

## **ALTERNATIVE #3 - An In-Basin Solution Using An Enlarged Lake Ashtabula Reservoir**

This is an in-basin alternative that adds storage capacity by raising the height of Bald Hill Dam and thereby increasing the size of Lake Ashtabula. It incorporates six features:

Feature 1 — Enlargement of Lake Ashtabula to provide additional storage on the Sheyenne River. The model results show that the maximum pool size that could be attained at any point during a 1930's-style drought would be 120,000 acre-feet (compared to the existing 66,600-acre-foot pool). A reservoir of this capacity can be created with about a 7-foot raise of the reservoir maximum water surface.

Feature 4 — A water-supply pipeline from the Sheyenne River near Kindred to the upper Red River near Wahpeton, with a branch to Abercrombie. The pipeline and its associated pumping plant provide water at 18 cfs to offset shortages at the existing Cargill plant and at New Industry 3 near Abercrombie.

Feature 5 — A 22,000-acre-foot ring-dike reservoir near Fargo to store high spring flows from the Red River, and a second ring dike reservoir on the Sheyenne River. Red River ring dike requires a high-capacity (400-cfs), low-head pumping plant to take advantage of short-duration high spring flows. Sheyenne River ring dike requires a 200 cfs capacity low head pump. Water in the ring dike can be released later in the year for use by Fargo, West Fargo, Moorhead, or New Industry 2 near Fargo. No specific site has been selected for the ring dikes, but they are assumed to be within 1 mile of the river channel.

Feature 7 — Secure additional ground water from the Spiritwood Aquifer. This feature is required to meet projected future rural water system shortages and shortages at New Industry 5. The rural water system using this well field is the Dakota Water Users. The projected shortage is met without construction of an extensive pipeline transmission system. No additional treatment plant costs are used since Dakota Water Users current treat and deliver some Spiritwood Aquifer water. A cost estimate, based on 6600 ac-ft of annual withdrawal, with booster pump and pipeline to Lake Ashtabula, as estimated from Feature 7, as \$25.0M.

Feature 8 — Secure additional ground water from the purchase of existing irrigation water rights in the Sheyenne Delta, Page/Galesburg, and Elk Valley aquifers. The main aquifers described in Feature 8 can be considered for supplying ground water to rural water systems by the water right transfer estimate. The rural water systems currently hold ground water appropriation rights in these same aquifers, therefore it would become an expansion on their existing water source.

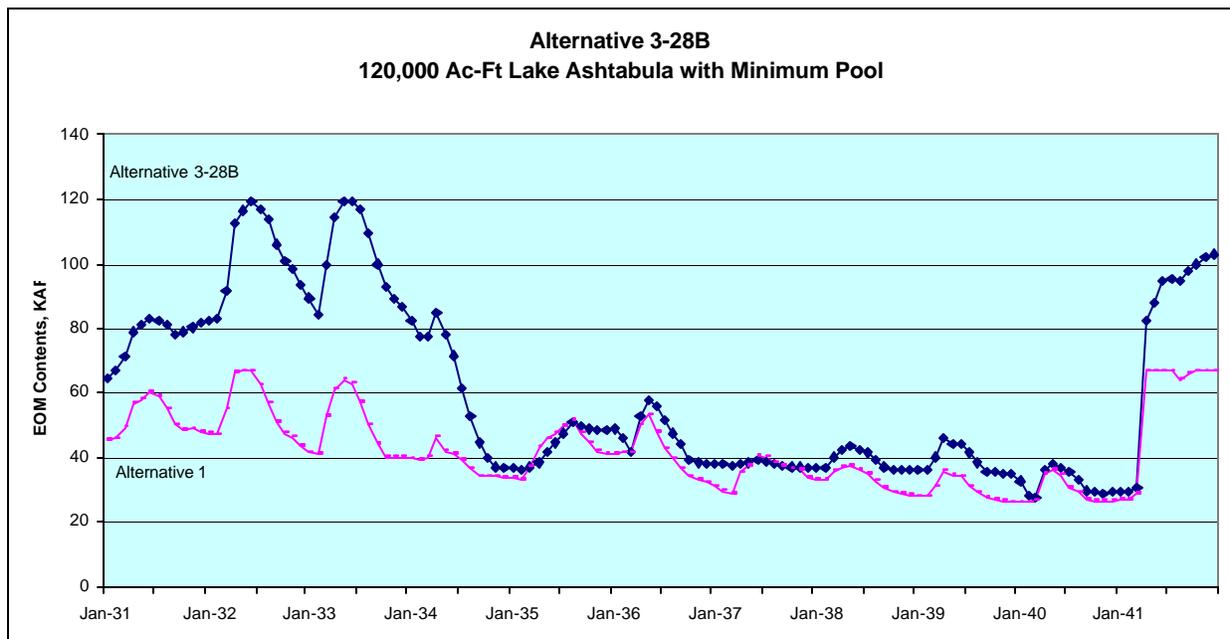
Feature 12 — Conservation. This is about a 15-percent reduction in demand. However, it is offset by a 15- to 20-percent increase in demand during drought years. (See discussion of this feature in chapter 5.)

