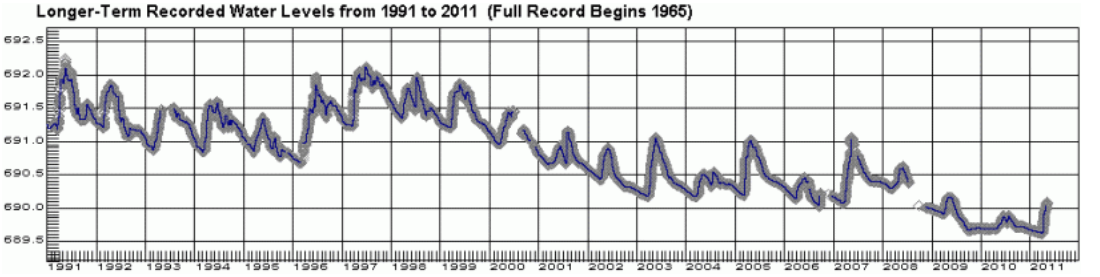
Entwistle Well # 377
Depth: 25.6m
Aquifer Name: Paskapoo
Type: Confined



Hubbles Lake Well # 325
Depth: 74.7m
Aquifer Name: Beverly Valley
Type: Confined

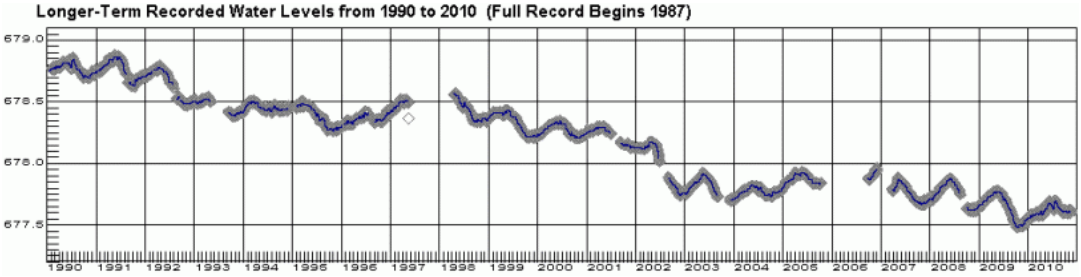


Hubbles Lake Well # 326
Depth: 83.8m
Aquifer Name: Wapiti
Type: Confined



Devon Well #159
Depth: 7.62m
Aquifer Name: Surficial
Type: Unconfined

FIGURE 8: GROUNDWATER LEVELS[xvi]



Botanic Garden Well # 160
Depth: 91.1m
Aquifer Name: Horseshoe canyon
Type: Confined

Despite the natural and annual fluctuations in groundwater levels observed in the wells across the County, one trend is clearly visible in all the graphs – groundwater levels have been slowly but steadily decreasing. While the observed decreases in groundwater levels over the last 20 years have been relatively small (0.8 – 2.5m), the decrease is consistent at all the well sites. This decrease may be the result of natural processes, but it may also indicate that the ability of the County's aquifers to recharge their water reserves may be outmatched by the water withdrawal demands placed on them by humans. If current trends persist, this could pose a long-term sustainability challenge for Parkland County.

(Photo Credit: Cybera)

(Photo Credit: Mark Daymond)

PRESSURES FACING PARKLAND COUNTY'S GROUNDWATER

Pressure Indicator: *Water Well Density*

Water well density is an important indication of the level of human-induced stresses on local groundwater systems. Higher well densities, though not necessarily indicative of an unhealthy aquifer, do point to a higher susceptibility of the well owners to groundwater shortages as a result of long-term structural changes to the aquifer. In areas with high well densities, it is therefore important to ensure that none of the wells are withdrawing water at rates that exceed the aquifer's ability to supply it. The two figures below show Parkland County's well density and map out the maximum recommended water extraction rate based on local aquifer geology.

FIGURE 9: WATER WELL DENSITY[xvii]

