## ALTERNATIVES DESIGN INFORMATION

This section presents the alternatives that have been considered to meet the Year 2050 water supply shortages. These alternatives are combinations of the "Features" previously described. Various sizes and capacities have been used to represent a range of water supply options and also to assist in developing a range of costs. Modeling methods, assumptions and results of each alternative can be found in the Hydrology Appendix.

## ALTERNATIVE #1 - No Action (Future Without)

The "Future Without" is intended to represent the most likely future condition in the study area if no new major water supply project is constructed. This includes water available from local utility-sponsored changes currently in progress or likely to be constructed. It is anticipated that existing communities, rural water systems, and industrial developments will attempt to secure additional water supplies as their needs grow.

This alternative is presented as a basis for comparing future scenarios "with" a proposed water supply. In this No Action Alternative, there are no estimates of future construction cost since there are no specific proposals for development. A cost has been included for the on-going O&M of the existing Garrison Diversion Unit (GDU) facilities.

The modeling of the No Action Alternative is described in the Hydrology Appendix. The primary assumptions used in this future scenario are:

- Assumes Reclamations 2050 demand projections.
- Start with Lake Ashtabula active conservation pool half-filled (47,300 ac-ft).
- Maintain existing Thomas Acker allocations for Lake Ashtabula reservoir.
- Reserve Ashtabula minimum pool (28,000 acre-feet) for drought contingency.
- Include future Rural Water System shortages, but not in modeled surface water demands.
- Include conservation. This is about a 15% reduction in demand; however, it is offset by a 15% to 20% increased demand in drought years (see Hydrology Appendix for details).

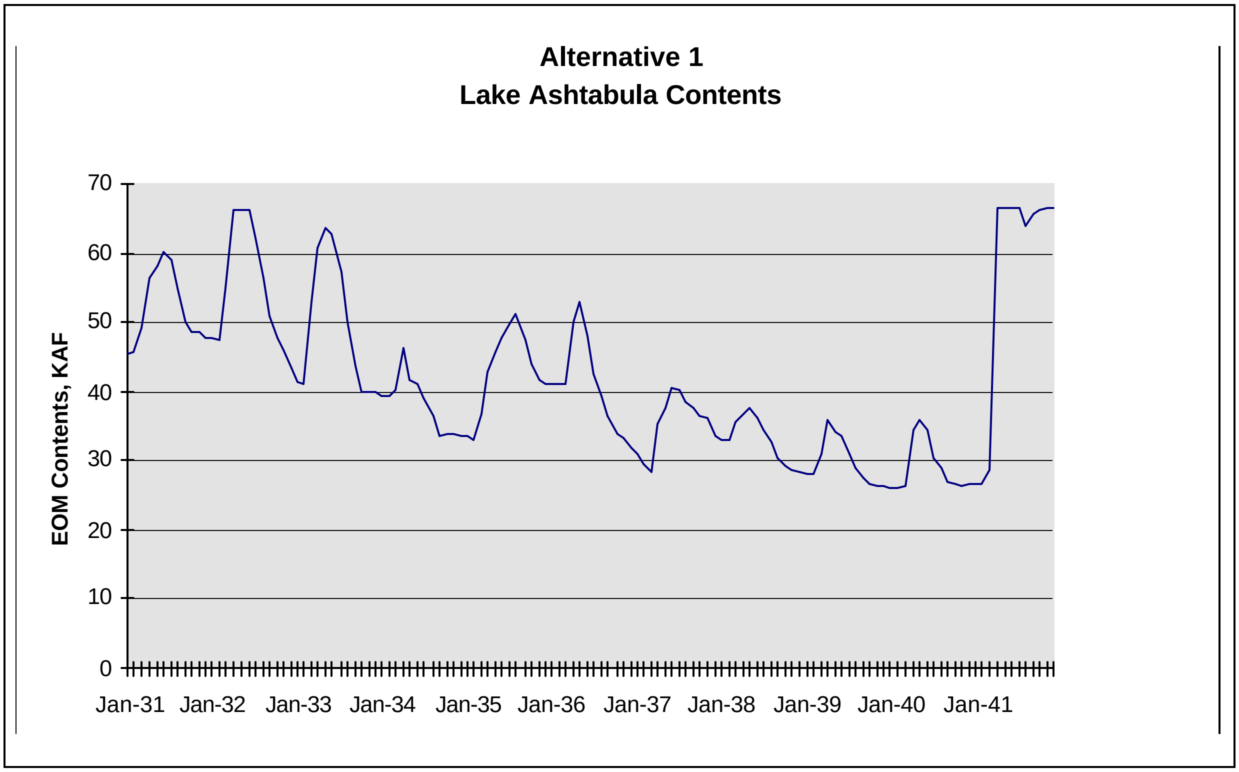
Future shortages have been estimated for rural water systems, however, they are not represented as surface water demand points in the No Action model. The expected initial course of action for rural water systems is expansion into groundwater supplies, these demands are included in the following table so that all future MR&I supply shortages are identified. Southern Valley combined rural water system shortages include Cass Rural, Southeast and Ransom Sargent, and Dakota Water Users. The combined Northern Valley Rural Water Systems include shortages for Agassiz, Tri-County, Walsh Water, Grand Forks-Traill, Traill Water Users, and Langdon Rural.