These additional parameters also apply to Alternative 3:

- # The enlarged Lake Ashtabula is started at one-half of the active conservation pool, which is approximately 75,000 acre-feet of volume.
- # The ring-dike reservoirs near Fargo are started half full (11,000 acre-feet).
- # The 28,000 acre-foot minimum pool in Lake Ashtabula is maintained. As a result, this alternative has a reserve available in case of a drought even more severe than that of the 1930's. The minimum reservoir content during the 1930's drought is 27,590 ac-ft.
- # Existing water-storage allocation plans are modified. The concept here is to use Lake Ashtabula in the most efficient manner to assist in meeting peak demands during extreme drought. The most significant impact is the release of Grand Forks allocation for use by others. The Grand Forks water supply is subsequently made up of return flows on the Red River.

This alternative does meet all of the projected 2050 Reclamation demands. Due to the limited inflow to Lake Ashtabula during the critical years of the modeled drought period, a reservoir larger than 120,000 acre-feet would not fill. The 120,000 ac-ft reservoir is an increase in the conservation pool elevation from 1266 ft to 1273 ft. The cost estimate used from this design estimate is a total of \$39M, including land ROW and relocations.

An enlarged Lake Ashtabula meets all of the future shortages, however, existing groundwater supplies have to be re-allocated from irrigation to rural water system uses. Cost estimates have been included for purchase of irrigation water rights (Feature 8) to make up the shortages of the rural water systems.

