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CHAPTER 5.0 : IMPACTS OF WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY AND IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS

5.1 Water Quality Impacts

All Water Management Strategies (WMSs) explained in Chapter 4, except Advanced Water Conservation, Conveyance Improvements, and On-farm Improvements, involve transferring water or water rights from rural land to urban. This process is known as urbanization; as the region's population expands, irrigable land is lost. In order to make up the projected shortfall of water for municipal use, ten WMSs were developed; additional groundwater, advanced water conservation, non-potable reuse, potable reuse, Brownsville weir and storage, water rights purchase, water rights acquisition by long-term contract, water rights acquisition through urbanization, brackish desalination, and seawater desalination. Advanced water conservation is aimed at reducing the amount of water used per capita, thereby reducing overall municipal demand.

Since municipal water has the highest priority in the Amistad/Falcon system, irrigation water is in a constant state of shortage. Accordingly, conveyance and on-farm improvements are needed to reduce the impact of irrigation shortages. Municipal water management strategies are not cost-effective when applied to irrigation use.

Chapter 4 gives an in-depth look at each of these WMSs.

The following table breaks out the water quality impacts, both positive and negative, associated with each WMS. Note that the majority of WMSs deal similarly with urbanization's effects; in other words, as rural land is urbanized, water quality impacts are consistent from WMS to WMS. Pollutants in agricultural runoff include eroded soil particles (sediments), nutrients, pesticides, salts, bacteria, viruses, and organic matter.[1] Sediment and chemical runoff associated with rural land are eliminated when that land becomes urbanized. On the flip side, urban runoff will increase as reduced porous surface areas prevent rainwater from soaking into the ground. Urban runoff pollutants include sediment from construction sites, oil and gas, fertilizers, pesticides, and household chemicals.[2] Also, as municipal water use increases, wastewater production increases—both inevitable effects of rising populations.

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[1] Lowrance, R., Smith, M., & Vellidis, G. (2003). Impact and Control of Agricultural Runoff. *Stormwater, The Journal for Surface Water Quality Professionals*. Retrieved May 26, 2005 from World Wide Web. http://www.forester.net/sw_0305_impact.html

[2] United States Environmental Protection Agency. (1995, September). Economic Benefits of Runoff Control. Retrieved May 26, 2005 from World Wide Web. http://www.epa.gov/owow/nps/runoff.html

Table 5.1: Water Quality Impacts by Water Management Strategy (Municipal Use)

Water Management Strategy	Positive Impacts	Negative Impacts
Additional Groundwater	• Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation	• Increased wastewater flows to receiving streams, i.e. higher organic levels • Increased urban runoff during storm event
Advanced Water Conservation	• Decreased wastewater flows	• Increases concentration of organic matter in wastewater
Non-potable Reuse	• Reduced wastewater flows • Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation • Decreased wastewater flows, resulting in lower organic levels in receiving streams	• Increased urban runoff during storm event
Potable Reuse	• Reduced wastewater flows • Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation • Decreased wastewater flows result in lower organic levels in receiving streams	• Increased urban runoff during storm event
Brownsville Weir and Storage	• Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation	• Increased urban runoff during storm event • Increased wastewater flows resulting in higher organic levels in receiving stream

Purchase of Water Rights	• Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation	• Increased urban runoff during storm event • Increased wastewater flows to receiving streams, i.e. higher organic levels
Acquisition of Water Rights by Urbanization	• Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation	• Increased urban runoff during storm event • Increased wastewater flows to receiving streams, i.e. higher organic levels
Acquisition of Water Rights by Long-term Contracts	• Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation	• Increased urban runoff during storm event • Increased wastewater flows to receiving streams, i.e. higher organic levels
Brackish Desalination	• Improved water quality in wastewater effluent • Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation	• Increased urban runoff during storm event • Increased wastewater flows to receiving streams, i.e. higher organic levels • Increased levels of TDS in receiving streams due to concentrate discharge
Seawater Desalination	• Improve water quality in wastewater effluent • Decreased sediment and/or agricultural chemical runoff due to storm events or excessive irrigation	• Increased urban runoff during storm event • Increased wastewater flows to receiving streams, i.e. higher organic levels • Increased levels of TDS in receiving streams due to concentrate discharge

