

WHERE IS THE WATER COMING FROM?

RAPHAEL J. MOSES

Many people have written and spoken on the subject of water for oil shale development—people far better qualified than I. Only as recently as last year Mr. Robert Delaney of Glenwood Springs pointed out to this same symposium the necessity of water storage for the orderly development of the oil shale industry. What he said then was sound and is equally applicable now, although much has transpired in the past year which bears directly on the subject at hand.

It has never appeared to me that development of the water needed for oil shale posed much in the way of legal or engineering problems. Perhaps it is an erroneous assumption based principally on my unfamiliarity with money or finance in any quantity, but I have long felt that the only barrier to the development of water for oil shale has been an economic barrier.

I feel so strongly about this that I seriously question the wisdom of including any more speeches such as this one in future symposia. Some of the titles I suggested for this speech, all discarded by wiser and less impatient persons, were "Re-plowing the North Forty" or "Wringing Water from Hands" or "Admonitions of a Common Scold."

I suppose my attitude is an unsympathetic one, and not designed to elicit huzzas from an industry-oriented audience, but my overpowering reaction is "Get on with it, and quit talking it to death."

Obviously, the problem the oil industry faces is one of uncertainty, both as to timing and quantity of needs of water for oil shale processing and the associated population growth.

As one eminent authority has put it, the development of a two-million-barrel-per-day industry will consume between 110,000 and 200,000 acre feet of water per year, depending on whether the refining operation is conducted in the shale oil area. The supplemental domestic and industrial water requirements will necessitate 165,000 additional acre feet of water annually, of which 55,000 will be consumed.¹ This accords generally with the estimates made by Cameron & Jones for the Colorado Water Conservation Board.²

¹Raymond D. Sloan, Manager, Shale Oil Project, Humble Oil & Refining Co., *Shale Oil: An Emerging Industry—Potential, Development and Water Requirements*, an address to The Colorado River Water Users Association, December 2, 1965, Las Vegas, Nevada.

²Cameron & Jones, *Status and Problems of Colorado Oil Shale Development*, 1963.

Attorney, Boulder, Colorado.

No one knows just what timetable to project in the development of these water supplies. The demand will not occur overnight. Nor can it be satisfied overnight. The orderly supply of water—when and where it is needed—requires the closest cooperation, not only between the various producers, but between the industry and government.

Unfortunately (or fortunately, perhaps) Colorado law does not permit the earmarking or reservation of water for future use. Colorado is the leading exponent of the appropriation doctrine, where priority of time of appropriation to a beneficial use secures the prior right.³ This doctrine causes no problem if the supply is not a limited one, but in western Colorado the supply is limited, not only by nature, but by the terms of the Colorado River Compact,⁴ and the Mexican Treaty burden.⁵

In 1965, the firm of R. J. Tipton and Associates, in a report prepared for the Upper Colorado River Commission,⁶ found that, instead of 7,500,000 acre feet of water being available to the Upper Basin States, as anticipated by the framers of the Compact, only 5,600,000 would be available if the past 34 years' record of stream flow is repeated.

As Colorado's share of the Upper Basin allocation is 51.75 percent,⁸ it appears that Colorado's available portion of Colorado River water may be as little as 2,484,000 acre feet.

Without importation of water, and such modifications in the required delivery of water at Lee Ferry as would be necessary for the Upper Basin to benefit from the importation of water, it is assumed that the total net beneficial consumptive use in the states of the upper division cannot be more than 5.6 maf per year, and might not be more than 4.8 maf per year.

A tabulation prepared by the Colorado Water Conservation Board,⁹ and attached as an appendix hereto, demonstrates that while we have enough water for oil shale if it is husbanded, the availability of the supply depends upon its diversion and application to this beneficial use before competing uses effect valid prior appropriations by diversions and applications to different beneficial uses elsewhere.

Once the waters of a Colorado stream are appropriated by another, a statutory judicial proceeding to change the point of diversion is necessary, even assuming the water right can be acquired.¹⁰ But this is not an easy task, and is fraught with many hazards.

We start with the oft-stated basic premise that "a decreed water right is

³Wiel, *Water Rights in the Western States*, 3d ed., Vol. 1, p. 139; *Coffin v. Left Hand Ditch Co.*, 6 Colo. 443.

⁴Art. 2, Chap. 149, C.R.S., 1963 (approved by Congress in Sec. 13(a) of the Boulder Canyon Project Act (45 Stat. 1057, 1064).

⁵*supra*, Art. III(c).

⁶Tipton & Kalmbach, Inc.; *Water Supplies of The Colorado River*; July, 1965.

⁸Art. 8, Chap. 149, C.R.S., 1963 (63 Stat. 31).

