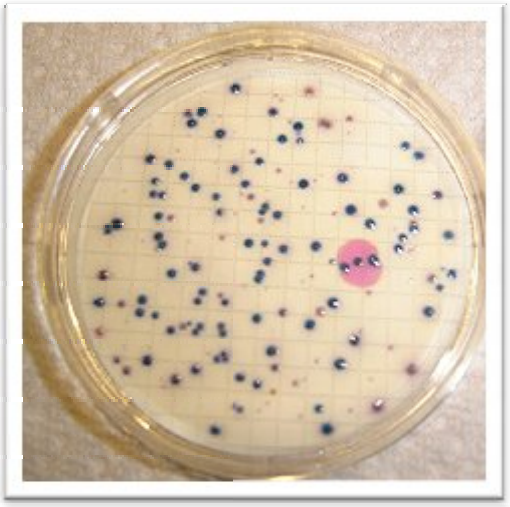
BOUNDARY *environmental* **ALLIANCE**

MARCH 2008

The following article, Pathogens & Protection, is the first in a series of articles to come which will examine cattle range-use in our sensitive dryland area, and the consequences to water quality, riparian zones, sensitive grasslands and habitat. Future articles will cover the abuses of public-lands from range cow overload, the give-away of the public lands, the efforts of the ranching sector to obtain greater control over these public lands, and the cost to the public of maintaining the present range tenure system.

Pathogens & Protection

Health authorities advise that stream water and open water sources should not be considered safe for drinking (unless treated) as these sources are open to contamination from a variety of sources. Water from wells close to streams and open water may also be at risk, depending on the effectiveness of ground filtration, and may also need treatment to provide protection from a variety of pathogens. Large communities and some smaller "community wells" chose to provide treatment with chlorine and sometimes filtration to protect against some pathogens that can survive chlorine treatment; e.g. Giardia, Cryptosporidium. Individual well owners are 'on their own' with the expense and maintenance of a treatment system. Failure of treatment can result in the consequences seen in 2000 in Walkerton, Ontario[i1] where 7 died



A sample of a test on streamwater approx two weeks after range cattle occupied upstream area. 10/100 ml dilution. Dark blue represents a fecal coliform count of approx 860 colonies per 100 ml

[1] Failure of the water system operators to properly test & disinfect highly contaminated source water, poorly sited wells and contamination of the water source by cattle all contributed to this outbreak. The outbreak was primarily reported as caused by e-coli 0157 however 67% of those tested also were infected by Campylobacter. The estimated cost of this outbreak is over $155 million dollars. As a result of a class-action suit against the Government, compensation of $65.5 million has been paid plus $13 million to the adjusters so far, with numerous claims still to settle,.. (all at taxpayer expense).

and half of the population of 5000 were sickened. Protection will see later comment.

What is important for our area is an evaluation of the local sources and potential sources of contamination. Factors generally affecting contamination include weather events that can flush distant fecal deposits (from wild or domestic animals, birds, rodents,) into water courses or water bodies. Overflow from sewage plants or leaking septic systems and leaching or wash-off of manures, and densities of wild or domestic animals with direct access to water bodies. Other factors include dilution by stream volumes and "purity" and volume of receiving waters. Much of the research and statistics available are reflective of areas where most or all of the above factors are in play.

In our "dry-land" arid area, which we have in common with much of the American west, **fewer of these factors are in play**. Here, where the heavy rainfall or rapid melt required to transport distant fecal deposits seldom occurs, where no sewage plants are discharging to upland streams and where water sampling is taken above human settlement, only a few factors are usually in play. The primary factors affecting these streams are therefore:

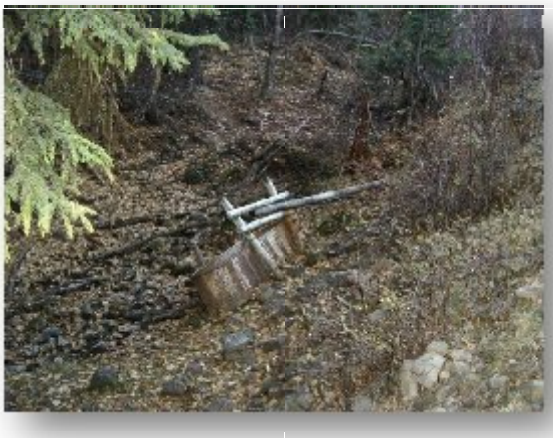
a. Amount of time spent in or about the stream by wildlife and cattle.
b. Density of fecal contributing populations and relative fecal volumes of contributing populations
c. Stream volumes, gradient and turbulence affecting dilution and deposition