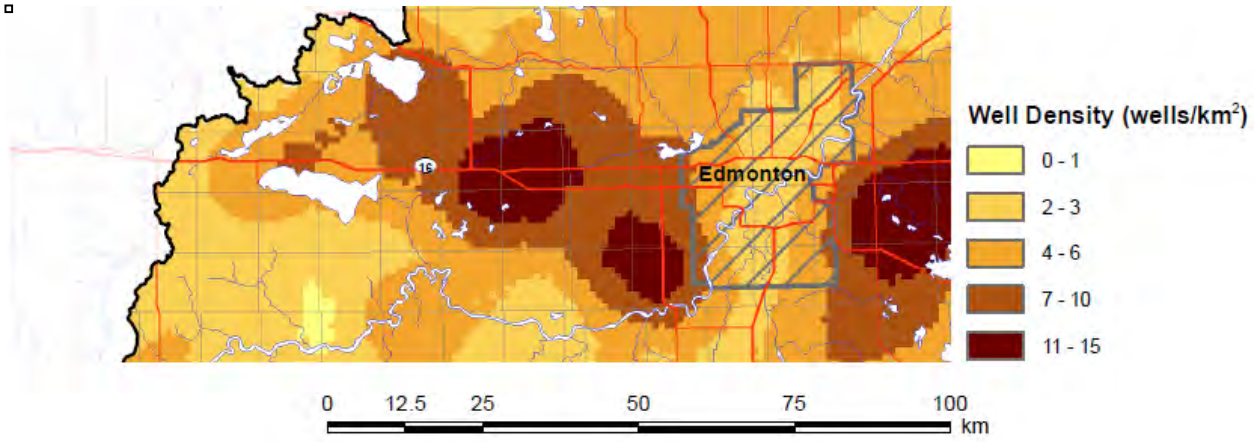
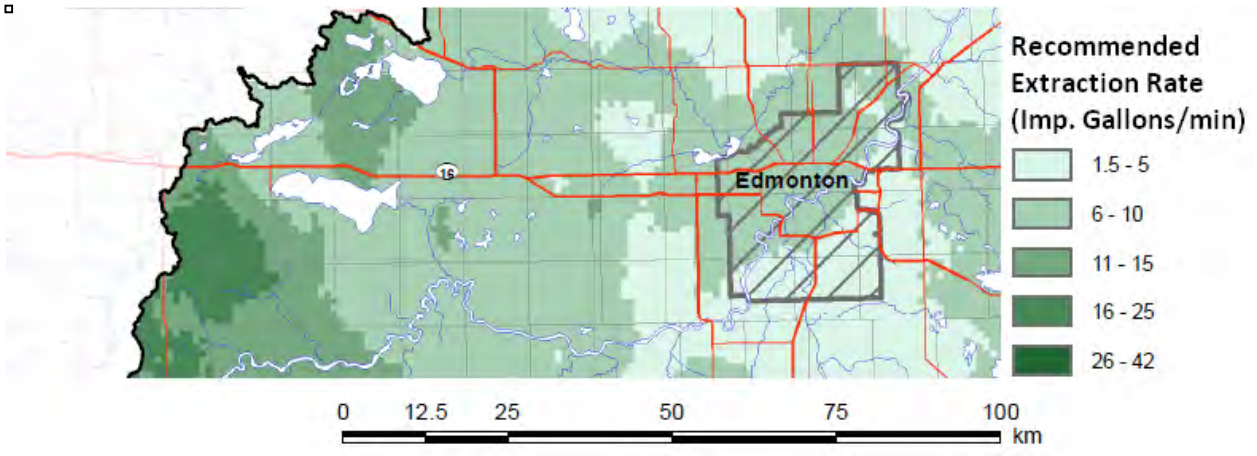


FIGURE 10: RECOMMENDED EXTRACTION RATE[xviii]

