

Water use to each community served in the proposed service area will be metered. A master water meter that meters all diverted flow is located on the south end of Shelby. The City of Shelby keeps accurate records of the quantity of water diverted and supplied to other service areas. The City records daily water use, peak flow rates, and totalized monthly and annual volumes for the total diverted flow. The total monthly volume is metered and recorded to each community in the proposed service area and for residential use in the City. Service area water is tracked for water use agreement purchases. A portion of the water reservation point of diversion will be assigned to each well located in the well field. No new measurement plans will be necessary for the water reservation.

Currently a master water meter that measures all water diverted from the well field is located near the storage tank on the south side of Shelby. Other water meters maintained by the City measure or will measure water going to the service areas proposed in this application. A map of all current and proposed water meters is provided on the Water Meter Location Map NIR.5.C. The City currently maintains the water meters described in Table NIR.3.1.

NIR.5.D Adequate Diversion Means and Operation

For applications that propose new conveyance facilities, provide preliminary design plans and specifications for the proposed diversion and conveyance facilities and the equipment used to put the water to beneficial use.

Water Reservation and Water Rights 41P 192878 00, 41P 192880 00, 41P 192881 00, 41P 192882 00, 41P 4489 00, 41P 4490 00, and 41P 58129 00:

No new diversion facilities are needed to complete the proposed change for the water rights, and no new wells will be drilled to initiate use of the water reservation. The City's engineer conducted a well field pumping test to evaluate the current total yield of the well field. The pumping test was conducted on Wells 1, 2, 3, 5, 7, 8, 9, 10, 11, 12, and 13 on October 2-3, 2013. As described in NIR.4.C, Wells 4 and 6 are currently not operational. The well field pumping test found a total maximum pumping rate of 2,079 gpm and 2,993,760 gpd. These totals are greater than the total peak day demand estimated in NIR.4.A; therefore, the existing diversion facilities are adequate for the proposed change applications (all wells and reservation). The well field pumping test report is attached to this application package.

The City's engineer also completed a water system model to assess the capability of the City's water system to handle the additional demands. This report is attached to this application. The report includes description of well pump modeling, clear well and booster stations, water storage tanks, and the modeled demands. From the report:

'Water is pumped into the clear well from all points of diversion according to their individual pumping schedules. From the clear well, four booster pumps pump the water through the water treatment system where it is disinfected. From the treatment plant, water is pumped to the south side of Shelby and the volume is recorded at the location of the master water meter. From here water is pumped, aided by several booster pumps, to the south tank, airport tank, shop tank, and prison tank. Check valves are located along the lines at selected locations to prevent backflow. Water meters are located at selected locations, as shown on Map Figure NIR.5.C to record the amount of water distributed the Prison, Ethridge, Big Rose Colony, Cut Bank, and Devon'.

Conveyance facilities are built or are being designed for each of the proposed water service areas. Existing conveyance facilities are already in place to the prison, Ethridge, and Big Rose Colony. Conveyance facilities to Cut Bank and Devon and Dunkirk are in the design process.

Prison

There are three booster pumps that deliver water from the City's water tank on the south side of Shelby to the prison via a 12-inch PVC line. A 500,000 gallon water tank stores water at the prison. A water meter exists at the prison near the water tank. A 12-inch PVC line extends north from the prison to serve Ethridge and Cut Bank. Record drawings exist for the infrastructure improvements that were completed in 1999. The alignment of this pipeline is shown on a plan view record drawing sheet attached to this application.

Ethridge

The Ethridge service area is served from a 4-inch main line that is connected to the 12-inch waterline extending north from the prison. Water distribution lines within the Ethridge service area also include 1, 2, and 3-inch lines. A water meter exists where the system connects to the City's pipeline north of the prison. Record drawings exist for the infrastructure improvements that were completed in 2003. The alignment of this pipeline is shown on a plan view record drawing sheet attached to this application.

Big Rose Colony

An existing water pipeline extends north of Shelby to Big Rose Colony. The pipeline was constructed in 2004 and water use is metered by the City. A water meter exists where the system connects to the City's pipeline on the north side of the City. The City and the City's engineer could not locate record drawings or other information for this pipeline.

Cut Bank

Design drawings for the NCMRWA pipeline from Shelby to Cut Bank have recently been completed. The pipeline will be a 16-inch pipeline extending from Shelby to Cut Bank as shown on Map NIR.2.D. The pipeline would connect into the City's existing 12-inch waterline north of the prison, where water would be metered. The proposed pipeline would parallel the existing Ethridge pipeline and then continue northwest to Cut Bank where it would connect into Cut Bank's existing water distribution system. The alignment of this pipeline is shown on a plan view design drawing attached to this application.

Devon-Dunkirk

Design drawings for the pipeline from Shelby to the Devon-Dunkirk service area have recently been completed. The proposed pipeline alignment is shown on Map NIR.2.D. The pipeline would be a 4-inch waterline serving a total of 25 connections. The system is designed to be orifice limited to provide a maximum of 2.3 gpm per service connection (personal communication, Mike O'Brien, TD&H, January, 19, 2015). The constant flow rate would be fed into an existing distribution system of cisterns at each service connection. Existing cisterns vary in size from 500 gallons to 10,000 gallons, with the average cistern having a capacity of 3,000 gallons. Water use would include a community water depot where water could be trucked throughout the proposed service area. In addition to domestic and lawn and garden water use, water would be used to satisfy agricultural spraying demands. Agricultural spraying requires potable water to be mixed with chemicals at rates of 5 to 10 gallons of water per acre. Each farmer within the proposed service area treats on average 6,000 acres of dry-land crops multiple times per year through aerial application (personal communication, Roy Benjamin, Devon Water Inc., February 3, 2015). Water use would be metered by the City where the proposed Devon pipeline would connect to the City's distribution system. The alignment of the proposed pipeline is shown on a plan view design drawing attached to this application.

**TEMPORARY CHANGE ADDENDUM
FORM 606-TCA**

**APPLICATION FOR CHANGE OF A WATER RIGHT
TEMPORARY CHANGE ADDENDUM**

§ 85-2-407; § 85-2-408; § 85-2-436, MCA
ARM 36.12.1901

This addendum must be completed and the required information attached to a change application when a temporary change is requested under the statutes shown above. A temporary change can be made to a point of diversion, place of use, purpose of use, or place of storage of a water right. Complete an addendum for each water right that is proposed to be temporarily changed.

On a separate attachment provide the following information. Attachments must be labeled as shown in the sections below. (i.e. TCA.1.a) If a section is not applicable, label the section as Not Applicable or NA. Improperly labeled attachments will not be considered. Conclusions, calculations, references, data, and assumptions used must be included in the application materials.

