

Montana Engineering Practice Planning and Design Guide for Irrigation Water Conveyance System

RESOURCE INVENTORY	<u>References</u>	✓
(Use Irrigation Inventory Worksheet, MIM Pages 13-63.)	NPM 506.10	
	MIM Ch 9	
1. Measure acres to be serviced by conveyance system.		<input type="checkbox"/> x
2. Determine crops to be grown, cropping systems to be used.		<input type="checkbox"/> x
3. Data concerning water:		
▪ Source of water		<input type="checkbox"/> x
▪ Seasonal water availability, water rights, regulations		<input type="checkbox"/> x
▪ Water quality, moss, debris, sediment problems		<input type="checkbox"/> x
▪ Typical water availability times, restrictions		<input type="checkbox"/> x
▪ Water measurement procedures used		<input type="checkbox"/> x
▪ Delivery system management policies, restrictions		<input type="checkbox"/> x
4. Obtain all needed information about the existing delivery system from the operator, ditch company/district, NRCS case files, delivery system maps, observation, and/or measurement. Use Irrigation Inventory Worksheet to record information.	MIM Ch 9	
▪ Type of system components		<input type="checkbox"/> x
▪ Dimensions of system components (may need to measure)		<input type="checkbox"/> x
▪ Elevation data (may need engineering surveys)		<input type="checkbox"/> x
▪ Capacity of system components (may need to measure flow rates)		<input type="checkbox"/> x
5. Existing and proposed application system:		
▪ Type of system (furrow, graded border, side roll, pivot, hand move)		<input type="checkbox"/> x
▪ Estimated or measured system application efficiency		<input type="checkbox"/> x
▪ Exact location, elevation of all turnouts		<input type="checkbox"/> x
▪ Design pressure requirements at each turnout		<input type="checkbox"/> x

Irrigation Water Conveyance System

		<u>References</u>	✓
6.	Inlet structure or connection details.		
	▪ Dimensions, elevations of existing inlet if to be used in new installation.		<input type="checkbox"/> x
	▪ Problems associated with existing inlet		<input type="checkbox"/> x
	▪ User desires concerning new inlet, connection		<input type="checkbox"/> x
7.	Existing and proposed screening devices.		
	▪ Details of existing screening devices		<input type="checkbox"/> x
	▪ Problems presently encountered with debris, sediment		<input type="checkbox"/> x
	▪ User desires concerning screening devices		<input type="checkbox"/> x
8.	Pump characteristics (if a pump is used).		
	▪ Pump type (centrifugal, turbine, submersible)		<input type="checkbox"/> x
	▪ Pump model, ratings (get pump curve if possible)		<input type="checkbox"/> x
	▪ Condition of existing pump (by test or observation)		<input type="checkbox"/> x
	▪ Adequacy of existing plumbing and connections		<input type="checkbox"/> x
	▪ Details of suction pipe, pump columns, number of impellers, etc.		<input type="checkbox"/> x
	▪ Availability and cost of bringing in electric power		<input type="checkbox"/> x
	▪ User desires concerning pump		<input type="checkbox"/> x
9.	Irrigation management.		
	▪ Present method used to determine when and how much to irrigate?		<input type="checkbox"/> x
	▪ Labor availability? Skill? Basic knowledge?		<input type="checkbox"/> x
	▪ Present problems in managing water.		<input type="checkbox"/> x
10.	Site considerations.		
	▪ Determine location and details of any utilities in the construction area.	NEH 503.03	<input type="checkbox"/> x
	▪ Is the site within a flood plain?	NPM MT506.17	<input type="checkbox"/> x
	▪ Will wetlands be modified, disturbed or affected by installing project?	NPM MT506.17	<input type="checkbox"/> x
INTERPRETING, ANALYZING, AND EVALUATING			
1.	Are soils appropriate for the intended irrigation system?		<input type="checkbox"/> x
2.	If the site is within a flood plain, what effect will a flood have on the system and on the area?		<input type="checkbox"/> x