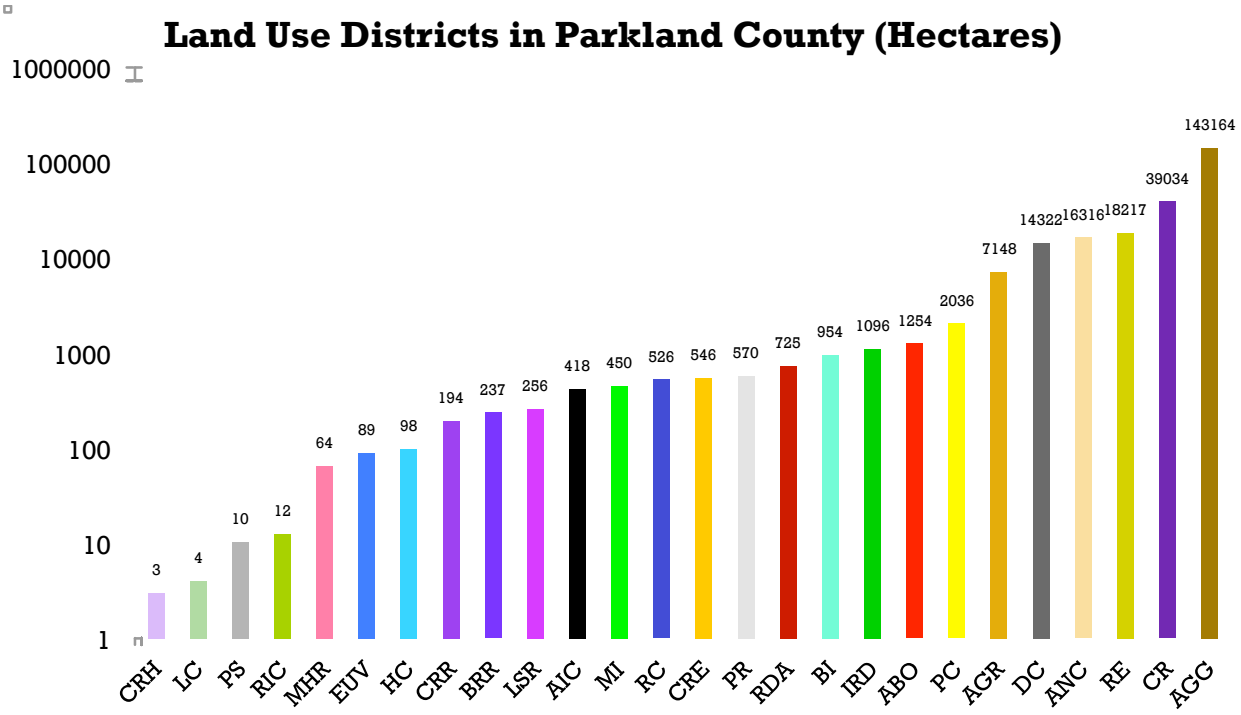


CONDITION OF PARKLAND COUNTY'S LAND

Condition Indicator: *Built Environment – Land Use Designations*

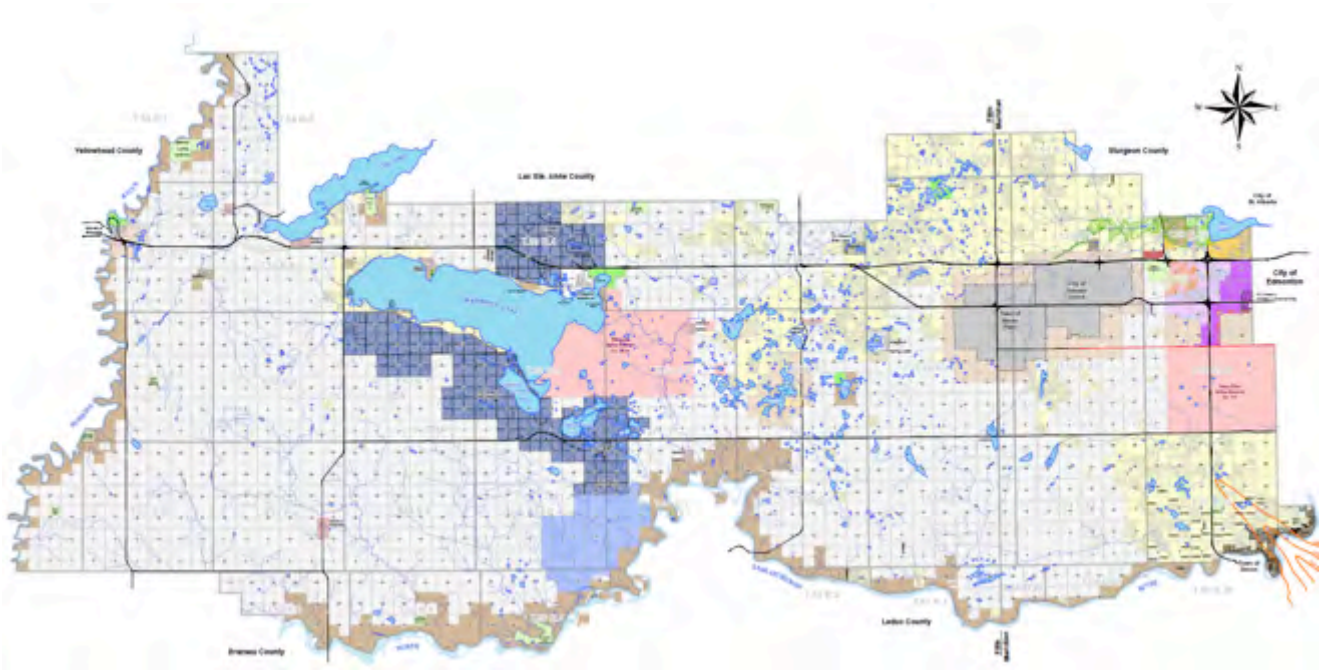
The geographical footprint of Parkland County's designated land uses provides a broad snapshot of the intensity of current and potential future human induced impacts on Parkland County's natural environment. The following figures illustrate the current designated land uses in Parkland County.

FIGURE 11: LAND USE DISTRICTS IN PARKLAND COUNTY



- AGG - Agriculture General
- AGR - Agriculture Restricted
- ANC - Agriculture Nature Conservation
- CR - Country Residential
- CRR - Country Residential Restricted
- CRE - Country Residential Estate
- CRH - Residential Row Housing
- MHR - Manufactured Home Residential
- LSR - Lakeshore Residential
- DC - Direct Control
- AIC - Acheson Industrial Commercial Overlay
- ABO - Atim Creek Big Lake Overlay
- RDA - Restricted Development Area
- BRR - Bareland Recreational Resort
- RC - Rural Centre District
- EUV - Entwistle Urban Village
- LC - Local Commercial
- HC - Highway Commercial
- BI - Business Industrial
- MI - Medium Industrial
- IRD - Industrial Reserve
- RIC - Rural Industrial Commercial
- RE - Resource Extraction
- PC - Conservation
- PR - Recreational
- PS - Public Service