⁹Memorandum, Felix L. Sparks, Director; Colorado Water Conservation Board, to members of the board, September 14, 1965.

¹⁰Secs. 148-9-22, *et seq.*, C.R.S. 1963.

a valuable property right; it may be used, its uses changed, its point of diversion relocated; . . . provided that no adverse effect be suffered by other users from the same stream, particularly those holding junior appropriations.”¹¹

Sounds easy, doesn't it? Then reflect on these words, from another leading case: “It is a matter of common knowledge that, except on streams in which the appropriations have not exceeded the constant supply, few instances arise in which the change of place of diversion of large quantities of water, for a long distance, can be made without substantial injury to juniors, and the utmost care and scrutiny should be exercised to guard against such injury.”¹²

That the “utmost care and scrutiny” is truly exercised by courts may be observed from the fact that in the first case mentioned¹³ the court permitted the transfer of 1.80 cubic feet per second out of 16.00 and limited consumptive use to 90 acre feet per year, or only slightly more than 72 hours' run of the original decree!

The cost of prosecuting such a change of place of diversion and type of use can be considerable and, if opposed, may result in litigation extending over several years.

In a water-short West, projects hundreds of miles from our boundaries cause repercussions on our own water development. Many questions have been asked as to the impact of the Central Arizona Project on shale-oil development in Colorado.

In theory, under the Colorado River Compact, it should have little effect. Practically, however, the effect on future federally financed projects in Colorado may be serious. At the time this is prepared, the fate of the legislation is unknown. Human nature being what it is, we may expect a noticeable lack of enthusiasm for federally financed projects in Colorado, no matter what the fate of the legislation may be. If it fails, or is stalled, the massive political weight of the Lower Basin States may be felt opposing Colorado projects which would place a prior call on the limited federal funds available for reclamation projects. If the legislation passes without the inclusion of some major projects for Colorado,¹⁴ it may be difficult to arouse Lower Basin enthusiasm for projects which will hasten the day when insufficient water is available for the Central Arizona Project.¹⁵

¹¹*Green v. Chaffee Ditch Company*, 150 c. 91, 371 P^{2d} 775.

¹²*Farmers' High Line and Res. Co. v. Wolf*, 23 Colo. App. 570, cited with approval in *Trinchera Ranch Co. v. Trinchera Irrigation Dist.*, 83 Colo. 451, 462.

¹³n. 11, *supra*.

¹⁴The present draft of H.R. 4671, Eighty-ninth Congress, First Session, tentatively approved by all seven Colorado River Basin States (except New Mexico), provides for the authorization of four Colorado projects and one joint Colorado-New Mexico project. Of these, Wyoming and Utah have specifically reserved, at the time this paper is written, the right to examine further the San Miguel, West Divide and Dallas Creek projects.

¹⁵This date has variously been projected as 1985, 2000 and 2030. See, however, *Colorado River Basin Project Hearing on H.R. 4671 and similar bills*, Serial No. 17, 89th Cong., 1st Session.

In view of the hazards involved in purchasing rights and attempting to change their place and purpose of diversion, and in view of the limited supply available, it behooves all of us, and particularly the shale oil industry, to look at all possible alternatives.

One answer to the admitted total shortages on the Colorado is augmentation of that supply from outside the Basin. Augmentation means more than importation, although admittedly importation is an exceedingly important facet of augmentation. Augmentation includes desalinization, water conservation practices and weather modification.

All of you are familiar with the progress being made on desalinization,¹⁶ and it is not unreasonable to anticipate that such progress will keep pace with progress in shale oil extraction techniques. Desalinized sea water cannot, because of economics, be pumped into Colorado, but it can, by exchange, make available to Colorado greater quantities of water from the Colorado River and its tributaries within the state.

Weather modification, however, can perhaps bring about a more dramatic increase in water supply in the Upper Basin more cheaply than can desalinization, with the added benefit of physically depositing more water on Colorado River watersheds in Colorado.

In pleading for funds to finance basic research in weather modification in testimony before the Senate Committee on Interstate Commerce recently, Dr. Walter Orr Roberts, Director of the National Center for Atmospheric Research, said:

Orographic precipitation . . . occurs in regions where a mountain barrier uplifts and thus cools the air flowing across it. It now appears certain that in some mountainous regions, winter snowpack can be increased at least a few percent by seeding of all appropriate winter storms with silver iodide. Having said this, we have said a good deal of all we know today. We know that it happens, and we have some theories to explain why. But there are enormous holes in our knowledge. If we are looking for the best possible design to produce the greatest possible result, we have almost certainly not yet understood the factors that will allow us to specify such a design.

