Section 4.2 - Soil Resources in the La Salle River Watershed (Source: Manitoba Agriculture Food and Rural Initiatives)

Soil Resources in the La Salle River Watershed - Supporting Text Descriptions:

A series of soil and landscape maps were presented at the February 23, 2007 meeting of the Watershed Planning Authority Team (WPAT) in partnership with Jason Vanrobaeys of PFRA. Following is a brief description and interpretation of the seven watershed maps presented:

Note: map scale

Approximately the western 2/3 of the watershed (RMs of Grey and Portage la Prairie, along with small portions of Cartier and Macdonald) have been mapped at a "detailed" scale of 1:20 000 (i.e. approximately 32 inspection sites per section of land were used to map the soils of the area). The remaining eastern 1/3 of the watershed (largely the majority of Cartier and Macdonald municipalities) has been mapped at a "general" or reconnaissance level of 1:126 720 (i.e. approximately 1-6 inspection sites per section of land).

Detailed soil survey maps identify more of the variation in soil types across smaller landscapes. As a result, detailed soil survey maps are much more accurate and reliable for making decisions at the farm-level. Reconnaissance or general soil surveys give only a broad picture of the dominant soil types and distribution of soils that occur over relatively large areas. The landscape may actually include farily significant areas of different soils that are not identified on the map. As such, reconnaissance soil surveys are best suited to making general comparisons of soil capabilities and limitations on a regional or national scale.

1. Surface Texture:

Soil texture is the relative proportion of sand, silt and clay. The texture of a soil cannot be altered. In agriculture, soil texture is determined by measuring the size and distribution of particles less than 2 mm in diameter. Sandy soils are referred to as "light" soils because they are easily tilled; clay soils are referred to as "heavy" soils because of their difficult workability.

The map reports on surface texture of soils in the watershed because some soils have a change in texture from the surface layer to the texture found at depth.

In this watershed, about 74% of the area has a **clay** surface texture, with lighter soils (sands and coarse loamy soils) making up about 18% of the watershed, concentrated in the western areas.

Sandy soils (such as Almasippi sands) are more prone to leaching losses of soluble nutrients such as nitrogen fertilizers because water moves quickly through them (at about 2 inches per hour). By contrast, clay soils (such as Red River clays) have extremely slow infiltration rates (less than 0.04 inches per hour), which makes them more prone to water ponding and losses of soluble nutrients via runoff.

2. Internal Drainage:

Soil drainage refers to the speed and extent of water removal from the soil by runoff (surface drainage) and downward flow through the soil profile (internal drainage). It also refers to the frequency and duration when the soil is not saturated. The drainage classes reported in the watershed map are as follows:

- Rapid – water is removed rapidly in relation to supply – very coarse textured soils in higher landscape positions have rapid internal drainage (about 1% of this watershed).
- Well – water is removed readily in relation to supply, such that there is development of a subsoil horizon which typifies well drained soils (about 5% of this watershed).
- Imperfect – water is removed somewhat slowly in relation to supply to keep the soil wet for a significant part of the growing season, either due to shallow water tables in sandy soils or slow infiltration rates in clay soils (about **61%** of this watershed).
- Poor – water is removed so slowly that the soil remains wet or the water table is near the surface for a large part of the time. These are usually the lower-lying areas where surface drainage improvements have not been made (about 2% of the watershed).
- Poor (Improved) – areas that were originally poorly drained but surface drainage improvements have resulted in soils behaving as if they have imperfect internal drainage characteristics, even though soil properties may still be indicative of poorly-drained conditions. These are usually clay soils in lower-lying areas where surface drainage enhancements have been made (about 28% of the watershed).
- Very Poor – soils that are so poorly drained that peat material has built up and saturated conditions are prevalent. Very poorly drained soils are organic (peat) soils with no drainage improvements made (about 1% of the watershed).

3. Agriculture Capability or Canada Land Inventory (CLI) rating:

Agriculture capability is a seven-class rating of mineral soils based on the severity of limitations for dryland farming. This system does not rate the soil's productivity, but rather its capability to sustain agricultural crops based on limitations due to soil properties, topography and climate.

Class 1 soils have no limitations, whereas class 7 soils have such severe limitations that they are not suitable for agricultural purposes. The general gradation of agriculture capability classes is as follows:

- Class 1, 2 and 3 soils are capable of sustained production of common field crops, and are thus considered as "prime agricultural lands".
- Class 4 soils are marginal for sustained arable agriculture and should be in permanent forage production.
- Class 5 soils are suitable only for improved permanent pasture.
- Class 6 soils are suitable only for native pasture use.
- Class 7 soils are incapable of use for arable agriculture or permanent pasture (i.e. it is nearly impossible to drive on class 7 soils, let alone try to farm them).

Agriculture capability subclasses identify the soil properties or landscape conditions that may limit use, such as: adverse climate (C); dense subsoils (D); erosion damage (E); inundation or flooding by streams or lakes (I); lack of soil moisture (M); salinity (N); stones (P); shallow depth to bedrock (R); topography or slopes (T); excess water other than from flooding (W); or two or more minor limitations in combination (X).

