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SUBJECT: NAT RES PROJ - FISCAL YEAR 1983 WATER RESOURCES COUNCIL (WRC)  
REFERENCE HANDBOOK

Purpose. To distribute WRC's FY-83 Reference Handbook.

Expiration Date. This bulletin expires December 30, 1982.

Enclosed are copies of the Fiscal Year 1983 Reference Handbook compiled by the Water Resources Council. This handbook should aid in formulating and evaluating water resources management and development plans. Its contents include discount rates, new agricultural price standards, and other information, data, and guidance.

Planning staff leaders, water resources coordinators, economists, and others will find this handbook useful in water resources planning.

JOSEPH W. HAAS  
Deputy Chief for  
Natural Resource Projects

Enclosure

DIST: L (Info.), T (5 ea.), S (4 ea.), BAP (50)



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FISCAL YEAR 1983

REFERENCE HANDBOOK

For Use with the Economic and Environmental  
Principles and Guidelines for Water and  
Related Land Resources Implementation Studies

U.S. WATER RESOURCES COUNCIL

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## FOREWORD

This handbook has been compiled by the Water Resources Council staff with the assistance of member agencies to aid planners in formulating and evaluating water resources management and development plans. Several sets of information, data, or guidance are provided to comply with the Principles and Guidelines (P&G). The Principles and Guidelines are to be published to replace the Principles, Standards, and Procedures which are to be repealed.

The agency contacts listed herein will be advised of developments relating to the P&G and will pass this information on to field planners.

September 1982

i. Agency Contacts

The following persons will be advised of developments relating to this Handbook that affect their agencies and will pass this information on to planners.

Recommendations for changes in this Handbook may be submitted to:

1. Secretary, U.S. Department of the Interior
2. Secretary, U.S. Department of Agriculture
3. Assistant Secretary for Civil Works, U.S. Department of the Army
4. General Manager, Tennessee Valley Authority

I. Discount Rates

- A. Section 1.4.11 of the Principles and Guidelines states: "Discounting is to be used to convert future monetary values to present values. Calculate present values using the discount rate established annually for the formulation and economic evaluation of plans for water and related land resources."

The interest rate of 7 7/8% is to be used by Federal agencies in the formulation and evaluation of plans for water and related land resources for the period October 1, 1982 through and including September 30, 1983.

The rate has been computed in accordance with Section 80 of Public Law 93-251, and is to be used in the evaluation of National economic effects of water and related land resources plans for the purpose of discounting future benefits and computing costs, or otherwise converting benefits and costs to a common time basis.

The plan evaluation discount rate after September 30, 1983 can be obtained from any one of the affected Federal agencies.

Fiscal Year	B.B.C. A-47	S.D. 97	WRC 1968 Reg.	Prin. & Stand.	WRDA 1974 Sec. 80	WRC 1974 Notice
1957	2.500	1958	2.500			
1959	2.500					
1960	2.500					
1961	2.625					
1962	2.625	2.625				
1963		2.875				
1964		3.000				
1965		3.125				
1966		3.125				
1967		3.125				
1968		3.250				
1969		3.250	4.625			
1970			4.875			
1971			5.125			
1972			5.375			
1973			5.500			
1974			5.625	6.875	5.625	5.625
1975					5.875	5.875
1976					6.125	6.125
1977						6.375
1978						6.625
1979						6.875
1980						7.125
1981						7.375
1982						7.625
1983						7.875

Effective dates of the indicated documents:

Budget Bureau Circular A-47	(December 31, 1952 - May 15, 1962)
Senate Document 97	(May 15, 1962 - December 24, 1968)
Water Resources Council	(December 24, 1968 - October 25, 1973)
Principles and Standards	(October 25, 1973 - March 7, 1974)
WRDA of 1974 (Section 80)	(March 7, 1974 - Continuing)
Water Resources Council (1974)	(August 14, 1974 - Continuing)

B. Conversion factors for selected discount rates.

<u>Present Value of Annuity of \$1</u>		
<u>i%</u>	<u>50 years</u>	<u>100 years</u>
5.625	16.62554	17.70390
5.875	16.04106	16.96483
6.000	15.76186	16.61755
6.125	15.49091	16.28376
6.375	14.97253	15.65380
6.625	14.48359	15.06963
6.875	14.02195	14.52661
7.125	13.58565	14.02069
7.375	13.17288	13.54831
7.625	12.78201	13.54831
7.875	12.41153	12.69193
10.000	9.91481	9.99927