Water Right No. 41P 192878 00 (Well 2) See attachment

Complete this form for each water right being changed.

Section 1. Temporary Change Details

TCA.1.a Who is the owner of the water right?
City of Shelby

TCA.1.b Yes No Is the owner of record changing the water right for another's use? If no, explain whose use is it being changed for?
The water right use will remain as municipal beneficial use. The water right will be changed to change the places of use (service area) and points of diversion.

TCA.1.c How many years will the water right will be temporarily changed? 10 years

TCA.1.d Yes No Will the temporary change will be intermittent over the years? If yes, explain how it will be used.

TCA.1.e For what purpose will the water right be temporarily used?
Municipal water supply until the North Central Montana Regional Water System is operational.

TCA.1.f Yes No Is the quantity of water subject to the temporary change being made available from the development of a new water conservation or storage project? If yes, explain the water conservation or storage project.

This Temporary Change Addendum includes 41P 192878 00 (Well 2) as well as the following water rights. The Temporary change details are all the same.

Water Right	Well Number
41P 192880 00	4
41P 192881 00	5
41P 192882 00	6
41P 4489 00	7
41P 4490 00	8
41P 58129 00	9,10,11,12,13
41P 71891 00	None

WELL LOGS

31N 02W 21E

Copy of log of Shelby No. 5 well

1002

Top of Ground
(Elev. above sea level)

0
to
1 ft.- Soil
to
7 ft. 6 in.-Sand
to
15 ft.-Gravel & Sand
to
18 ft.- Dark Clay
to
36 ft.-Gravel & Sand
to
48 ft. 6 in.-Dark Clay

#5
by Voorheese

MONTANA STATE BOARD OF HEALTH
Water and Sewage Division
WELL DRILLER'S REPORT

not coded
coded

Registration No. 16

Driller M.M. Ulrich Address Missoula, Montana

Owner of Well City of Shelby

Exact Location of Well On river bottom about 200 feet from the other well

Water to Be Used for Domestic

Drilling Begun May 29, 1940 Well Finished June 6, 1940

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Casing Record

Size of Pipe	Kind and Weight of Material Used	From (Feet)	to (Feet)	PERFORATIONS		
				Kind Size	From (Feet)	to (Feet)
15 1/2	L.D. 70 lb. oil well casing	4 Ft. above surface	26 Ft. 2 in. below surface	Screen 28 ft. x 20 ft.	26 ft.	36 ft.

Describe the type of joints in casing Screw

Describe any screens used 6 ft. of 12 1/2 inch pipe above screen- 12 1/2 ft. of 12 1/2 inch pipe below screen. The screen is a Johnson Copper screen

Capacity of Well 500 to 600 G.P.M.
(In Gallons or Barrels)

How Determined Will be tried out with a pump
(Pump, Baller, Weir, Etc.)

Signed M.M. Ulrich

Date June 10, 1940

(Law and Regulations on Reverse Side)

Show exact depth of bottom.

87581

File No. **101 31N 02W 21 E DCB**

WELL NO. 2

101 T **31** N R **2** W **21** E

TRIPLICATE

Triplet

County **Toole**

DCB

Montana Bureau of
Mines and Geology

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Top of Ground
(Elev. above sea level **3007**)
3100 (2)

to 8' clay

to 12' clay and gravel

to 15' gravel sand & water

to 18 clay & gravel

to 20 some water

to 24 loose gravel & water

to 29' tight gravel, clay & seepage

to 32' loose gravel some clay

to 48' shale

Show exact depth of bottom.

Notice of Completion of Groundwater Appropriation by Means of Well

(Under Chapter 237, Montana Session Laws, 1961)

Owner **City of Shelby #2** Address **Box 743, Shelby, Montana**

Driller **J. M. Ulrich** Address **Unknown**

Date of Notice of Appropriation of Groundwater _____

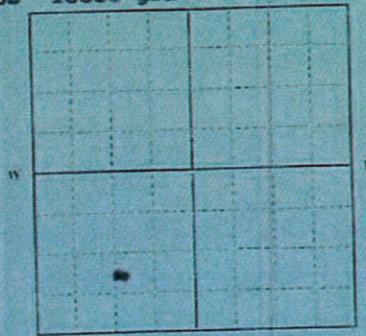
Date well started **9/11/46** Date Completed **10/1/46**

Type of well **Drilled** Equipment Used **Drill Rig**
(dug, driven, bored or drilled) (Churn, drill, rotary or other)

Water Use: Domestic Municipal Other Irrigation
Industrial Drainage Stock

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS		
				Kind Size	From (Feet)	To (Feet)
	15 1/2 I. D.	0	34	5/8 x 1 3/8 slots	13'	15'
	12 1/2 I. D.	32'	46		19'	32'



1/4 Sec. **21** T. **31** R. **2**

Indicate location of well and place of use, if possible. Each small square represents 10 acres.

Static Water Level for non-flowing Well **15** feet.

Shut-in Pressure for Flowing Well _____

Pumping Water Level **30** feet at **300** gal. per minute.

Discharge in gal. per min. of flowing well **Not known**

How Tested **gauge** Length of Test **Not known**

Remarks: (Gravel packing, cementing, packers, type of shutoff, location of place of use of groundwater if not at well, and any other similar pertinent information, including number of acres irrigated, if used for irrigation)

Not known
Driller's License Number

J. M. Ulrich
Driller's Signature

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology and Quadruplicate for the Appropriator.

M: 87577

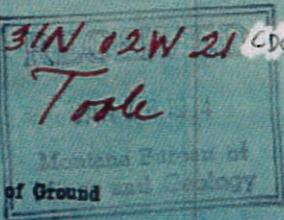
File No. 101 31N 02W 21 CDCB

3703-2

WELL NO. 3

101 T 31 N R 2 W 21 CDCB

TRIPLICATE



County Toole

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Top of Ground (Elev. above sea level -3094)

Notice of Completion of Groundwater Appropriation by Means of Well

(Under Chapter 237, Montana Session Laws, 1961)

Owner City of Shelby #3 Address Box 743 Shelby, Montana

Driller J. M. Ulrich Address Unknown

Date of Notice of Appropriation of Groundwater Unknown

Date well started 6/27/39 Date Completed 7/7/39

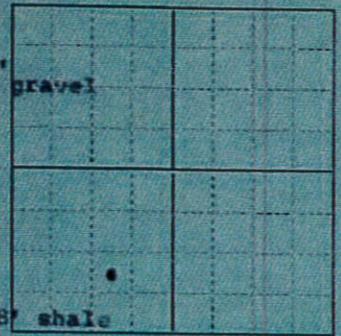
Type of well Drilled Equipment Used Spudder
(dug, driven, bored or drilled) (Churn, drill, rotary or other)

Water Use: Domestic Municipal Other Irrigation
Industrial Drainage Stock

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which water rises in the well.

to 7' top soil
water at 10'
to sand & gravel 22
to 23 sand & clay with some gravel
to 27 gravel & sand
to 30' sand & little fine gravel
to 41' sand & gravel
to 48' shale

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS		
				Kind Size	From (Feet)	To (Feet)
	2 15" x 90 lb steel casing	0	24	screen	24'	34'



1/4 Sec. 21 T 31 R 2
Indicate location of well and place of use, if possible. Each small square represents 10 acres.

