to both the covenant holders and the Society. We hope to place small unobtrusive signs on the trails to inform walkers when they are entering water protection lands. The trail network and roads on the western slopes of Channel Ridge drain to the westward, and are less of a threat to the well-being of St. Mary Lake.

Tom Wright

An Invitation to You.

If you would like to contribute to this Newsletter, please send your contribution to John Hedelle jheddle@yorku.ca. Opinions, complaints, suggestions, photographs, and articles relevant to drinking water on our island are among the possibilities – even jokes and cartoons will be considered!

Knowing About Water: ***Part one of a series.....***

WHAT IS IT?

Water seems to be all around us. This odourless, colourless and tasteless compound of hydrogen and oxygen covers nearly three-quarters of the earth's surface as oceans. With icefields, lakes, rivers, groundwater and atmospheric water, there are altogether 1.4 billion cubic kilometres of water on Earth. We might therefore be tempted to think of it as a 'common' substance.

On the contrary, water is very unusual, if not downright quirky. It is our good fortune that that the chemical and physical properties of water include several oddities which are vital to our well-being.

The forces bonds that bind molecules of water together are remarkably strong, requiring tremendous energy to pull them apart. This causes the surface tension that forms a 'skin' on water, allowing drops to form, and preventing bodies of water from fizzing away into the atmosphere. The same force gives water that strange ability (called capillarity) to rise against gravity in narrow tubes. This trick is vital for plant growth, as it allows roots and leaves to work. Think how much of our food comes from plants.

Water draws away from most organic materials, but is strongly attracted to inorganic substances, including itself. It is as close to being a universal solvent as appears in nature. Water can dissolve about half of all chemical elements to a greater or lesser degree. It is such a powerful and corrosive solvent that, given time, it can even dissolve metals and glass. Perfectly pure water probably never occurs in nature, and most water is so full of dissolved salts that we can't drink it. Only a little over two and a half percent of Earth's water is fresh enough to drink, and most of this is where it is hard to get, frozen into icecaps or deep underground. Available fresh water is therefore one of our most precious commodities.

Even salty water is benign enough that diversified forms of life can thrive within it, and water solutions are involved in virtually all life processes. Without water life on earth as we know it simply would not exist.

Almost every substance, whether solid, liquid or gas, shrinks in volume as its temperature falls. Water follows this rule through 96 percent of the Centigrade temperature range, but at 4 degrees Centigrade a surprising thing happens. It begins to expand instead. By zero degrees Centigrade, as it freezes, it has gained about nine percent in volume. In short, ICE FLOATS. This strange property of water allows our very existence, for if frozen water were to sink, all the oceans and lakes would turn to ever-lasting solid ice, making most life impossible. A side effect would be enormous and probably fatal fluctuations in climate.

Even the temperatures at which water freezes and boils are extraordinary. Most related substances freeze and boil at predictable temperatures based on their atomic weights. If water followed the same pattern it would freeze at minus 100 degrees Centigrade, and boil at minus 91 degrees Centigrade. There would be no liquid water on earth, only steam! Happily for us, water freezes at the much more reasonable (for us) temperatures of zero and boils at 100 degrees Centigrade.

Because of those powerful molecular bonds in water very large amounts of energy (heat) are needed to break them. Consequently great amounts of heat are exchanged whenever water changes temperature or changes state from solid to liquid to gas. Oceans absorb and store great quantities of solar heat, then release it slowly, acting as giant air conditioners, keeping continental temperatures within a life-supporting range. At the same time, the energy it would take to melt even a moderately sized iceberg could drive an ocean liner across the Atlantic Ocean hundreds of times. Man-made global climate change is a modern-day threat to these stabilizing mechanisms.

All life on Earth evolved in the presence of water, and to this day water continues to support that life. A few simple organisms can survive without air, but none can survive without water. We certainly cannot. Not only should we stop using our deteriorating oceans as garbage dumps and sewers, but we should cherish and protect our limited supplies of water fresh enough to drink. It is pretty special stuff, and in many parts of the world there is already not enough to go around.