C. Present value of an annuity of \$1. at 7.875%.

$$PV = \sum_{t=1}^n \frac{1}{(1+i)^t} = \frac{1 - (1+i)^{-n}}{i}$$

t = 1

where: n = years of growth  
t = year  
i = interest rate (.07875 in this example)

<u>Year (t)</u>	<u>PV, \$1. Ann., 7-7/8%</u>	<u>Year (t)</u>	<u>PV, \$1. Ann., 7-7/8%</u>
1	.927	15	8.625
2	1.786	16	8.923
3	2.583	17	9.198
4	3.321	18	9.454
5	4.006	19	9.691
6	4.640	20	9.910
7	5.229	25	10.790
8	5.774	30	11.392
9	6.279	35	11.804
10	6.748	40	12.086
11	7.182	45	12.279
12	7.585	50	12.412
13	7.958	75	12.655
14	8.304	100	12.692



D. Formula for the present value of a compound growth series.

This formula applies in those cases where there is a benefit at the end of the first planning period that grows at a constant rate during successive planning periods. Although the initial benefit is not realized until the end of the first period, it and all successive benefits are discounted back to the beginning of the first period. If an initial benefit of  $B_1$  grows at  $j$  percent for each of  $t = 1, 2 \dots, n$  years and the applicable interest rate is  $i$  percent, then the present value of the stream of benefits is:

$$PV = \sum_{t=1}^n B_1 \frac{(1+j)^{t-1}}{(1+i)^t}$$

which simplifies to

$$= B_1 \left[ \frac{(1+i)^n - (1+j)^n}{(i-j)(1+i)^n} \right]$$

where again

- $B_1$  = initial benefit
- $j$  = growth rate of benefits
- $i$  = interest rate
- $n$  = years of growth

Example: Assume benefits at end of first year are \$235,000,  $i = 7\frac{7}{8}\%$ ,  $j = 2\%$ ,  $n = 50$  years, then

$$\begin{aligned} PV &= \$235,000 \frac{(1.07875)^{50} - (1.02)^{50}}{(.07875 - .02)(1.07875)^{50}} \\ &= \$3,756,180 \end{aligned}$$

E. Interest rates determined by the Department of the Treasury in accord with provisions of the Water Supply Act of 1958 (Section 301(b)).

Note: These rates are limited in application to calculation of interest during construction and repayment of construction costs allocated to water supply purposes under Title III of Public Law 85-500, the Water Supply Act of 1958 (Section 301(b)).

<u>Fiscal Year</u>	<u>Rate</u>	<u>Fiscal Year</u>	<u>Rate</u>
1959	2.670%	1971	3.463%
1960	2.699	1972	3.502
1961	2.632	1973	3.649
1962	2.742	1974	4.012
1963	2.936	1975	4.371
1964	3.046	1976	5.116
1965	3.137	1977	5.683
1966	3.222	1978	6.063
1967	3.225	1979	6.595
1968	3.253	1980	7.250
1969	3.256	1981	8.605
1970	3.342	1982	9.352
		1983	----- (to be determined after 9/30/82)

F. Interest rates determined by the Department of the Treasury relating to hydropower purposes under Secretarial Order RA 6120.2 Paragraph 11(b) of the Secretary of Energy and Departmental Manual 730 DM 3 superceding Secretarial Order 2929 of the Secretary of the Interior.

Note: These rates are limited in application to calculation of interest during construction and repayment of

construction costs allocated to hydropower purposes.

Thus, the principal to be repaid should include interest compounded over the period of construction.

<u>Fiscal Year</u>	<u>Rate</u>	<u>Fiscal Year</u>	<u>Rate</u>
1973	5.500%	1978	7.000%
1974	5.625	1979	7.500
1975	6.125	1980	8.000
1976	6.625	1981	8.500
1977	7.000	1982	9.000
		1983	(to be determined after 9/30/82)

## II. Agricultural Price Standards

### Purpose

The orderly development and use of water and related land resources require that the Council and its member agencies use a consistent set of economic standards and criteria when evaluating agricultural benefits. Agricultural price standards provide the price base for evaluating the agricultural effects of alternative plans for the development and management of water and related land resources.

