MEMORANDUM ON CONSUMPTIVE WATER USE INVESTIGATIONS FOR THE CLARK COUNTY WETLANDS PARK

Prepared for

Clark County Parks and Recreation

By

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BACKGROUND

Consumptive water use by phreatophytes and hydrophytes is considered a major consumptive water use issue for the Clark County Wetlands Park (Park). Therefore a considerable effort has been expended to define the potential impact that this water use may have upon the Colorado River water return flow credits calculated by the Bureau of Reclamation (BOR). In 1994, the Southwest Wetlands Consortium (SWC) prepared an estimate of consumptive water use by plants and compared it to estimates made in 1975, 1982, and 1986 by BOR. The results have been cited in numerous planning documents which were used as primary sources of information for this investigation regarding the adequacy of data on consumptive water use estimates for the proposed Clark County Wetlands Park. We have examined the five major publically available documents in which water use issues are explained, described, and/or predicted as well as one internal memo from Montgomery Watson to Clark County Parks and Recreation. The documents which were reviewed are:

1. The Final Program Environmental Impact Statement for the Clark County Wetlands Park (EIS) (December 1998).

2. The Park Master Plan Report (MPR.), July 1995;

3. The Planning Process Report (PPR), July 1995;

4. The Pabco Road Environmental Assessment (PREA), February 1996; and

5. The Nature Center Environmental Assessment (NCEA), December 1999; and

6. Estimated Reclaimed Water Requirements for D-14 Dike Wetlands Area, Memo from Montgomery Watson to Clark County Parks and Recreation, 1998.

We searched these documents for references to consumptive water use, evapotranspiration, acreages of plantings projected for the park and corresponding estimates of water use. We have used additional sources available from the UNLV library system and interlibrary loans to develop independent estimates of evapotranspiration ranges in desert environments and compared them to the consumptive water use estimates contained in the public planning documents.

Table 1 presents summaries of both the EIS and other literature values for ET Rates including ranges for various species and habitat types. The EIS column in this table is a composite of information presented in Tables 3.3.5 and TR3-1 in the EIS and is therefore not entirely consistent with either source of information. Table 2 presents consumptive water use estimates in acre feet per year (afy) based on the ET and acreages presented in Table 1.

TABLE 1: Evapotranspiration Estimates (Feet/year) for Community Assemblages and Acreages Projected for the Clark County Wetlands Park.

Community/Species	Acreage	EIS	Literature
Hydroriparian	202		
Cattail		4.92–9.84[5]	4.92-9.84[9]
Cattail			5.04[3]
Bullrush			6.53-7.03[3]
Enhanced riparian	130		4.18-6.61*
Tamarisk, 40%	52		4.92–6.89[7,9,14]
Native species, 40%	52	(Fre. cottonwood)	5.40–8.80[12]
Open area, 20%	26		0.25–1.67[10]
Open Water (Evaporation only)	6		8.3[16]
Strand	17		
Fre. Cottonwood			5.40–8.1[1,12]
Goodding Willow			2.54–4.40[2,12]
Big saltbush			3.67[10]
Fourwing saltbush			3.17[10]
Common Reed	278	3.28–4.92[5]	3.28–4.92[9]
Tamarisk	786	4.92–6.70[5]	4.92–6.89[7,9,14]
Alkali	181	2.70–4.01[5]	
Saltgrass			0.82–2.62[17]
			1.12–4.07[12]
			2.74[3]
Alkali sacaton			3.44–3.94[2]
Russian thistle			0.60–0.65[2]

* ET values for the combined enhanced riparian habitat were calculated by taking weighted averages of literature values for the three species.

TABLE 2. Consumptive Water Use Due to Evapotranspiration (Acre-feet/year for Acreages and Vegetation Communities Projected for the Clark County Wetlands Park

Community/Species	**Acreage**	**EIS**	**Literature**
Hydroriparian	202		
Cattail *		993.8–1987.7	993.8–1987.7
River bulrush			
Enhanced riparian	130	543.4-859.3	
Tamarisk, 40%	52		255.8-358.3
Native species, 40%	52		280.8–457.6
Open area, 20%	26		6.5–43.3
Open Water	6		49.8
Strand	17 **		62.8-106.3
Fre. Cottonwood			
Goodding Willow			
Big saltbush			
Fourwing saltbush			
Common Reed	278	911.8–1367.8	911.8–1367.8
Tamarisk	786	3867.1–5266.2	3867.1–5415.5
Alkali	181	488.7–725.8	
Saltgrass ***			175.6–605.4
Totals		**6805–10,207**	**6604–10,392**

* Range of values for cattails only was used in ET estimates.