Re: (a) where few or no working water sources have been constructed or maintained, cattle can spend 80% or more of their time in riparian zones even though these zones occupy only about 2% of the range. In most of these riparian zones their presence is apparent in the form of pugged and hummocked areas and fecal deposits that significantly outnumber or obscure evidence of other wildlife presence. That unfettered access also means that fecal contaminants that might settle out in sediments are constantly redisturbed and redistributed into streams. Although studies have shown that off-stream water sources can reduce cattle impacts on streams by 80% to 90%, little or no effort has been made over the years by ranchers or Range Branch to reduce the impacts on riparian zones. As a result, water quality is degraded, streams are degraded and riparian vegetation is overgrazed. The habits of cattle, fecal deposits and loafing in streams has been studied[ii].An abundance of other studies have identified the benefits of off-stream watering devices to riparian zones, water quality and the health of cattle.[iii]

Re: (b) to state the obvious; fecal volumes are in proportion to volume of feed consumed. When it is observed that wildlife use of riparian zones is occasional and fleeting, compared to cattle; when testing for fecal contamination in stream water shows background levels, (before cattle arrive) to be low or nonexistent, where

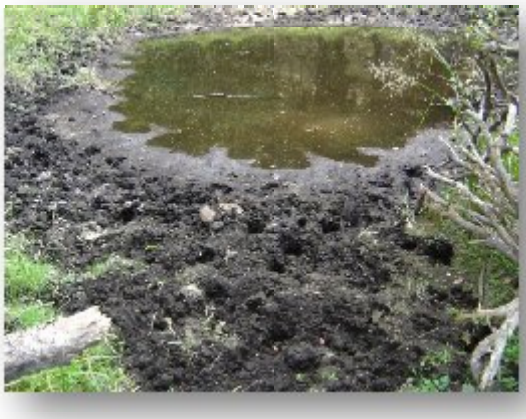
wildlife numbers are seen to be fairly steady seasonally, except for increased winter use in some areas by ungulates, it is reasonable to expect that the large animals (cattle) in the watershed, are responsible for the great majority of fecal contamination that shows up in streams shortly after their arrival.

Re: (c) rapid melt or heavy rain could affect dilution, particularly in spring and affect water testing results by diluting "background levels". No such events occurred in the week(s) prior to our testing. Turbulence at all testing was very low.



Fairly typical broken down cattle waterer that has not been maintained. Poor location in stream bed has resulted in washout.

Our test results were contrary to the preferred belief of many in Range Branch who appear to be guided by a study, financed by Cattlemen, that suggests that cattle are well down the list as contamination sources. That study, conducted in an area where the precipitation and contamination sources were all in play, (not our dryland version) has no application here. It may well be that the study has no useful relevance anywhere, as the area of the study had



numerous offstream watering places, both man-made and natural, some riparian fencing and appears to have stocking numbers of range cattle well below norms.

Waterhole (dugout) created for cattle. Fecal coliform counts can be 16,000 cfu or higher per 100 ml. These levels are unhealthy for cattle, unhealthy for wildlife and unhealthy for anyone whose water source is nearby.

We are expanding our testing in 2008 to several more streams to better establish contamination levels in the presence and absence of range cows.

Pathogen Sources

The sources and types of pathogens are well described in the reference link, Rosen Article, USDA. That report however has limited its incidents to "waterborne disease outbreaks" and as a result, numerous outbreaks that had a contaminated water component; e.g. recent lettuce, spinach contamination outbreaks in the U.S. that were tied to cattle contaminated water, are classed as "food-borne" and therefore not in the reports stats.

The Rosen article describes human campylobacter outbreaks due to livestock as "uncommon". The Center for Disease Control in the U.S. however reports that Campylobacter is one of the most common of diarrheal illness in the U.S. and that virtually all cases occur as isolated, sporadic events and are not part of large outbreaks. The CDC estimates that it affects over 1 million/year, many undiagnosed or reported and that 40% of Guillain-Barre in the U.S. may be triggered by Campylobacter. In Canada, Campylobacter has been described as the most common cause of gastroenteritis [iv] and its association with cattle is better known thanks to Walkerton and studies in Alberta[v].