Without a doubt, we are thus still in the Model-T era of cloud seeding. We do not yet understand the life cycles of mountain clouds well enough to know the best time and place to insert the silver iodide. We are not yet sure of where to place our generators so that the silver iodide will get to the right part of the cloud, assuming we knew where that was. We do not yet know adequately the abundance of *natural* seeding nuclei in given cloud systems. The design of seeding generators is still rudimentary and empirical; engineering and research wisdom must be put to this problem. The 'best' generator depends on what size, concentration and character of silver iodide particles you wish to generate, and our knowledge of these winter-storm clouds is not yet sufficient to answer any of these questions with certainty. And so on.¹⁷

¹⁶For a brief note, see *American City*, Aug., 1965, p. 19.

¹⁷Statement of Walter Orr Roberts before the Senate Committee on Interstate and Foreign

Secretary Udall, in addressing the American Meteorological Society here in Denver on January 26 of this year, in speaking of weather modification, said:

In New York our pitchers are dry. In Denver, our cup briefly runneth over. If we are to achieve some sort of nationwide distribution which will correct this condition then we must make progress in orders of magnitude greater than we are now making. Many ways of hastening this progress are open to us and we cannot afford to neglect any of them. But to my mind the most logical and challenging is the one which most stirs the imagination. This is worthwhile utilization of the water resources of the sky.¹⁸

The time when the Upper Basin will be able to utilize its Colorado River Compact allocation has been estimated to be as early as 1985¹⁹ and as late as 2030 by the Bureau of Reclamation.²⁰ We cannot anticipate the timetable on weather modification or desalinization, but either could, hopefully, provide some solace if research proceeds at a substantially greater rate of funding. Similarly, enlightened phreatophyte control practices, channel improve- and other water conservation procedures can, from the point of view of timing, be helpful.

In addition to relief from water shortages by augmentation, regardless of method, there is the very practical problem of developing the presently available supply in a manner designed to recognize the legitimate requirements of the shale oil industry.

In his able address to your group last year, Mr. Delaney spoke of a contract providing for monetary investments by the industry in the development and construction of Iron Mountain Reservoir on the Eagle River.²¹ This is all very well, and there should be more of it. But Iron Mountain is a reservoir which the Bureau of Reclamation has never found to be feasible for construction by the Federal Government. What about feasible reclamation projects—is there any opportunity for the oil shale industry to assist in the authorization of these projects? Certainly.

Let us look again at the Colorado Water Conservation Board tabulation I have previously referred to.²² On that list we find the West Divide, Yellow Jacket and Juniper Projects. All of these have municipal and industrial water for oil shale and its supporting communities and industry. Well, perhaps not Juniper, but some of us armchair engineers think it might be cheaper to get Juniper water up over Yellow Jacket Pass than to get Colorado River water over the Rio Blanco Divide.

Commerce, February 21, 1966.

¹⁸“Water Resources in the Sky, an address by Secretary of the Interior Stewart L. Udall before the American Meteorological Society; January 26, 1966; Denver, Colorado.

¹⁹*supra*, n. 11, p. 519.

²⁰*ibid.* p. 229.

²¹“The Necessity of Water Storage for the Oil Shale Industry” by Robert Delaney, Vol. 60, No. 3, *Quarterly of the Colorado School of Mines*, pp. 111-118; July, 1965.

²²*supra*, n. 9.

None of these are presently authorized. However, the West Divide project is included in the current version of H.R. 4671 which is scheduled for hearings May 9. It is in trouble.²³ It has 77,500 acre feet for municipal and industrial water.²⁴ How many of your companies have been actively working for its authorization?

I am aware that the Secretary of the Interior, by his leasing policies, has not won many popularity contests with the shale oil interests. This is no reason, in my opinion, to fail to exert, in your own most enlightened self-interest, all possible effort to get not only West Divide authorized now, but the others authorized as soon as practicable.

Is it not better to be a contracting partner with the Bureau of Reclamation in the construction of these major reservoirs than, on your own, to build smaller, less efficient storage? When one considers the gestation period of Federal reclamation projects, it is plain that yesterday is not soon enough, and tomorrow may well be too late to meet your yet unpublished timetable.

Let me remind you also that conservation, desalinization, weather modification and importation all depend, almost entirely, on Federal funding. Couple this fact with the sizeable amounts which would be spent in the construction of these Colorado projects, and it is apparent that a major impact on the Federal treasury is involved.

Any expenditure in this area—and by area I refer to both the geographic and scientific areas—faces basic opposition from a substantial segment of the Congress, so that the assistance of the major oil shale interests in supporting authorization of these funds is not only of great value, but is almost imperative if progress is to be made on any of these fronts, much less all of them.

This then is the burden of my refrain today. In the important battle for the essential water supply for oil shale, it is not sufficient for the industry to wait to be drafted. The industry must volunteer its time, talent, money, prestige and power in the cause. This is the only way that the necessary supplies will be available when and where you want and need them. At the risk of schizophrenia, you must put to one side your leasehold arguments with the black-hatted villain and support the Secretary of Interior when he wears his white hats of reclamation, desalinization and weather modification.