** Average values of low and high literature values for all species in Table 1 were used.

*** Average values of low and high literature values of *Distichlis* were used for Alkali acreage estimates.

CONSUMPTIVE WATER USE ESTIMATES FROM PARK PLANNING DOCUMENTS

In the MPR. (pg. 85) and the EIS (pg. 3.3-15, Integrated Alternative), the estimated consumptive water use for phreatophytes and hydrophytes for the completed Park is given as 10,440 afy. This estimate was derived from "the estimated acreages impounded by erosion control structures and other water impoundments." (EIS, pg. 3.3-15). However, it was not clear in the EIS how these acreages were calculated.

The PPR states (pg. 28), "...sufficient water allocation for the park's maintenance and enhancement will depend on the Master Plan adopted for the Park...[which] will depend on desired future vegetative conditions and other water needs including sanitary use or irrigation of landscaping...." The enhancements in vegetation planned for the Park in the Integrated Alternative are estimated within the EIS (Table 2.6) as increases of existing wetlands (158 acres) and riparian habitats (130 acres). In addition, further estimates of "conserved" acreages of wetland plants are presented in Table TR3-1 - Topical response No. 3 of the EIS (p.F-10). This table contains additional categories of wetland plant types but is not consistent with the acreages presented in Table 2.6. Since additional detail on projected acreages was provided in Table TR3-1, this information was deemed the best available detail of projected acreages for the park.

EVAPOTRANSPIRATION ESTIMATES DERIVED FROM LITERATURE

The following methodology was used for determination and comparisons of ET rates:

1) The ET rates in the EIS (EIS, 3.3.10) were first noted and the applicable references for these obtained. The plants for which rates were found were: cattail, ({Young and Blaney, 1942; McNaughton, 1966; McDonald and Hughs, 1968} cited in Jackson and Patten, 1988; Christensen and Low, 1970), Bullrush (Christiansen and Low, 1970), tamarisk (Jackson and Patten, 1988; Gay and Hartman, 1981; Sala et.al., 1999); Fremont Cottonwood (Anderson, 1982; Muckel and Blaney, 1945), Willows (Blaney and Hansen, 1965; Muckel and Blaney, 1945), saltbush (McDonald and Hughes, 1968) common reed (Jackson and Patten, 1988; Haslam, 1970; Shay and Shay, 1986) and saltgrass (Muckel and Blaney, 1945; USBOR, 1973; Christiansen and Low, 1970); Russian Thistle and Alkali Sacaton (Blaney and Hansen, 1965).

2) References cited in the EIS were examined for ET rates and, using appropriate conversion factors, the rates re-calculated from the literature. These values were compared with those reported in the EIS and, as would be expected, the agreement was excellent, indicating the original calculations performed by the authors of the EIS were valid.

3) ET rates for all pertinent plant communities mentioned in the EIS as were also sought to develop a more detailed park-wide ET estimate. Information on the Fremont cottonwood and Goodding willow was especially sought, since these are anticipated replacement plants for tamarisk. Rates for Fremont cottonwood appear to be very similar to those for

tamarisk ({Anderson, 1982; Muckel and Blaney, 1945} cited in Robinson's Phreatophytes, 1958). No rates for Goodding willow were found, but data from two localities, Santa Ana, Calif. and Isleta, New Mexico, for *salix laevigata* and "willows" were found (Blaney et al, 1933; Young and Blaney, 1942). It should be mentioned that some studies found no significant difference in stream flows or other indications of success after removal/replacement of tamarisk (Weeks et al., 1987; Culler et al., 1982).

Estimates of accuracy were generally not made in these studies. The determination of ET rates is affected by a large number of variables, many of which do not lend themselves well to quantitative studies, and the comparison of results produced using one method of ET rate determination to data produced using another is not always possible. Extrapolating measurements in time and transferring them in space, even to nearby areas, requires that assumptions of uncertain reliability be made (Weeks et al., 1987; Ward and Elliot, 1995). The rate for open water was taken from that for lake evaporation, stated in Thompson (1999) as exceeding "100 inches per year in the deserts of southeastern California." No further data useful for meaningful comparison was found although references were searched. Consumptive water use due to evapotranspiration or evaporation was calculated by multiplying the rates by the appropriate acreage from the table TR-3-1 - Topical Response No. 3 of the EIS.