The individual systems and the shortages represented in the worse case year No Action Alternative are:

| 1934 (worse case year for shortages) | R2050 M&I Shortages, Ac-Ft | R2050 Southern Rural Water System Shortages, Ac-Ft | R2050 Northern Rural Water Systems Shortages, Ac-Ft | Total Annual Shortage, Ac-ft |
|---|---|---|---|---|
| January | 4200 | 340 | 320 | 4860 |
| February | 4380 | 325 | 290 | 4995 |
| March | 1500 | 340 | 320 | 2160 |
| April | 0 | 360 | 265 | 625 |
| May | 1840 | 395 | 325 | 2560 |
| June | 6140 | 445 | 365 | 6950 |
| July | 6780 | 440 | 360 | 7580 |
| August | 6400 | 415 | 320 | 7135 |
| September | 6190 | 365 | 265 | 6820 |
| October | 5590 | 350 | 315 | 6255 |
| November | 4770 | 330 | 245 | 5345 |
| December | 5400 | 345 | 265 | 6010 |
| Total Annual | 53190 | 4450 | 3655 | 61295 |

Lake Ashtabula During Drought Sequence

The following graph shows the water surface elevation of Lake Ashtabula under simulated Reclamation projected (R2050) demands with the drought style of the 1930's. The maximum reservoir content is 66,600 ac-ft and the minimum content is held to 28,000 ac-ft.




<u>Alternative 1 MR&I Demand Shortage</u>

The following table represents a summary of the shortages determined from the HYDROSS model. The shortages include the demands, and subsequent shortages, for all four projected New Industries. Rural water shortages are also listed. The year with the greatest annual shortage is 1934.

**No Action Alternative Composite M&I Shortages from HYDROSS model run, KAF (includes misc. industry)**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1931** | 1.5 | 1.5 | 0 | 0 | 0 | 0 | 2.01 | 2.01 | 2.01 | 1.5 | 0.95 | 1.5 | 12.98 |
| **1932** | 1.53 | 1.57 | 0 | 0 | 1.5 | 1.5 | 2.35 | 3.27 | 2.72 | 2.01 | 1.76 | 2.6 | 20.81 |
| **1933** | 3.09 | 5.79 | 0 | 0 | 1.12 | 1.5 | 2.01 | 2.86 | 2.74 | 2.88 | 4.23 | 3.64 | 29.86 |
| **1934** | **4.20** | **4.38** | **1.50** | **0.00** | **1.84** | **6.14** | **6.78** | **6.40** | **6.19** | **5.59** | **4.77** | **5.40** | **53.19** |
| **1935** | 5.8 | 4.93 | 0 | 0 | 0 | 1 | 0 | 2.01 | 2.21 | 1.9 | 2.05 | 4.94 | 24.84 |
| **1936** | 3.4 | 4.48 | 1.96 | 0 | 0 | 2.77 | 4.37 | 5.81 | 5.66 | 5.43 | 5.36 | 4.6 | 43.84 |
| **1937** | 4.36 | 5.66 | 5.17 | 0 | 0 | 0 | 0.51 | 2.01 | 0.5 | 0 | 1.24 | 2.37 | 21.82 |
| **1938** | 3.99 | 3.98 | 0 | 0 | 0 | 0 | 0.51 | 3.51 | 1.76 | 2.92 | 3.18 | 3.23 | 23.08 |
| **1939** | 0.01 | 0.01 | 0 | 0 | 0 | 0 | 0.73 | 4.82 | 5.9 | 4.31 | 3.75 | 3.78 | 23.31 |
| **1940** | 5.49 | 5.11 | 3.31 | 0 | 0 | 0 | 3.26 | 5.78 | 5.91 | 4.7 | 2.66 | 2.7 | 38.92 |
| **1941** | 2.06 | 0.19 | 0.94 | 0 | 0 | 0 | 0 | 1.5 | 0 | 0 | 0 | 0 | 4.69 |
| **Max KAF** | **5.80** | **5.79** | **5.17** | **0.00** | **1.84** | **6.14** | **6.78** | **6.40** | **6.19** | **5.59** | **5.36** | **5.40** | **60.46** |
| **Max CFS** | **94.33** | **104.25** | **84.08** | **0.00** | **29.92** | **103.19** | **110.27** | **104.09** | **104.03** | **90.91** | **90.08** | **87.82** | |

**Rural Water System Shortages, KAF (above existing level of groundwater appropriations)**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Southern** | 0.340 | 0.325 | 0.340 | 0.360 | 0.395 | 0.445 | 0.440 | 0.415 | 0.365 | 0.350 | 0.330 | 0.345 | **Total** |
| **Northern** | 0.320 | 0.290 | 0.320 | 0.265 | 0.325 | 0.365 | 0.360 | 0.320 | 0.265 | 0.315 | 0.245 | 0.265 | **Annual** |
| **Total Rural** | **0.660** | **0.615** | **0.660** | **0.625** | **0.720** | **0.810** | **0.800** | **0.735** | **0.630** | **0.665** | **0.575** | **0.610** | **8.105** |

***Combined Alternative 1 Total MR & I Shortage for Worse Year, Ac-Ft.***

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **"1934"** | 4860 | 4995 | 2160 | 625 | 2560 | 6950 | 7580 | 7135 | 6820 | 6255 | 5345 | 6010 | 61295 |