Montana Department of ENVIRONMENTAL QUALITY

WATER PROTECTION BUREAU

Agency Use
Permit No.:
Date Rec'd
Amount Rec'd
Check No.
Rec'd By

FORM
PW-1

Produced Water Impoundment Capacity Self Evaluation

READ THIS BEFORE COMPLETING FORM: Before completing this form (Form PW-1), oil and natural gas operators need to read the Produced Water General Permit (PW-GP) (MTG310000), particularly Part I. B. and part V. B and the "Instructions For Filling Out Form PW-1," found at the back of this form. Form PW-1 is intended to help oil and natural gas operators develop a site-specific impoundment capacity self evaluation to ensure the proposed area(s) in ephemeral drainages have enough impoundment capacity for produced water discharge. Sections B and C on your Form PW-1 must state the information exactly the same way as it was stated on the most recently submitted version of your DEQ Form 1, and Form 2C or 2D. Attachment I is required, Attachment II and III are optional. Attach additional pages as necessary, indicating the corresponding section number on this PW-1 Form. For additional help in filling out this form please contact the Department's Water Protection Bureau by finding the contact information at the back of this form.

Section A - PW-1 Status *(Check one):*

☐ New — No prior PW-1 submitted.

☐ Resubmitted — Previous PW-1 Form is deficient.

☐ Renewal with modification — Permit renewal with change or update to existing PW-1.

☐ Renewal without modification — Permit renewal without change or update to existing PW-1.

Permit Number: MT _ _ _ _ _ _ _ (Specify the permit number previously assigned to your facility if any.)

Section B - Facility or Site Information:

Facility Name: _____

Facility Location: _____

City, State, Zip: _____ County: _____

Latitude: _____ Longitude: _____

Township/Range/Section: _____

Receiving Water: _____

Section C - Facility Contact:

Facility Contact/Title: _____

Mailing Address: _____

City, State, and Zip: _____

Phone Number: Email:

Section D - Water Balance Calculation:

Fill out for each impoundment, if more than one outfall discharges into one impoundment, the sum of the discharge volumes shall be used in Step 1 as Annual Discharge; several naturally or artificially connected impounded areas can be regarded as one impoundment.

Step. 1 Annual Discharge

Outfall # (fill out all outfalls that discharge into this impoundment)_____

Discharge Rate:_____ gpm × C = _____ acft

(acft = acre- foot; gpm = gallons per minute ; C is Conversion Factor, C = 525,600 minutes × 3.069×10^{-6} acft/gal = 1.61 min.acft/gal)

Step. 2 Impounding Area and Depth

Do you know the average impoundment area and depth?

☐ Yes, the average impoundment area is A= _____acre, and the average depth is _____feet. Attach a topographic map in appropriate scale as ***Attachment I*** with the impoundment area(s) marked on the map.

☐ No. Please complete the following: (1) Look at Appendix A to estimate needed area and depth of the impoundment based on estimated volume of produced water from Step 1. (2) Look at a topographical map, or visit the field, or conduct a field survey to estimate the area and depth of the impoundment, and fill them in the blanks below, attach a topographic map as ***Attachment I*** with the impoundment area(s) marked on the map.

The average impoundment area is _____acres, and the average impoundment depth is _____feet. Then continue on to step 3.

Step. 3 Other Water Balance Components

A. Annual Precipitation (P): Annual average precipitation in the proposed impoundment area is p =_____inches. The total precipitation received for the impounding area is P = _____(p) × 1/12 ft/in × _____(Impounded area) = _____acft.

(Where: Impoundment area is the value identified in Step 2, in acres.).

B. Annual Evaporation Loss (E): E = _____(Class A Pan Coefficient) × _____(Impoundment Area) × _____(Class A Pan Evaporation) × 1/12 ft/in = _____ acft.

(Where: Class A Pan Coefficient =0.7; Impoundment area is the value identified in Step 2, in acres. Class A Pan Evaporation can be found from Appendix B, in inches).

C. Average annual seepage or infiltration loss (check only one of the following):

☐ I chose not to calculate this number. I accept the default assumption that the seepage loss is __0__ acft.

☐ My calculated seepage from the site is _____ acft (Attach calculation as ***Attachment II***).

D. Annual water use (check only one of the following options):

☐ I chose not to calculate this number. I accept the Department's conservative approach and assume the water use is __0__ acft for the purpose of impoundment capacity assessment.

☐ My calculated livestock and wildlife water use is _____ acft (Attach calculation work as ***Attachment III*** following the template provided. Please reference Appendix C for Livestock and Wildlife Water Use Requirement).

