GEOTOUR GUIDE
FOR PRINCE GEORGE,
BRITISH COLUMBIA

OUR LAND SUSTAINS US:
GEOLOGY, LANDSCAPES, AND EARTH RESOURCES

Figure 1. A winter view of Prince George from Highway 16 looking west across "the Bowl". Prince George's downtown lies beyond the ice-covered Fraser River with Cranbrook Hill in background.

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BRITISH COLUMBIA | Ministry of Energy, Mines and Petroleum Resources

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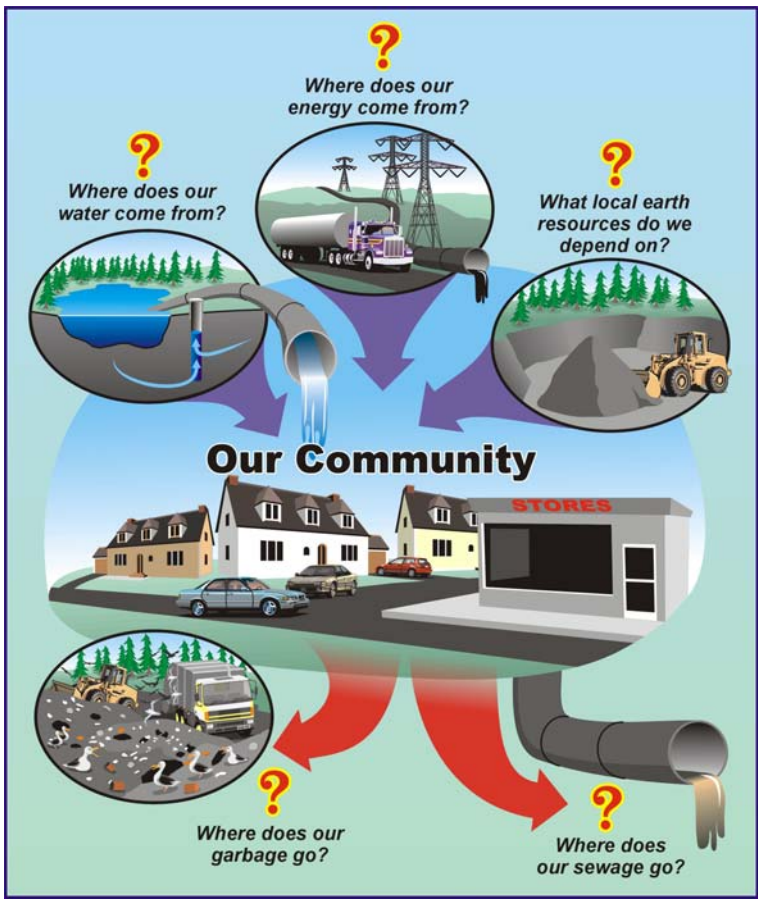
WHAT IS THIS GUIDE ABOUT?

We live where two great rivers - the Fraser and the Nechako - join. Each river has cut a wide valleys into the rolling Nechako Plateau. Where these two rivers meet, these valleys combine to form "the bowl" within which Prince George has grown. Prince George now covers over 300 km^2 and has spread up onto the surrounding plateau. Two hundred and fifty million years of geologic processes have created, and continue to create, Prince George's geological landscape.



Today we still "live off the land". Prince George, like any other community, is dependent on the Earth for water, food, materials, energy. Not only does the Earth provide resources, but it accepts our wastes. The purpose of this field guide is to explore how our community of Prince George "lives off the land". How has our local landscape shaped human use of the area? Where does our drinking water supply come from? Where does our sewage go? Where does our garbage go? Where does our energy, that fuels our lives, come from? What earth materials underlie this landscape and how do they affect us? What local earth resources do we depend on? Are we sustaining the land that sustains us?

Figure 2. How our community depends on the land.

First Nations peoples used the "land where the rivers meet" for thousands of years before the arrival of the first Europeans. The arrival of Simon Fraser and the establishment of a tiny outpost in 1807 mark the origin of the City of Prince George. Subsequent development of the railways, the highways, and industry resulted in the growth of the City to make it the "capital" of northern B.C. The signature of the City of Prince George pays tribute to the traditional name for the area "the land where the rivers meet", and depicts the conjoining of two different paths: two great rivers, two railways and two major highways.

This guide takes us on a tour of the city area. Our sites will be familiar to many, but the guide may inspire a new look with "landscape eyes". A better understanding of how we depend on the land, helps us to better consider how "best practices" can protect the land and ensure that the land continues to sustains us.