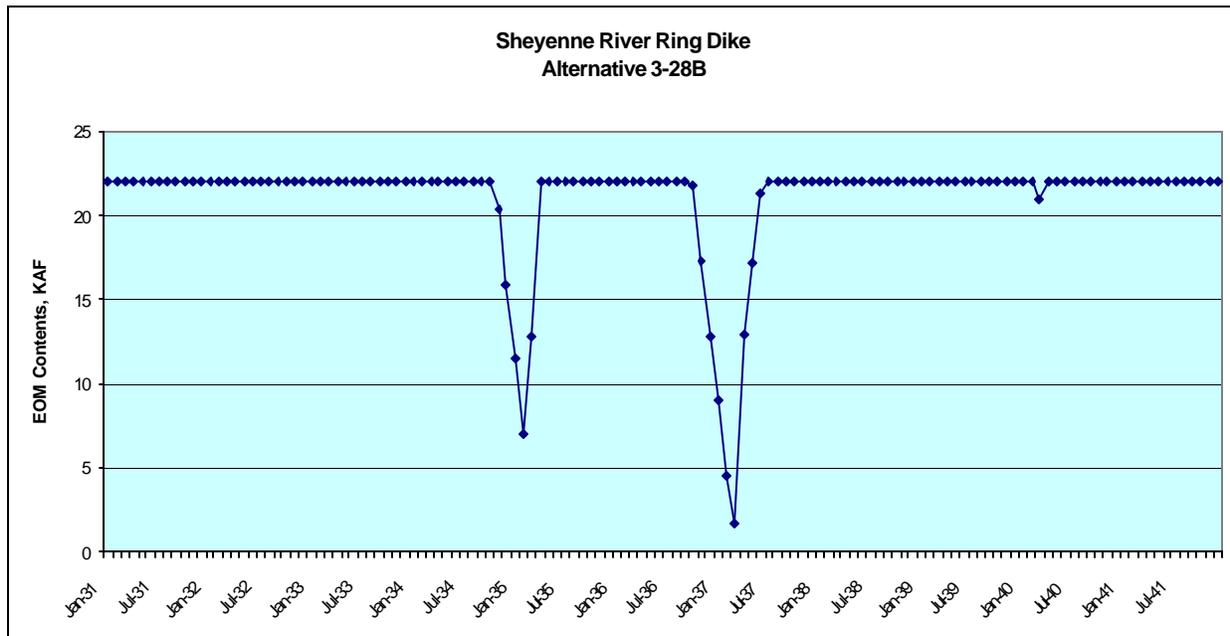


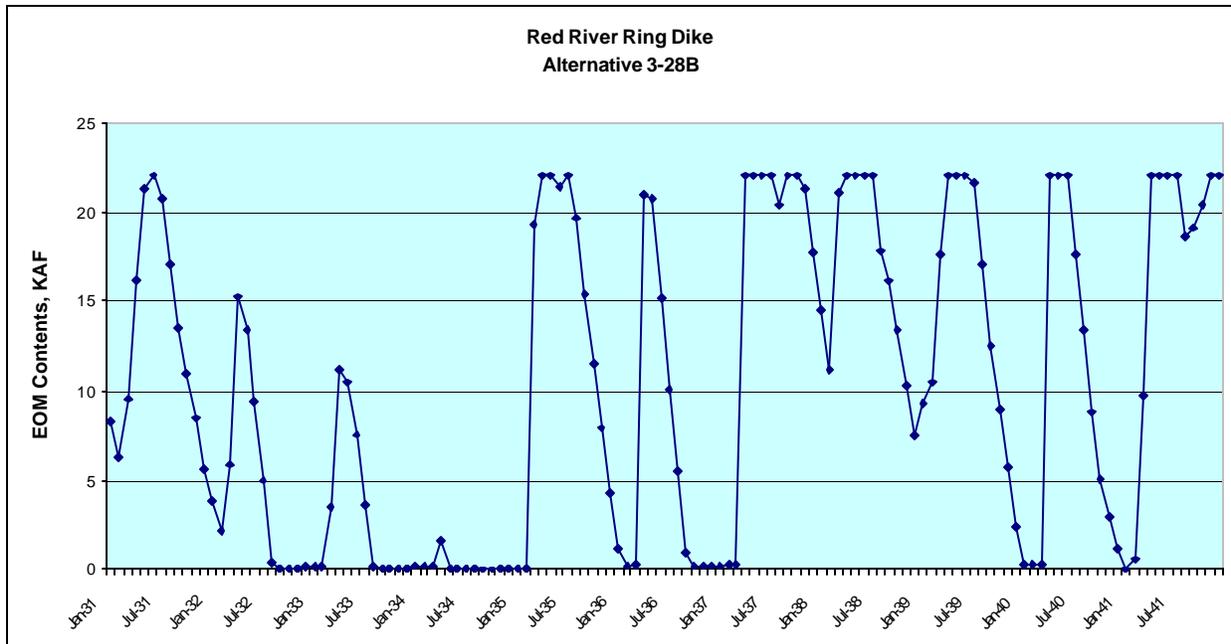
Feature 4D Summary: Pipeline Supply From Sheyenne River to Upper Red River

This feature has been included in this alternative in order to supply water needed on the upper Red River for shortages at the existing Cargill industry and the New Industry 3 located at Abercrombie. This feature provides for a diversion on the Sheyenne River near Kindred with an 18 cfs capacity pumping plant and discharge pipeline as described in Alternative 2.

Feature 5 Summary: Ring Dike Reservoirs

Two 22,000-acre-foot ring-dike reservoirs near Fargo are included to store high spring flows from the Red and Sheyenne Rivers. Capturing these flow with the capacity to fill the ring dike in one month requires a high-capacity (400-cfs for Red River and 200-cfs for Sheyenne River), low-head pumping plant to take advantage of short-duration high spring flows. Water in the ring dike can be released later in the year for use by Fargo, Moorhead, or New Industry 2. No specific site has been selected for the ring dike, but it is assumed to be within 1 mile of the river channel. Costs for real estate and relocations are the same as in Alternative 2.





Feature 7 Summary: Expanded Spiritwood Aquifer Use

This feature is required to meet projected future rural water system shortages. A cost estimate has been prepared for a potential withdraw of 6660 ac-ft of ground water per year from an area of the aquifer in northwestern Barnes County. The rural water system that benefits from this well field would be the local Dakota Water Users. The projected shortage could be met without construction of an extensive pipeline transmission system. No additional treatment plant costs are used since Dakota Water Users current treat and deliver some Spiritwood Aquifer water. A cost estimate, based on 875 ac-ft of annual withdrawal, and with smaller booster pump and pipeline, as estimated from Feature 7, would be \$25.15M.