Step. 4 Annual Water Balance

_____	+	_____	–	_____	–	_____	–	_____	=	_____ (acft)
Produced water Discharge		Precipitation		Evaporation		Seepage		Livestock Water Use		To be Impounded

Step. 5 Impoundment Capacity Evaluation

Using the amount of water to be impounded calculated from Step 4 above, find in Appendix A the closest number in column B, look at the numbers in the same row, then find the one that corresponds to the total impoundment area of your outfall. Record this number here: _____ ft. This is the depth of the impoundment needed. Is this number less than your proposed or current impoundment depth in Step 2 (_____ft) ?

☐ Yes. My impoundment capacity is enough.

☐ No. The impoundment area is not adequate. You should extend your impoundment capacity by either increasing the impoundment area or depth (e.g., find more area or a new location, build earth dam/dike, etc…). Start this process over until you have enough impoundment capacity. The final location and boundary of the proposed impoundment shall be identified and illustrated on your topographic map, and attached to this form. If you are unable to find ephemeral drainages with enough impounding capacity for your discharge, you may apply an individual MPDES permit by submitting forms DEQ 1 and Form 2D.

Step. 6 Attachment check list for Section D (check the box next to the Attachment you have attached).

☐ Attachment I (required); ☐ Attachment II (optional); ☐ Attachment III (optional).

Template for Attachment III (optional):

Animal Water Use Estimation Worksheet [(1)]

Animal Type or/and Condition [(2)]	Number of Animals	Typical Annual Water Use (Gal per head per year)	Annual Water Use (Gal)	Annual Water Use (acft)[(3)]
Total:				

Note:

(1) This page can be copied and extra pages can be added if necessary.

(2) See Appendix C for more details about animal type and conditions.

(3) 1 acft = 325,851 gal.

Section E - CERTIFICATION

Permittee Information:

This Form PW-1 must be completed, signed, and certified as follows:

- For a corporation, by a principal officer of at least the level of vice president;
- For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or
- For a municipality, state, federal, or other public facility, by either a principal executive officer or ranking elected official.

All Permittees Must Complete the Following Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information; including the possibility of fine and imprisonment for knowing violations. [75-5-633, MCA]

A. Name (Type or Print)	
B. Title (Type or Print)	**C. Phone No.**
D. Signature	**E. Date Signed**

Return the Form PW-1, Impoundment Capacity Self Evaluation Worksheet together with other application materials to:

Department of Environmental Quality
Water Protection Bureau
PO Box 200901
Helena, MT 59620-0901
(406) 444-3080

INSTRUCTIONS FOR
Form PW-1 – Produced Water Impoundment Capacity Self Evaluation for Oil and Natural Gas Produced Water Discharge to Ephemeral Drainages under Produced Water General Permit (MTG310000)

The purpose of this form: The Produced Water General Permit authorizes the discharge of produced water from oil and gas production facilities into ephemeral drainages. This form is designed to allow permittee to self evaluate if the proposed receiving water has enough impoundment capacity for the containment of the discharge.

Fill out the form for <u>each impoundment</u>. One facility usually has one outfall, the produced water discharge will form one impoundment. Several naturally or artificially connected impounded areas are regarded as one impoundment. A facility may have multiple outfalls discharging all into one impoundment, the sum of the discharge rate/volumes shall be used in Step 1 of this form. If a facility has several outfalls each discharge to a separate impoundment, the form shall be completed for each impoundment.

You may need the following items in order to complete this form: A copy of your most recently submitted Form 1; Form 2C or Form 2D; Appendix A, B, and C of this form (provided).

Please type or print legibly; forms that are not legible or are not complete will be returned.

SPECIFIC ITEM INSTRUCTIONS

Section A – PW-1 Status:

Check the box that applies and provide the requested information. If Form PW-1 has not been previously submitted for this site, check the first box (New). If you submitted a Form PW-1 and the Department returned it to you as deficient or incomplete, check the second box (Resubmitted); if you are now submitting an Form PW-1 with permit renewal with impoundment area modification, check the third box (Renewal with modification); if you are submitting a permit renewal without change in the facility or site information, check the last box (Renewal without modification). Fill in the permit number if you have one already. If the site is covered under the *Produced Water General Permit*, the number can be found on deficiency letter, completeness letter, or Authorization letter sent to you by the Department. The permit number must be included on any correspondence with the Department regarding this site.

Section B – Facility or Site Information:

The information must be stated exactly the same way as it was stated on the most recently submitted version of your DEQ Form 1, Form 2C or 2D.

Section C – Applicant (Owner/Operator) Information:

The information must be stated exactly the same way as it was stated on the most recently submitted version of your Form 1.