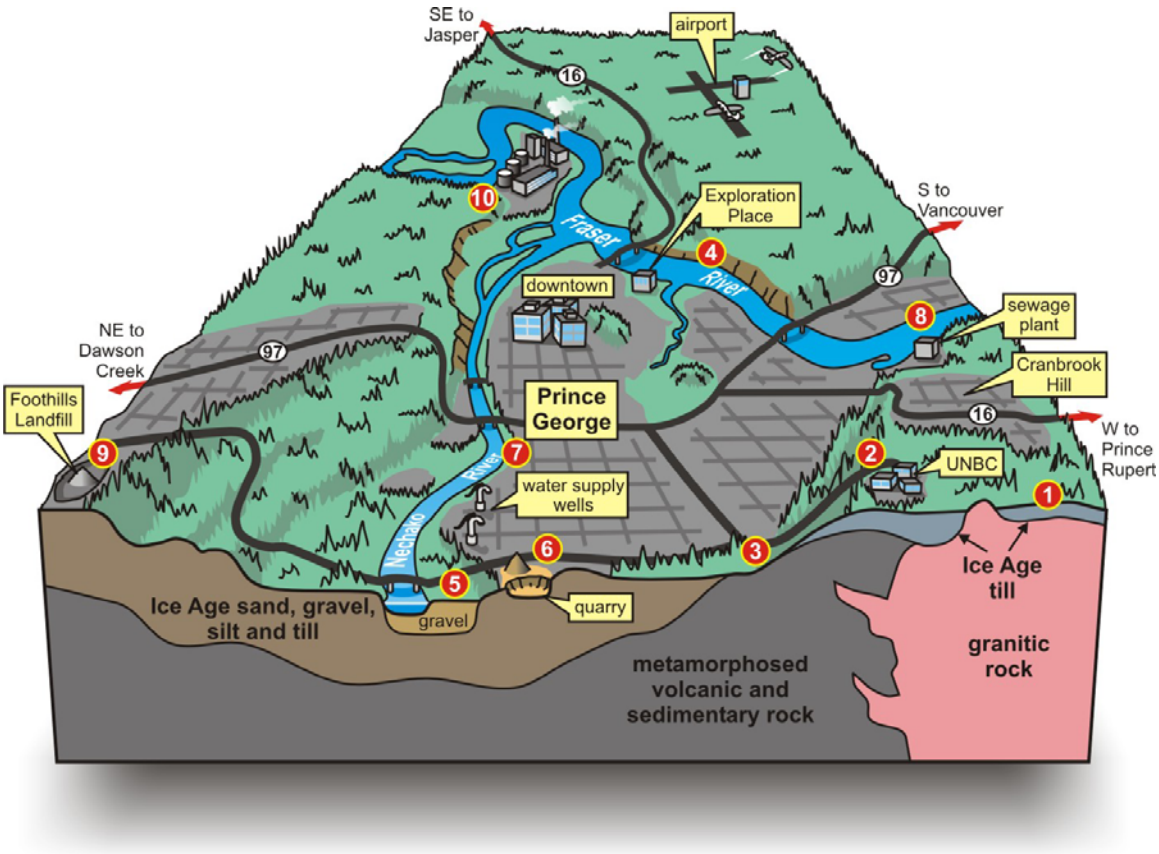


Figure 3. *A schematic view to the southeast across the Prince George area, illustrating the geological materials that underlie the area. GeoTour sites discussed in this guide are indicated with numbers.*
Site 1, *Forests for the World lookout.* ***Site 2****, University of Northern British Columbia access road lookout.* ***Site 3****, Foothills Road outcrop of volcanic bedrock.* ***Site 4,*** *Fort George Park view of "silt" bluffs across the Fraser River.* ***Site 5****, Otway Ski Park: a close look at gravels.* ***Site 6,****. Concrete and asphalt plants, Foothills and Otway roads.* ***Site 7,*** *City of Prince George well house.* ***Site 8,*** *City of Prince George Wastewater Treatment Centre.* ***Site 9****,Foothills Landfill.* ***Site 10****, Husky oil refinery.*

BUT FIRST - HOW OUR LAND CAME TO BE. A QUICK TOUR THROUGH GEOLOGIC TIME

We know that Prince George is a young city. Europeans and settlement only goes back to the mid 1800s. Of course, First Nations settlement in the Prince George is much older and goes back thousands of years. But the land itself, is much, much, much older. Geologists will tell you that the volcanic rock that underlies Prince George is as much as 200 million years old. How old then are the gravels that fill the "Bowl". How old is the Fraser River? What follows is a brief summary of our geological history. As you might suspect, trying to piece together such an ancient story is very difficult. There is some educated guess work involved. As we learn more, some of the details of the story will be modified. That is how science works. We are always trying to learn more and improve our understanding.

So, in eight stages, this is the geological history of the Prince George region (Figures 4 and 5). The geological history introduces us to the various geological materials that today underlie Prince George. Each material has a history and represents a period of earth history.

(1) ANCIENT VOLCANOES AND SEAFLOOR

The oldest local rocks are 250 to 180 million year old volcanic lavas and deep-sea sediments. The volcanic rocks were erupted from volcanoes that were once part of an oceanic chain of volcanic islands, perhaps similar to modern day Japan, or the Aleutian Islands. The islands lay west of the coastline of ancient North America, which at the time was near the present site of the Rocky Mountain Trench. Adjacent to the volcanic islands, silica-rich plankton accumulated as oozes on the seafloor along with muds that later became layered chert and shale. Geologists call the volcanic rocks the "Nicola Group" and the chert and shale the "Cache Creek Group". These groups of rocks form belts that run the length of B.C. Site 3 takes a look at these volcanic rocks.

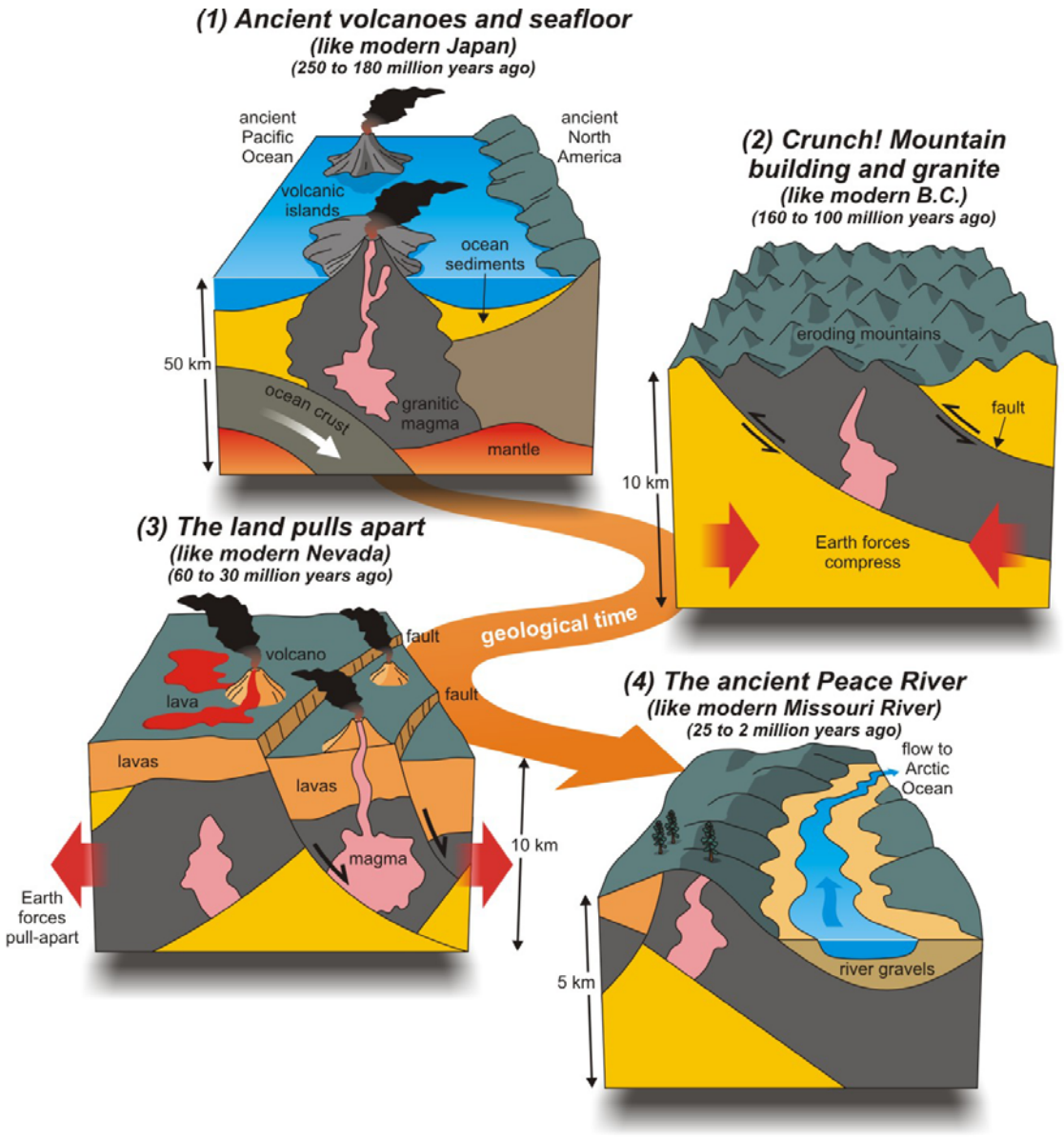


Figure 4. *A schematic geological history of Prince George area from 250 million to 10 million years ago. This history is continued in Figure 5.*

(2) CRUNCH! MOUNTAIN BUILDING AND GRANITES

One hundred and sixty million years ago, the Atlantic Ocean started to open and North America moved westwards. It soon collided with the volcanic island chain and seafloor, welding them to its margin, and extending North America westwards near to present day Vanderhoof. The collision deformed the volcanic and seafloor rocks, creating folds and faults that can be seen in these rocks today. Later, a second volcanic island chain, referred to by geologists as "Stikinia", collided with North America, again expanding North America westwards, and forming much of the land west of Vanderhoof. Still later melted rock, or magma, rose up through the deformed rocks to cool, crystallize, and form granitic rocks. We take a look at these rocks at Forests of the World parking lot (Site 1).