Feature 8 Summary: Purchase of Irrigation Water Rights

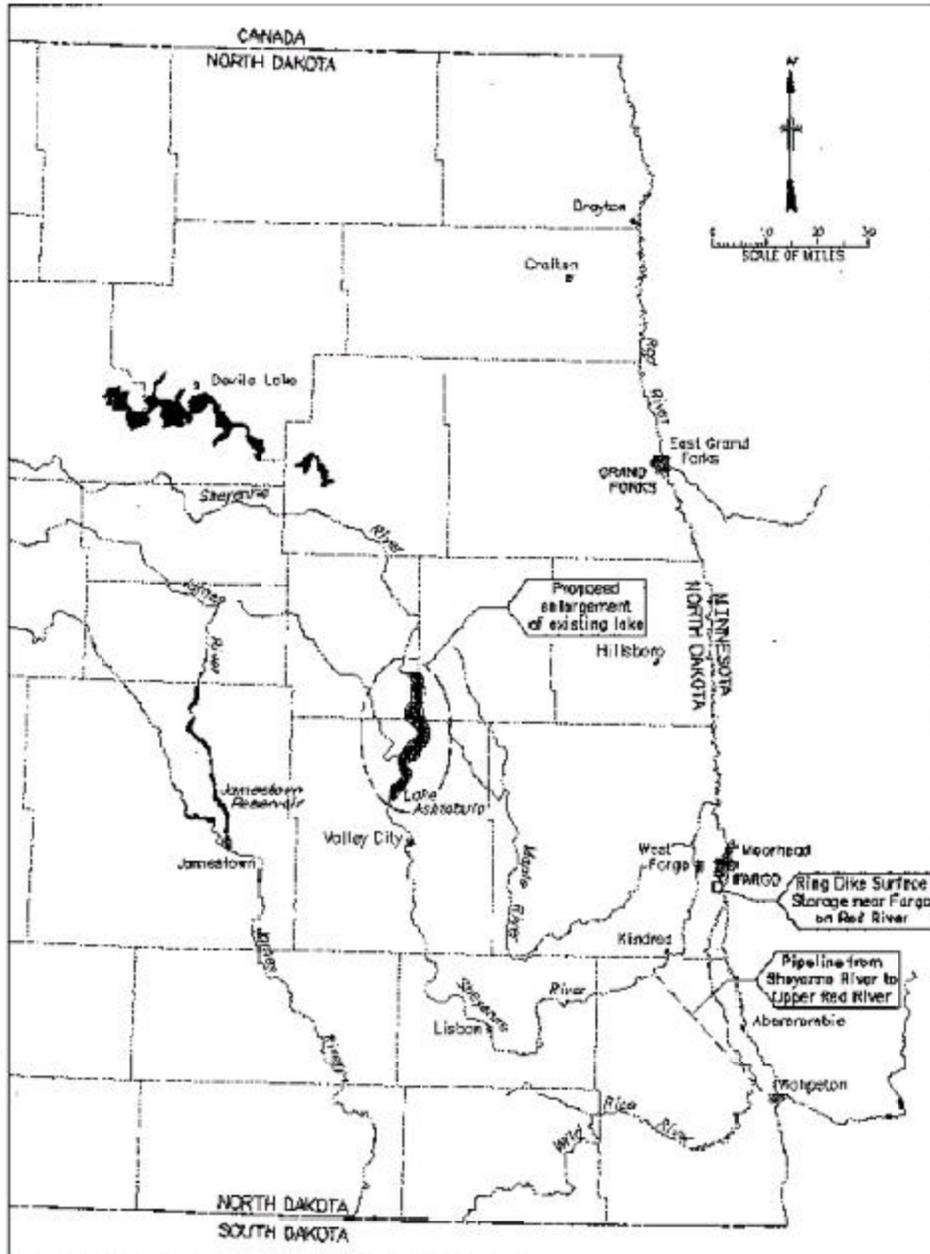
As described in Feature 8, future development of the existing aquifers is limited due to the size of each aquifer and the level of existing appropriations. Therefore, an estimate has been developed for the purchase of some irrigated land with the transfer, or re-appropriation of the existing irrigation water right to municipal use. The main aquifers described in Feature 8 can also be considered for suppling ground water to rural water systems by the same water right transfer estimate. The rural water systems currently hold ground water appropriation rights in these same aquifers, therefore it would become an expansion on their existing water source.

Using the previous Feature 8 estimate of annual yield of ground water available from the major aquifers, the following estimate is provided to meet future rural water shortages.

Sheyenne Delta Aquifer estimated annual yield from the purchase and re-appropriation of ground water

supplies is 2600 ac-ft for use by Cass, Southeast, and Ransom Sargent Rural Water systems. The Elk Valley estimated transfer amount is 3120 ac-ft per year to benefit Agassiz, Langdon, Walsh, and Grand Forks-Traill Rural Water systems. Transfers from the Page/Galseburg Aquifer are estimated at 1640 ac-ft per year and would serve the balance of Cass Rural, Traill, and Tri-County Rural Water systems.

