Appendix 17
Excerpt from *Critical Lands Status Report: The North Flathead Valley and The Flathead River Corridor*

The following excerpt from the Flathead Lakers' *Critical Lands Status Report* summarizes work by Nobel and Stanford (1986) on the relationship between the shallow aquifers of the Upper Flathead Valley and the mainstem of Flathead River.

Floodplain areas

Groundwater near the surface indicates the extent and width of riparian corridors and floodplain areas (J. Stanford, 2001). A Depth to Water Table Map (Fig.2E) was produced for this project using well data provided by the Montana Bureau of Mines and Geology (MBMG). This map shows water table depth (5 ft. intervals) in the North Flathead Valley.

Noble and Stanford (1986) identified two unconfined aquifers in the Flathead Valley which are hydrologically independent of one another: the shallow alluvial gravel aquifer and the deltaic sand aquifer. Both are recharged primarily by snowmelt and rainfall infiltration.

The Flathead and Whitefish rivers hydrologically bound the *shallow alluvial aquifer* to the east and west, and Badrock Canyon and the confluence of the Flathead and Whitefish rivers confine it to the north and south. There is significant groundwater-surface water interaction between the aquifer and the Flathead River (Noble and Stanford, 1986). Consequently, pollution, including dissolved nutrient loads, entering the alluvial aquifer is flushed into the Flathead River system.[3]

Nutrient concentrations in the shallow alluvial aquifer were found to be highest in the urbanized areas. Fecal coliform bacteria were found to be widespread indicating both human (from septic systems) and animal pollution (Noble and Stanford, 1986).

Noble and Stanford (1986) determined that groundwater movement between the aquifer and the Flathead River is faster north of Kalispell than it is to the south of Kalispell. To the south, the river is wide and deep and has effectively created a channel in the deltaic sand and silts which characterize the valley south of Kalispell. Further, this riparian corridor is lacustrine and narrower, and the fine-grained deltaic sediments are less permeable, restricting water movement. Thus, water exchange between the groundwater and the river is slower to the south, and nutrients in the groundwater are less likely to be immediately flushed into the river and the lake (J. Stanford, 2001).

The *deltaic sand aquifer* is hydrologically bounded by the north shore of Flathead Lake on the south, the Flathead River on the north and east and Highway 93 on the west. There is little groundwater-surface water exchange. Water for domestic, municipal and agricultural use is drawn from this deep aquifer. It is believed that the deltaic aquifer does not contribute to nutrient loads of the river and the lake (Noble and Stanford, 1986).

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[3] Groundwater flows into the Flathead River about mid-November, while surface water supplements groundwater in the shallow alluvial aquifer in May and June when Flathead Lake is being brought to full pool (Noble and Stanford, 1986).