Section D – Water Balance Calculation:

Step. 1 Annual Discharge: Include all outfalls discharge into the impoundment, convert the discharge rate in gallon per minute (gpm) into acre-foot (acft).

Step. 2 Impounding Area and Depth: When propose ephemeral drainage area(s) for produced water impoundment, the permittee shall conduct a field visit or land survey if necessary to estimate the total area and depth for impoundment. The impoundment area shall be marked on a topographic map with sufficient details including the boundary of the impoundment area. The topographic map is a required attachment (Attachment I) to this PW-1 Form. The permittee is responsible to acquire any necessary permit or license if any structures are involved.

Step. 3 Annual Water Balance Calculations:

For annual evaporation loss, please use Appendix B to figure out the Class A Pan Evaporation for your area.

For annual precipitation, please consult local conservation or county.

If permittee choose to calculate the annual seepage or infiltration loss, the calculation process and results shall be attached as Attachment II to this PW-1 Form. The Department does not provide a guideline for this calculation because the seepage and infiltration can be very site specific. However, permittee shall perform the calculation following the hydrogeological principles based on reliable data sources from existing studies, field survey, or professional consultants.

The livestock annual water use can be estimated based on number and type of animals, and average annual water consumption of each animal. The annual water consumption for most of the common animals are provided in Appendix C. If there are animals that are not listed in Appendix C, please provide supporting document to demonstrate the average annual water consumption. The livestock annual water use calculation shall be attached at Attachment III following the template provided in this PW-1 Form.

Step. 4 Annual Water Balance: Substitute the water balance components from Step 1 and Step 3 into the blanks, calculate the annual amount of water need to be impounded.

Step. 5 Impoundment Capacity Evaluation: Follow the instructions of Step 5 in the Form.

If your answer is ***Yes***, then stop, you have enough impoundment capacity. Submit your Form PW-1 together with your new or renewal application materials.

If your answer is ***No***, you don't have enough impoundment capacity. You have to choices: 1) you have to extend your impoundment capacity by either increasing the impoundment area or depth (e.g., find more area or a new location, build earth dam/dike, etc…). Then start this process over until you have enough impoundment capacity. Only the final results (topographic map with marked impoundment area, calculations, etc.) shall be kept with your final PW-1 Form. 2) If you are unable

to find ephemeral drainages that have enough impoundment capacity for your discharge, you have to apply for an individual MPDES permit by submitting necessary forms (DEQ Form 1 and Form 2D).

Step. 6 Attachment check list: Attachment I is required, Attachment II and III are optional.

Section F – Certification:

If Form PW-1 is filled out by one person and signed by another, the person signing the document should read it thoroughly. Always retain a copy of each of the documents that you send to the Department.

The PW-1 Form and other forms for oil and natural gas produced water discharge permitting or authorization are available at Montana Department of Environmental Quality's Water Protection Bureau website: http://www.deq.mt.gov/wqinfo/WPBForms/Forms1.mcpx. If you have any questions concerning how to fill out this form, or other forms related to the Montana Pollutant Discharge Elimination System (MPDES) discharge permitting program, please contact the Department's Water Protection Bureau at:

Phone: (406) 444-3080
Fax: (406) 444-1374
1520 East Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901