ALTERNATIVE #3 ENLARGED LAKE ASHTABULA 120,000 Acre Feet Capacity		PROJECT: Red River Valley Water Supply									
		DIVISION:									
DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT	LIFE	Annual Operation	Annual Maintenance	Annual Replacement	Annual Energy	TOTAL ANNUAL
Feature 1 (Cost estimate based on 7 ft water surface raise at \$2,375,000 per ft from previous 9.1 ft raise estimate)											
Enlarge Lake Ashtabula (w/overtopping protection)		120,000	Ac-Ft	LS	\$16,625,000			\$100,000			\$100,000
Land ROW and Relocations (same as 9.1 ft water surface raise)		130,000	Ac-Ft	LS	\$8,900,000						\$0
Roads and Bridges (same as 9.1 ft water surface raise)		130,000	Ac-Ft	LS	\$13,500,000						\$0
Feature 4D											\$0
Pumping Plant and Pipeline to upper Red River		18	cfs	LS	\$44,000,000		\$53,000	\$15,200	\$195,300	\$104,000	\$367,500
Feature 5											\$0
Ring dike on the Red River near Fargo		22,000	Ac-Ft	LS	\$26,490,000		\$1,000		\$8,600		\$9,600
Ring dike Pumping Plant		400	cfs	LS	\$28,000,000		\$30,000	\$25,000	\$2,200	\$118,000	\$175,200
ROW and Relocations				LS	\$2,320,000						\$0
Ring dike on the Sheyenne River near Fargo		22,000	Ac-Ft	LS	\$26,490,000		\$1,000		\$8,600		\$9,600
Ring dike Pumping Plant		200	cfs	LS	\$16,500,000		\$35,000	\$20,000	\$1,400	\$70,000	\$126,400
ROW and Relocations				LS	\$2,320,000						\$0
Feature 7									\$0		\$0
Spiritwood Aquifer Use		6600	ac-ft	LS	\$25,000,000		\$79,300	\$31,700	\$206,500	\$21,600	\$339,100
Land & ROW (Dakota Rural & New Industry 5)		150	acres	LS	\$150,000						
Feature 8											
Sheyenne Delta Aquifer Use (Cass Rural, Southeast, Rnasom-Sargent)		2600	ac-ft	LS	\$8,757,000		\$25,000	\$15,000	\$45,700	\$10,500	\$96,200
Page/Galesburg Aquifer Use (Cass Rural, Traill, Tri-County)		1640	ac-ft	LS	\$12,310,000		\$25,000	\$15,000	\$64,100	\$41,000	\$145,100
Elk Valley Aquifer Use (Agassiz Rural, Langdon Rural, Walsh Water, Grand Forks-Traill)		3120	ac-ft	LS	\$14,500,000		\$40,000	\$30,000	\$63,100	\$29,400	\$162,500
						<b>Subtotal</b>	\$289,300	\$251,900	\$595,500	\$394,500	\$1,531,200
Existing GDU Supply Works, Continuing O&M									Unlisted Items +/- 20% GDU Assigned Cost		\$306,200 \$2,139,000
Mobilization (+/- 5%)					Included Above						
<b>SUBTOTAL</b>					\$245,862,000				<b>TOTAL ANNUAL OM&amp;R</b>		<b>\$3,980,000</b>
Unlisted Items (+/- 20%)					Included Above						
<b>CONTRACT COST</b>					\$245,862,000				<b>ANNUALIZED CAPITAL COST</b>		<b>\$17,540,000</b>
Contingencies (+/- 25%)					Included Above						
<b>FIELD COST</b>					\$245,862,000						
USBR Invest., Mitig., Engr. & Constr. Mgt. (+/- 33%)					Included Above				<b>TOTAL ANNUALIZED COST</b>		<b>\$21,520,000</b>
<b>TOTAL ESTIMATE</b>					<b>\$245,900,000</b>						
<b>QUANTITIES</b>		<b>PRICES</b>									
BY R. Burnett		BY K. Copeland	CHECKED								
DATE	APPROVED	DATE	PRICE LEVEL Appraisal								



**ALTERNATIVE 3 – Enlarged Lake Ashtabula**

Pipeline from Sheyenne River to Upper Red River Ring Dike on Red River – also includes conservation, modified Thomas Acker Plans, reservoir starting half full.