Tom Wright

KNOWING ABOUT WATER: FAST AND SLOW CYCLES

Part 2 of a series by Tom Wright

In Part 1 we saw that water is extremely stable and present in enormous quantities, but is so chemically active that most of it is too salty to drink. Luckily for us several water cycles combine to provide a continually renewing source of fresh water.

Most important is the worldwide sun-driven cycle which lifts water vapour from the surface of oceans, rivers, lakes and plants into the atmosphere. At any given time there are 13,000 cubic kilometres of fresh water hanging in Earth's atmosphere, an amount over six times greater than the flow of all the rivers of the world combined. Invisible water vapour soon condenses into the bright droplets which form the towering clouds which are so familiar to us. In an average of only twelve days the droplets have combined into larger drops, which then fall back to earth as rain, hail or snow, a fresh water bonanza.

Three quarters of the rainfall worldwide, however, falls back into the salt sea, and some of the remainder falls into uninhabited regions such as mountains and icecaps. To make use of what's left we must move quickly, for already the water quality is deteriorating due to dust, smoke and chemicals, and most of the water we can see is already running down the rivers to the sea, a journey usually measured in only days.

Water which trickles underground can remain there for decades, centuries or even thousands of years, if we don't pump it out first for our own use.

If only rain would fall in the 'right' places there would be plenty for all, but unfortunately many parts of the world get hardly any, and people there can die of thirst.

The arid American southwest pumps water from falling aquifers to fill swimming pools, keep golf courses green, and otherwise satisfy an ever-growing population, all at a quite unsustainable rate.

Even in more fortunate Canada some regions such as the Okanagan and our own Gulf Islands are in water deficit for significant parts of the year. Just ask your neighbour whose well has run dry!

Tom Wright

KNOWING ABOUT WATER: SURFACE WATER ON SALT SPRING ISLAND

Part 3 of a series by Tom Wright

As described in Part 2, much of the rain falling on our island finds its way as runoff into the creek system, and thence into the ocean. Low areas along some of the creeks allow water to collect into lakes and ponds. The creek flow is thereby slowed down, giving us extended access to some of the water. Three large lakes, St. Mary, Maxwell and Cusheon, are of sufficient size to lend themselves to significant water withdrawal for domestic purposes.

Some of the smaller lakes, such as Stowell, Weston and Blackburn, are of marginal size and quality for domestic water withdrawal, and a dozen or so even smaller lakes, including Bullock's, Ford, Roberts, Rosemurgy and others unnamed are too small, too hard to access or they have less than adequate quality to provide significant water.

While it takes nearly 15 years for water to pass through St Mary Lake, Cusheon Creek passes through Cusheon Lake in less than a year, and Ford and Blackburn are traversed in a little over one month.

Some rain and surface water trickles down into fractures in the underlying rocks, and then moves slowly through them towards the sea, as groundwater. More on groundwater next time. *Tom Wright*

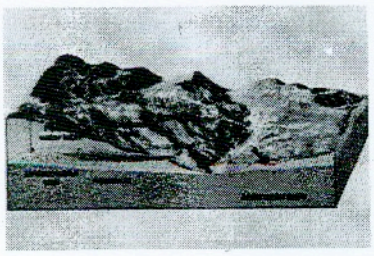
KNOWING ABOUT WATER: Ground Water Under Salt Spring Island

Part 4 of a series by Tom Wright

Some precipitation does not run off as surface water, but instead trickles down into the rocks below to become groundwater.

Some fortunate parts of the world are underlain by porous and permeable rock formations called aquifers. These provide good storage and easy transmission of significant quantities of fresh water.

We are not so lucky. Our entire island forms an aquiclude, a mass of essentially dense rocks



without effective porosity or permeability, other than an irregular and intermittent network of fractures. These fractures are the result of regional folding and faulting, but their exact location is poorly known. They may occur at seemingly random depths, or may be absent altogether.

As a result, drilling for water on Salt Spring Island is something of a lottery. One lucky householder may find several producing zones in a well drilled to only 35 metres, while his less fortunate neighbour might drill a deeper well to 350 metres, and find no fracture zones at all. No fractures, no water!