### Authority

The authority for these standards is set forth in the Water Resources Planning Act (P.L. 89-80) and by the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. These Principles and Guidelines state in part:

#### "Section 1.4.10 Prices

- (a) The prices of goods and services used for evaluation should reflect the real exchange values expected to prevail over the period of analysis. For this purpose, relative price relationships and the general level of prices for outputs and inputs prevailing during, or immediately preceding, the period of planning generally represent the real price relationships expected over the life of the plan, unless specific considerations indicate real exchange values are expected to change.
- (b) The general level of prices for outputs and inputs prevailing during or immediately preceding the period of planning is to be used for the entire period of analysis. In the case of agricultural planning, normalized prices prepared by the Department of Agriculture should be used."

### Conceptual Basis for Normalized Agricultural Prices and Costs

The project evaluation process should yield valid estimates of the aggregate benefits and costs to those affected during the life of the projects and programs under consideration. Ideally, a set of relative price relationships representative of the period of analysis over which costs are incurred and benefits accrue is needed. Since price standard forecasting is not presently feasible the Principles and Guidelines suggest that current price relationships should generally be used. Therefore price relationships observed in a recent time period serve as a proxy for future prices. Current price relationships should not be distorted by short-term abnormalities. Further the prices should reflect a consistent price level. Agricultural prices and costs are generally influenced by highly variable factors such as weather, insect infestations, sudden demand changes, and inflationary forces. Thus, since a procedure, such as the one described in the next section, is needed to correct for the effects of these factors.















































