(3) THE LAND PULLS APART

About 60 million years ago, western North America started to pull apart. The land broke into fault blocks, and over the next 30 million years, volcanoes periodically spewed lava and ash where melted rock rose to the surface along faults. A thick blanket of volcanic rocks covered the land. The final eruptions of basalt lavas, 10 million years ago, covered much of the central BC Interior and smoothed the surface to a flat plateau. The region was drained by a large river system that drained to the east.

(4) THE ANCIENT PEACE RIVER

Five to ten million years ago, the Coast Mountains and Rocky Mountains started to rise. The rising mountains blocked the westward and eastward flow of rivers; instead rivers collected in the interior and flowed north toward a gap in the Rockies that today is occupied by the Peace River. This ancient Peace River drained most of the central Interior, as far south as Williams Lake. This river system carved broad valleys filled with thick gravels, including the valleys near Prince George now occupied by the Fraser and Nechako rivers.

(5) THE ICE AGE

Two million years ago, great continental ice sheets started to form in northern North America. Ice Ages came and went. The last great Ice Age reached its maximum about 25,000 years ago when the ice sheet was two kilometers thick over the Prince George area. The slow-moving ice carved the land, deepening valleys, and leaving behind a carpet of stone, gravel, sand, and clay debris called "till".

(6) THE BIG MELT

About 12,000 years ago, the great ice sheets started to melt. Great rivers filled with melt waters carried vast quantities of gravel and sand eroded from the unvegetated glacial debris that covered the landscape. Thick deposits of gravel and sand accumulated in the valleys of the modern Fraser and Nechako Rivers. These gravels and sands form most of the "silt bluffs" along the Fraser and Nechako River (Site 4), and are quarried in many places in the Nechako River valley.

(7) PLUGGED! A GLACIAL LAKE

As the ice sheets melted, glaciers would periodically surge forward, temporarily blocking the flow of melt waters in valleys to the north and south. During these blockages, glacial lakes formed in the river valleys. Glacial Lake Prince George flooded all of the Prince George and Vanderhoff area, leaving behind a layer of fine sand several metres thick. In the Prince George area, we can see this layer exposed at the top of the silt bluffs along the Nechako and Fraser Rivers (Site 4).

(8) TODAY. THE RIVER CUTS THROUGH ICE AGE DEPOSITS

After the ice sheets had melted, the modern Fraser River was born, carrying waters from the central interior southward to the Pacific Ocean. The Fraser and its tributaries, including the Nechako, cut down through the thick glacial deposits that filled the valleys, forming riverside cliffs that exposed the layers of glacial gravels and sands. Where the Nechako River joined the Fraser River, both rivers migrated back and forth over time, eroding away the uppermost glacial gravels and deepening the valley we now call the "Bowl". As the Nechako migrated back and forth it cut ever downwards, leaving behind a "staircase" of flat terraces that marked former river plains. Today, Prince George is built on this staircase of terraces or "benches". Good examples of these former river plain surfaces, now left high and dry, are the flat topped Connaught

Hill Park near the downtown, and the Nechako Bench and Edgewood Terrace neighbourhoods along North Nechako Road.

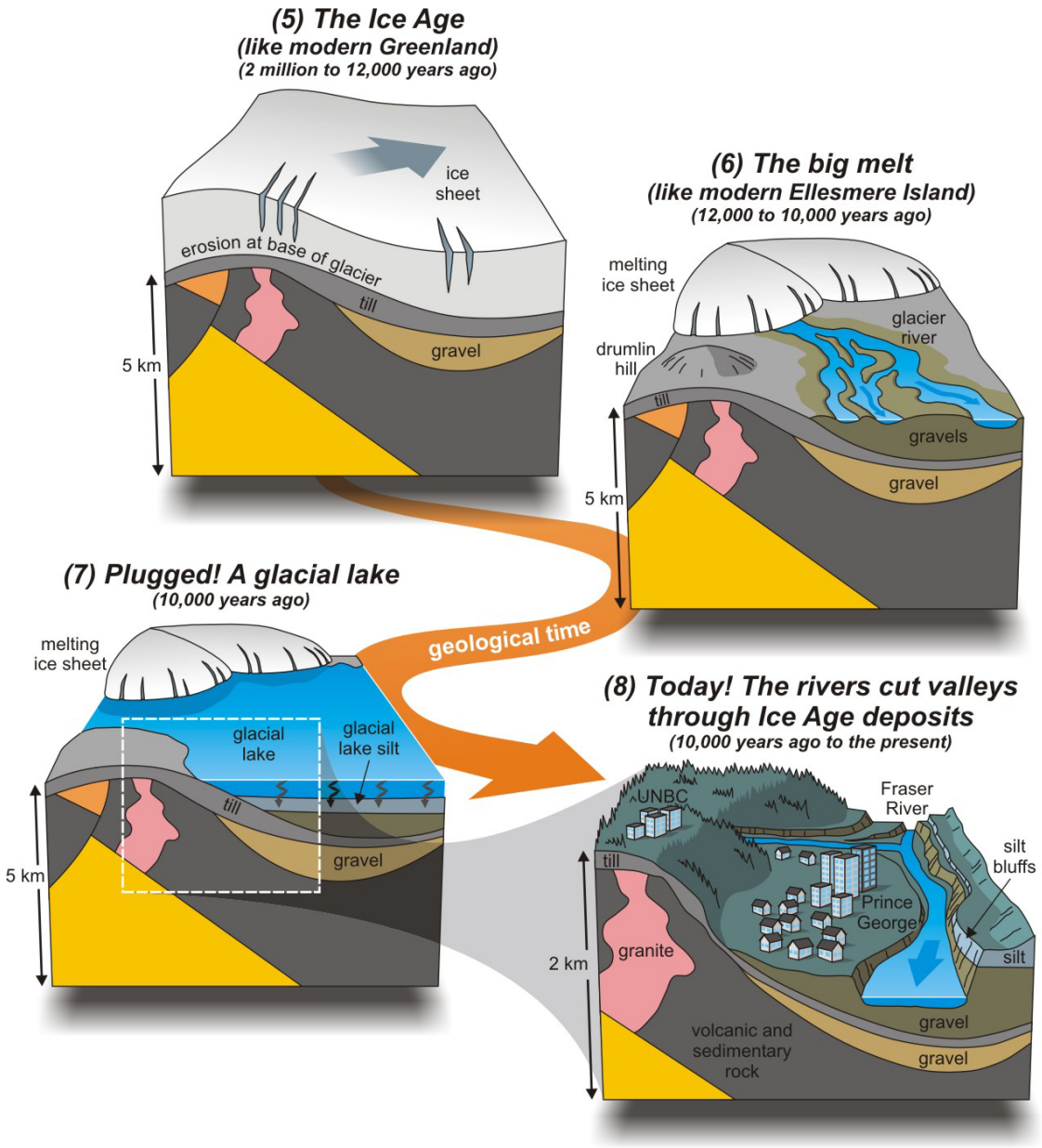


***Figure 5**. A schematic geological history of Prince George area from 25,000 years ago to the present.*

(SITE 1) FORESTS FOR THE WORLD LOOKOUT: THE "BIG PICTURE"

Figure 6. *The view of Prince George region looking east from the lookout at Forests for the World.*

So, with our geological history in mind, lets head out and take a look at the landscapes of Prince George. Our first site is the great viewpoint of the Prince George region at Forests of the World. From the viewpoint, a panorama unfolds to the east and south that provides the "big picture" setting of Prince George. Far to the east and on the skyline are the Rocky Mountains, the big ridge that separates the Interior Plateau from the Interior Plains of Alberta. Between the viewpoint and the Rockies is the Interior Plateau, an elevated region of gently rolling hills. In the foreground, the valleys of the Nechako and Fraser rivers that are cut into the plateau surface. To the southeast is the northern end of the Cariboo Mountains; highlands that rise in height to the south to form the rugged peaks of the Quesnel Lake region. The gently-rolling expanse of the Interior Plateau stretches as far south as the eye can see.