To see an example of the kind of rock which lies below us, look at the rock face across from Mouat's Store. Notice the sparse pattern of fractures.

More about groundwater production next time.

Ed note: Last June Tom had this to say:
"Here are the four concluding parts of the series 'Knowing About Water' for you to use when you put the next four WPS newsletters together. I felt it would be good to get them done in advance."

RIPARIAN REGULATIONS UPDATE

As I write this, the Local Trust Committee gave first reading to bylaw 449 to implement the Riparian Area Regulations for the purpose of protecting and restoring our salmon and trout streams on Salt Spring Island. By protecting our streams, we will also be helping to restore our drinking water lakes that are suffering from blooms of algae and toxin-producing cyanobacteria. This bylaw is required by the provincial government.

The bylaw has already undergone some revisions and we expect more as the trustees respond to comments from the community. If passed with most of its provisions intact, bylaw 449 will set a new higher standard for environmental protection on Salt Spring Island. We expect a public hearing on the bylaw in middle or late May and then the bylaw will most likely receive 2nd and 3rd readings by our trustees. After that, the bylaw will go to Trust Executive and the Ministry of Community, Sport and Cultural Development for approval before it hopefully comes back to our Local Trust Committee for final reading in the Fall.

We are fortunate to have trustees who are continuing this effort despite some vocal opposition. We believe a majority of islanders support efforts like this bylaw, to provide stronger protection for our island's natural environment consistent with the mandate of the Islands Trust.

Maxine Leichter

KNOWING ABOUT WATER: Groundwater Production

Part 5 of a series by Tom Wright

In Part 4 we saw that our island is an aquiclude, a mass of dense rock containing an irregular network of fractures. Within the fracture network is a lens of fresh water, derived from rainfall, but accessible only where fracture porosity exists. (No fractures, no water!)

The aquiclude fills up to the land surface during winter rains, but during the dry season the upper surface of the water lens (called the water table) progressively falls as water is removed by pumping. If the water table falls beneath the producing fracture zones, a particular well goes dry.

Many wells on Salt Spring Island go dry in late summer or autumn, and the householder must then buy water from a water district or other supplier.

As the island population increases, wells go dry more frequently. The phenomenon of a newly drilled well causing a neighbouring well to go dry is also becoming increasingly common.

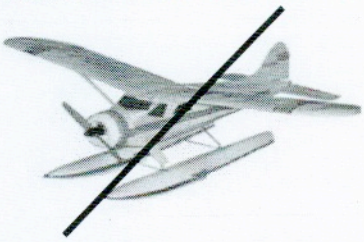
Some water wells on Salt Spring will produce at a rate of several gallons per minute for only a few hours before the water table around the well is pulled down into a 'cone of depression', cutting off the water flow. The well must then rest for a few hours to allow the cone of depression to refill before pumping can begin again.

Regional groundwater movement will be the topic of Part 6 in this series.

NO FLOATPLANES ON SALT SPRING ISLAND LAKES!

One of the important accomplishments of the Water Preservation Society is taking the legal case to the Supreme Court of Canada that after a ten-year battle, established that communities nation-wide can declare their lakes Electric Motors Only (EMO) for the purpose of preventing pollution. WPS has always believed that floatplanes do not belong on SSI drinking water lakes. Two years ago, when a floatplane landed on Cusheon Lake, former WPS Board Member Wayne Hewitt called Transport Canada to see what could be done. The Transport Canada staff agreed that the floatplanes are not allowed on SSI drinking water lakes and promised to make a note of this in the appropriate pilot guides.

We recently learned that the Transport Canada Water Aerodrome Supplement, Planning Section, under Flight Restrictions Affecting Seaplanes, page 85, now officially lists Cusheon, St. Mary, Stowell, Weston and Maxwell Lakes as restricted from floatplane access.



Unfortunately, pilots are not always aware of this. Should you observe a floatplane on any of these lakes, please record the location, date and time of the landing or take-off and if possible the registration letters and numbers on the plane. Report it to our RCMP who will contact the pilot or household hosting the floatplane. Our experience is that the local RCMP will respond to such a report.