PW-1 Appendix A: Estimating Impoundment Capacity Look-up Table

Discharge		-------Impounded Area (acre)-------																
A: Rate (gpm)	B: Annual volume (acft)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		-------Impounded Depth(feet)-------																
1	2	1.6	0.8	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	3	3.2	1.6	1.1	0.8	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
3	5	4.8	2.4	1.6	1.2	1.0	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3
4	6	6.4	3.2	2.1	1.6	1.3	1.1	0.9	0.8	0.7	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4
5	8	8.1	4.0	2.7	2.0	1.6	1.3	1.2	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5
6	10	9.7	4.8	3.2	2.4	1.9	1.6	1.4	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.6
7	11	11.3	5.6	3.8	2.8	2.3	1.9	1.6	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7
8	13	12.9	6.4	4.3	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.8
9	14	14.5	7.2	4.8	3.6	2.9	2.4	2.1	1.8	1.6	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9
10	16	16.1	8.1	5.4	4.0	3.2	2.7	2.3	2.0	1.8	1.6	1.5	1.3	1.2	1.2	1.1	1.0	0.9
11	18	17.7	8.9	5.9	4.4	3.5	3.0	2.5	2.2	2.0	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1.0
12	19	19.3	9.7	6.4	4.8	3.9	3.2	2.8	2.4	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1
13	21	20.9	10.5	7.0	5.2	4.2	3.5	3.0	2.6	2.3	2.1	1.9	1.7	1.6	1.5	1.4	1.3	1.2
14	23	22.5	11.3	7.5	5.6	4.5	3.8	3.2	2.8	2.5	2.3	2.0	1.9	1.7	1.6	1.5	1.4	1.3
15	24	24.2	12.1	8.1	6.0	4.8	4.0	3.5	3.0	2.7	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.4
16	26	25.8	12.9	8.6	6.4	5.2	4.3	3.7	3.2	2.9	2.6	2.3	2.1	2.0	1.8	1.7	1.6	1.5
17	27	27.4	13.7	9.1	6.8	5.5	4.6	3.9	3.4	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.6
18	29	29.0	14.5	9.7	7.2	5.8	4.8	4.1	3.6	3.2	2.9	2.6	2.4	2.2	2.1	1.9	1.8	1.7
19	31	30.6	15.3	10.2	7.6	6.1	5.1	4.4	3.8	3.4	3.1	2.8	2.5	2.4	2.2	2.0	1.9	1.8
20	32	32.2	16.1	10.7	8.1	6.4	5.4	4.6	4.0	3.6	3.2	2.9	2.7	2.5	2.3	2.1	2.0	1.9
21	34	33.8	16.9	11.3	8.5	6.8	5.6	4.8	4.2	3.8	3.4	3.1	2.8	2.6	2.4	2.3	2.1	2.0
22	35	35.4	17.7	11.8	8.9	7.1	5.9	5.1	4.4	3.9	3.5	3.2	3.0	2.7	2.5	2.4	2.2	2.1
23	37	37.0	18.5	12.3	9.3	7.4	6.2	5.3	4.6	4.1	3.7	3.4	3.1	2.8	2.6	2.5	2.3	2.2
24	39	38.6	19.3	12.9	9.7	7.7	6.4	5.5	4.8	4.3	3.9	3.5	3.2	3.0	2.8	2.6	2.4	2.3
25	40	40.3	20.1	13.4	10.1	8.1	6.7	5.8	5.0	4.5	4.0	3.7	3.4	3.1	2.9	2.7	2.5	2.4
26	42	41.9	20.9	14.0	10.5	8.4	7.0	6.0	5.2	4.7	4.2	3.8	3.5	3.2	3.0	2.8	2.6	2.5
27	43	43.5	21.7	14.5	10.9	8.7	7.2	6.2	5.4	4.8	4.3	4.0	3.6	3.3	3.1	2.9	2.7	2.6
28	45	45.1	22.5	15.0	11.3	9.0	7.5	6.4	5.6	5.0	4.5	4.1	3.8	3.5	3.2	3.0	2.8	2.7
29	47	46.7	23.3	15.6	11.7	9.3	7.8	6.7	5.8	5.2	4.7	4.2	3.9	3.6	3.3	3.1	2.9	2.7
30	48	48.3	24.2	16.1	12.1	9.7	8.1	6.9	6.0	5.4	4.8	4.4	4.0	3.7	3.5	3.2	3.0	2.8
31	50	49.9	25.0	16.6	12.5	10.0	8.3	7.1	6.2	5.5	5.0	4.5	4.2	3.8	3.6	3.3	3.1	2.9