FIGURE 12: LAND USE DISTRICTS IN PARKLAND COUNTY - MAP

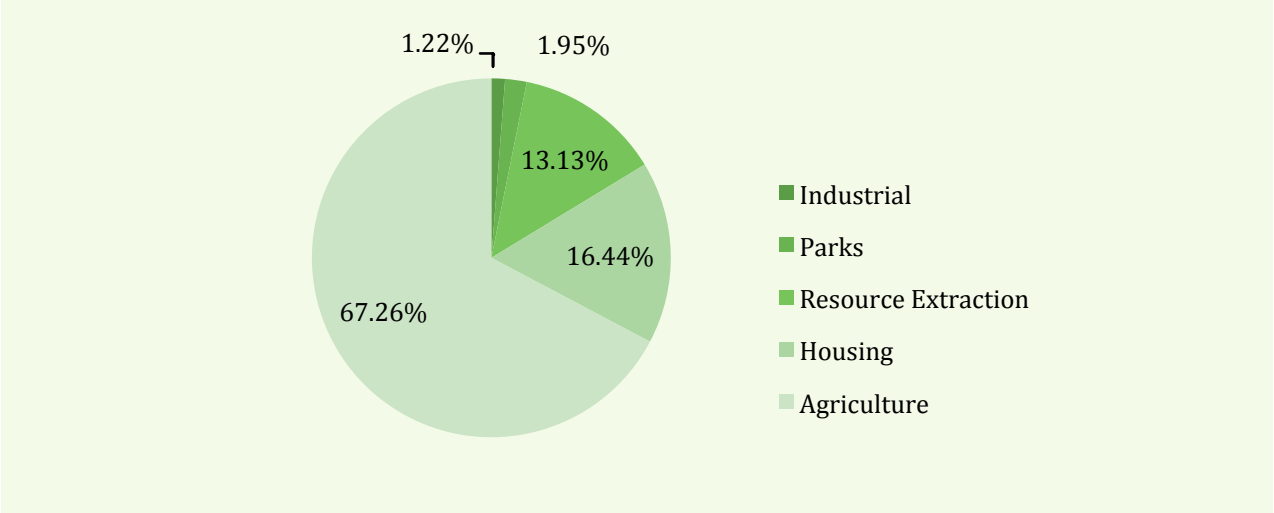


Legend

- AGR - Agriculture General District
- AGR - Agriculture Restricted District
- ANC - Agriculture Nature Conservation District
- CR - Country Residential District
- CRWL - Country Residential Work\Live District
- CRR - Country Residential Restricted District
- CRE - Country Residential Estate District
- CCR - Cluster (Conservation) Country Residential District
- LSR - Lakeshore Residential District
- Atim Creek Big Lake Overlay
- CRH - Residential Row Housing District
- MHR - Manufactured Home Residential District
- BRR - Bareland Recreational Resort District
- RC - Rural Centre District
- EUV - Entwistle Urban Village District
- LC - Local Commercial District
- HC - Highway Commercial District
- BI - Business Industrial District
- MI - Medium Industrial District
- RDA - Restricted Development Area
- HI - Heavy Industrial District
- IRD - Industrial Reserve District
- RIC - Rural Industrial Commercial District
- RE - Resource Extraction District
- PC - Conservation District
- PR - Recreation District
- PS - Public Service District
- DC - Direct Control District
- Acheson Industrial Commercial Area Overlay
- Edmonton International Airport 2040 NEF Contour

(Photo Credit: gdefon.ru)

FIGURE 13: LAND USE DISTRICTS IN PARKLAND COUNTY - PERCENTAGE



Although the information contained in the above figures 11, 12 and 13 accurately represent the officially designated land uses in Parkland County, it is important to note that areas under natural resource extraction are likely to be under-represented. There are a number of reasons for this:

1. The "Resource Extraction" category in the above figure includes both RE (Resource Extraction) and DC (Direct Control) land use designations, which are lands dedicated to coal extraction.
2. Sand and gravel operations can potentially be undertaken in all the agricultural and industrial districts and therefore are not included in the resource extraction calculations.
3. Oil and gas extraction facilities are not regulated by the municipality and therefore are also not included in the resource extraction calculations.

One final caveat, of the total landmass that is officially designated for resource extraction (DC and RE land use designations), over 1800 hectares (The former TransAlta Whitewood Mine located north of Lake Wabamun) have been reclaimed and are now used for agricultural purposes.

PRESSURES FACING PARKLAND COUNTY'S LAND

Pressure Indicator: *Coal Mining Development*

Parkland County is well known for its strong mining background. Highvale Mine and Whitewood Mine are the two mines that have operated in the County.

Highvale Mine, located centrally in Parkland County, is situated just south of Lake Wabamun. Covering 14,000 hectares, Highvale Mine is Canada's largest surface strip coal mine. As of July 2012, six pits are actively licenced and mined, and TransAlta is seeking approval from Alberta Environment and Sustainable Resource Development and the Energy Resources Conservation Board to develop, operate and reclaim a new mine located to the south and east of the Highvale Mine.

Pressure Indicator: *Per Capita Waste Disposal*

The amount of solid waste generated per capita (per individual) is an important indication of a community's commitment to waste reduction specifically, and to the environment in general. Lowering the amount of waste generated by residents and businesses provides a number of tangible environmental benefits.

These include but are not limited to: lowering demand for new raw materials that need to be extracted, lessening the environmental impact of product manufacturing and of product disposal.

The following table summarizes the amount of waste collected at County-run waste transfer stations in 2011 and converts this into a Per Capita Waste Disposal Rate.

TABLE 9: PER CAPITA WASTE DISPOSAL RATE

Parkland County Transfer Station	Rural Transfer Stations*	Total Weight	2011 Population	Per Capita Waste Disposal
5449.75 Mt (Metric Tonne)	1879.28 Mt	7329.03 Mt	30568 people	**0.239762 Mt**

* Includes: Moon Lake, Seba Beach, Kapasiwin, Tomahawk, Cholla, and Keephills Transfer Stations

The above table shows that in 2011, the County collected just under 240kg of waste per County resident.