Maxine Leichter

KNOWING ABOUT WATER: Regional Groundwater Movement

Part 6/7of a series by Tom Wright

The fresh water lens contained within our aquiclude is bounded on all sides by sea water and also underlain by salt water at depth. It is therefore a finite resource, though the uppermost few tens of metres from which we draw our groundwater (if we are lucky enough to encounter fracture porosity) are recharged with fresh rainwater each winter season. If we pump too many wells the water table will begin to fall.

Over-pumping near shore wells draws down the water table and can cause permanent salt water incursion.

Lateral migration of groundwater is commonly only a few centimetres per day. At this rate it can take nearly 700 years for water falling on an upland 'recharge' area to migrate down to a lowland 'discharge' area 5 kilometres away, where it could replace water pumped out today.

It is commonly said that our groundwater 'originates' from somewhere near Mount Baker. Don't believe it! Our fresh water lens is completely isolated by surrounding salt water, and besides it would take about 20,000 years for groundwater to migrate this far, even if there were a reason for it to do so. There isn't.

We had better get used to the idea that once each dry season has arrived we are dealing with a non-renewable resource. This brings us to the importance of protecting the integrity of our precious fresh groundwater supply. It is already contaminated in some areas by natural minerals such as arsenic or salt. Above all, it deserves our best efforts to protect it from pollution caused by human activities.

More about this in Part 7.

REPORT ON CUSHEON LAKE: FOLLOWUP

In the last edition of the newsletter, I reported that Cusheon Lake had very clear water for the whole summer. Much to everyone's surprise, high toxin levels were reported in October and the Vancouver Island Health Authority (VIHA) issued a drinking water advisory to those residents of Cusheon Watershed that drew their water directly from the lake. Continued monitoring of the lake continued to show clear water with a Secchi disk reading of over 4 metres. After three weeks of toxin level measurements, the toxin levels had dropped to their former levels and the drinking advisory was lifted.

During this period, a meeting between VIHA, representatives of Water Council, the Water Preservation Society and North Salt Spring Water District explored the methods used to inform lake residents about the potential health hazard. It was decided that the CRD Emergency Preparedness system, when fully functional would communicate a drinking water advisory to the POD leaders for Cusheon Lake. Until the PODs are fully functional, a parallel system involving the Cusheon Lake Stewardship Committee and the CRD POD network would communicate the advisory to lake residents.

We hope the system never needs to be tested.

KNOWING ABOUT WATER: Protecting Ground Water

Part 7/7of a series by Tom Wright "DON'T".

We saw in Part 6 that we must treat our fresh groundwater as a finite resource. Only the upper few metres are replaced by annual rainfall, and we have no water laden aquifer to replace water withdrawn by pumping. Cleaning up polluted or contaminated groundwater is virtually impossible.

Meanwhile we humans continue to use (or misuse) the hundred thousand or so bizarre and unnatural chemicals which we have invented over the years. This witch's brew includes pesticides, herbicides, fertilizers and solvents. Petrochemicals and chlorinated solvents, the so-called volatile organic compounds (VOCs) move freely into water. Persistent organic pollutants (POPs) such as dioxins and dihedron are particularly bad news. It is this kind of stuff which appears in mothers' milk as far away as the Arctic.

Unfortunately we have inherited a tradition of "out of sight, out of mind". It is all too easy to flush what we don't need down the nearest drain, any handy hole in the ground, or our septic system. The best advice is -

In the past we simply piled unwanted stuff in heaps called garbage dumps. More recently we have tried with varying success to isolate these with plastic or rubber liners, and called them sanitary landfills. The potential for accidental spills increases along with the population.

On our island we are fortunate to have no massive sources of pollution such as refineries or chemical factories but in view of our small and finite reserves of fresh groundwater we must try to avoid even the smallest spills of the toxic materials we use in day-to-day activities. (Even if nobody is looking!) In rural areas animal wastes can be a problem around water wells.

We should also note that we have placed our household septic systems right on top of our underground supply of fresh water. As the population increases, the day may come when we wonder if this was such a good idea.