On your way back to the parking lot, keep an eye out for exposures of bedrock in the forest. Bedrock, the solid rock mass that underlies all landscapes, is partly buried by glacial till along the trail and only locally pokes out at the surface. The best bedrock exposures occur along the exit road from the parking lot. Take a look! If you break off a piece and look at a fresh surface (most weathered rock surfaces are covered with lichen or mineral stains) you will see the rock is a pale grey colour and speckled with black grains. Closer inspection will reveal a mosaic of grey and black minerals, several millimetres in size. This is granite that formed deep in the earth as a molten liquid that cooled and crystallized to rock. Uplift of the land in concert with erosion of kilometres of rock has brought this granite to the surface.

GO TAKE A LOOK

Drive up Cranbrook Hill on Cranbrook Hill and Kueng roads, off Foothills Boulevard, to the Forests of the World parking lot. The trail to the viewpoint is a pleasant 15 minute walk.

(SITE 2) UNIVERSITY OF NORTHERN BRITISH COLUMBIA ACCESS ROAD LOOKOUT: THE VALLEY OF PRINCE GEORGE

The Nechako and Fraser rivers have carved the "bowl", a broad valley cut into the surrounding plateau. A great place to view the bowl is from the access road to the University of Northern British Columbia.

Figure 7*. View from UNBC access road looking east across Prince George.*

The "bowl" has a generally flat appearance with a few isolated flat-topped hills. Topographic maps show that the Bowl slopes gently toward the Fraser River. Geologists know that the surface of the bowl represents old river plains of the Nechako and Fraser Rivers, as they eroded down through the thick Ice Age sands and gravels. Remnants of the old glacial lake floor and underlying glacial gravels are preserved as flat-topped Connaught Hill just to the west of the downtown, and the flat-topped benches with "silt bluffs" along the Fraser and Nechako rivers. Underlying the "Bowl" are thick layers of gravel and sand that contain Prince George's water supply for the city. The City of Prince George fills the bowl and has spread onto the plateau top to the northeast along the Hart Highway, to the southeast at the airport, to the west on Cranbrook Hill, and to the southwest at UNBC and along Highway 16.

GO TAKE A LOOK Drive into UNBC and park in one of the parking lots towards the edge of the hill. Take the trail that descends to the access road. Cross the road to the far side for the view of Prince George.

(SITE 3) FOOTHILLS BOULEVARD: OUR ROCK FOUNDATIONS

Bedrock is hard to find in the Prince George area! A thick blanket of sand, gravel, silt, and glacial till cover the underlying bedrock throughout much of the Prince George area. However, bedrock is exposed at the base of Cranbrook Hill along Foothills Boulevard north of its intersection with 5th Avenue. Go take a look, though mind the traffic and be careful of loose rock that might fall from the cliffs above you.

Figure 8. *Volcanic rock exposed along Foothills Boulevard*

The dark grey-green to grey rock are ancient volcanic lavas and volcanic ash layers that formed 200 million years ago as part of oceanic volcanic islands (Figure 4, #1). These volcanic rocks were later buried deep in the earth, cooked, and squeezed by the earth's heat and tectonic forces (geologists call this "metamorphism"; Figure 4, #2). The greenish tint is caused by green minerals that formed during metamorphism. Large blocks of similar volcanic rock are used as rip-rap to protect river banks from erosion–a good example is along the Heritage River Trail by the Fraser River just north of the Yellowhead Bridge.

Many different rock types underlie the Prince George region. You might remember that at Forests for the World parking lot, the bedrock was granite. If you drive east into the Rocky Mountains, the dominant rocks are limestone and sandstone. Geologists compile maps of the distribution of different rock types and sediment types. These maps assist in the search for mineral and energy resources such as copper or oil that only occur in specific types of rock. Cave hunters use geological maps as well, as caves are most likely to be found in areas underlain by limestone.

GO TAKE A LOOK

The bedrock exposures are along Foothills Boulevard, north of 5th Avenue, at Freimuller Avenue. There is roadside parking along Freimuller Avenue.

(SITE 4) FORT GEORGE PARK: ANCIENT STORIES IN THE "SILT BLUFFS"

The Prince George area is underlain by extensive deposits of Ice Age sand and gravel. We depend on these deposits in many ways. Sands and gravel aquifers below Prince George hold the city water supply (Site 7). Sands and gravels are an essential component of concrete and asphalt (Site 6), and are quarried in several places within the city to meet this need. The Foothills Landfill is located in a previous sand and gravel quarry (Site 9). The banks and bars of the Nechako and Fraser Rivers, visible when river levels are low, remind us that rivers are conveyor belts of gravel and sand. Our sand and gravel are bound for Vancouver!

Most sand and gravel deposits were formed during the waning stages of the last Ice Age, when large rivers flowing from melting glaciers moved great quantities of sand and gravel (Figure 5, 6). These gravels form flat "benches" or "terraces" that stand at various elevations above the modern river. These benches are flat because they once were river floodplain surfaces, but have since been left "high and dry" as the rivers cut down to their modern floodplain levels. Today the Nechako and Fraser Rivers erode older gravels and bedrock, creating new gravels that form the river bed and bars, and underlie the low floodplain areas such as Cottonwood Park.

Figure 9. *"Silt bluffs" rise above the Fraser River across from Fort George Park.*

Fort George Park near The Exploration Place is a good place to view the sand and gravel deposits. You get a good look at "silt bluffs" across the Fraser River from the riverside walk. The "silt bluffs" are, in fact, mostly layers of sand and gravel. The forested land above the cliffs is a very flat surface - it is the floor of ancient Glacial Lake Prince George that once flooded the Prince George region (Figure 5, 7). Just below the forest floor is a thin light tan-colour layer of sand 2-3 metres thick (Figure 10). These sands were deposited on the floor of the glacial lake. The underlying cliff exposes layers of gravel deposited by glacial meltwaters prior to formation of the glacial lake. The Fraser River, which formed after the Glacial Lake Prince George drained, has eroded down through these ancient sediments, forming the cliffs.

Figure 10*. Close-up of the upper sand layer underlying forest floor (left) and underlying lower layers of gravel (right).*

GO TAKE A LOOK Take Queensway and 20th Avenue to Exploration Place in Fort George Park. Walk from the parking lot to the Fraser River to view the bluffs across the river.

(SITE 5) LOCAL GRAVELS: READING THE LOCAL GEOLOGY WITH NICELY ROUNDED SPECIMENS

There are diverse rock types in central British Columbia and the Prince George region. A simple way to view this diversity is to take a look at any natural gravel deposit. Gravels are fragments of rock that have been worn smooth by the bumping, grinding, and sand blasting that occurs in rivers over long periods of time. The smooth surfaces of pebbles, particularly if they are wet, reveal detailed textures and colours that greatly assists in their identification. The diversity of pebble types reflects the scavenging that streams and rivers do over time, eroding rock, glacial gravels and tills, and spreading them across the landscape.

