

MEMORANDUM

July 27, 1966

TO: S. E. Reynolds, State Engineer
FROM: Philip B. Mutz, Staff Engineer
SUBJECT: Bureau of Reclamation Re-evaluation Report on Navajo Indian Irrigation Project

The subject report and its appendices have been reviewed. No attempt was made to review designs and estimates.

REPORT CONCLUSIONS

The Bureau's conclusion 1, first page 6 of the report, and the similar conclusion page U1-13 of the appendices, are subject to discussion.

1) The available depletion is not likely to support the depletion requirements listed by the Bureau.

2) The Bureau's "presently predictable potentials" do not include: a) municipal and industrial water for expansion of population in the San Juan Basin; b) an appraisal of the total irrigation potential of the basin; c) water for the oil industry and d) the listed potential for petrochemical development is so small that it should not be categorized as "petrochemical".

3) The Bureau's selection of the predictable potential/especially selective to thermal power which leads to additional assumptions on coal development, water use, etc. which may be

questioned.

Bureau conclusion 2, page 6, does not appear to be supported by the report. The conclusion may be valid but should point out objectives or otherwise be specific.

PLAN FORMULATION

1) The report assumes development of the proven economically mineable coal reserves within a period of 35 to 40 years. The report also assumes this coal to be used for thermal-electric power generation and assumes further that coal-fired units would not be competitive 30 to 40 years hence in light of the progress in nuclear power development. These assumptions, coupled with the normal life expectancy of thermal power facilities, brings the Bureau to conclude that it is necessary to exhaust all the economically mineable coal in 40 years. Coal-fired thermal-electric plants would require an average annual diversion of about 126,000 acre-feet of water and an associated depletion averaging 116,800 acre-feet per year to exhaust the coal in 40 years. It seems to me that:

a) There should be no great rush to exhaust all of the economically mineable coal in the area;

b) It may be reasonable to assume that not all of the fossil-fueled thermal-electric plants will be replaced by nuclear power within the next 40 years; and

*Account of
them must complete
for only 39 years*

c) If all the projected generating capacity is constructed, it may be reasonable to assume that there will be sufficient life in these large installations to exhaust the economically mineable coal reserves; about 48 years would be required at the projected capacity.

Thus, it is my opinion, neglecting political or legal barriers, that the 6975 megawatts of existing, scheduled and tentative planned generating capacity should be the maximum capacity assumed for this area.

The report uses 90 to 93% depletion of each acre foot of water diverted to thermal-electric uses. The depletion rate per megawatt installed is comparable to that of Arizona Public Service Company, about 19 acre feet per megawatt. However, the diversion is considerably lower rate per megawatt installed capacity than Arizona Public Service Company's existing and scheduled facilities. It appears, therefore, that additional consideration might be given the diversion requirement of these large thermal-electric generating plants.

2) The report submittal states that the object of the studies reported on is "... to develop a plan to optimize the net benefits to the Indians from the water allotted to the Navajo Indian Irrigation Project." The report appears to deviate from the above quoted objective or to expand the Navajo Indian

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revised*

Not revised!

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Irrigation Project. The report finds that there is an average annual depletable water supply of 364,000 acre-feet available for the development of petro-chemical and footloose industries, thermal power and a 110,630 acre Indian irrigation project.

Why?
(Emphasis supplied) The words "depletable water supply" could be misleading and confusing. Why not use an accurate description, i.e. depletion?

3. The total depletion^(364,000) is composed of 254,000 acre-feet from the authorized Navajo Indian Irrigation Project, 100,000 acre-feet of municipal and industrial water supply at Navajo Reservoir and 10,000 acre-feet depletion from the unused municipal supply in the Farmington-Shiprock area. Further, the report finds that the total depletion resulting from full development of the potential petro-chemical and footloose industries, thermal power and a 110,630 acre irrigation project would average 379,300 acre-feet per year, leaving a deficiency of 15,300 acre-feet per year, (379,300 less 364,000). The report goes on to state that conservatively low efficiencies were used in estimating the water requirements for irrigation and with a small increase in the overall efficiency, sufficient water would be available to supply the indicated deficiency. Thus, a controversial subject may be injected by this assessment of the available water supply and its projected use. It could be said that the report projects all the

water supply remaining available to New Mexico in the San Juan Basin, except for the irrigation portion of the Animas-La Plata Project, as usable to benefit the Navajo Indians.