Table 5.2 Water Quality Impacts by Water Management Strategy (Irrigation Use)

Water Management Strategy	Positive Impacts	Negative Impacts
Conveyance Improvements	• none	• none
On-farm Improvements	• Decreased sediment and/or agricultural chemical runoff due to increased management and metering	• none

5.2 Impacts of Moving Water from Rural and Agricultural Areas

As part of Special Study #2: Classifying Irrigation Districts as Water User Groups, information was gathered detailing the raw water conveyance systems of each Irrigation District in the Region. Often, Irrigation District conveyance system are used to pump and transport municipal water from the Rio Grande to municipal users. This role of the Irrigation Districts is in addition to their function of delivering irrigation water to agricultural users as well as other water deliveries including steam-electric, mining, and livestock.

Each Irrigation District supports and maintains their own respective conveyance infrastructure, and each District's infrastructure is composed of varying miles of open canals, lined canals, and pipelines. On average throughout the region, there is approximately 15.2 miles of open canal for each mile of pipeline.

In terms of conveyance efficiencies, open canals typically experience higher losses when compared to pipelines. This is primarily due to two natural occurring reasons: seepage and evaporation. It has previously been established that pipeline efficiencies are approximately 95%, with 5% losses occurring due to leaky joints and subsequent seepage. Generally speaking, pipelines do not experience losses due to evaporation. The lining of canals is an effective way at reducing losses due to seepage, but evaporation is still an element of loss that remains in any open canal. Often, financial considerations come into play when considering whether to line an existing canal or convert it to a pipeline. For canals that carry a large amount of water, the diameter of pipeline needed to convey the water within acceptable limits of pressure loss results in a relatively large diameter pipe which can be costly.

As land is converted from agricultural and rural uses to urban uses, the water rights attributed to that land may be converted. The Water Right Conversion Bill, as detailed earlier in the report, is a method of conversion that is unique to this Region. Regardless of the method of conversion, urbanization plays a critical role in the delivery of raw water. For Class A Irrigation Water Rights, the conversion ratio required to convert that right to a municipal right is 2 to 1. Therefore, it takes 2 acre-feet of Class A water rights to convert to 1 acre-foot of municipal rights.

Therefore, as land becomes urbanized and water rights are converted from agriculture to municipal, the total amount of water available for use is decreased.

The result is a direct impact on Irrigation Districts and environmental flows in the Rio Grande. The overall quantity of water diverted has the potential to decrease. This would result in less available push water in the irrigation district conveyance system which in turn would result in lower conveyance efficiencies. In Special Study #2, it was estimated that Irrigation District Conveyance efficiencies range from 68% to 71% (using the best available figures for conveyance efficiencies). As push water is reduced, it would be expected that delivery efficiencies would decrease with identical conveyance infrastructure.

The ultimate impact would be a reduction in final water delivery volume with similar infrastructure. This in turn would have an impact on the types of crops planted and the number of acres irrigation at any given time. The strongest trend currently is a shift from cotton to grain sorghum. This historical trend is expected to continue due to urbanization and rainfall. The impact of such a paradigm shift impacts irrigation water deliveries due to a change in water requirements for the crops, and vice-versa.

As is the case with many Irrigation Districts, small parcels of land are excluded from the District due to urban development. Many times, this parcel of land is surrounded by acreage that continues to be irrigated. In other cases, land that is irrigable may be surrounded completely by urbanized acres thereby reducing the potential for irrigation such land.

In terms of environmental flows in the Rio Grande, a similar dilemma exists with the conversion of water rights from agricultural uses to municipal uses. Again, the amount of push water available is potentially decreased resulting in a decrease in conveyance efficiencies. Therefore, more water must be diverted from the Rio Grande to deliver a similar quantity of water to the end user. There then remains the potential for increased flows from the reservoirs to the diversion point, but a decrease in the amount of excess water available in the system. As information is made available regarding environmental flow requirements in the Rio Grande, this impact would be quantifiable. However, as it exists now, the analysis can only be performed on a preliminary basis.

5.3 Socioeconomic Impacts

The socioeconomic impacts of unmet water needs in the region will be analyzed by the TWDB.