There are many places to view gravels, including the banks of the Nechako and Fraser Rivers, and the various gravel quarries in the city. A safe place is the gravel parking lot at the Otway Ski Centre on Otway Road. The ski area lies on a flat bench of land above the Nechako River. The flat bench is an old gravel river plain surface that the Nechako River has since cut down through to its present level. The parking lot has been cut down into these gravels, and a low bank on the edge of the parking lot exposes gravels below the forest. A close look will show you that there are several major types.

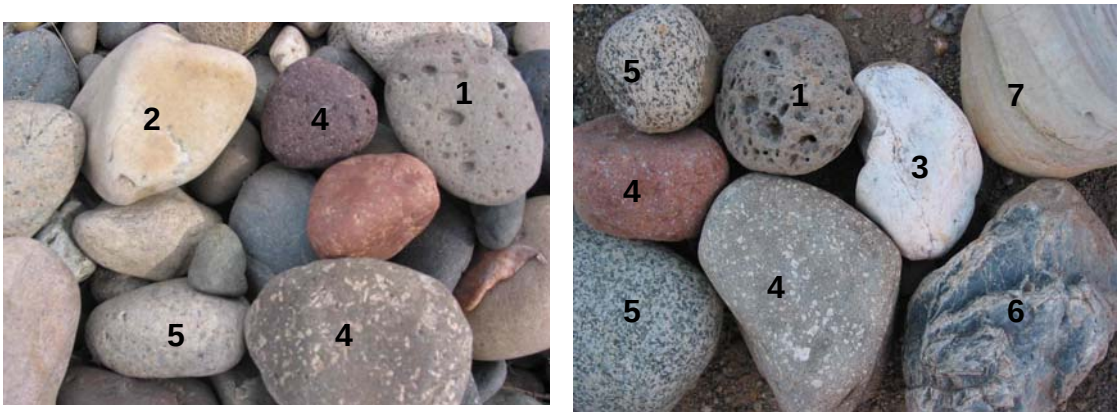


***Figure 11**. Different types of pebbles in gravel. 1, volcanic lava with gas bubbles. 2, quartzite. 3, quartz. 4, volcanic lava. 5, granitic rock. 6, chert. 7, mudstone.*

You might give each a descriptive name based on its colour, lustre, or texture. For example, you might describe one group of pebbles "grey dull swiss cheese rock" because it is full of holes, another "creamy polished harder-than-knife rock"; another "white, shiny, harder than knife rock". Here is what a geologist might call those same rocks.

- Grey dull swiss cheese rock = volcanic lava
- Creamy polished harder-than-knife rock = "quartzite" (metamorphic sandstone)
- white, shiny, harder than knife = quartz
- Purple-brown shiny speckled rock = volcanic lava
- Grey and pink speckled "salt and pepper" rock = granitic rock
- Grey soft dull circled rock (locals call this "schmoo") = mudstone

***Figure 12.** Gravel underlies the forest at the Otway Ski area.*

GO TAKE A LOOK Drive north on Otway Road from Foothills Boulevard to the Otway Ski area. Examine the gravel in the parking lot, and the low gravel cuts along the edge of the parking lot.

(SITE 6) MINING SAND AND GRAVEL FOR CONCRETE AND ASPHALT

Try to imagine Prince George without concrete. There would be few bridges and no highway overpasses. No high rise buildings downtown. No house foundations. No basements. No roadside curbs. Now try to imagine Prince George without asphalt. No sealed roads. Roads sure would be dusty in summer and muddy in winter. Millions of tons of concrete and asphalt are made each year in the Prince George area. This is human-made rock, and we are making more each year. And all that concrete and asphalt could not be made without locally quarried gravel and sand.

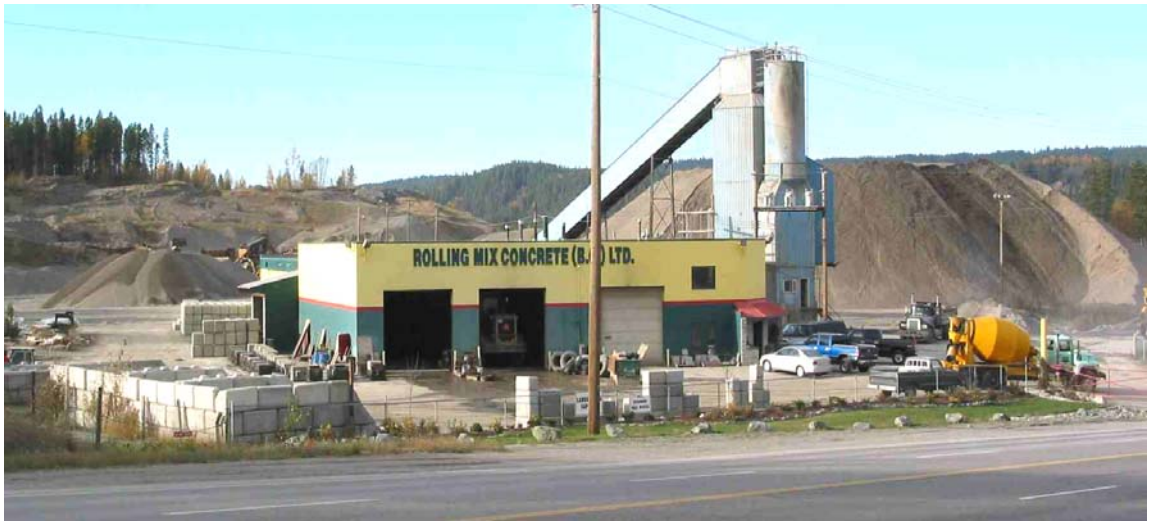


Figure 13. *Concrete plant and sand-gravel quarry on Foothills Boulevard. Sand and gravel are quarried from the forested flat-topped bench (an ancient river plain) in the background.*

Sand and gravel is quarried in many parts of Prince George such as along the Nechako River near Otway and North Nechako roads, as well as along the Hart Highway on the uplands north of downtown. These quarries provide sand and gravel for concrete and asphalt plants. Concrete is produced by mixing sand and gravel with lime and clay. Lime is calcium oxide created by roasting limestone. Asphalt is produced by mixing sand and gravel with liquid asphalt. The liquid asphalt is brought to Prince George by rail car from a petroleum refinery in Edmonton that processes heavy oil extracted from the earth near Lloydminster, Alberta.

GO TAKE A LOOK

The Rolling Mix Concrete Ltd. gravel quarry and concrete plant is visible from Foothills Boulevard just south of Otway Road. The sand and gravel is quarried from deposits left behind by glacial meltwater rivers of the ancient Nechako River.

Figure 14. Asphalt plant and sand and gravel quarry on Otway Road. Revegetated slopes of the sand-gravel quarry are visible in the background.

GO TAKE A LOOK The Columbia Bitulithic Ltd. Asphalt Plant is on Otway Road north of Foothills Boulevard. The plant is beside a large sand and gravel quarry that supplies aggregate for the asphalt. The sand and gravel deposits are similar in origin to those at the Rolling Mix Concrete Ltd. plant.