Show exact depth of bottom.

Static Water Level for non-flowing Well Not known feet
Shut-in Pressure for Flowing Well Not known
Pumping Water Level Not known feet at Not known gal. per minute.
Discharge in gal. per min. of flowing well Not known
How Tested Not known Length of Test Not known
Remarks: (Gravel packing, cementing, packers, type of shutoff, location of place of use of groundwater if not at well, and any other similar pertinent information, including number of acres irrigated, if used for irrigation)

Not known
Driller's License Number
J. M. Ulrich
Driller's Signature

ELEV: 3100 (2)

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology and Quadruplicate for the Appropriator.

M: 87576

File No. 101 31N 02W 21CDBC
WELL NO. 4

101 T 31 N R 2 W 21 C

TRIPLICATE

Toole

County Toole CDBC

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater
Appropriation by Means of Well

(Under Chapter 237, Montana Session Laws, 1961)

- Top of Ground (Elev. above sea level 3000)
- to 8' clay
- to 10' clay & sand
- to 15' clay, sand & seepage
- to 20' gravel and water
- to 25' coarse sand & fine gravel & water
- to 30' coarse sand & gravel clay mixed with water
- to 50' shale Show exact depth of bottom.

Owner City of Shelby #4 Box 743 Address Shelby, Montana

Driller J. M. Ulrich Address Not known

Date of Notice of Appropriation of Groundwater _____

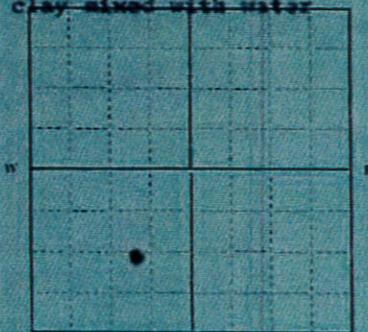
Date well started 10/3/46 Date Completed 10/12/46

Type of well Drilled Equipment Used spudder
(dug, driven, bored or drilled) (Churn, drill, rotary or other)

Water Use: Domestic Municipal Other Irrigation
Industrial Drainage Stock

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS		
				Kind Size	From (Feet)	To (Feet)
	15 1/2" ID	0	33'	5/8x3/8	15'	30'
	12 1/2" ID	31'	49' 6"			



1/4 Sec. 21 T. 31 R. 2
Indicate location of well and place of use, if possible. Each small square represents 10 acres.

Static Water Level for non-flowing Well 19' 6" feet.

Shut-in Pressure for Flowing Well Not known

Pumping Water Level 29' feet at 300 gal. per minute.

Discharge in gal. per min. of flowing well Not known

How Tested Not known Length of Test Not known

Remarks: (Gravel packing, cementing, packers, type of shutoff, location of place of use of groundwater if not at well, and any other similar pertinent information, including number of acres irrigated, if used for irrigation)

Not known
Driller's License Number

J. M. Ulrich
Driller's Signature

ELEV: 3100 (2)

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology and Quadruplicate for the Appropriator.

M: 87578

File No. 101 31N 02W 21CDB

WELL NO. 5

31 N. R. 2 W. 21

County Toole

TRIPLICATE Toole

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater
Appropriation by Means of Well

(Under Chapter 237, Montana Session Laws, 1961)

0' Top of Ground

(Elev. above sea level 3094)

Fill Rock & Gravel

8"

Coarse gravel

16'

Sand, gravel, rock

23'

Sand, gravel, rock & hard clay

27'

Fine sand, rock, clay

30'

rock and gravel

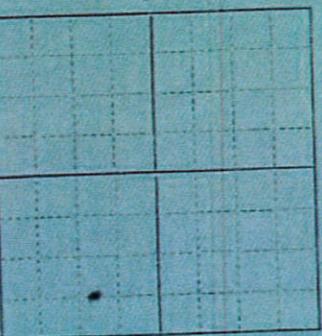
32'

Sand, gravel, rock & Shale

36'

38'

"



Sec. 21 T. 31 R. 2
Indicate location of well and place of use, if possible. Each small square represents 10 acres.

Show exact depth of bottom.

Owner City of Shelby #5 Address Shelby, Montana
Box 743

Driller Layne-Minnesota Address Minneapolis, Minn.

Date of Notice of Appropriation of Groundwater

Date well started 1962 Date Completed 1962

Type of well Gravel Well Equipment Used Caisson
(dug, driven, bored or drilled) (Churn, drill, rotary or other)

Water Use: Domestic Municipal Other Irrigation
Industrial Drainage Stock

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS		
				Kind Str	From (Feet)	To (Feet)
60"	38"	5	4'0"			
38"		"	21'			
24"		"	34'2"			
24"	34'2"		44'2"	5	34'2"	44'2"

Static Water Level for non-flowing Well 19' 11" feet.

Shut-in Pressure for Flowing Well Not known

Pumping Water Level 34' feet at 350 gal. per minute.

Discharge in gal. per min. of flowing well Not known

How Tested Turbine Pump Length of Test 8 hrs

Remarks: (Gravel packing, cementing, packers, type of shutoff, location of place of use of groundwater if not at well, and any other similar pertinent information, including number of acres irrigated, if used for irrigation)

Double gravel wall - 52" dia. to 24" screen, 38" casing cemented in 60" hole, 1 1/2" PVC treatment coil around screen

208

Driller's License Number

Layne-Minnesota Company
Driller's Signature

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology and Quadruplicate for the Appropriator.