²³Letter of Felix L. Sparks, Director; Colorado Water Conservation Board, to members of the board, March 10, 1966.

²⁴Feasibility Report; March, 1966; West Divide Project, Colorado, Bureau of Reclamation.

COLORADO RIVER BASIN
PRESENT DEPLETIONS CHARGEABLE TO COLORADO

Units — 1,000 acre feet

		Trans- mountain diversions	Irrig., M&I, & res. evap.	Total
Yampa & Green Rivers	(a)		65	65
Hayden Steam Plant			4	4
White River	(a)		34	34
Gunnison River	(b)		407	407
Smith Fork Project	(c)		6	6
Paonia Project	(c)		10	10
Colorado River—Main Stem	(d)	(e)	481	481
Collbran Project	(c)		7	7
Pueblo-Eagle River Diversions		8		8
Colorado-Big Thompson Project		260		260
Small Ditches		1		1
Colorado Springs-Blue River		15		15
Denver-Blue River		45		45
Denver-Moffat Tunnel		65		65
Denver-Williams Fork		10		10
Busk-Ivanhoe Tunnel		5		5
Independence Pass Tunnel		33		38
Grand River Ditch		20		20
San Juan & Dolores Rivers	(b)	4	285	289
Florida Project	(c)		16	16
TOTAL PRESENT		471	1,315	1,786

(a) Engineering Advisory Committee Report.

(b) Jex Report.

(c) USBR Reports.

(d) SCS Report. Includes little Dolores.

(e) SCS Estimate as of 1960 adjusted to 1965 as shown, according to Denver Water Board and Colorado Water Board estimates.

COLORADO RIVER BASIN

ESTIMATED AUTHORIZED OR COMMITTED DEPLETIONS
CHARGEABLE TO COLORADO

(Subject to adjustment)

Units — 1,000 acre feet

	Trans- mountain diversions	Irrig., M&I, & res. evap.	Total
Yampa & Green Rivers			
Savery-Pot Hook Project		26	26
Hayden Steam Plant		12	12
Gunnison River			
Fruitland Mesa Project		28	28
Bostwick Park Project		3	3
Colorado River—Main Stem			
Homestake Cr. Diversion	74		74
Pueblo-Eagle River	3		3
Fryingpan-Arkansas Project	70		70
Silt Project		6	6
Colo. Springs-Blue River	6		6
Denver-Blue River	240		240
Denver-Moffat Tunnel			
Denver-Williams Fork			
Denver-Eagle & Piney R.			
Englewood-Moffat Tunnel	10		10
Independence Pass Tunnel	14		14
General			
Oil shale development (a)		100	100
Main stem res. evap.		342	342
TOTAL—			
AUTHORIZED & COMMITTED	417	517	934
GRAND TOTAL—PRESENT,			
AUTHORIZED & COMMITTED	888	1,832	2,720

(a) Private appropriations supplemented by Ruedi and Green Mountain Reservoirs.

COLORADO RIVER BASIN
ESTIMATED POTENTIAL DEPLETIONS CHARGEABLE TO
COLORADO

(Subject to adjustment)

Units — 1,000 acre feet

	Oil shale	Total Irrig., M&I. & res. evap.	Accum. total
Total—Present, authorized & committed			2,720
* Animas-La Plata		93	2,813
* Dolores		74	2,887
* Dallas Creek		37	2,924
* West Divide	44	71	2,995
* San Miguel		74	3,069
* Yellow Jacket	32	57	3,126
Battlement Mesa		11	3,137
* Bluestone	10	13	3,150
* Grand Mesa		32	3,182
* Upper Gunnison (Including Tomichi Creek, East River & Ohio Creek)		22	3,204
Basalt		26	3,230
* Juniper (Including Great Northern) Middle Park (Including Troublesome & Rabbit Ear)		97	3,327
		29	3,356
* Four counties export—Yampa		10	3,396
* Potential oil shale uses	64	64	3,460
* Potential transmountain diversions		130	3,590

* Includes municipal and industrial water.

Colorado allocation by Upper Basin Compact: $7,450 \times 51.75\% = 3,855$.

Available supply re Tipton Report: $6,250 \times 51.75\% = 3,234$.

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Mr. Moses has both his undergraduate and his law degree from the University of Colorado. He is a past president of the Colorado Bar Association and the San Luis Valley Bar Association. Other positions include that of Vice Chairman of the Western States Water Council; Chairman, Water Law Committee, Rocky Mountain Mineral Law Foundation; and member of the Executive Committee of the University of Colorado Law Alumni Fund.