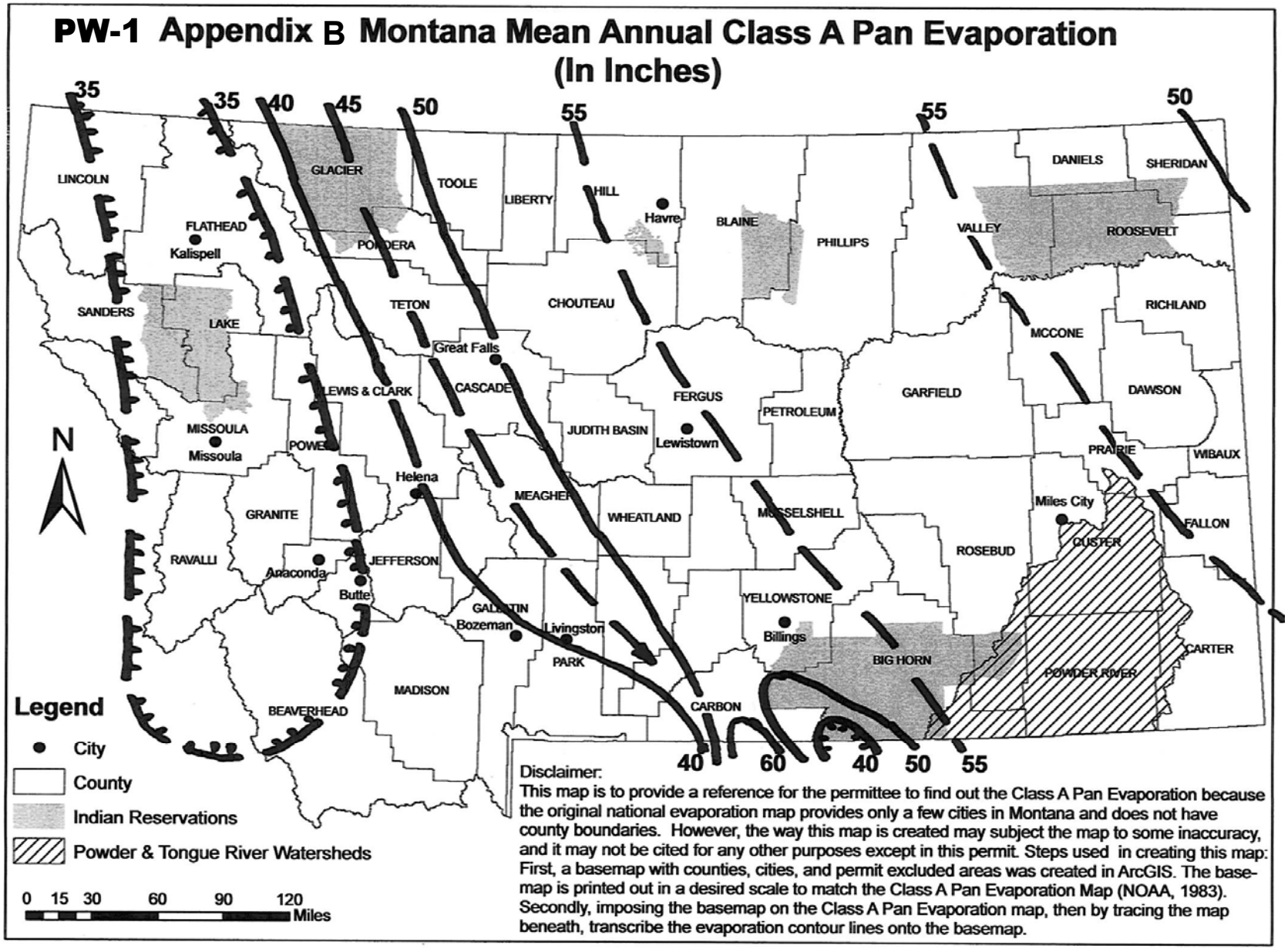
PW-1 Appendix A: Estimating Impoundment Capacity Look-up Table (Continued)