(SITE 7) WHERE DOES OUR WATER COME FROM? GROUNDWATER BELOW PRINCE GEORGE!

Water is a vital resource. The City of Prince George is supplied with water from a series of water wells within the city and along the Nechako River. The wells are drilled into gravel deposits that underlie much of Prince George within the "bowl" area. These gravel deposits contain groundwater and are excellent aquifers. Although Prince George's water supply is very high quality and abundant, this underground water supply does present Prince George with a challenge. Because the city is built on top of its water supply, it is possible that what is spilled on the ground could infiltrate down through the gravels to the groundwater and contaminate it. Therefore, it is very important that industry, businesses, and homeowners use "best practices" to prevent any contamination.

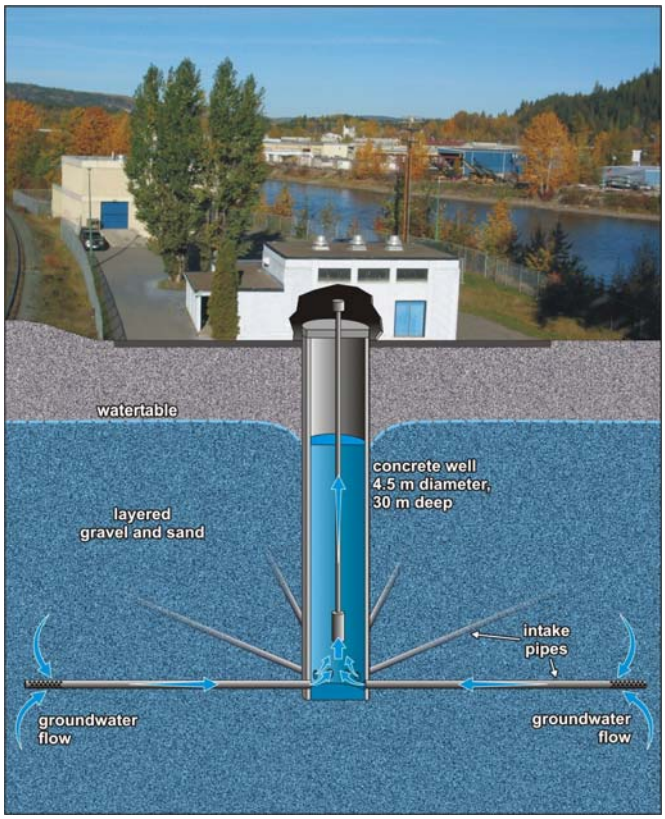


Figure 15. *The City of Prince George wellhouse near the Nechako River derives water via a large diameter well from gravel aquifers that underlie the city.*

(SITE 8) WHERE DOES OUR WASTE WATER GO? AFTER TREATMENT, INTO THE FRASER RIVER

So, where does our sewage go when we drain the sink or flush the toilet? The answer for most parts of the city is the Landsdowne Road Wastewater Treatment Plant along the Fraser River below the Simon Fraser Bridge. The facility includes both primary and secondary treatment and the treated water is discharged into the Fraser River. The treated waste water meets Provincial requirements for effluent disposal.
This treatment plant is very important! The health of the Fraser River depends on our efforts to properly treat our waste water before draining it to the river.

Waste water treatment combines many steps and processes. First, rags, sticks, plastics and other large objects are removed by screens from the wastewater and sent to the landfill. Solid particles "biosolids" are removed in settling tanks where light particles to float and heavy particles to sink. Waste water is then trickled over bacteria-covered plates ("biofilters") that absorb dissolved organic materials and trap particles. Waste water is held for further settling in "clarifiers". Biosolids from the primary sedimentation tanks and secondary clarifiers are pumped to anaerobic digestors where they are digested by bacteria. Methane gas produced by the bacterial activity is captured and burned to provide heat. The digested biosolids are dewatered to form a soil-like material. Biosolids are mixed with greenwastes at the Foothills Landfill and composted to produce a soil amendment material used in Prince George gardens and on nearby farms. Treated wastewater effluent is discharged into the Fraser River through an outfall pipe.

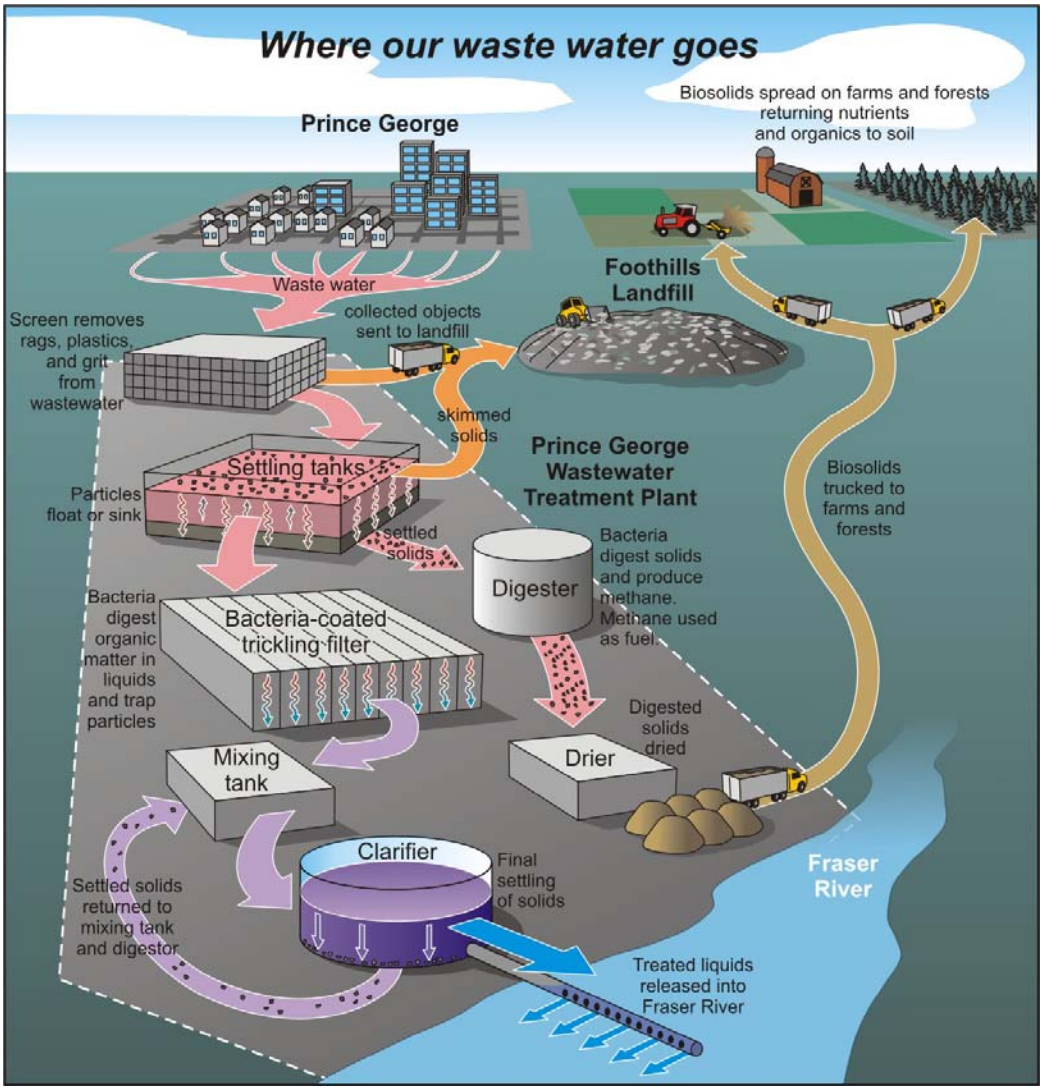


***Figure 16**. A schematic drawing of a waste water treatment plant.*

Figure 17. *(Left) Waste water arriving at the treatment plant. Solids are trapped and removed on screens.*