RESPONSES TO THE PRESSURES FACING PARKLAND COUNTY'S LAND

Response Indicator: *Coal Mining Reclamation*

The TransAlta Whitewood Mine ceased operations in 2010 when the Wabamun power plant was retired. Reclamation of this former coal mine is now in its final stages. As of June 2012, **95%** (**1,804 hectares**) of the 1,900 hectares mined has been reclaimed.

Response Indicator: *Waste Diversion Rate (Recycling Rate)*

While the Per Capita Disposal Rate looks at a community's waste generating habits, the Waste Diversion Rate (Recycling Rate) completes the picture by looking at a community's waste disposal habits. This is because all recyclables can theoretically be disposed as solid waste, but not all waste can be recycled. Also, because recycling requires extra effort on the part of the resident (to sort out recyclables), and on the part of the County (to provide additional facilities, to find markets for recyclables etc.), the Waste Diversion Rate assesses a community's overall commitment to implementing an environmentally responsible waste management process.

Parkland County Transfer Station & Recycling Centre - *Range Road 11*

TABLE 10: 2010 WASTE DIVERSION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Recycling Weight (Mt)	**36.5**	**64.8**	**73.9**	**145.6**	**173.7**	**180**	**147.2**	**157.1**	**111.7**	**148.1**	**103.5**	**53.6**	**1395.03**
Total Waste (Mt)	**409.4**	**404.6**	**487.8**	**696.9**	**746.8**	**786.5**	**706.9**	**650.6**	**589.1**	**649.3**	**409.7**	**488**	**7025.75**
Diversion Rate (%)	**9**	**16**	**15**	**21**	**23**	**23**	**21**	**24**	**19**	**23**	**25**	**11**	**20**

TABLE 11: 2011 WASTE DIVERSION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Recycling Weight (Mt)	**44.2**	**55.3**	**48.6**	**70.1**	**170.4**	**162.3**	**152.3**	**178.1**	**136.6**	**158**	**119.1**	**67.4**	**1362.33**
Total Waste (Mt)	**302.4**	**279.6**	**350**	**436.5**	**609.6**	**579.1**	**525.9**	**601.4**	**524.3**	**514.4**	**393.2**	**333.5**	**5449.75**
Diversion Rate (%)	**15**	**20**	**14**	**16**	**28**	**28**	**29**	**30**	**26**	**31**	**30**	**20**	**25**

TABLE 12: 2012 WASTE DIVERSION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Recycling Weight (Mt)	**81.2**	**77.2**	**50.7**	**121**	**195.1**	**204.2**	**171.1**	**191.8**	**143.2**	**148.1**	**86.1**	**55.9**	**1525.52**
Total Waste (Mt)	**332.6**	**265.3**	**265.3**	**348.5**	**456.6**	**529.5**	**517.3**	**529.3**	**493.7**	**528.5**	**361.5**	**291.3**	**4919.15**
Diversion Rate (%)	**24**	**29**	**19**	**35**	**43**	**39**	**33**	**36**	**27**	**30**	**24**	**19**	**31**

The previous tables show an increasing recycling rate at the Parkland County Transfer Station over the years. This is an encouraging sign that residents and the County are working together to reduce the amount of salvageable material that ends up in landfills.

Response Indicator: *Composting of Organic Materials*

Household organic materials, along with leaves and grass clippings are now accepted at the Parkland County Transfer Station on Range Road 11.

County residents also have the chance to purchase backyard composters directly from the County at a discount. During 2012, the County sold more than 300 backyard composters to County residents.

(Photo Credit: EnviroWorld)

CONDITION OF PARKLAND COUNTY'S BIODIVERSITY

Condition Indicator: *Status of Alberta Species*

The Status of Alberta Species is a Province-wide assessment of the species that are facing existential pressures. Not all species are necessarily found in Parkland County, but County-specific data is not maintained by the Province. When assessing the biodiversity of species within the County both the Boreal Plains and Prairies ecozones are considered. This is because parts of the County lie in both ecozones. Canadian Geographic defines ecozones as "a classification system that defines different parts of the environment with similar geography, vegetation and animal life" [xix].

The Prairie ecozone stretches from central Alberta to southeastern Manitoba and covers 520,000 square kilometers. This ecozone contains little forest, extensive grasslands, and its topography features vast flat plains and small water bodies, although half the wetlands in the ecozone have disappeared since settlement. It is the most altered ecozone in Canada with 94% of its total land base dedicated to agriculture. Many of the native animal species are facing severe habitat shortages and the remaining native habitats are among the most endangered in the Country[xx].

The Boreal ecozone stretches from northeastern British Columbia to southeastern Manitoba and covers 650,000 square kilometers. Boreal forests cover more than 84% of this ecozone and the majority of the remaining land base is devoted to agriculture. Its topography features gently rolling hills, and many small water bodies[xxi].

FIGURE 14: ECOZONES OF THE CANADIAN PRAIRIES[xxii]

The following is a list of endangered, threatened and species of concern that are native to the boreal plains and the prairie ecozones.