Discharge		-------Impounded Area (acre)-------																
A: Rate (gpm)	B: Annual volume (acft)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		-------Impounded Depth(feet)-------																
32	52	51.5	25.8	17.2	12.9	10.3	8.6	7.4	6.4	5.7	5.2	4.7	4.3	4.0	3.7	3.4	3.2	3.0
33	53	53.1	26.6	17.7	13.3	10.6	8.9	7.6	6.6	5.9	5.3	4.8	4.4	4.1	3.8	3.5	3.3	3.1
34	55	54.7	27.4	18.2	13.7	10.9	9.1	7.8	6.8	6.1	5.5	5.0	4.6	4.2	3.9	3.6	3.4	3.2
35	56	56.4	28.2	18.8	14.1	11.3	9.4	8.1	7.0	6.3	5.6	5.1	4.7	4.3	4.0	3.8	3.5	3.3
36	58	58.0	29.0	19.3	14.5	11.6	9.7	8.3	7.2	6.4	5.8	5.3	4.8	4.5	4.1	3.9	3.6	3.4
37	60	59.6	29.8	19.9	14.9	11.9	9.9	8.5	7.4	6.6	6.0	5.4	5.0	4.6	4.3	4.0	3.7	3.5
38	61	61.2	30.6	20.4	15.3	12.2	10.2	8.7	7.6	6.8	6.1	5.6	5.1	4.7	4.4	4.1	3.8	3.6
39	63	62.8	31.4	20.9	15.7	12.6	10.5	9.0	7.8	7.0	6.3	5.7	5.2	4.8	4.5	4.2	3.9	3.7
40	64	64.4	32.2	21.5	16.1	12.9	10.7	9.2	8.1	7.2	6.4	5.9	5.4	5.0	4.6	4.3	4.0	3.8
41	66	66.0	33.0	22.0	16.5	13.2	11.0	9.4	8.3	7.3	6.6	6.0	5.5	5.1	4.7	4.4	4.1	3.9
42	68	67.6	33.8	22.5	16.9	13.5	11.3	9.7	8.5	7.5	6.8	6.1	5.6	5.2	4.8	4.5	4.2	4.0
43	69	69.2	34.6	23.1	17.3	13.8	11.5	9.9	8.7	7.7	6.9	6.3	5.8	5.3	4.9	4.6	4.3	4.1
44	71	70.8	35.4	23.6	17.7	14.2	11.8	10.1	8.9	7.9	7.1	6.4	5.9	5.4	5.1	4.7	4.4	4.2
45	72	72.5	36.2	24.2	18.1	14.5	12.1	10.4	9.1	8.1	7.2	6.6	6.0	5.6	5.2	4.8	4.5	4.3
46	74	74.1	37.0	24.7	18.5	14.8	12.3	10.6	9.3	8.2	7.4	6.7	6.2	5.7	5.3	4.9	4.6	4.4
47	76	75.7	37.8	25.2	18.9	15.1	12.6	10.8	9.5	8.4	7.6	6.9	6.3	5.8	5.4	5.0	4.7	4.5
48	77	77.3	38.6	25.8	19.3	15.5	12.9	11.0	9.7	8.6	7.7	7.0	6.4	5.9	5.5	5.2	4.8	4.5
49	79	78.9	39.4	26.3	19.7	15.8	13.1	11.3	9.9	8.8	7.9	7.2	6.6	6.1	5.6	5.3	4.9	4.6
50	81	80.5	40.3	26.8	20.1	16.1	13.4	11.5	10.1	8.9	8.1	7.3	6.7	6.2	5.8	5.4	5.0	4.7
51	82	82.1	41.1	27.4	20.5	16.4	13.7	11.7	10.3	9.1	8.2	7.5	6.8	6.3	5.9	5.5	5.1	4.8
52	84	83.7	41.9	27.9	20.9	16.7	14.0	12.0	10.5	9.3	8.4	7.6	7.0	6.4	6.0	5.6	5.2	4.9
53	85	85.3	42.7	28.4	21.3	17.1	14.2	12.2	10.7	9.5	8.5	7.8	7.1	6.6	6.1	5.7	5.3	5.0
54	87	86.9	43.5	29.0	21.7	17.4	14.5	12.4	10.9	9.7	8.7	7.9	7.2	6.7	6.2	5.8	5.4	5.1
55	89	88.6	44.3	29.5	22.1	17.7	14.8	12.7	11.1	9.8	8.9	8.1	7.4	6.8	6.3	5.9	5.5	5.2
56	90	90.2	45.1	30.1	22.5	18.0	15.0	12.9	11.3	10.0	9.0	8.2	7.5	6.9	6.4	6.0	5.6	5.3
57	92	91.8	45.9	30.6	22.9	18.4	15.3	13.1	11.5	10.2	9.2	8.3	7.6	7.1	6.6	6.1	5.7	5.4
58	93	93.4	46.7	31.1	23.3	18.7	15.6	13.3	11.7	10.4	9.3	8.5	7.8	7.2	6.7	6.2	5.8	5.5
59	95	95.0	47.5	31.7	23.7	19.0	15.8	13.6	11.9	10.6	9.5	8.6	7.9	7.3	6.8	6.3	5.9	5.6
60	97	96.6	48.3	32.2	24.2	19.3	16.1	13.8	12.1	10.7	9.7	8.8	8.1	7.4	6.9	6.4	6.0	5.7
61	98	98.2	49.1	32.7	24.6	19.6	16.4	14.0	12.3	10.9	9.8	8.9	8.2	7.6	7.0	6.5	6.1	5.8
62	100	99.8	49.9	33.3	25.0	20.0	16.6	14.3	12.5	11.1	10.0	9.1	8.3	7.7	7.1	6.7	6.2	5.9
63	101	101.4	50.7	33.8	25.4	20.3	16.9	14.5	12.7	11.3	10.1	9.2	8.5	7.8	7.2	6.8	6.3	6.0

PW-1 Appendix A: Estimating Impoundment Capacity Look-up Table (Continued)