DATA GAPS

Wetlands will develop behind the planned erosion control structures and a varying amount of open water habitat will be created along with the developing wetlands. Tamarisk and common reed will be removed from the areas to be flooded and within a 20-ft zone around the planned planting areas. No estimates of planting acreages are given within the text of the planning documents but rather a statement is made that "a detailed planting plan will be required for each erosion control structure at the time of construction." It is assumed that these plans would include estimates of extent of upstream innundation and wetland creation as well as estimates of the number of acres of each wetland plant type that will be created. These data do not currently exist and therefore cannot be specifically evaluated for potential effects on evapotranspiration losses in the Park.

Riparian and landscape enhancements will occur around the erosion control structures and will involve the removal of tamarisk and reed to allow establishment of willow, cottonwood, mesquite, and other trees, shrubs, and grass. "The objective is ...a community of 40 percent tamarisk, 40 percent planted native riparian species, and 20 percent open area....Native trees will be planted in an average density of 60 per acre over the entire riparian enhancement area. The actual number of trees per acre of converted riparian habitat will vary from zero in the open patches to over 100 trees per acre in some of the planted patches" (MPR., A-6). It is not known at present which species of trees and shrubs will thrive in the newly created habitats nor in what densities. Finally, no estimates are evident in any of the planning documents for consumptive water use of "other water needs including sanitary use and irrigation of landscaping". Given this level of uncertainty in the final configuration of the Park, the planning document acreage estimates

of general habitat types represent the most realistic base of information for use in estimation of water loss from these sources.

CONCLUSIONS AND RECOMMENDATIONS

Following the review of existing planning document information on consumptive water use for the Park, it was evident that the most commonly cited estimates of phreatophytes and hydrophyte water consumption in the Las Vegas Wash (10,300 afy BOR return flow calculation), or the somewhat larger number presented in the EIS for the Integrated Alternative (10,440 afy - Table 3.3-7) could be criticized for a number of reasons. While the EIS cites a number of literature sources for ET rates, most of those studies are quite dated and some would be difficult and/or time consuming to obtain through normal library channels. There are inconsistencies in the figures presented in the planning documents for acreages and ET rates which are difficult to resolve. For example, the only available estimates of acreages of total wetland plant types within the park are contained in Table 2.6 (Specific Components of the Integrated Alternative) and Table TR3-1 (Topical Response No. 3) of the EIS which are not completely consistent with each other. However, even given this level of potential error, the maximum ET rates presented herein (Table 2), which were independently derived from a larger more current literature base, were remarkably similar to those presented in the planning documents.

Ultimately to refine the water consumption estimates for the Park, it would be necessary to define more specifically the types and acreages of phreatophytes and hydrophytes which will be created in the mature park and then compare the use of these plant assemblages to those that are currently present. Ideally a table similar to Table 2 in the NCEA which provides species-specific planned acreages of wetland enhancements would be available for all portions of the park. This could be a fairly large task that may not provide substantially more accurate information than currently exist. ET rates for a given species in a given environment can be quite variable and so a refined Park-wide ET estimate will probably have error bounds that are similar to those presented in the EIS or are noted in Table 2 of this document. Therefore we would not recommend additional effort at this time to refine the information contained in Table TR3-1 in the EIS or to obtain additional information regarding species-specific ET rates.

There still remains one element of consumptive water use in the Park which has not been addressed. The PPR states (pg. 28), "...sufficient water allocation for the park's maintenance and enhancement will depend on the Master Plan adopted for the Park...[which] will depend on desired future vegetative conditions *and other water needs including sanitary use or irrigation of landscaping*..." There is no mention in any of the planning documents of sanitary water use or irrigation needs of the park. Drinking and sanitary water would be supplied as city supplied water which will be a function of facilities which are constructed in each portion of the park. We do not believe that planning documentation has been prepared to date which would allow a detailed estimate of the future needs for this water source.

Irrigation needs would presumably be obtained from effluent water or the Park ponds and

would become part of the consumptive water use totals that have been previously estimated. Although this is probably not a large number compared to the ET figures, it should be investigated in the future to determine the magnitude of this potential water use. This effort would require an estimate of the total irrigation needs of the park to determine defensible potential consumption figures. Possibly this information is available in generalized planting plans or other documents that have been produced for you in the past which could be extrapolated to Park wide estimates. Additional information on irrigation needs of the park might become available in the Programmatic Biological Assessment effort currently underway. We would recommend these data be requested from your contractors, or that a request be included in the PBA to provide total irrigation needs based on the projected impact analysis which will be an outcome of the PBA.

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