TABLE 13: ALBERTA'S ENDANGERED SPECIES[xxiii]

	Alberta	
Endangered Species	**Bison** **Piping Plover** **Sage Grouse** **~~Ord's Kangaroo Rat~~** **~~Short-horned Lizard (*eastern*)~~** **~~Burrowing Owl~~** **~~Ferruginous Hawk~~** **Tiny Cryptanthe** **Soapweed**	**Western Spiderwort** **Swift Fox** **Whooping Crane** **Mountain Plover** **Porsild's Bryum** **Limber Pine** **Whitebark Pine** **Slender Mouse-Ear-Cress**
Threatened Species	**Peregrine Falcon** **Barren Ground Caribou** **Trumpeter Swan** **~~Northern Leopard Frog~~** **St. Mary Sculpin** **Stonecat**	**Shortjaw Cisco** **Grizzly Bear** **Western Silvery Minnow** **Lake Sturgeon** **Small-Flowered Sand Verbena** **Westslope Cutthroat Trout**
Species of Concern	**Sprague's Pipit** **Long-Towed Salamander** **Long-Billed Curlew** **Black Throat Green Warbler** **Bull Trout** **White-Winged Scoter** **Prairie Falcon** **Barred Owl** **Harlequin Duck** **Logerhead Shrike**	**Western Blue Flag** **Artic Grayling** **Weidemeyer's Admiral** **Western Grebe** **Western Small Footed Bat** **Stemless Lady's Slipper** **Mountain Lady's Slipper** **Yellow Lady's Slipper**

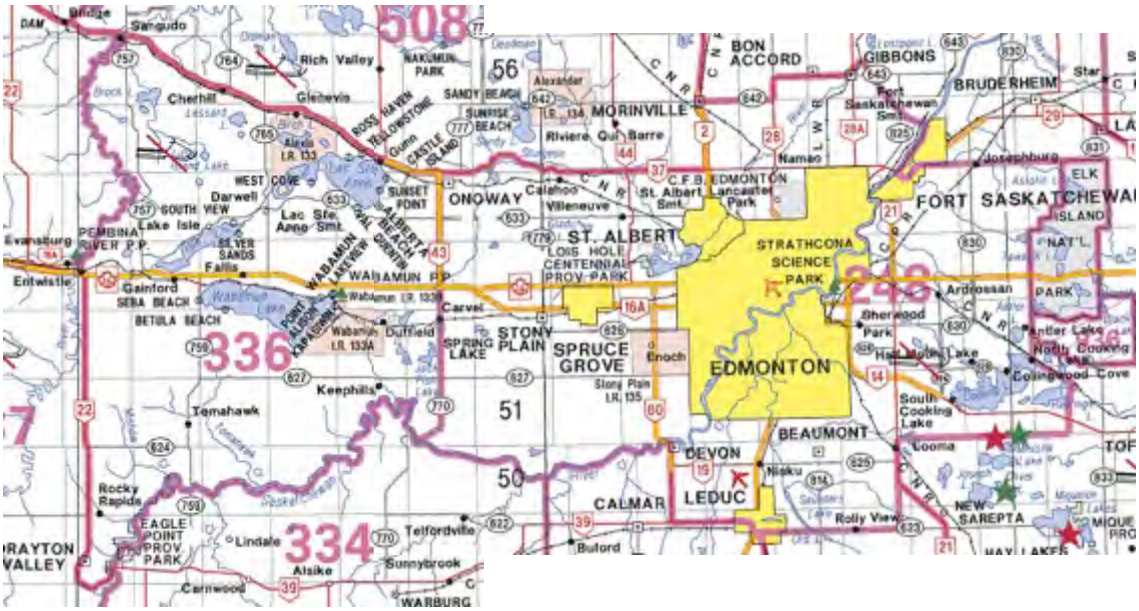
Discussions with representatives from Alberta Fish and Wildlife indicate that they have not found the following species in Parkland County: burrowing owls, short-horned lizards, ferruginous hawks, or Ord's kangaroo rats. The same discussions revealed that leopard frogs have disappeared from Parkland County in the last 30 years.

(Photo Credits: Simon Eade, Red Dog, and Adam Brown)

Condition Indicator: *Big Game Survey*

In order to manage big game populations in Alberta, the Province has divided its territory into wildlife management units (WMU). Parkland County is almost evenly split between 2 wildlife management units: the western portion of the County is part of WMU 336 and the eastern portion of the County is part of WMU 248 which includes the City of Edmonton and Strathcona County. The map below shows WMUs 248 and 336 in relation to Edmonton and Parkland County.

FIGURE 15: WILDLIFE MANAGEMENT UNITS OF PARKLAND COUNTY[xxiv]



In 2012, an aerial survey was conducted by the Province for moose, mule deer and white-tailed deer in WMU 336. No aerial survey has been conducted by the Province for WMU 248 since at least 2007. The following table summarizes the findings from the aerial survey for WMU 336.