Figure 18. *(Right) Wastewater is sprayed onto a grill coated with bacteria that absorb dissolved organic matter and trap particles.*

Figure 19. *More solids settle out in large tanks (clarifiers).*

Figure 20. *Sewage solids are recovered and used as a soil amendment.*

GO TAKE A LOOK

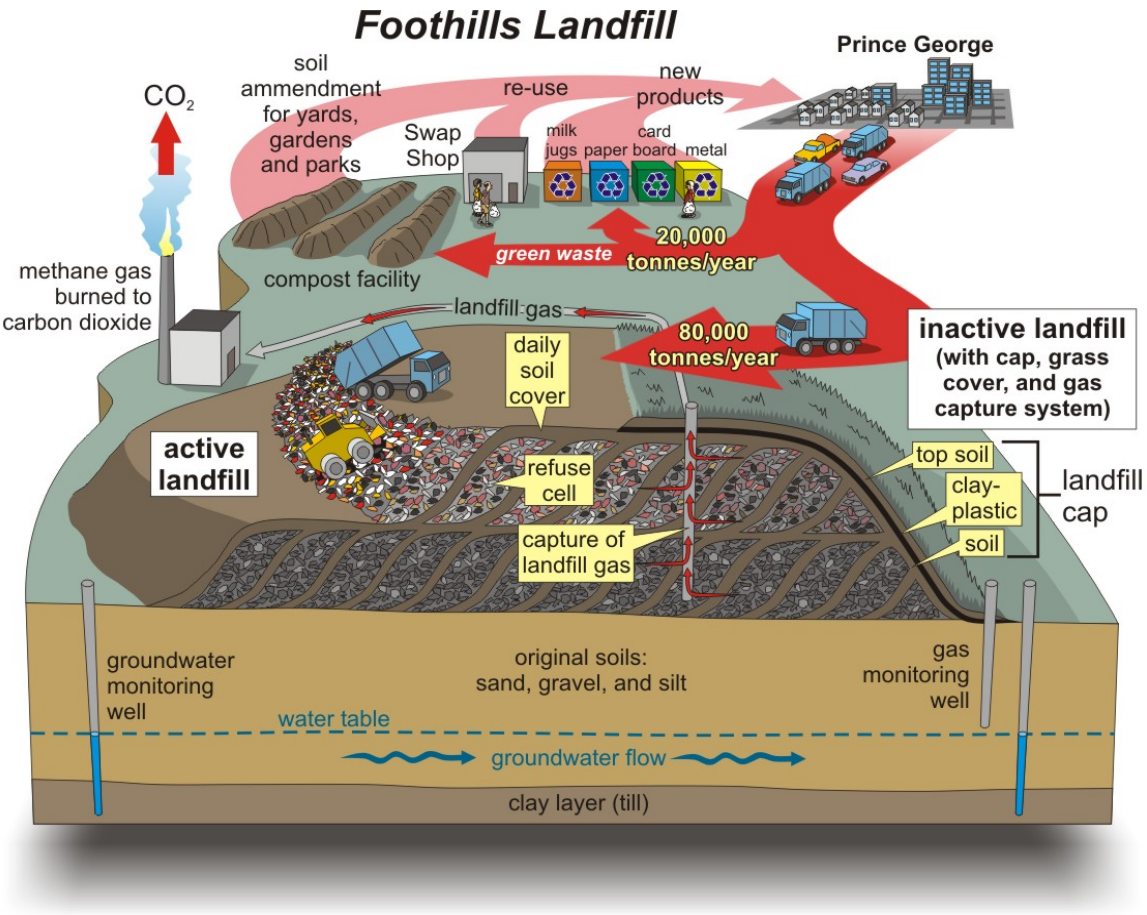
The City of Prince George Landsdowne Road Wastewater Treatment Plant is on Landsdowne Road off Ferry Avenue just southwest of the Highway 97 where it crosses the Simon Fraser Bridge. Tours of the plant are available if arranged in advance through the City of Prince George.

(SITE 9) WHERE DOES OUR GARBAGE GO? THE FOOTHILLS LANDFILL

How well do we manage our solid waste? How effectively do we reuse materials, and recycle what we do not reuse?

Garbage from Prince George goes to the Foothills Landfill managed by the Fraser-Fort George Regional District. The landfill includes a recycling area, composting operation for greenwaste, and the active landfill where garbage is buried. The landfill receives about 80,000 tonnes of solid waste, and 20,000 tonnes of greenwaste and recyclables each year from Prince George and nearby regions.

Figure 21. *Schematic illustration of the Foothills landfill showing recycling, reuse, composting, landfill, and capture of landfill gases and groundwater effluents.*



The landfill is a giant anaerobic (lacking oxygen) compost pile that produces liquids and gases that must be monitored and managed carefully. The landfill is a geologic feature containing diverse materials that decompose at different rates and into different byproducts. Bacteria digest organic material and produce a landfill gas that is a mixture of carbon dioxide, methane, and trace other gases. Materials such as metals, plastics, glass, and concrete will decompose very slowly, if at all. Older parts of the landfill are now closed and covered with layers of gravel, sand, tight clays, and a plastic membrane. This cap prevents rain and snow melt from infiltrating the landfill, creating leachate. The cap also allows for the capture of landfill gas which is piped to an incinerator where the methane fraction is burned and converted to carbon dioxide. This greatly reduces the greenhouse gas production from the landfill as methane is 21 times more effective as a greenhouse gas than carbon dioxide. Eventually the landfill gas collected will be used to heat homes or

greenhouses, or to create electicity. By 2020, it is estimated that the reduction in greenhouse gas emissions will be the equivalent to removing 60,000 cars from the road.

The landfill is carefully monitored. Wells monitor gas levels in the soil to ensure that landfill gas is not leaving the landfill property by an underground route. Groundwater wells around the landfill monitor to ensure that the landfill does not pollute the local groundwater.

Figure 22*. Compacted garbage is ready for a cover of soil. The dumped soil will be spread across the garbage to create a refuse cell. The soil-covered slope in the background is underlain by many refuse cells.*

Figure 23. *Composted greenwaste piles (brown, foreground) will be used as a soil amendment. After the landfill has been covered with soil (right, background) it is seeded with grass (left, background)*

Figure 24. *Swap Shed at landfill allows community members to share unneeded goods (left). Gas plant burns methane generated in the landfill to reduce greenhouse gas emissions (right).*

GO TAKE A LOOK

The Foothills Regional District Landfill is located on Foothill Boulevard on the north rim of the Nechako River Valley, about 5 kilometers north of the Foothills Bridge. The recycling area and Swap Shed are near the entrance to the Landfill. Regional District landfill staff can provide a tour of the landfill if it is arranged in advance.

(SITE 10) WHERE DOES OUR GASOLINE COME FROM? FROM DEEP IN THE EARTH VIA THE LOCAL REFINERY.