The stated criteria^{ow} of the report was to optimize the net benefits to the Indians from the water allotted to the Navajo Indian Irrigation Project.

4) The report has not evaluated future water requirements for population expansion of any of the communities in the San Juan Basin, nor has it given consideration to furnishing water to the Town of Gallup. Other alternative uses of water, including secondary oil recovery or irrigation of additional lands, are not given consideration.

The report appendices state that water could be used in the San Juan Basin for secondary recovery of oil, then dismisses such use as follows: "Use of water allotted to the Navajo Indians for this purpose would not be very beneficial to the Navajos. Thus, it is unlikely that a permit could be obtained to use a portion of their allotted water for oil well flooding." ~~Such an approach is appalling.~~ The return in dollars per acre foot of depletion for water used in secondary recovery is one of the largest returns per acre foot for any type of water use. In addition, there are other interests and other water supplies in the San Juan Basin than that of the Navajos. Use of a portion of New Mexico's San Juan water for secondary recovery likely will

Not
Navajo
for Indian

provide more return to this state and to the Navajos than the other uses projected by the report.

5) The average annual depletion available includes water from the Animas River that would be made available by the Animas-La Plata Project, and water to which the City of Farmington holds a water right but has not put all the water to use. It does not appear logical to ~~us~~^{us} to consider Farmington's unused water available for the industrial and irrigation requirements of this report. As pointed out previously, the report makes no estimate of Farmington's future growth and apparently does not make allowance for water for the population expansion that is bound to result from the developments projected by the report. It appears unreasonable to report on potential development in the San Juan Basin that will use all of New Mexico's available water and at the same time neglect to report on or allow water for population expansion in the Basin. It is even more unreasonable to project no additional municipal requirement by Farmington and others.

In connection with Farmington's water rights, the report states that Farmington owns water rights totaling 17,800 acre-feet of water annually and the present annual depletion is about 3900 acre-feet. The 17,800 acre foot value is only alright for a "ballpark number". The 3900 acre-feet of present depletion by Farmington is too high. Our estimates in 1965 indicated a smaller depletion by the town.

The table on page 21 of the report shows a ^{diversion}~~division~~ of 17,500 acre-feet which probably should be 20,000 acre-feet.

6) The report states that an increase in overall efficiency of irrigation operations would supply approximately 15,000 acre-feet annually of additional depletion. The language of the report may be intended to imply a reduction of the incidental depletions associated with the irrigation project. An increase in the efficiency of the irrigation project, especially if it is the farm irrigation efficiency, would not ~~result in~~ decrease ~~in~~ the total depletion by the irrigation project. The wording in the report and the appendices should be revised.

7) On page II-6 the reports state that the 100,000 acre-feet of municipal and industrial water available from Navajo Reservoir has been applied for as follows:

Company	Acre Feet
UC and M Co.	48,000
E P N G Co.	30,000
P S Co. of N.M.	22,000

It was my understanding that additional expressions of interest in water available from Navajo Reservoir have been received by the Bureau. Notable among those left out of the report is the Town of Gallup, who have long stated that they wish to be considered for at least 15,000 acre-feet of water from Navajo

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Reservoir. Also left out of the report is the Humble Oil Company's application for about 15,000 acre-feet of water.

Thus, the Bureau's report is selective and ^{preferential} ~~selective~~ to thermal power development.

8) On page II-8 the Bureau states that a generating plant site could be selected which would be convenient to the individual coal leases of U C and M Co., E P N G Co. and P S Co. of New Mexico, water could be delivered from the irrigation project facilities and the site would not interfere with the proposed irrigation facilities. Previous to this statement, the report states that the Public Service Company of New Mexico owns two coal areas; one located near the above mentioned site, the other located north of Fruitland, New Mexico and which could not be served through the irrigation facilities of the Navajo Indian Irrigation Project.

The report does not state and it is not known if the Public Service Company's coal area near Bisti is sufficient for development of the generating capacity assumed. Further, it is not clear to me why such emphasis has been placed by this report on the development of the P S Co. of N. Mex. coal leases which are off the Navajo Indian Reservation. It is true that development of these coal reserves would have an impact on the Navajo Tribe because of the employment opportunity to Navajos that would be associated with the development of these coal reserves.

9) At page II-9, Appendices, it is suggested that a possible source of water for the additional thermal-electric capacity required to exhaust the known economical coal reserves in 40 years would be a temporary use of 26,000 acre-feet of Navajo Indian Irrigation Project water. The report suggests that full development of irrigation project will likely be spread out over a long period of time and such temporary use of the water would be desirable and beneficial to the Tribe.