M: 807579

File No. **101 31N 02W 21E1** BC

101 T 31 N R 2 W

TRIPPLICATE

Toole

WELL NO. 6

County **Toole** CD BC

STATE OF MONTANA *Well 1*
 ADMINISTRATOR OF GROUNDWATER CODE
 OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

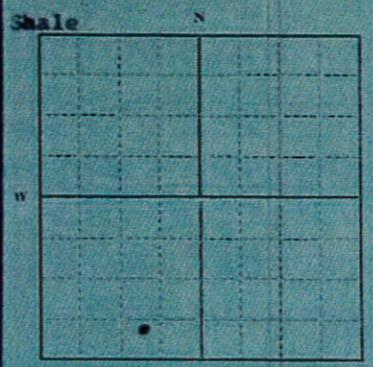
(Under Chapter 237, Montana Session Laws, 1961)

0' Top of Ground
 (Elev. above sea level **3694**)
 Sandy clay **3095**
 4 1/2'
 Sand - fine to coarse
 11'
 Sand & Gravel
 17 1/2'
 Soft clay
 21'
 Sand, gravel & Rock
 34 1/2'
 Shale

Owner **City of Shelby #6** Address **Box 743 Shelby, Montana**
 Driller **Layne-Minnesota** Address **Minneapolis, Minn.**
 Date of Notice of Appropriation of Groundwater _____
 Date well started **6/22/62** Date Completed **8/4/62**
 Type of well **Gravel wall** Equipment Used **Caisson**
 (dug, driven, bored or drilled) (Churn, drill, rotary or other)
 Water Use: Domestic Municipal Other Irrigation
 Industrial Drainage Stock

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS		
				Kind Size	From (Feet)	To (Feet)
52"	Steel	5 1/2'	18'			
24"	Steel	"	30 1/2'			
24"	Stainless	30 1/2'	40 1/2'	#5	30 1/2'	40 1/2'



1/4 Sec. **21 T 31 R 2**
 Indicate location of well and place of use, if possible. Each small square represents 10 acres.

Show exact depth of bottom.

Static Water Level for non-flowing Well **19' 11"** feet.
 Shut-in Pressure for Flowing Well **Not known**
 Pumping Water Level **30'** feet at **250** gal. per minute.
 Discharge in gal. per min. of flowing well **Not known**
 How Tested **Turbine pump & Grifice** Length of Test **8 hrs**
 Remarks: (Gravel packing, cementing, packers, type of shutoff, location of place of use of groundwater if not at well, and any other similar pertinent information, including number of acres irrigated, if used for irrigation)
Double gravel wall - 52" dia. to 24" screen, outer casing cemented in 60" dia. hole. 1 1/2" PVC treatment coil around screen

208
 Driller's License Number
Layne-Minnesota Company
 Driller's Signature

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology and Quadruplicate for the Appropriator.

M: 87580

STATE OF MONTANA
Department of Natural Resources and Conservation

Handwritten signature/initials

WELL LOG REPORT

GOLDENROD—DRILLER

State law requires that this form be filed by the water well driller on any water well completed by him on and after July 1, 1973 within sixty (60) days after completion of the well.

1. WELL OWNER: Name City of Shelby #8 Address Shelby, Mont. 59474

2. WELL LOCATION: County Toole Lot 5; $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$, Sec. 21, Twp. 31N N-S, Rg. 24 E-W

3. PROPOSED USE: Domestic Stock Municipal Industrial Lawn and Garden
 Irrigation Other (if other, specify) _____

4. METHOD DRILLED: Cable Bored
 Forward Rotary Reverse Rotary
 Jetted Other (if other, specify) _____

5. WELL CONSTRUCTION:
Diameter of hole 13 inches. Depth 31 ft.
Casing: Steel Plastic Concrete
 Threaded Welded Other (if other, specify) _____
Pipe Weight: Dia.: From: To:
48 lb/ft. 13 inches 0 feet 21 feet
 lb/ft. inches feet feet
 lb/ft. inches feet feet
Was perforated pipe used? Yes No
Length of pipe perforated none feet
Was casing left open end? Yes No
Was a well screen installed? Yes No
Material stainless steel Dia. 11 inches
(stainless steel, bronze, etc.)
Perforation type: slots holes
Size 30 set from 20 feet to 24 feet
Size 40 set from 24 feet to 30 feet
Size set from feet to feet
Was a packer or seal used? Yes No
If so, what material lead
Well type: Straight screen Graveled
Was the well grouted? Yes No
To what depth? 0-10 feet
Material used in grouting next cement
Well head completion: Pitless adapter
12" above grade Other _____
(if other, specify) _____
Was the well disinfected? Yes No

6. WATER LEVEL:
Static water level 7 ft. below land surface
If flowing: closed-in pressure _____ psi
GPM flow _____ through _____ inch pipe
Controlled by: Valve Reducers
 Other, specify _____

7. WELL TEST DATA: Pump Bailer Other
(if other, specify) not tested
Pumping level below land surface:
 ft. after hrs. pumping gpm
 ft. after hrs. pumping gpm

8. WELL LOG:
Depth (ft.)
From To Formation
0 30 gravel & sand
 water @ 17 ft.
30 31 dark shale

9. DATE STARTED: Jan. 15 1975

10. DATE COMPLETED: Feb. 25 1975

11. WAS WELL PLUGGED OR ABANDONED? Yes No
If so, how _____

12. DRILLER'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.
Aising Drilling Co. 3 99
Driller's or Firm Name License No.
Shelby, Mont 59474
Address
James A. Aising
Signed by Date

M: 87573

Toole

White-Department
 Yellow-Department
 Pink-Well Owner
 Gold-Driller

CODED

WELL LOG REPORT

009481

State law requires that this form be filed by the water well driller within 60 days after completion of the well, a
 of Completion of Groundwater Development, be filed by the well owner within 60 days after the water has been

1. WELL OWNER Name Shelby City Water Well #9

2. CURRENT MAILING ADDRESS City Hall Shelby MT 59474

3. PROPOSED USE _____ domestic (includes lawn and garden); _____ stock; municipal; _____ industrial;
 _____ irrigation; _____ other (specify)

4. WELL LOCATION

		NW		NE
		SW		SE

T. 31N R. 2W Section 21

OR, Lot #9 N or S _____ E or W _____
 Subdivision _____
 City _____ County Toole
 Elevation _____ Accuracy: _____ +10'; _____ +50'; _____ ±100';

8. WELL TEST DATA pump _____ bailer _____ other _____
 (if other, specify) _____
 Pumping level below land surface:
18 ft. after 8 hrs. pumping 235 gpm
 _____ ft. after _____ hrs. pumping _____ gpm

9. WAS WELL PLUGGED OR ABANDONED? Yes No _____
 If yes, how? _____

10. DATE STARTED Aug 15 84
 DATE COMPLETED March 13 85

11. WELL LOG

Depth (ft.)		Formation
From	To	
0	15	sand & silt
15	16	gravel water
16	26	gravel
26	29	Multi colored gravel
29	40	gravel
40		lath shale

5. DRILLING METHOD cable, _____ bored,
 _____ forward rotary, _____ reverse rotary, _____ jetted,
 _____ other (specify)

6. WELL CONSTRUCTION AND COMPLETION

Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations and/or Screen
8	8 3/8 30 lb	0	24	Johnson 40 24 Standard screened