E-coli 0157 is one of the more common types of toxin producing e-coli, and a common cause of diarrheal illness and subsequent complications in some. 0157 has been linked to a number of beef recalls, lettuce and spinach recalls. Although the illness prompting these recalls is usually called "foodborne" the e-coli 0157 generally originated in cattle contaminated water or irrigation water or in cattle as a result of watering and feed practices that encourage the growth or spread of e-coli 0157[vi].[vii] .

The Membrane Filter testing methods generally used to test water for fecal and general coliforms are unable to detect e-coli 0157. It is therefore possible that water that meets potability tests could be contaminated by 0157, however it is generally accepted that 0157 is unlikely to be found in the absence of other fecal coliforms.

Protection

All systems that remove pathogens from water have weaknesses. In addition to innate weakness in the process, failure to adequately maintain systems can result in inadequate treatment.

Chlorine treatment (which is somewhat ineffective on Giardia & Cryptosporidium) can be compromised by turbidity in the water. Reverse Osmosis can allow a fraction of the living bacteria to pass thru minor imperfections in membranes or seals. UV effectiveness can be reduced by accumulating deposits on lamp glass. No visual inspection of water that has been through "treatment" can determine that the water

is safe. For home-owner systems, "disinfection" by whatever method can require additional continuing expense to filter or condition water so that "disinfection" is effective. In most installations it would be too expensive to provide more than a "house system", and outside water for animals or for watering gardens would therefore be untreated. California produce growers are increasingly aware of the danger of contaminated water on produce.

The quality of the "source water" remains a concern, regardless of treatment. If that source water is being contaminated by range cows, and there is no effort being made by ranchers or Range Branch to reduce, control or eliminate the contamination, it is unreasonable, unacceptable and contrary to guidelines and objectives in legislation governing range use.

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[i] Failure of the water system operators to properly test & disinfect highly contaminated source water, poorly sited wells and contamination of the water source by cattle all contributed to this outbreak. The outbreak was primarily reported as caused by e-coli 0157 however 67% of those tested also were infected by Campylobacter. The estimated cost of this outbreak is over $155 million dollars. As a result of a class-action suit against the Government, compensation of $65.5 million has been paid plus $13 million to the adjusters so far, with numerous claims still to settle, (all at taxpayer expense).

[ii] U of Cal. *Fact Sheet # 25 Manure Loading into Streams from Direct Fecal Deposits* http://danr.ucop.edu/uccelr/h25.htm

[iii] S McIver. *Using Off Stream Water Sources as a Beneficial Management Practice in Riparian Areas-A literature Review*. Agriculture Canada, Aug 2004.
Water Quality & Cattle-Importance of Water Quality to Cattle. Agriculture Canada. http://www.agr.gc.ca/pfra/water/wqcattle_e.htm
Viera D. *Improving Cattle Access to Clean Water*. Agriculture Canada, Lethbridge Research Centre & *Water Wisdom Boosts Cattle Performance, Protects the Environment*. both in Mar 2003 Farm & Ranch Guide

[iv] Mauro, William et al, *Campylobacter from animal & faecal & water samples*.... Public Health Agency of Canada

[v] Inglis, Doug, of Agri-Food Canada in article from Canada Alberta Beef Industry Development Fund. "been limited research in Canada but implicated in Walkerton and the high prevalence in the Chinook Health Region of Southern Alberta, along with high densities of Cattle, suggest cattle as a reservoir. Ignoring the contamination of water and food by this group of bacteria from bovine sources and their adverse impacts on human populations will in all likelihood severely damage public confidence in the safety of the Canadian Beef Industry"

[vi] Rosen, B – *Waterborne Pathogens in Agricultural Watersheds*. USDA Watershed Science Institute Jun 2000 ftp://ftp-fc.sc.egov.usda.gov/WSI/pdffiles/Pathogens_in_Agricultural_Watersheds.pdf

Hoorman J. *Livestock & Streams-Pathogenic Effects of Livestock Grazing Riparian Areas.* Ohio State U, Extension Factsheet http://ohioline.osu.edu/ls-fact/pdf/0005.pdf

[vii] Benbrook, Dr Charles- *Published Research on the Sources & Spread of e-coli 0157.* The Organic Center Sept 2006 www.organic-center.org