*Irrigation
feet*

Agricultural Economy and Land Classification

1) The report states that 32% of the area selected for the 110,630 acres is subject to only a low-grade, reconnaissance, land classification. This is same type of classification the 1957 report used to delineate 110,630 acres, and was one reason for the selection of different lands in ^{the} reappraisal report of 1965.

2) The report computes the payment capacity of the proposed project to average \$62.55 per acre. Such value appears high when compared to the payment capacity computed for other irrigation projects. The report assumes 40% of the area will be represented by a general farm with potatoes. The budget for this type farm has a payment capacity of \$53.03 per acre. The budgets have not been examined in detail, and items noted include:

- a) The investment for livestock appears low; \$11 per animal unit for sheep, \$226 per animal unit for dairy stock and \$87 per animal unit for beef cattle.
- b) Yields used were estimated to occur about 20 years following the end of the development period. The effect of such yield assumption on the projects annual return is not explained.
- c) Of the total value project of farm sales, apples constitute 30%, onions 16%, potatoes 10% and lettuce 6%, or 62% of the farm sales are from

these crops. Are markets and facilities for market preparation available or expected?

d) Apple yields are estimated @ 450 bushels per acre. Probably twice the present average yield in the San Juan Basin and likely 50% more yield than the project might produce.

e) Use of realistic yields for apples and corn could reduce the payment capacity from \$62 to \$20-\$25 per acre.

3) The beef budget, assumed for 15% of the project area, has a repayment capacity of \$8.31 per acre, \$2.3 less than the amount required for O & M. Who makes up this \$2.13 deficit?

4) The average payment capacity per acre for the project is \$62.55. The average payment capacity of the new lands in New Mexico in the Bureau's Animas-La Plata Project is \$7.25 per acre, with the highest payment capacity only \$7.70 per acre. The average payment capacity per acre computed for the Navajo Indian Project in the 1955 report was about \$9.00 per acre. Neither the 1955 report nor the Animas-La Plata Project would produce sufficient payment capacity to return the \$10.44 per acre O & M cost of the proposed project.

5) At page III-15, the report states that no attempt is made to adjust the average 23-year crop production to reflect water shortages. The water shortages listed in the 23-year period include a 10% shortage in 1954, a 43% shortage in 1955 and a 46% shortage in 1956. The report states that shortages

of less than 15% are not possible of accurate evaluation in terms of payment capacity. The shortages in 1955 and 1956 probably affect payment capacity and would be expected to occur twice during the repayment period of the project. The report states that adjustments for water shortage are not warranted because overall payment capacity of ^{the} project is more than adequate to meet operation and maintenance charges. However, reference is made to comment 4 page 11 this memo.

6) No Colorado River depletion charge is used in the benefit/cost analysis.

Operation and Maintenance

1) The report shows that the operation and maintenance costs for the 110,630 acre project would be \$10.44 per acre and the construction cost would be \$175 million. The Construction cost is 22.6 million dollars less than the cost of developing the 110,630 acre project which crosses the Chaco. The operation and maintenance cost estimated for a 110,630 acre project which crosses the Chaco is only \$6.30 per acre. Thus, in 49 or 50 years the difference in construction cost, neglecting interest, between the re-evaluation and the reappraisal project plans will be used up by the increased operation and maintenance costs required for the plan in the re-evaluation report.

2) About 70% of the total acreage to be served in the re-evaluation report requires a pump lift. The energy purchase cost for the project is a large part of the increased O & M.

3) The largest portion of the increased O & M is to

serve about 20,000 acres near Bisti, which area requires several re-lift pumps. O & M costs for a 90,000 acre project east of the Chaco are

estimated at \$7.37 per acre. Thus, to increase the project 20,000 acres increases the O & M cost for the entire project by \$3.07 per acre. The increment of O & M for the 20,630 acres would be about \$24 per acre. The difference in construction cost between the 110,630 acre and 90,000 acre project is 28 million dollars. In 57 years this difference in construction cost, neglecting interest, will be used up by the increased operation and maintenance costs required for the 110,630 acre project.