3/13/85

Was casing left open end? Yes, _____ No _____
 Was a packer or seal used? Yes, _____ No _____
 If so, what material neoprene
 Was the well gravel packed? Yes, _____ No _____
 Was the well grouted? Yes, _____ No _____
 To what depth? 20 ft
 Material used in grouting Portland
 Well head completion: Pitless adapter _____
 12 in. above grade other _____
 (if other, specify) _____
 Pump horsepower _____, pump type _____
 Pump intake level _____ feet below land surface
 Power (electric, diesel, etc.) _____

Received State water test 3/13/85

7. WATER LEVEL
 Static water level 10 feet below land surface
 If flowing, closed-in pressure _____ psi
 _____ gpm flow through _____ inch pipe
 Controlled by: _____ valve, _____ reducers, _____ other
 (if other, specify)

12. DRILLER'S CERTIFICATION
 This well was drilled under my jurisdiction and this report is true to the best of my knowledge.
 Date 3/21/85
 Signature Russell Aikin License No. 99
 Firm name Aikin Drilling Co
 Address 15110th Ave N Shelby MT 59474

M: 875 74

White-Department
 Yellow-Department
 Pink-Well Owner
 Gold-Driller

WELL LOG REPORT

CODED

009482

State law requires that this form be filed by the water well driller within 60 days after completion of the well, and of Completion of Groundwater Development, be filed by the well owner within 60 days after the water has been

<p>1. WELL OWNER Name <u>Shelby City Well #10</u></p>	<p>2. CURRENT MAILING ADDRESS <u>City Hall Shelby MT 59474</u></p>																
<p>3. PROPOSED USE _____ domestic (includes lawn and garden); _____ stock; <input checked="" type="checkbox"/> municipal; _____ industrial; _____ irrigation; _____ other (specify) _____</p>																	
<p>4. WELL LOCATION</p> <div style="border: 1px solid black; width: 150px; height: 150px; margin: 0 auto; position: relative;"> <div style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); font-size: 20px;">NW</div> <div style="position: absolute; top: 50%; right: 50%; transform: translate(50%, -50%); font-size: 20px;">NE</div> <div style="position: absolute; bottom: 50%; left: 50%; transform: translate(-50%, 50%); font-size: 20px;">SW</div> <div style="position: absolute; bottom: 50%; right: 50%; transform: translate(50%, 50%); font-size: 20px;">SE</div> </div> <p>T. <u>31N</u> R. <u>2W</u> Section <u>21</u> N or S _____ E or W _____ OR, Lot <u>#10</u> Block _____ Subdivision _____ City _____ County <u>Toole</u> Elevation _____ Accuracy: ±10'; ±50'; ±100';</p>	<p>8. WELL TEST DATA <input checked="" type="checkbox"/> pump _____ bailer _____ other _____ (if other, specify) _____ Pumping level below land surface: <u>14.5</u> ft. after <u>8</u> hrs. pumping <u>320</u> gpm _____ ft. after _____ hrs. pumping _____ gpm</p> <p>9. WAS WELL PLUGGED OR ABANDONED? Yes <input checked="" type="checkbox"/> No _____ If yes, how? _____</p> <p>10. DATE STARTED <u>Oct 20 1984</u> DATE COMPLETED <u>March 13 1985</u></p> <p>11. WELL LOG Depth (ft.)</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>From</th> <th>To</th> <th>Formation</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>15</td> <td>silt + sand</td> </tr> <tr> <td>15</td> <td>17</td> <td>gravel water</td> </tr> <tr> <td>17</td> <td>40</td> <td>sand + gravel</td> </tr> <tr> <td>40</td> <td>41</td> <td>dark shale</td> </tr> </tbody> </table>	From	To	Formation	0	15	silt + sand	15	17	gravel water	17	40	sand + gravel	40	41	dark shale	
From	To	Formation															
0	15	silt + sand															
15	17	gravel water															
17	40	sand + gravel															
40	41	dark shale															
<p>5. DRILLING METHOD <input checked="" type="checkbox"/> cable, _____ bored, _____ forward rotary, _____ reverse rotary, _____ jetted, _____ other (specify) _____</p>																	
<p>6. WELL CONSTRUCTION AND COMPLETION</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Size of drilled hole</th> <th>Size and weight of casing</th> <th>From (feet)</th> <th>To (feet)</th> <th>Perforations and/or Screen</th> <th>Kind Size</th> <th>From (feet)</th> <th>To (feet)</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>8 3/8 20lb</td> <td>0</td> <td>29</td> <td>X</td> <td>Johnson Steels Stud</td> <td>41</td> <td>29</td> </tr> </tbody> </table> <p>Was casing left open end? <input checked="" type="checkbox"/> Yes, _____ No Was a packer or seal used? <input checked="" type="checkbox"/> Yes, _____ No If so, what material <u>resin</u> Was the well gravel packed? <input checked="" type="checkbox"/> Yes, _____ No Was the well grouted? <input checked="" type="checkbox"/> Yes, _____ No To what depth? <u>0-80</u> Material used in grouting <u>Cement</u> Well head completion: Pifess adapter 12 in. above grade <input checked="" type="checkbox"/> _____ other _____ (if other, specify) _____ Pump horsepower _____, pump type _____ Pump intake level _____ feet below land surface Power (electric, diesel, etc.) _____</p>		Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations and/or Screen	Kind Size	From (feet)	To (feet)	8	8 3/8 20lb	0	29	X	Johnson Steels Stud	41	29
Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations and/or Screen	Kind Size	From (feet)	To (feet)										
8	8 3/8 20lb	0	29	X	Johnson Steels Stud	41	29										
<p>7. WATER LEVEL Static water level <u>9</u> feet below land surface If flowing, closed-in pressure _____ psi _____ gpm flow through _____ inch pipe Controlled by: _____ valve, _____ reducers, _____ other (if other, specify) _____</p>																	
<p>12. DRILLER'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge. _____ Date <u>3/21/85</u> <u>Harold Akin</u> 99 Signature _____ License No. _____ <u>Akin's Drilling Co</u> Firm name <u>151-10 Ave N Shelby MT 59474</u> Address</p>																	

M: 87575

WELL LOG REPORT

File No. 41P-1058129

State law requires that the Bureau's copy be filed by the water well driller within 60 days after completion of the well.