TABLE 14: WMU 336 AERIAL SURVEY RESULTS[xxv]

	Moose	Mule Deer	White-Tailed Deer
Population Estimate	**1071** ***Big game population estimates are generally accurate within 20%****	**936** ***Big game population estimates are generally accurate within 20%****	**3292** ***Big game population estimates are generally accurate within 20%****
Density	**0.41/km²**	**0.36/km²**	**1.26/km²**
Population Ratio	***Bull:Cow:Calf*** **31:100:57**	***Buck:Doe:Fawn*** **36:100:102** ****Demographic ratio must be interpreted cautiously as the male cohort is likely underrepresented due to the fact that all males with shed antlers would have been recorded as unclassified****	***Buck:Doe:Fawn*** **7:100:118** ****Demographic ratio must be interpreted cautiously as the male cohort is likely drastically underrepresented due to the fact that all males with shed antlers would have been recorded as unclassified****
Survey Type Conducted	**Stratified Random Block Design**	**Stratified Random Block Design**	**Stratified Random Block Design**
Date of Survey	**March 2012**	**March 2012**	**March 2012**

PRESSURES FACING PARKLAND COUNTY'S BIODIVERSITY

Pressure Indicator: *Big Game Hunting Tags*

Big game hunting tags are issued to hunters by the Province of Alberta. Each tag gives the hunter permission to hunt one individual from one animal species. This indicator is an estimate of the number of animals hunted per year in wildlife management units 336 and 248 and is based on the number of tags sold to hunters by the Province. This indicator is an indirect approximation of the pressures facing Parkland County's big game animal population because the number of tags offered for sale in a given year is based on latest aerial survey results for the WMU in question. Therefore, higher numbers of tag sales indicates a higher observed animal population, not necessarily an increase in human induced stress. Adding to this is the fact that the number of tags sold does not necessarily represent the number of animals hunted since hunters may not use all the tags that they buy.

In WMU 336, special hunting tags are issued for:

- Antlered Mule Deer
- Anterless Mule Deer
- Antlerless Elk
- Antlered Moose
- Antlerless Moose

In WMU 248, special hunting tags are issued for:

- Antlerless Moose

The table below summarizes the number of tags issued by the Province per animal species for 2012.

TABLE 15: BIG GAME HUNTING TAGS[xxvi]

	Antlered Mule Deer	Anterless Mule Deer	Antlerless Elk	Antlered Moose	Antlerless Moose
WMU 336	**155**	**139**	**67**	**177**	**148**
WMU 248	**0**	**0**	**0**	**0**	**20**

Pressure Indicator: *Invasive Plant Species*

Invasive species have been identified by the World Conservation Union to be the second most significant threat to biodiversity, after habitat loss. These are plants that are not from the local area and which compete with the local plant community for nutrients, space, and water. Invasive species are generally more hardy, robust and resistant than local native plants, which is how they come to be invasive to begin with. They simply outcompete and crowd out native plants, which can alter local biodiversity. The Province of Alberta implemented the Alberta Weed Control Act 2010 to control the spread of invasive plants. The Act lists 75 species of invasive plants and divides them into one of two classes:

1. **Prohibited Noxious:** Plants that fall in this category are invasive and their presence in Alberta is low enough that eradication is still considered possible. There are 46 plants listed as prohibited noxious in Alberta. If prohibited noxious plants are found on a property, eradication by landowner is legally required.

2. **Noxious:** Plants in this category are invasive and their presence in Alberta is so widespread that eradication is no longer considered feasible or practical. There are 29 plants listed as noxious in Alberta. If noxious plants are found on a property, control by landowners is legally required.

Prohibited Noxious Species located in Parkland County by Parkland County's Agriculture Services:

TABLE 16: PROHIBITED NOXIOUS PLANTS IN PARKLAND COUNTY

Autumn Olive	Giant Hogweed	Medusahead
Himalayan Balsam*	**Pale Yellow Iris***	Yellow Nutsedge
Common Barberry	Bighead Knapweed	Puncturevine
Red Bartsia	Black Knapweed	Tansy Ragwort
Common Buckthorn	Brown Knapweed	Rush Skeletonweed
Sulphur Cinquefoil	Diffuse Knapweed	**Saltcedar***
Common Crupina	**Hybrid Knapweed***	Saltlover
Dyer's Woad	Meadow Knapweed	Common St John's Wort
Eurasian Water Milfoil	Russian Knapweed	Yellow Starthistle
Flowering Rush*	Spotted knapweed	Chinese Tamarisk
Garlic Mustard	Squarrose Knapweed	Smallflower Tamarisk
Jointed Goatgrass	Tyrol Knapweed	Marsh Thistle
Meadow Hawkweed*	Giant Knotweed	Nodding Thistle
Mouse-Ear Hawkweed	Hybrid Japanese Knotweed	Plumeless Thistle
Orange Hawkweed*	**Japanese Knotweed***	
Hoary Alyssum	**Purple Loosestrife***	

*Parkland County's Agriculture Services located 9 species of prohibited noxious plants in Parkland County in 2012.