Discharge		-------Impounded Area (acre)-------																
A: Rate (gpm)	B: Annual volume (acft)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		-------Impounded Depth(feet)-------																
64	103	103.0	51.5	34.3	25.8	20.6	17.2	14.7	12.9	11.4	10.3	9.4	8.6	7.9	7.4	6.9	6.4	6.1
65	105	104.7	52.3	34.9	26.2	20.9	17.4	15.0	13.1	11.6	10.5	9.5	8.7	8.1	7.5	7.0	6.5	6.2
66	106	106.3	53.1	35.4	26.6	21.3	17.7	15.2	13.3	11.8	10.6	9.7	8.9	8.2	7.6	7.1	6.6	6.3
67	108	107.9	53.9	36.0	27.0	21.6	18.0	15.4	13.5	12.0	10.8	9.8	9.0	8.3	7.7	7.2	6.7	6.3
68	109	109.5	54.7	36.5	27.4	21.9	18.2	15.6	13.7	12.2	10.9	10.0	9.1	8.4	7.8	7.3	6.8	6.4
69	111	111.1	55.5	37.0	27.8	22.2	18.5	15.9	13.9	12.3	11.1	10.1	9.3	8.5	7.9	7.4	6.9	6.5
70	113	112.7	56.4	37.6	28.2	22.5	18.8	16.1	14.1	12.5	11.3	10.2	9.4	8.7	8.1	7.5	7.0	6.6
71	114	114.3	57.2	38.1	28.6	22.9	19.1	16.3	14.3	12.7	11.4	10.4	9.5	8.8	8.2	7.6	7.1	6.7
72	116	115.9	58.0	38.6	29.0	23.2	19.3	16.6	14.5	12.9	11.6	10.5	9.7	8.9	8.3	7.7	7.2	6.8
73	118	117.5	58.8	39.2	29.4	23.5	19.6	16.8	14.7	13.1	11.8	10.7	9.8	9.0	8.4	7.8	7.3	6.9
74	119	119.1	59.6	39.7	29.8	23.8	19.9	17.0	14.9	13.2	11.9	10.8	9.9	9.2	8.5	7.9	7.4	7.0
75	121	120.8	60.4	40.3	30.2	24.2	20.1	17.3	15.1	13.4	12.1	11.0	10.1	9.3	8.6	8.1	7.5	7.1
76	122	122.4	61.2	40.8	30.6	24.5	20.4	17.5	15.3	13.6	12.2	11.1	10.2	9.4	8.7	8.2	7.6	7.2
77	124	124.0	62.0	41.3	31.0	24.8	20.7	17.7	15.5	13.8	12.4	11.3	10.3	9.5	8.9	8.3	7.7	7.3
78	126	125.6	62.8	41.9	31.4	25.1	20.9	17.9	15.7	14.0	12.6	11.4	10.5	9.7	9.0	8.4	7.8	7.4
79	127	127.2	63.6	42.4	31.8	25.4	21.2	18.2	15.9	14.1	12.7	11.6	10.6	9.8	9.1	8.5	7.9	7.5
80	129	128.8	64.4	42.9	32.2	25.8	21.5	18.4	16.1	14.3	12.9	11.7	10.7	9.9	9.2	8.6	8.1	7.6
81	130	130.4	65.2	43.5	32.6	26.1	21.7	18.6	16.3	14.5	13.0	11.9	10.9	10.0	9.3	8.7	8.2	7.7
82	132	132.0	66.0	44.0	33.0	26.4	22.0	18.9	16.5	14.7	13.2	12.0	11.0	10.2	9.4	8.8	8.3	7.8
83	134	133.6	66.8	44.5	33.4	26.7	22.3	19.1	16.7	14.8	13.4	12.1	11.1	10.3	9.5	8.9	8.4	7.9
84	135	135.2	67.6	45.1	33.8	27.0	22.5	19.3	16.9	15.0	13.5	12.3	11.3	10.4	9.7	9.0	8.5	8.0
85	137	136.9	68.4	45.6	34.2	27.4	22.8	19.6	17.1	15.2	13.7	12.4	11.4	10.5	9.8	9.1	8.6	8.1
86	138	138.5	69.2	46.2	34.6	27.7	23.1	19.8	17.3	15.4	13.8	12.6	11.5	10.7	9.9	9.2	8.7	8.1
87	140	140.1	70.0	46.7	35.0	28.0	23.3	20.0	17.5	15.6	14.0	12.7	11.7	10.8	10.0	9.3	8.8	8.2
88	142	141.7	70.8	47.2	35.4	28.3	23.6	20.2	17.7	15.7	14.2	12.9	11.8	10.9	10.1	9.4	8.9	8.3
89	143	143.3	71.6	47.8	35.8	28.7	23.9	20.5	17.9	15.9	14.3	13.0	11.9	11.0	10.2	9.6	9.0	8.4
90	145	144.9	72.5	48.3	36.2	29.0	24.2	20.7	18.1	16.1	14.5	13.2	12.1	11.1	10.4	9.7	9.1	8.5
91	147	146.5	73.3	48.8	36.6	29.3	24.4	20.9	18.3	16.3	14.7	13.3	12.2	11.3	10.5	9.8	9.2	8.6
92	148	148.1	74.1	49.4	37.0	29.6	24.7	21.2	18.5	16.5	14.8	13.5	12.3	11.4	10.6	9.9	9.3	8.7
93	150	149.7	74.9	49.9	37.4	29.9	25.0	21.4	18.7	16.6	15.0	13.6	12.5	11.5	10.7	10.0	9.4	8.8
94	151	151.3	75.7	50.4	37.8	30.3	25.2	21.6	18.9	16.8	15.1	13.8	12.6	11.6	10.8	10.1	9.5	8.9
95	153	153.0	76.5	51.0	38.2	30.6	25.5	21.9	19.1	17.0	15.3	13.9	12.7	11.8	10.9	10.2	9.6	9.0