<p>1. WELL OWNER Name <u>City of Shelby</u></p> <p>2. CURRENT MAILING ADDRESS <u>P.O. Box 743</u> <u>Shelby, MT 59474</u></p> <p>3. WELL LOCATION Twp. <u>1/4 SE 1/4 SW 1/4</u> Section <u>21</u> Township <u>31</u> Range <u>2</u> County <u>Toole</u> Gov't Lot _____ or Lot _____ Block _____ Subdivision Name _____ Tract Number _____</p> <p>4. PROPOSED USE: Domestic <input checked="" type="checkbox"/> Stock <input type="checkbox"/> Irrigation <input type="checkbox"/> Other <input type="checkbox"/> specify <u>PWS</u></p> <p>5. TYPE OF WORK: New well <input checked="" type="checkbox"/> Method: Dug <input type="checkbox"/> Bored <input type="checkbox"/> Deepened <input type="checkbox"/> Cable <input type="checkbox"/> Driven <input checked="" type="checkbox"/> Reconditioned <input type="checkbox"/> Rotary <input type="checkbox"/> Jetted <input type="checkbox"/></p> <p>6. DIMENSIONS: Diameter of Hole Dia. <u>12</u> in. from <u>0</u> ft. to <u>20</u> ft. Dia. <u>8</u> in. from <u>20</u> ft. to <u>38</u> ft. Dia. _____ in. from _____ ft. to _____ ft.</p> <p>7. CONSTRUCTION DETAILS: Casing: Steel Dia. <u>8</u> from <u>+10</u> ft. to <u>26</u> ft. Threaded <input type="checkbox"/> Welded <input checked="" type="checkbox"/> Dia. _____ from _____ ft. to _____ ft. Type <u>38.55 lbs</u> Wall Thickness <u>.322</u> Casing: Plastic Dia. _____ from _____ ft. to _____ ft. Weight _____ Dia. _____ from _____ ft. to _____ ft. PERFORATIONS: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Type of perforator used _____ Size of perforations _____ in. by _____ in. _____ perforations from _____ ft. to _____ ft. _____ perforations from _____ ft. to _____ ft. _____ perforations from _____ ft. to _____ ft. SCREENS: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Manufacturer's Name <u>Houston Well Screen</u> Type <u>Stainless Steel</u> Model No. <u>304SS</u> Dia. <u>8</u> Slot size <u>.060</u> from <u>26</u> ft. to <u>36</u> ft. Dia. _____ Slot size _____ from _____ ft. to _____ ft. GRAVEL PACKED: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Size of gravel _____ Gravel placed from _____ ft. to _____ ft. GROUTED: To what depth? <u>20</u> ft. Material used in grouting <u>Cement</u></p> <p>8. WELL HEAD COMPLETION: Pitless Adapter <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>9. PUMP (if installed) Manufacturer's name _____ Type _____ Model No. _____ HP. _____</p> <p>10. WELL TEST DATA The information requested in this section is required for all wells. All depth measurements shall be from the top of the well casing. All wells under 100 gpm must be tested for a minimum of one hour and provide the following information: a) Air _____ Pump <input checked="" type="checkbox"/> Bailor _____ b) Static water level immediately before testing _____ ft. If flowing; closed-in pressure _____ psi. _____ gpm. Flow controlled by: _____ valve, _____ reducers, _____ other, (specify) _____ c) Depth at which pump is set for test _____ <u>36</u> d) The pumping rate: <u>430</u> gpm. e) Pumping water level <u>22</u> ft. at <u>1/2</u> hrs. after pumping began.</p>	<p>f) Duration of test: Pumping time <u>24</u> hrs. g) Recovery time <u>2</u> hrs. h) Recovery water level _____ ft. at <u>1/2</u> hrs. after pumping stopped. Wells intended to yield 100 gpm or more shall be tested for a period of 8 hours or more. The test shall follow the development of the well, and shall be conducted continuously at a constant discharge at least as great as the intended appropriation. In addition to the above information, water level data shall be collected and recorded on the Department's "Aquifer Test Data" form. NOTE: All wells shall be equipped with an access port 1/2 inch minimum or a pressure gauge that will indicate the shut-in pressure of a flowing well. Removable caps are acceptable as access ports.</p> <p>11. WAS WELL PLUGGED OR ABANDONED? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, how? _____</p> <p>12. WELL LOG Depth (ft.) From To Formation</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>0</td><td>4 1/2</td><td>Brown Sand - Medium Grain</td></tr> <tr><td>4 1/2</td><td>9</td><td>Brown Sand - Small Gravel</td></tr> <tr><td>9</td><td>12</td><td>Brown Sand - Medium Grain</td></tr> <tr><td>12</td><td>23</td><td>Brown Sand - 1/2" - 1" Gravel</td></tr> <tr><td>23</td><td>26</td><td>Gravel Sand - Medium Grain</td></tr> <tr><td>26</td><td>36</td><td>Gravel Sand - 3/4" - 1 1/2" Gravel</td></tr> <tr><td>36</td><td>38</td><td>Gravel Shale/Clay</td></tr> </table> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">RECEIVED</p> <p style="text-align: center;">OCT 22 1993</p> <p style="text-align: center;">MONTANA - D.N.R.C. HAVRE FIELD OFFICE</p> <p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">RECEIVED</p> <p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">M.B.M.G.</p> <p style="text-align: right;">ATTACH ADDITIONAL SHEETS IF NECESSARY</p> <p>13. DATE COMPLETED <u>5-31-93</u></p> <p>14. DRILLER/CONTRACTOR'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge. <u>152-1888</u> Date <u>7-24-93</u> <u>Bobland Drilling Co.</u> Firm Name _____ <u>4601 7th Ave. Great Falls,</u> Address _____ <u>MT 59405</u> <u>Chris Bobland</u> License No. <u>482</u> Signature _____</p>	0	4 1/2	Brown Sand - Medium Grain	4 1/2	9	Brown Sand - Small Gravel	9	12	Brown Sand - Medium Grain	12	23	Brown Sand - 1/2" - 1" Gravel	23	26	Gravel Sand - Medium Grain	26	36	Gravel Sand - 3/4" - 1 1/2" Gravel	36	38	Gravel Shale/Clay
0	4 1/2	Brown Sand - Medium Grain																				
4 1/2	9	Brown Sand - Small Gravel																				
9	12	Brown Sand - Medium Grain																				
12	23	Brown Sand - 1/2" - 1" Gravel																				
23	26	Gravel Sand - Medium Grain																				
26	36	Gravel Sand - 3/4" - 1 1/2" Gravel																				
36	38	Gravel Shale/Clay																				

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
1520 EAST SIXTH AVENUE HELENA, MONTANA 59620-2301 444-6610

DNRC

RECEIVED

SEP 08 2005

MT DEQ PUBLIC WATER & SUBDIVISIONS BUREAU

Well No 11

PWS# 00328012

M: 251167

31N 02W 21 CDA

WELL LOG REPORT

File No. 41P-0058129

State law requires that the Bureau's copy be filed by the water well driller within 60 days after completion of the well.