4) The Bureau report proposes a hydro-power plant at Navajo Dam. The energy generated would be fed into the Colorado River Storage Project power pool and equivalent energy from the pool used to pump water on the project. The report indicates the energy produced by the Navajo Dam power plant would supply practically all energy required for a 90,000 acre project, but about \$450,000 additional annual energy purchase would be required for the 110,630 acre project. If all of the M & I water from Navajo Reservoir is diverted in the Navajo Irrigation Project Canal, will water remaining for downstream release through the power plant at the dam generate the assumed available energy for project pumping? We doubt that the remaining water would produce the power assumed; a hydro-power plant may not even be justified. If additional energy for project pumping must be furnished who will pay? Additional O & M charge? Might add several dollars per acre to O & M.

5) No O & M charges are listed for O & M on the additional development required by others, although the cost of the additional development is ~~developed~~ ^{estimated} by the report.

These factors should be considered carefully by those who must assume the O & M charges. 12

Miscellaneous

- 1) Page 2 of the report states a final meeting was held July 21. The date should be changed.
- 2) Page 3 of the report, 1st paragraph under Crude Oil, the language of the last sentence could be revised to eliminate assumed . . . estimates . . . are fairly accurate.
- 3) Page 16 of report - a typo - 11,630 should be 110,630.
- 4) Page 23 of the report - first table, 3rd line, "field irrigation" should be "crop irrigation".
- 5) The report, on page 8, lists payroll and other income per acre foot of depletion and indicates that irrigation will produce more such income per acre foot of depletion than will thermal electric power. Previous studies made by the University of New Mexico had indicated that the return from thermal electric power exceeded the return from irrigation. How does the relation of the analysis of the payroll and other income per acre foot of depletion compare to the University of New Mexico estimate?
- 6) In the basic estimate of the report a total of 9.5 million dollars is included for drains. At page A-2 of the Appendices, it is stated that ^{to \$15} \$10₁ per acre has been added to the development costs to provide sub-surface drainage. Is one of these items a duplication of drainage facilities?
- 7) The map at the beginning of Appendix Chapter III shows a 110,630 acre project encompassing lands west of the Chaco.

No P

References to this map in the narrative of Chapter III indicates that the report is dealing only with lands located east of the Chaco.

8) The Bureau of Sport Fisheries and Wildlife report on the project recommends construction of three reservoirs on return flow channels to provide additional fishery in the area and suggests ^{another} potential project to provide fishery. These recommendations have not been commented on by the Bureau of Reclamation. Of course, such development would increase the consumptive use attributable to the project. The New Mexico Department of Game and Fish has approved the report of Bureau of Sport Fisheries and Wildlife.

9) According to the schedule of operation, Gallegos reservoir would release water in June and July and would be refilled in August, September and October. Probably more than 50 percent of the evaporative loss from the reservoir could be saved if it were filled in the March-July period. The report indicates canal capacity available in these months for filling the reservoir. Some loss to fish and wildlife benefit would result if the filling schedule were changed. However, it may be more important to save water than to secure the relatively minor fish and wildlife benefits.

10) At page VI-13 the conclusion is reached that sufficient water is available, with careful management practices, to permit the full development of the potential petro-chemical and footloose industries, thermal power and the 110,630 acre irrigation project. This

conclusion is reached by pooling all available water, including Farmington's existing water rights and assuming that irrigation efficiencies can be increased to supply the required depletion. We do not agree with this conclusion nor the similar conclusion 1 on page 6 of the report for several reasons which have been advanced previously.

CONSUMPTIVE USE AND DIVERSION DEMAND

1) The report, at page VI-2, states that the growing season and K-values for the growing season were taken from the New Mexico State Engineer Technical Report No. 32. In Table V of the report, appendix, the growing season is tabulated to include a portion of the month of April, which is in the pre-frost period. The report K-value for the pre-frost period is not the same K-value listed for this period in Technical Report 32. The frost-free periods listed in the report for Bloomfield, Shiprock and Newcomb are not the same as the frost-free periods listed in Technical Report No. 32.

2) The report computes the total crop consumptive use requirement for irrigation water including an estimate for winter consumptive use, the latter labeled primarily a loss of available soil moisture. The methodology is similar to that advanced by the Bureau for the recently reviewed El Rito report and proposed by the Bureau for the Pojoaque unit of the San Juan-Chama Project. The report K-value used for the winter months is less than that used by the Bureau in the El Rito report and proposed for the Pojoaque Unit. We do not agree with the methodology or the assumptions used in the Bureau's soil-moisture analysis.

3) We have made an independent analysis of crop irrigation requirements, employing methods previously used by this office, Technical Report No. 32 and Department of Agricultural Technical

Release No. 21. While no actual data is available on local irrigation practices, the irrigation season dates used in our analysis are believed reasonable in light of personal knowledge of practices in the area.