Noxious Species located in Parkland County by Parkland County's Agriculture Services:

TABLE 17: NOXIOUS PLANTS IN PARKLAND COUNTY

Common Baby's Breath*	**Scentless Camomile***	**Common Mullein***
Creeping Bellflower*	**Yellow Clematis***	Broad-Leaved Pepper Grass
Field Blindweed*	**White Cockle***	**Field Scabious***
Blueweed	**Oxeye Daisy***	**Perennial Sow Thistle***
Downy Brome	**Dames' Rocket***	**Leafy Spurge***
Japanese Brome	Black Henbane	**Common Tansy***
Great Burdock*	Globe-Podded Hoary Cress	**Canada Thistle***
Lesser Burdock*	Heart-Podded Hoary Cress	Dalmatian Toadflax
Woolly Burdock*	Lens-Podded Hoary Cress	**Yellow Toadflax***
Tall Buttercup*	Hound's Tongue	

*Parkland County's Agriculture Services located 19 species of noxious plants in Parkland County in 2012

REFERENCES

[i] Alberta Environment (2012): Is Air Quality Affecting Your Health? URL http://environment.alberta.ca/0977.html [December 2012]
[ii] Data compiled from: CASA (2012): Air Quality Data. URL http://www.casadata.org/Reports/SelectCategory.asp [December 2012] and from: Health Canada (2006): National Ambient Air Quality Objectives. URL http://www.hc-sc.gc.ca/ewh-semt/air/out-ext/reg-eng.php#a3 [December 2012]
[iii] Ibid.
[iv] Environmental Protection Agency (2012): Ground-Level Ozone – Health Effects. URL http://www.epa.gov/glo/health.html [December 2012]
[v] CASA (2012): Air Quality Data. URL http://www.casadata.org/Reports/SelectCategory.asp [December 2012]
[vi] Alberta Environment (2009): Annual Alberta River Flow Quantity Index. URL http://environment.alberta.ca/images/Historical-River-Flow-Quantity-Index-full.jpg [December 2012]
[vii] Alberta Environment (2010): Alberta River Water Quality Index – '09/'10. URL http://environment.gov.ab.ca/info/library/7680.pdf [December 2012]
[viii] Alberta Environment (2011): Water Allocations Compared to Natural Flow. URL http://environment.alberta.ca/01722.html [December 2012]
[ix] Ibid.
[x] Ibid.
[xi] Alberta Environment (2009): Ranking of Annual Lake Levels. URL http://environment.alberta.ca/images/lake_index_historical_table-full.jpg [December 2012]
[xii]Graph created with data compiled from: Alberta Environment (2011): Trophic State of Alberta Lakes. URL http://environment.alberta.ca/images/Trophic-State-of-AB-Lakes-Graph.jpg [December 2012] and from: University of Alberta (2005) Atlas of Alberta Lakes. URL http://sunsite.ualberta.ca/Projects/Alberta-Lakes/view/ [December 2012]
*Lake Mayatan data obtained from: North Saskatchewan Watershed Alliance (2012) Mayatan Lake State of the Watershed Report. URL http://www.nswa.ab.ca/content/mayatan-lake-state-watershed-report [December 2012]
[xiii] Alberta Environment (2012): Surface Water Quality Data. URL http://environment.alberta.ca/01288.html [December 2012]
[xiv] Ibid.
[xv] Alberta Environment (2012): Groundwater Observation Well Network. URL http://www.environment.alberta.ca/apps/gown/Default.aspx [December 2012]
[xvi] Ibid.
[xvii] Alberta Geological Survey (2011) Edmonton-Calgary Corridor Groundwater Atlas. URL http://www.ags.gov.ab.ca/groundwater/ecc-atlas.html [December 2012]
[xviii] Ibid.
[xix] Canadian Geographic (2012) Glossary. URL http://www.canadiangeographic.ca/glossary/definition.asp?word=ecozone&id=31 [December 2012]
[xx] Evergreen Foundation (2012): Canada's Ecozones. URL http://www.evergreen.ca/en/resources/native-plants/canada-ecozones.sn [December 2012]
[xxi] Ibid.
[xxii] Natural Resources Canada (2009) Climate Change: Introduction URL http://www.nrcan.gc.ca/earth-sciences/climate-change/community-adaptation/assessments/498 [December 2012]
[xxiii] Alberta Sustainable Resource Development (2012) ESRD/Species Assessed by Alberta's Endangered Species Conservation Committee: Short List. URL http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/SpeciesSummaries/documents/SpeciesAssessed-EndangeredSpeciesConservationCommittee-ShortList-Nov06-2012.pdf [February 2013]
[xxiv] Alberta Sustainable Resource Development (2012) Wildlife Management Units URL http://www.srd.alberta.ca/FishWildlife/FishingHuntingTrapping/HuntingAlberta/WildlifeManagementUnits.aspx [December 2012]
[xxv] Alberta Conservation Association (2012): Big Game surveys. URL http://www.ab-conservation.com/go/default/index.cfm/programs/wildlife/wildlife-projects/aerial-ungulate-surveys/overview/ [December 2012]
[xxvi] My Wild Alberta (2012) Hunting Draws Summary Report – 2012. URL http://mywildalberta.com/Hunting/HuntingDraws/HuntingDrawsReports/DrawsSummaryReport/Default.aspx [December 2012]

Parkland County's State of the Environment Report 2012 was written by Parkland County Sustainability Services. For additional information, please contact:

Gabriel Clarke

Email: gclarke@parklandcounty.com

Tel: 780-968-8888 ext. 8261