TABLE 1

	BEA REGIONAL ECONOMIC PROJECTIONS															
	TOTAL EARNINGS (MILLIONS OF 1972 DOLLARS)				TOTAL EMPLOYMENT (THOUSANDS)				TOTAL POPULATION (THOUSANDS)				TOTAL PERSONAL INCOME (MILLIONS OF 1972 DOLLARS)			
	1969	1978	1985	2000	1969	1978	1985	2000	1969	1978	1985	2000	1969	1978	1985	2000
CT	11844	13424	17049	24981	1350	1502	1667	1802	3000	3099	3232	3541	15735	18416	23022	33601
ME	2665	3391	4503	7463	419	491	558	666	992	1091	1138	1317	3357	4589	5999	9914
MA	20320	22982	28766	40761	2546	2784	2977	3069	5650	5774	5809	6037	25532	30510	37898	53746
NH	2106	2997	4185	7102	316	415	495	597	724	871	970	1174	2892	4285	5847	9839
RI	3035	3366	4314	6806	416	445	490	552	932	935	955	1060	3837	4640	5885	9186
VT	1312	1627	2180	3480	193	228	261	299	437	467	522	586	1607	2142	2851	4550
DE	2115	2650	3477	5566	252	283	321	374	540	583	614	706	2604	3313	4310	6852
DC	6216	7547	9021	12545	647	654	693	707	762	674	641	633	3730	3410	5048	6883
MD	12728	15872	19751	29145	1576	1801	1986	2147	3868	4143	4239	4574	17424	23054	29131	43342
NJ	25391	30127	38644	57445	2913	3248	3640	3970	7095	7327	7615	8329	34949	42865	54267	80311
NY	73404	74037	88767	117118	8048	7784	8193	8004	18105	17748	17316	16559	88535	97373	115323	152170
PA	39687	46444	58440	83428	4951	5217	5655	5854	11741	11750	11728	11851	48240	60660	75150	106891
IL	43275	51968	66360	96021	4972	5338	5877	6221	11039	11243	11544	12264	52632	66477	84038	120891
IN	17798	22088	29143	45388	2189	2482	2785	3098	5143	5374	5680	6199	20985	27598	36181	55990
HI	33027	41876	54229	83011	3481	3989	4523	5103	8781	9189	9553	10368	39325	51990	66423	99818
OH	37696	44882	58088	86155	4463	4870	5432	5833	10563	10749	11054	11622	45090	56304	72242	106703
WI	14084	18348	23997	36436	1849	2215	2516	2777	4378	4679	4928	5366	17360	23494	30512	46526
IA	8677	11412	14390	21609	1204	1424	1552	1698	2805	2896	2959	3196	10907	15165	19144	28854
KS	6448	8923	11717	18463	955	1146	1287	1456	2236	2348	2467	2707	8766	12281	15774	24270
MN	12449	16934	22626	36687	1588	1989	2289	2662	3758	4008	4302	4984	15094	21120	28016	45141
MO	15379	19130	24549	36526	2057	2297	2533	2712	4640	4860	5001	5256	17921	23609	30227	44658
NE	4578	5963	7529	11496	665	795	866	955	1474	1565	1618	1746	5776	7873	9962	15249
ND	1664	2466	3061	4785	263	327	337	355	621	652	673	727	2068	3230	4086	6393
SD	1678	2267	2934	4503	289	340	368	397	668	690	707	751	2184	3027	3897	5942
AL	8526	12244	16403	26796	1304	1584	1802	2073	3440	3742	3935	4231	10477	15779	21220	34622
AR	4281	6657	8699	14282	725	931	1052	1237	1913	2186	2274	2514	5553	8920	11659	19131
FL	19150	29129	40229	69629	2642	3808	4557	5673	6641	8594	10191	12683	25789	43420	62512	111660
GA	13502	18475	24450	40273	1984	24429	2736	3171	4551	5084	5438	6251	15923	22976	30700	51309
KY	8273	11824	17005	29187	1213	1484	1763	2112	3198	3498	3792	4279	10362	15404	21725	36859
LA	9339	14016	19566	33469	1346	1699	2006	2428	3619	3966	4297	4901	11610	17815	24577	41827
MS	4753	6845	9375	16727	812	1008	1163	1445	2220	2404	2557	2981	5838	8944	12178	21733
NC	14779	19847	26438	43896	2288	2748	3098	3620	5031	5377	5978	6871	17018	24686	33184	55773
SC	6716	9650	12934	22305	1094	1378	1567	1898	2501	2918	3146	3672	12667	19061	26423	45243
TN	10738	15304	21317	36189	1618	2029	2412	2909	3897	4357	4761	5649	12667	19061	26423	45243
VA	13815	19430	26039	42632	1980	2421	2785	3273	4614	5148	5566	6432	17728	26497	35301	57567
WV	4388	6314	9292	15186	602	742	885	1024	1746	1860	2023	2129	5398	8218	11692	18570
AZ	5213	8729	12133	21036	672	1057	1279	1595	1737	2354	2794	3442	6498	11588	16801	28906
NH	2629	4111	5639	9402	370	521	612	730	1011	1212	1346	1537	3221	5332	7323	12263
OK	6861	9894	13698	22364	998	1368	1471	1726	2535	2880	3124	3557	8795	13684	18509	29997
TX	33260	52730	73985	128361	4620	6235	7418	9232	11045	13014	14812	18130	40871	67202	93966	162804
CO	6934	11361	16635	29824	931	1360	1718	2206	2166	2670	3178	4042	8642	14649	20979	37339
ID	1969	3205	4405	7587	288	418	488	594	707	878	1000	1194	2390	4138	5705	9776
MT	1923	2719	3642	6137	276	361	406	473	694	785	829	926	2457	3617	4756	7812
UT	2888	4668	6915	12809	408	585	737	957	1047	1307	1556	1904	3464	5748	8437	15372
WY	993	1972	3032	5268	148	227	294	367	329	424	537	669	1266	2453	3728	6415
CA	76192	102375	134313	212112	8458	10796	12475	14662	19711	22294	24456	28443	93591	132519	173414	272683
NV	2000	3417	5215	10158	232	395	535	774	480	663	873	1348	2306	4148	6428	12968
OR	6590	10277	14451	25900	854	1175	1436	1859	2062	2444	2850	3652	8101	13157	18461	33602
WA	12003	16511	22891	36172	1431	1763	2138	2504	3343	3774	4288	4933	14759	21517	29668	46859
AK	1387	2810	3679	6881	140	210	259	375	296	403	473	674	1406	2913	3952	7636
HI	2943	3932	5247	8601	379	478	558	667	743	885	1005	1229	3501	4993	6731	11184
US	679459	879168	1153351	1810100	85416	101118	114965	130943	201298	218051	232346	259845	834161	1139744	1491758	2336905

























