4) The Bureau's assumed crop pattern for the project may not be reasonable because of: a) the required scheduling of farm operations to accomplish initial irrigation and planting; b) the area devoted to annual crops may not provide sufficient allowance for crop rotation and soil building; and c) the assumed cropping pattern has onions double cropped with lettuce and carrots; such double cropping likely cannot be accomplished in this area within the growing season available.

Our independent analysis of the crop irrigation requirements was made using the Bureau's crop pattern.

OK | 5) The Bureau's report assumed farm efficiency for the project area at 60%. Data secured in the area by Mr. C. H. Deibold, and used by the San Juan Technical Committee and apparently used by the Bureau of Indian Affairs in their 1955 feasibility report on the Navajo Indian Project, indicates that the farm efficiency probably will not exceed 55%. Our analysis assumes a 55% farm irrigation efficiency.

6) According to the Bureau report conveyance system ^{sew} seepage losses for the entire system will average 5.5% and the

seepage losses in the Shiprock area will be higher than in the South San Juan area. The Bureau report states that all canals and laterals of the system will be concrete lined.

The report computed seepage losses for the entire system will total about 99 cfs; over a seven-month irrigation season the total loss would be about 42,000 acre feet. The report tabulates the total of seepage losses and waste from the conveyance system at 162,000 acre-feet per year. Subtracting the seepage loss would leave 120,000 acre-feet for waste, or ^{about} ~~more than~~ 25% of the diversion would be wasted from the conveyance system. The Bureau's total seepage and unavoidable waste in the conveyance system averages 33% of the diversion for the Shiprock area and 30% for the South San Juan area.

It appears that the estimate ^{of} ~~and~~ total seepage and waste loss are too high for the project. With a lined canal system and with 70% of the project area to be served by pumping it appears reasonable to assume that unavoidable waste in the system will be much less than used by the Bureau. An allowance of 15% of the diversion for unavoidable waste in the ^{South} San Juan division and 20% in the Shiprock division should provide ample allowance for this type of loss. Adding 5% for conveyance seepage loss would result in a total conveyance system loss of 20% in the south San Juan Division and 25% in the Shiprock division. Our analysis assumed these values.

The following tabulation compares the crop irrigation and diversion requirements computed by our analysis to that by the Bureau.

	Unit-Acre Feet per Acre			
	Bureau 1966 Re-evaluation Report		ISC Analysis	
	South San Juan	Shiprock	South San Juan	Shiprock
Crop Irrigation Requirement	1.88	2.00	1.9	1.9
Farm Efficiency	60%	60%	55%	55%
Farm Delivery	3.14	3.34	3.5	3.5
Conveyance Loss	30%	33%	20%	25%
Diversion Demand	4.50	5.00	4.40	4.70

The Bureau's crop irrigation requirement provides sufficient water for the crop pattern assumed. It also appears that the Bureau's diversion requirement provides ample ^{water} ~~diversion require-~~ment and may attempt to duplicate the diversion requirement set forth in the feasibility report of 1955 without regard to the changed conditions.

The principal differences between the 1966 report and the 1955 report are: a) a change in cropping pattern; b) increased

crop consumptive use rates; c) an increase in farm efficiency; d) an improved and shorter conveyance system; e) relocation of lands to a more compact "block" and f) additional pumping required to serve the lands selected.

Stream Depletion

1) The report indicates annual lake surface evaporation rates of 2.8 feet for Cutter and Gallegos Reservoirs. Data on evaporation rates secured from the area by this office indicate that the annual rate is about 4.0 feet at Cutter and about 4.3 feet at Gallegos.

2) The Bureau's report states that depletion of project return flows were computed by determining the average sandbedded width of the major return flow channels, the length of such channels and applying the free water surface evaporation rate to the area of the channels. The report states ". . . losses from a sandbedded stream with water at a 1-foot depth are approximately the same as free water surface evaporation." Apparently, the above quotation is intended to imply that the loss from a sandbedded stream with water table at a depth of 1-foot is approximately the same as free water surface evaporation. Such an assumption would be reasonable. The Bureau's listed rate of "free water surface evaporation" is 2.8 feet. The 2.8 feet is probably free water surface evaporation less total precipitation. It is believed that this rate is too low. Free water surface evaporation in this area, using a 0.7 pan coefficient, probably would be 4.5 to 5.0 feet.

