652.0106 State Supplement

(a) General Information

The Montana Supplement to the National Engineering Handbook (NEH), Part 652, Irrigation Guide, has been adapted from the Montana Irrigation Guide developed in the late 1980's and has been prepared to cover all areas of Montana.

The state supplements are developed to assist engineers, technicians, and others working with Montana irrigators to provide general planning and design criteria on various methods of irrigation commonly used in the state. When the irrigation system is installed and operated in accordance with basic data, the irrigator is assured, first of all, that the system will be capable of supplying the amounts of water needed by plants for optimum production and, secondly, that with proper seasonal adjustments, and adjustments for soil site conditions, irrigation water can be applied efficiently.

Irrigation Water Requirements (IWR) should follow the methods found in the NEH, Part 623, Chapter 2. Additional information can be obtained from this guide, NEH, Part 652, Chapter 4, Water Requirements. A computerized planning tool (IWR software) for Montana locations and crops not shown in Chapter 4, is available. This software is explained and examples shown in the Chapter 4 Montana supplement.

The suitability of surface or sprinkler irrigation methods for use in each soil group, crop, and slope group must consider the elements in Chapter 5 and 6 of the National Irrigation Guide and the Montana supplements to those chapters. The criteria in the appropriate practice standard for the type of irrigation application also must be met.

The irrigation planner must be aware that every irrigation system should be designed to minimize erosion [see Part (c) Control of Erosion below]. Polymer (PAM) is particularly useful for this in surface irrigation systems. Alternatives include a tail-water recovery system with polymer or sedimentation basins for areas where wastewater is recycled to down-gradient irrigators. Tailwater systems and polymer are discussed further in Section IV of the Montana Field Office Technical Guide (eFOTG).

Recommendations relating to economic evaluation of irrigation systems are included in NEH, Part 652, Chapter 11, Economic Evaluations. The economics of irrigation is usually an individual field or farm determination. Pumping costs will vary based on the head and gallons per minute pumped as well as the fee structure of the local power supply.

A map of the annual precipitation in Montana can be found on the Montana NRCS web page. This is located under the eFOTG, Section 1, Maps, Climatic Data, in Management Reference Maps. The link to the NRCS is listed as follows:

http://efotg.nrcs.usda.gov/treemenuFS.aspx?Fips=30031&MenuName=menuMT.zip

Within the same eFOTG Map site you can also find the map of irrigation climatic areas a few items down, or at the following link:

http://efotg.nrcs.usda.gov/treemenuFS.aspx?Fips=30031&MenuName=menuMT.zip

(b) Irrigation Specifications

Applicable specifications are developed for different practices and practice elements. Specifications for items such as excavation, earth fill, concrete, pipelines and other components that

are used in various irrigation systems have been developed. Additionally, sprinkler irrigation system specifications have been developed, and these, as well as the other specifications, are filed in the Montana Supplement to the Engineering Field Handbook, Part 650, Book 1, Chapter 50, Engineering Specifications.

(c) Control of Erosion

This guide contains the maximum slope recommendations for each crop and method along with companion practices such as PAM and contouring to be used on the various soils under normal conditions to prevent excessive water erosion whether by irrigation or by rainfall. The guide also designates irrigation water application rates, stream sizes, length of run, and time of irrigation to minimize erosion.

The conservation treatment of land for wind and water erosion is listed in the Field Office Technical Guide, Section I-A.

(d) Conservation Treatment Specifications

Section IV of the Field Office Technical Guide (eFOTG) contains System Standards for sprinkler, surface and subsurface, and micro-irrigation conservation practices. Standards and specifications for such common irrigation component practices including: land leveling; underground irrigation pipeline; canal and ditch lining; farm irrigation structures; and tail water recovery systems as well as other practices are in the FOTG and eFOTG as well.

(e) Procedure Guide for Irrigation Land Development

(1) Criteria for Irrigation Systems

The design of all irrigation systems shall follow the criteria in the applicable Montana standards and specifications.

(2) Basic Information

The following basic information shall be considered when planning and designing an irrigation system:

(i) Aerial photo, along with a topographic, or grid map

(ii) Quantity of water available

Water right information shall be obtained by the landowner from the Montana Department of Natural Resources, Water Rights Bureau.

(iii) Soils information

Soils data from published soils report, or the http:// soildatamart.nrcs.usda.gov website shall be collected (see Chapter 2. Soils, of this guide).

(iv) Water quality analysis

In areas where local water quality knowledge is unavailable, a water quality analysis should be obtained by the irrigator prior to design.

For information on a water quality analysis, refer to Agriculture Handbook, Number 60, "Diagnosis and Improvement of Saline and Alkali Soils," Chapter 5, Quality of Irrigation Water, and/or usual salinity limits of water are based on electrical conductivity (millimhos per centimeter) as follows:

< 0.75 mmhos	-	Safe water
0.75-2.25 mmhos	-	Safe where drainage is adequate
> 2.25 mmhos	-	Very limited use on high salt tolerance crops in large quantities and very good subsoil drainage.

Note: Convert millimhos to micromhos by multiplying by 1,000:

0.75 mmhos x 1,000 = 750 micromhos

For detailed information, refer to Chapter 13, "Quality of Water Supply".

Subsurface Drip Irrigation (SDI) systems will need a water quality analysis, including problems with sand or grit, prior to system design.

For irrigated areas with incomplete or limited soil information – Contact your local soil scientist who should make the following determinations in the field:

- Effective soil depth, texture, permeability, slope, erosion, and fertility potential.
- Intake rate with the effective rooting depth and water holding capacity.
- Soil salinity considerations.

Preparation of soils report – The soil scientist will then prepare a soils report and submit it to the planner and the Field office District Conservationist to record this information in the appropriate place of Part 652.0204 and other field office references.

(3) Guidelines

In developing an overall irrigation system plan, the following guidelines should be observed and included:

(i) Conservation cropping system –

This will be developed in accordance with the Montana Standard and Specifications for Conservation Cropping System (Code 328). This may be listed on the irrigation development plan or in the case file with adequate cross references.

(ii) Land to be developed for irrigation using surface irrigation methods –

The amount of land to be developed will depend on the planned cropping system, the intensity of irrigation desired by the irrigator, and the amount of irrigation water available.

To determine the maximum irrigated acres, use the procedure outlined in Part 652.0605. This indicates the crop acres that can be completely irrigated throughout the growing season with no limitation of crop production due to moisture.

In some cases, the irrigator may desire or need to adjust the system operation to something less than maximum as far as pumping time and water use are concerned. Factors include energy costs, restrictions on water availability (timing or quantity), type of cropping system, or other items that may affect this choice. Usually irrigations will be limited to several pre-determined times during critical crop-growing periods. There may be other instances where the irrigator will use the same irrigation frequency, except they will use the amount of water available and adjust the irrigated acres accordingly.

If supplemental irrigation is planned, the amount of irrigated acres will usually be determined by the irrigation intensity desired and the typical crop growth curves. The primary purpose is to provide supplemental moisture during any dry period that usually occurs at a critical stage of crop growth.

(iii) Fields planned for land leveling –

These fields shall meet the requirements of Montana Standard and Specifications for Irrigation Land Leveling (Code 464).

(iv) Irrigation Water Management –

The Irrigation Water Management (IWM) – plan will be a part of the irrigation system design. This plan shall meet the requirements of Montana Standard and Specification for Irrigation Water Management (Code 449).