Gasoline and other petroleum products are vital energy sources for transportation and industry. They are part of a broad range of products that come from fossil fuels and include plastics, petroleum and natural gas. The local Husky refinery offers us an insight into the petroleum industry and the many products it produces.

The Husky refinery produces gasoline for all the gas retailers in the Prince George area, as well as gas retailers throughout much of northern BC. The refinery also produces aviation gas, diesel, and heating oil. The refinery uses crude petroleum that is pumped from deep in the earth in northeastern British Columbia and adjacent Alberta. The crude oil is carried by pipeline to Prince George. The refined gasoline is shipped by tanker truck and rail car to gas stations. Heavy fuel oils produced at the refinery are used by nearby pulp mills. A tank farm behind the refinery can store over a million gallons of crude and refined products.

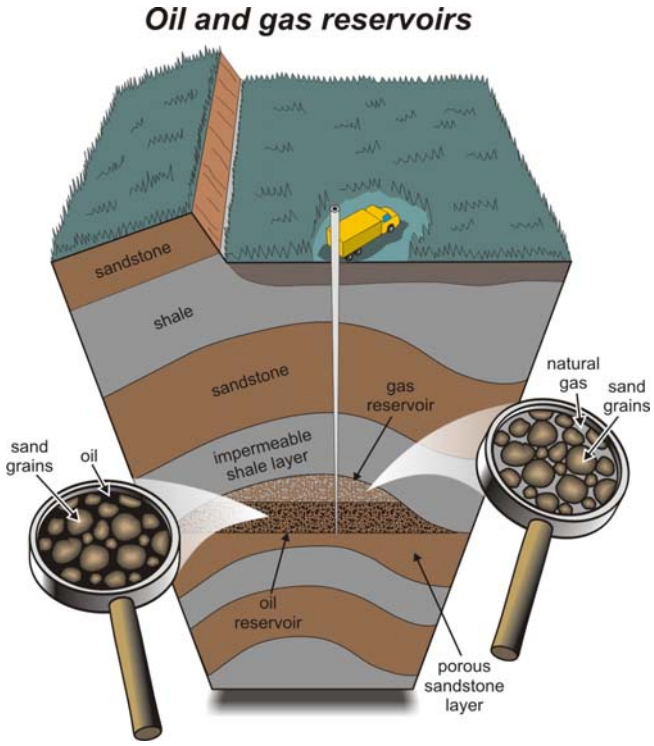


Figure 25. *Schematic view of an oil and natural gas reservoir below northeastern British Columbia. Photos are of the Husky Refinery (top) and a tanker truck leaving refinery with a load of gasoline (bottom).*

UH, OH. WHAT ABOUT CLIMATE CHANGE?

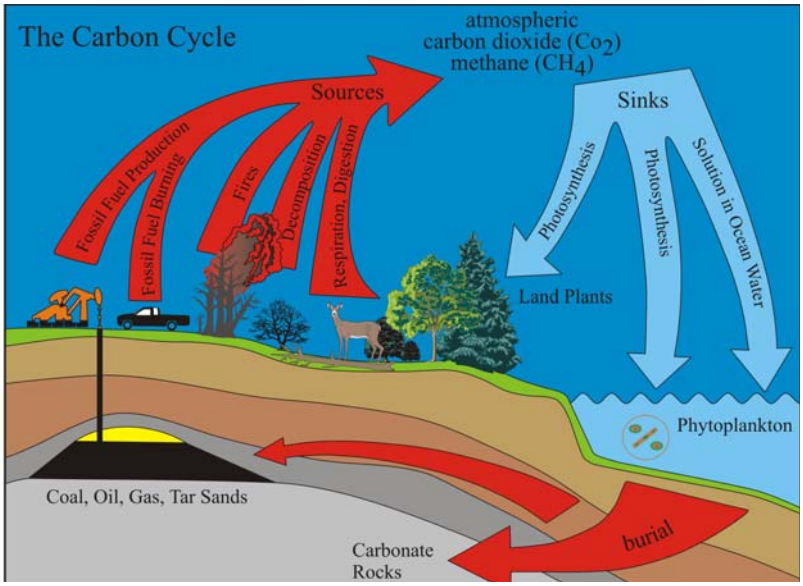


Figure 37. *The carbon cycle. Fossil fuel production and burning is rapidly adding carbon that was long ago stored in the Earth. This is upsetting the natural balance developed by nature.*

In spite of the tremendous benefits and convenience of fossil fuels, a consensus has developed in the scientific community that the greenhouse gases produced from use of oil and natural gas are dramatically changing the composition of our atmosphere, and producing very worrying global climate change.

Northern BC has warmed significantly in the last 100 years, and direct evidence of this is seen in the widespread and rapid retreat of glaciers in the Rocky and Cariboo mountains near Prince George.

Get informed. What are the likely impacts of climate change to British Columbia and the rest of Canada? Visit the Government of Canada websites **www.adaptation.nrcan.gc.ca** and **www.climatechange.gc.ca** that describe the science behind climate change, and likely impacts.

GO TAKE A LOOK

The Husky Refinery is located on the Prince George Pulpmill Road that runs along the north side of the Nechako River. Tours of the Husky Refinery are available if arranged in advance.

ACKNOWLEDGEMENTS

We would like to thank a number of individuals in Prince George who kindly assisted in the development of this guide. Darren King of The Exploration Place enthusiastically supported the idea of the guide and arranged tours of the landfill, wastewater treatment plant, and Husky refinery. Joseline Campbell reviewed a draft version of the guide and suggested many improvements. Derek Bates of Fraser-Fort George Regional District toured us through the Foothills landfill and Jim Martin of Fraser-Fort George Regional District provided information and advice. Tony Pirrillo of the City of Prince George took us on a tour of a municipal well house and explained the municipal water system. Ken Whitely of the City of Prince George provided us a tour of the Wastewater Treatment center and Norm Gobbi, also with the City, reviewed the section on wastewater treatment. Gina Layte-Liston of the City of Prince George provided information and helpful advice. Cory Sieben of Husky Oil Ltd. guided us through the Prince George refinery and explained the complexities of refining petroleum and its many byproducts.

WANT TO KNOW MORE?

MAKE YOUR OWN MAP
The City of Prince George website lets you to build your own map of the city, using the information you are interested in. www.city.pg.bc.ca: go to "PGMap" at top of home page.

Geology of the Northwest Mainland. The geology and paleontology of the Skeena, Nass and Kitimat drainages of British Columbia. Published by Kitimat Centennial Museum Association in 1985 and written by Allen Gottesfeld. An excellent reference on geology, fossils, mines, and geological history of northwestern BC.

Northern British Columbia Geological Landscapes Highway Map
Published by Geological Survey of Canada, Popular Geoscience 94E (British Columbia Geological Survey, Geofile 2007-1) in 2007. A geological map of northern BC with explanations and illustrations of geological features along major roads.

GeoTour guide for Terrace, British Columbia. Published by Geological Survey of Canada, as Open File 5558, and British Columbia Geological Survey, as Geofile 2007-10. A popular guide to sites of local geological interest, earth and water resources, and other features in the Terrace area.

GeoTour guide for Hazeltons, British Columbia. Published by Geological Survey of Canada, as Open File 5560, and British Columbia Geological Survey, as Geofile 2010-1. A popular guide to sites of geological interest, earth and water resources, and other features in the Hazeltons area.

Exploring Prince George by Mike Nash, Rocky Mountain Books, 2004, 280 pages.