In the La Salle River Watershed, nearly 50% of the soils are **Class 2** in terms of their agriculture capability, followed by 36% of the soils as **Class 3**. Although not depicted on the map, most of the clay soils found in the eastern 2/3 of the watershed have an excess water (W) limitation due to the slow infiltration of water (i.e. 2W or 3W). The sandy soils in the western 1/3 of the watershed have a lack of soil moisture (M) limitation and, in some cases, a combination of M and W limitations due to their sandy textures and shallow water tables, respectively. These soils are referred to as "wet sands" and usually have an agriculture capability rating of 3MW or 4MW.

4. Irrigation Suitability:

Irrigation suitability is a general suitability rating for irrigated crop production. This classification system considers soil and landscape characteristics such as texture, drainage, depth to water table, salinity, geological uniformity, topography and stoniness and ranks them in terms of their sustained quality due to long term management under irrigation. It does not consider factors such as water application, water availability, water quality or the economics of this type of land use. Irrigation suitability classes are excellent, good, fair and poor.

Almost 73% of the watershed is rated as having **poor** irrigation suitability because the heavy clay soils present higher risks of problems occurring if irrigation is practiced on them, such as increased risk of excess water ponding, runoff of nutrients, and development of salinity. About 16% of the watershed has good irrigation suitability, concentrated in the sandy areas and especially where internal drainage improvements could easily be made.

5. Soil Salinity:

Soil salinity is a limitation where plant growth is reduced due to the presence of soluble salts in soil which holds water more tightly than the ability of plants to extract water from the soil. As a result, many plants will exhibit symptoms of droughtiness, but the soil is often relatively moist.

For soil salinity to occur, there must be the presence of soluble salts in the subsoil, groundwater or in both, and the presence of wet conditions, either as a shallow water table or frequently saturated conditions that can result in soluble salts moving into the root zone of the soil through the upward movement of water.

Approximately 84% of the watershed is considered **non-saline**, due to a lack of salts present in the bedrock and subsoil, or due to the absence of a shallow water table or shallow bedrock with salts present. What little salinity does occur is only weakly saline, significantly affecting only the most sensitive crops, such as pulse crops and vegetables, and these areas are mostly confined to locations adjacent to watercourses and drainage ditches. Individual aerial photos, soil testing and producer experience would give more detail of the salinity status of specific fields in the watershed.

6. Water Erosion Risk:

Water erosion is the detachment, movement and depletion of soil from the land surface by precipitation leaving the landscape as runoff. Soil erosion by water is often accelerated on agricultural lands by leaving insufficient cover on soils prone to runoff at crucial times (i.e. just prior to or just after spring seeding). A general rule of thumb is to maintain at least 35% cover on soils at all times.

In general, soil erosion by water is more of a concern on clays and loam soils than sands, because the slower infiltration rates on the heavier-textured soils leaves them more prone to runoff and subsequent erosion. Slope length and steepness are other important factors: doubling the length of the slope increases soil losses by 1.5 times; doubling the incline of the slope increases soil losses by 2.5 times.

Approximately 96% of the watershed is at either a **negligible or low** risk of soil erosion by water, even under bare soil conditions. This is largely the result of very flat topography and the presence of sandy soils in the western 1/3 of the watershed. Coupled with management practices that leave enough cover on the soil, the risk of water erosion goes down even further. The greatest risk of water erosion occurs during rapid spring snowmelts and along ditches and watercourses with greater slopes. Of greater concern than soil erosion by water may be the transport of soluble nutrients during times of runoff in the watershed, but this should be discussed in more detail elsewhere.

7. Wind Erosion Risk:

Wind erosion is the detachment, movement and depletion of soil from the land surface by wind. Soil erosion by wind is often accelerated on agricultural lands by excessive tillage and by leaving insufficient cover on soils prone to wind erosion (i.e. just prior to or just after spring seeding). A general rule of thumb is to maintain at least 35% cover on soils at all times.

In general, soil erosion by wind is more of a concern on sands than on clays and loams, because sands tend to dry out quickly and what soils clods may form tend to break down easily into single-grained particles, which are highly prone to wind erosion.

About 65% of the watershed is rated as **moderate** risk for wind erosion, mostly corresponding to the areas with a clay surface texture. Almost 27% of the watershed is either at high or severe risk of wind erosion under bare soil conditions. The sandy surface texture is what makes these soils prone to wind erosion, but under management practices that promote adequate soil cover, such as forages and pasture, the risk of wind erosion is low. Extra care should be taken if some of these sandy soils are planted to low residue annual crops, such as field beans and potatoes. In these cases, cover crops should be included and the crop rotation should include high residue crops preceding and following low residue crops.

Reference Materials:

For more information about soils, landscapes and the issues presented and discussed, please refer to MAFRI's ***Soil Management Guide***, located on the MAFRI website at: http://www.gov.mb.ca/agriculture/soilwater/index.html. The reader is also encouraged to visit the Agri-Maps website at http://maf112gis1:90/website/index.html or to view the appropriate hard-copy soil survey reports, many of which are available at your local MAFRI office.