PW-1 Appendix B Montana Mean Annual Class A Pan Evaporation (In Inches)



Disclaimer:
This map is to provide a reference for the permittee to find out the Class A Pan Evaporation because the original national evaporation map provides only a few cities in Montana and does not have county boundaries. However, the way this map is created may subject the map to some inaccuracy, and it may not be cited for any other purposes except in this permit. Steps used in creating this map: First, a basemap with counties, cities, and permit excluded areas was created in ArcGIS. The base-map is printed out in a desired scale to match the Class A Pan Evaporation Map (NOAA, 1983). Secondly, imposing the basemap on the Class A Pan Evaporation map, then by tracing the map beneath, transcribe the evaporation contour lines onto the basemap.

PW-1 Appendix C. Livestock and Wildlife Water Use Requirement

Category of Animal	Type or condition of Animal	Daily Water Use per head (gal)	Average Typical Use (Gal)	Average Annual Use (Gal) **
Beef Cattle	Beef cows in general	10-16	13	4745
	Lactating Cows with Calves	11-18	14.5	5293
	Dry Cows, bred heifers	6-15	10	3650
	Bulls	7-19	10	3650
	Growing beef cattle 400 lbs	3.5-9.5	6.6	2409
	Growing beef cattle 600 lbs	5-13		2409
	Growing beef cattle 800 lbs	6-15		2409
	Finish beef cattle 600 lbs	5.5-14.5	10.8	3942
	Finish beef cattle 800 lbs	7-17.5		3942
	Finish beef cattle 1000 lbs	8.5-20.5		3942
	Finish beef cattle 1200 lbs	9.5-22.5		3942
Dairy Cattle	Calves (1-4 months)	1.3-3.5	2.4	876
	Dairy heifers (5-24 months)	3.8-9.6	6.6	2409
	Milk Cows	18-41	30.4	11096
	Dry Cows	9.0-13	10.8	3942
Horses	Horse in General	10-12	11	4015
	Small (500 lbs)	3.4-5.3	4.4	1606
	Medium (1000 lbs)	6.9-10.3	8.6	3139
	Weanling, 650 lbs	10.3-15.6	12.9	4709
Swine	Weaner (15-49 lbs)	0.3-0.9	0.5	183
	Feeder pig (50-79 lbs)	0.9-1.1	1.2	438
	Feeder pig (80-154 lbs)	1.2-1.9	1.2	438
	Feeder pig (155-243 lbs)	2.0-2.6	2.4	876
	Gesting sow/boar	3.6-4.5	4	1460
	Lactating Sow	4.8-6.0	5.3	1935
Sheep and Goats	Sheep and Goats in general	0.5-2	1.3	475
	Rams	2	2	730
	Dry Ewes	2	2	730
	Lactating ewes with Lambs	2.4-2.8	2.6	949
	Feeder Lambs (60-110 lbs)	1.0-1.4	1.2	438
	5-20 lbs Lambs	0.1-0.3	0.2	73
Other Animals	Elk	2-3	2.5	913
	Deer	0.5-1	0.75	274
	Antelope	0.5-1	0.75	274
	Chickens	0.05-0.1	0.08	29
	Turkeys	0.1-0.16	0.13	47

(1): Zacek, J., 1979. USDA Soil Conservation Service Technical Notes No.26. Bozeman, Montana
(2): Canada Ministry of Agriculture, Food and Rural Affairs, 2007. Water Requirements of Livestock Factsheet. Queen Printer for Ontario. Accessed 09/2009 at http://www.omafra.gov.on.ca/english/engineer/facts/07-023.htm
(3) Lardy, G., C. Stoltenow, and R. Johnson, 2008. Livestock and Water. North Dakota State University Extension Service, Publication AS-954. Fargo, North Dakota 58105
(4) National Academy of Sciences, 1974. Nutrients and toxic substances in water for livestock and poultry. Washington D.C.
** Numbers are calculated by timing 365 days to the daily use in previous column.