Irrigation Water Conveyance System

	<u>References</u>	✓
DEVELOPING AND EVALUATING ALTERNATIVES		
1. Determine Available Water Capacity (AWC), Management Allowed Depletion (MAD) and intake characteristics of soil.	MIG	<input type="checkbox"/> x
2. Analyze seasonal efficiency and how changes in system and management could be improved (can use FIRS computer program).	FIRS documentation	<input type="checkbox"/> x
3. Determine peak consumptive use for crops to be grown (may use tables in Irrigation Guide or TR21 computer program).	MIM Ch 4 MIG	<input type="checkbox"/> x
4. Determine minimum flow requirements during period of peak consumptive use (use Irrigation Planning Worksheet MIM, Pages 13-69).	MIM Ch 9	<input type="checkbox"/> x
5. Determine flow requirements required to complete irrigation during time period desired by irrigator.	MIM Ch 9	<input type="checkbox"/> x
6. Based on all known factors, design the delivery system alignment.		<input type="checkbox"/> x
7. Based on all available known factors, select a pipe type or ditch lining type.		<input type="checkbox"/> x
8. Select inlet, turnout, water control structure/fitting types, locations and preliminary sizes and elevations.		<input type="checkbox"/> x
9. Perform preliminary hydraulics to set size and grades (may use any approved computer programs to aid with calculations).	EFM Ch 3 MIM Ch 7	<input type="checkbox"/> x
IMPLEMENTING DECISIONS		
<u>Approval Authority</u>		
Determine approval authority for pipelines, canals, water control structures, pumps and ask for appropriate assistance.	NPM 506.10 NEM MT501.04 Individual Approval Authority	<input type="checkbox"/> x
<u>Collect Final Data for Design</u>		
1. Additional detailed engineering surveys which were not obtained during initial planning.	TR62 EFM Ch. 1	
▪ Topographic survey of structure sites (grid, cross section, stadia or EDM)		<input type="checkbox"/>
▪ Profile along pipeline or ditch alignment		<input type="checkbox"/> x
▪ Cross section data where required		<input type="checkbox"/>
▪ Water surface elevations		<input type="checkbox"/> x
2. Geologic investigation. Borings as required at structure sites and at questionable locations on-line.	NEH 531	<input type="checkbox"/> x

Irrigation Water Conveyance System

	<u>References</u>	✓
<u>System Design</u>		
1. Detailed hydraulic design which was not done previously.	Standard 640	
▪ Pipeline hydraulics (May use approved computer programs to aid in calculations.)	EFM Ch 3 MIM Ch 7	<input type="checkbox"/>
▪ Ditch hydraulics, size, shape, water surface (May use approved computer programs to aid in design.)	EFM Ch 3	<input type="checkbox"/> x
▪ Structure hydraulics, sizing, control elevations	EFM ch 3	<input type="checkbox"/> x
2. Structure design (inlet, turnouts, valves, crossings).		<input type="checkbox"/> x
3. Critical area seeding design.	FOTOG	<input type="checkbox"/> x
4. Quantity calculations (if needed for cost share, bidding or other reasons).		
▪ Schedule of pipe sizes, type, rating		<input type="checkbox"/>
▪ Schedule of ditch lining quantities		<input type="checkbox"/>
▪ Concrete, timber, seeding quantities		<input type="checkbox"/>
▪ Earthwork quantities		<input type="checkbox"/>
<u>Drawings</u>		
Minimum drawings shall include:	EFM Ch 5 NEM 542	
▪ Location map or enough description on plan view map to adequately locate job		<input type="checkbox"/> x
▪ Plan view map showing location and layout of all pipelines, ditches, structures, turnouts, etc.		<input type="checkbox"/> x
▪ Profiles along each pipeline or ditch		<input type="checkbox"/> x
▪ Typical cross sections at critical locations		<input type="checkbox"/>
▪ Table or drawing notes showing elevations, descriptions, dimensions and size of all structures, valves, special fitting and appurtenances		<input type="checkbox"/>
<u>Compliance Checking</u>		
1. Pipelines.	NEM 541	
▪ Take elevations at critical points if needed		<input type="checkbox"/> x
▪ Record markings from pipe		<input type="checkbox"/> x
▪ Pressure or operation checking		<input type="checkbox"/> x

Irrigation Water Conveyance System

	<u>References</u>	✓
2. Ditches and lining.		
▪ Concrete quality checks during construction		<input type="checkbox"/>
▪ Take grade elevations at minimum 200 foot intervals		<input type="checkbox"/> *
3. Structures.		
▪ Measure and record dimensions and key elevations on all structures		<input type="checkbox"/> *
▪ Record notes on the type and quality of materials and workmanship		<input type="checkbox"/> *
4. Vegetative measures.		
Check that critical area seeding has been completed properly.		<input type="checkbox"/> *
5. As-built drawings prepared.		<input type="checkbox"/> *

* This activity or documentation is usually required on each job.