3) Under careful project management, including drainage of seeped areas and good care of drainage facilities it appears reasonable to assume that incidental depletions could average

Insert to Page 22

2a) We suggest that the per acre rate of loss for return flow channels used by the San Juan Technical Committee be applied to the Bureau's channel acreage to estimate losses on the return channels. Employing such data the return channel depletion would be about 20,000 acre feet and 5,000 acre feet annually in the Shiprock and South San Juan areas, respectively. The unit rate per productive acre would be 0.30 and 0.14 acre feet per acre for the Shiprock and South San Juan divisions, respectively. Our analysis used these rates.

about 15% of the crop consumptive use requirement. Thus, the incidental loss would have a unit depletion rate of about 0.30 acre feet per acre.

4) The Bureau's depletion of conveyance system loss appears reasonable and was used.

	<u>Bureau Reevaluation Report</u>		<u>San Juan Technical Committee</u>		<u>ISC Analysis</u>	
	South San Juan	Shiprock	South San Juan	Shiprock	South San Juan	Shiprock
Crop C.U.	1.88	2.00	1.56	1.71	1.89	1.91
Incidental	.25	.26	.41	.44	.30	.30
Ret. Channels	.12	.24	.08	.21	.14	.30
Conveyance ¹	-1	-1	.10	.13	.06	.13
Total	<u>2.25</u>	<u>2.50</u>	<u>2.15</u>	<u>2.49</u>	<u>2.39</u>	<u>2.64</u>
Use	2.25	2.50	2.20	2.50	2.40	2.65

Our independent analyses of the depletion rates for lands in the Shiprock and South San Juan areas are tabulated above and compared to similar values from the Bureau report and to data from the San Juan Technical Committee.

1 Included in incidental. From data in report, conveyance loss depletion is 0.06 and 0.13 af/a for South San Juan and Shiprock, respectively.

It appears that the stream depletion computed by the Bureau for the project may be low.

N.B.

The following tabulation compares the computed stream depletion by the proposed project under our analysis and that computed by the Bureau:

	Unit Acre Feet	
	Bureau	ISC
Shiprock	171,200	182,000
South San Juan	80,100	85,000
Reservoir evap. (Cutter-Gallegos)	2,700	4,000
Total	254,000	271,000

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Our analysis of the proposed Animas-La Plata Project, my memorandum dated January 31, 1963, indicated that the Bureau's computed depletion for that project might also be low. Our review of the Navajo report supports this previous finding. Of course, the actual depletion by the respective projects must await actual project development. One of the chief factors causing stream depletion by an irrigation project is the crop pattern. A change from the assumed crop pattern can significantly affect the resulting depletion. ^{Deviation from assumed} Incidental use and losses on return flow channels can also affect the projects stream depletion.

Why?

N.B.

Our analysis also confirms our previous conclusions that reservoir evaporation loss rates used by the Bureau for Navajo Reservoir are too low.

How much?

Conclusion

- 1) The 110,630 acre project reported by the Bureau may cause a stream depletion exceeding 250,000 acre feet.
- 2) To achieve about 250,000 acre feet of depletion by the project may require a change in cropping pattern, reduction of incidental or return flow depletions, or a smaller acreage irrigated.
- 3) A reduction of about 8,000^{acres} of irrigated (productive) acres in the Shiprock division might reduce the total project depletion to about 250,000 acre feet.
- 4) The diversion demand at Navajo Dam for ^{the} project reported can reasonably be met by diversion rates of 4.40 acre feet per acre for the South San Juan and 4.70 acre feet per acre for the Shiprock areas, respectively. It is recommended that large wastes resulting from over-diversion at Navajo Dam be eliminated. Extra water diverted at Navajo Dam increases the opportunity for additional stream depletion, and may require unnecessary pumping.
- 5) The 20,000 acres of land requiring several pump lifts near Bisti and included in the 110,630 acre project requires relatively high operation and maintenance costs.
- 6) The payment capacity derived by the report should be reviewed.
- 7) The energy for project pumping should be reviewed in light of power production potential at the proposed Navajo Dam hydropower plant.

8) Water for expansion of municipalities in the San Juan Basin should be reserved and not considered available for petro-chemical and footloose industries, thermal-power and irrigation development. Such expansion may require 5 to 10 thousand acre feet of depletion.

Basin?
3000 for report - from LaPlata

9) Previous Bureau estimates of the depletion by the Animas-La Plata Project and the evaporation loss from Navajo Reservoir are likely too low.

Why?