1. WELL OWNER Name City of Shelby

2. CURRENT MAILING ADDRESS P.O. Box 743
Shelby, MT 59474

3. WELL LOCATION NE 1/4 SE 1/4 SW 1/4 Section 21
Township 31 N Range 2 E County Todd
Gov't Lot _____ or Lot _____ Block _____
Subdivision Name _____
Tract Number _____

4. PROPOSED USE: Domestic Stock Irrigation
Other specify PWS

5. TYPE OF WORK:
New well Method: Dug Bored
Deepened Cable Driven
Reconditioned Rotary Jetted

6. DIMENSIONS: Diameter of Hole
Dia. 12" in. from 0 ft. to 20 ft.
Dia. 8" in. from 20 ft. to 38 ft.
Dia. _____ in. from _____ ft. to _____ ft.

7. CONSTRUCTION DETAILS:
Casing: Steel Dia. 8" from 10 ft. to 24 ft.
Threaded Welded Dia. _____ from _____ ft. to _____ ft.
Type 28.55 Wall Thickness .32
Casing: Plastic Dia. _____ from _____ ft. to _____ ft.
Weight _____ Dia. _____ from _____ ft. to _____ ft.
PERFORATIONS: Yes No
Type of perforator used _____
Size of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
SCREENS: Yes No
Manufacturer's Name Houston Well Screen
Type Stainless Steel Model No. 30455
Dia. 8" Slot size .100 from 24 ft. to 36 ft.
Dia. _____ Slot size _____ from _____ ft. to _____ ft.
GRAVEL PACKED: Yes No Size of gravel _____
Gravel placed from _____ ft. to _____ ft.
GROUTED: To what depth? 20 ft.
Material used in grouting Cement

8. WELL HEAD COMPLETION:
Pitless Adapter Yes No

9. PUMP (if installed)
Manufacturer's name _____
Type _____ Model No. _____ HP _____

10. WELL TEST DATA
The information requested in this section is required for all wells. All depth measurements shall be from the top of the well casing.
All wells under 100 gpm must be tested for a minimum of one hour and provide the following information:
a) Air _____ Pump Bailor _____
b) Static water level immediately before testing _____ ft. If flowing; closed-in pressure _____ psi. _____ gpm.
Flow controlled by: _____ valve, _____ reducers, _____ other, (specify) _____
c) Depth at which pump is set for test _____ 36
d) The pumping rate: 440 gpm.
e) Pumping water level 23 ft. at 1 hrs. after pumping began.

11. WAS WELL PLUGGED OR ABANDONED? Yes No
If yes, how? _____

12. WELL LOG
Depth (ft.)
From To Formation CC

0	4	Brown Sand - Medium Grain
4	12	Brown Sand - 1/2" - 1" Gravel
12	20	Brown Sand - 3/4" - 1 1/4" Gravel
20	24	Gray Sand - Coarse Grain
24	36	Gray Sand - 3/4" - 1 1/2" Gravel
36	38	Gray Shale Clay

13. DATE COMPLETED 5-31-93

14. DRILLER/CONTRACTOR'S CERTIFICATION
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.
724-93
Date
Boland Drilling Co.
Firm Name
4601 7th Ave. So. Great Falls,
Address
Chis Boland 482
Signature License No.

RECEIVED

OCT 22 1993

MONTANA D.N.R.C.
HAVRE FIELD OFFICE

RECEIVED

P.M.O.

ATTACH ADDITIONAL SHEETS IF NECESSARY

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
1520 EAST SIXTH AVENUE HELENA, MONTANA 59620-2301 444-6510

DNRC

Well No 12

PWS # 00328013

RECEIVED

SEP 08 2005

H: 251162

MT DEQ PUBLIC WATER & SUBDIVISIONS BUREAU

KLJ WELL FIELD PUMPING TEST REPORT



Shelby Well Field Pump Test

Date: 10/2/2013 - 10/3/2013

To: Larry Bonderud (Shelby, NCMRWA)

Copy to: Julie Titchbourne (Missoula-KLJ)
Brad Koon (Helena-KLJ)
Mark Peterson (Helena-AE2S)

From: Jason Crawford (Helena-KLJ)

RE: NCMRWA Cut Bank to Shelby



PURPOSE

On October 2nd and 3rd 2013, the City of Shelby Public Works Department and KLJ conducted pump tests on Shelby's well field. The purpose of the tests was to determine the quantity of water that could be pumped from the wells to the 100,000 gallon tank situated near Williamson Park.

WELL FIELD

All of the water for the City of Shelby is supplied from eleven wells located in Williamson Park near the Marias River. The wells vary in depth from 31 to 50 feet. Seven of the eleven wells are shut down during the winter months. Six (Wells No. 7-12) of the seven wells that are shut down in the winter months are removed from service to prevent them from freezing and the other well (Well No. 5, which is capable of operating during the winter months) is shut down because the additional water is not needed during the winter months. Following is a summary of the operations of the eleven wells:

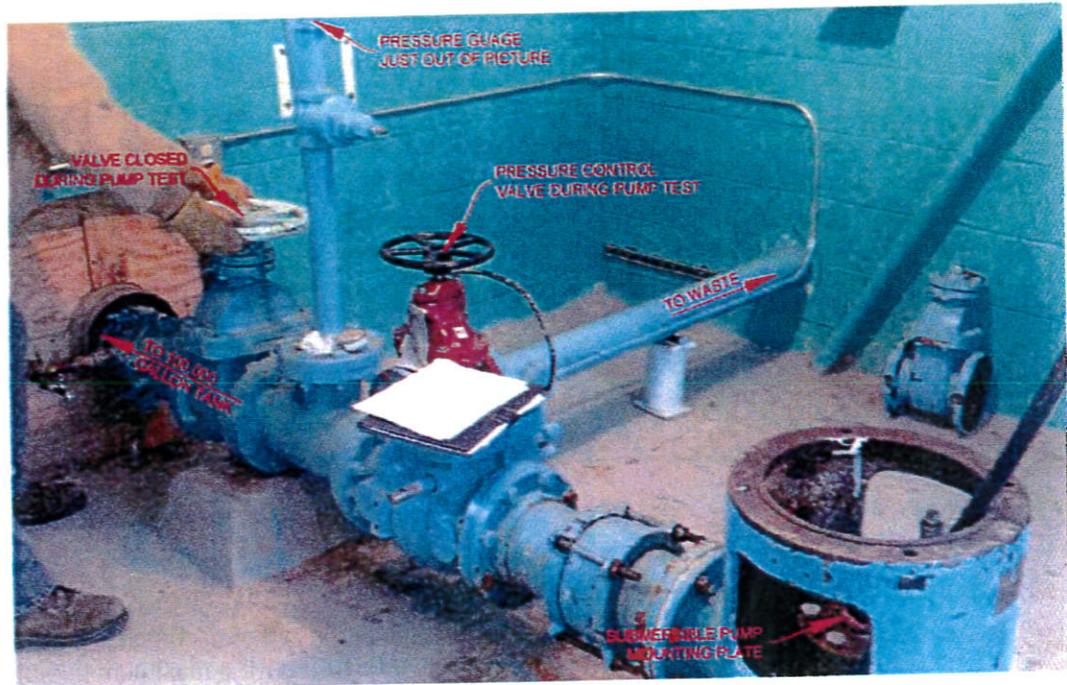


Well No.	Well Operation	Well Status
1	Pumps into the 100,000 gallon tank	Is used all year.
2	Pumps into the 100,000 gallon tank	Is used all year.
3	Pumps into the 100,000 gallon tank	Is used all year.
4 6	5 Pumps into the 100,000 gallon tank	Is shut down during winter months
	7 Pumps into the 100,000 gallon tank	Must be shut down during winter months
	8 Pumps into the 100,000 gallon tank	Must be shut down during winter months
	9 Pumps into the casing of Well No. 1	Must be shut down during winter months
	10 Pumps into the casing of Well No. 3	Must be shut down during winter months
	11 Pumps into the casing of Well No. 5	Must be shut down during winter months
	12 Pumps into the casing of Well No. 7	Must be shut down during winter months
	13 Pumps into the 100,000 gallon tank	Is used all year.

PUMP TESTING

The tests were conducted by pumping those wells that directly supply water to the 100,000 gallon tank. The wells were pumped at a known flow rate and pressure. The rate and pressures were incrementally adjusted until a maximum pumping rate was achieved. The testing setup for the wells generally consisted of the well, pump, pressure gauge, meter, and the plumbing.

The following picture represents the typical well house plumbing:



Wells 1-8 were pumped to waste.



Wells 1,3,5, and 7 receive supplementary water from wells 9-12. The supplementary water is pumped from the supplementary well to its corresponding receiving well casing.



The specifics of each test are as follows:

Well No. 1

Well No. 1 was pumped to waste. Well No. 9 pumps supplementary water into the casing of well No. 1. Prior to starting the pump test, well no. 9 was turned on and the pumping rate was recorded to be 160 gpm by review of the meter. Once the supplementary rate was recorded, well no. 1 was turned on. The pressure and pumping rate were incrementally adjusted and recorded. The following table provides a summary of the pump test results for well no. 1.



WELL # 1 - WITH WELL NO. 9 PUMPING TO IT AT 160 GPM	PRESSURE (PSI)	PUMPING RATE (GPM)	TIME (10/2/13)	COMMENT
	30	191	13:40	
	28	231		
	26	250		
	24	271		
	22	293		
	20	307		
	18	330		
	16	357		
	14	370		
	12	389		
	10	401		
	8	415		
	6	428		
	5.5	437	14:13	VALVE WIDE OPEN

Well No. 2

Well No. 2 was pumped to waste. Well No. 2 does not have supplementary water pumping to it. Well no. 2 was turned on and the pressure and pumping rate were incrementally adjusted and recorded. The following table provides a summary of the pump test results for well no. 2.

WELL # 2	PRESSURE (PSI)	PUMPING RATE (GPM)	TIME (10/3/13)	COMMENT
	40	35	9:28	
	35	70		
	32	73	9:45	MAXIMUM RATE

Well No. 3

Well No. 3 was pumped to waste. Well No. 10 pumps supplementary water into the casing of well No. 3. Prior to starting the pump test, well no. 10 was turned on and the



pumping rate was recorded to be 140 gpm by review of the meter. Once the supplementary rate was recorded, well no. 3 was turned on. The pressure and pumping rate were incrementally adjusted and recorded. The following table provides a summary of the pump test results for well no. 3.

WELL # 3 - WITH WELL NO. 10 PUMPING TO IT AT 140 GPM	PRESSURE (PSI)	PUMPING RATE (GPM)	TIME (10/2/13)	COMMENT
	30	87	15:07	
	25	163		
	20	235		
	15	271		
	10	298		
	6	370	15:30	VALVE WIDE OPEN

Well No. 5

Well No. 5 was pumped to waste. Well No. 11 pumps supplementary water into the casing of well No. 5. Prior to starting the pump test, well no. 11 was turned on and the pumping rate was recorded to be 175 gpm by review of the meter. Once the supplementary rate was recorded, well no. 5 was turned on. The pressure and pumping rate were incrementally adjusted and recorded. The following table provides a summary of the pump test results for well no. 5.

WELL # 5 - WITH WELL NO. 11 PUMPING TO IT AT 175 GPM	PRESSURE (PSI)	PUMPING RATE (GPM)	TIME (10/3/13)	COMMENT
	30	350	9:53	
	28	365		
	26	386		
	24	406		
	22	425		
	20	431		
	18	455		
	16	476		
	14	484		
12	508	10:10	MAXIMUM RATE	



Well No. 13

Well No. 13 was pumped to the tank because is it equipped with a meter inside the pump house unlike all of the other wells. Well No. 13 does not have supplementary water pumping to it. Well no. 13 was turned on and the pressure and pumping rate were incrementally adjusted and recorded. The following table provides a summary of the pump test results for well no. 13.

WELL # 13	PRESSURE (PSI)	PUMPING RATE (GPM)	TIME (10/3/13)	COMMENT
	54	40	10:30	
	40	190		
	35	265		
	32	320		
	24	340	10:45	VALVE WIDE OPEN

While well No. 13 was being test pumped to the tank, wells 1,2,3, and 5 were also pumping to the tank. Wells No. 3 and 13 both pump to the same 12" PVC water main that leads to the 100,000 gallon tank; therefore, resulting in a higher pressure reading when the valve was wide open than if pumped to waste or pumped to the tank on its own. Wells 1,2, & 5 all pump to a different 12" water main that leads to the 100,000 gallon tank.



SUMMARY

Well No.	Pumping Rate (GPM)	Volumes		Comments
		GPD	ACRE- FEET/YEAR	
1	437	629,280	704.9	Well No. 9 pumps to Well No. 1 at 160 gpm
2	73	105,120	117.8	
3	370	532,800	596.9	Well No. 10 pumps to Well No. 3 at 140 gpm
5	508	731,520	819.5	Well No. 11 pumps to Well No. 5 at 175 gpm
7	240	345,600	387.1	Well No. 12 pumps to Well No. 7 at 130 gpm
8	111	159,840	179.1	
9	160	230,400	258.1	These wells pump to the other wells as indicated above.
10	140	201,600	225.8	
11	175	252,000	282.3	
12	130	187,200	209.7	
13	340	489,600	548.5	
Totals	2,079	2,993,760	3,353.7	The rates from wells 9-12 have been included in the rates for 1,3,5, & 7.

KLJ WATER SYSTEM MODELING REPORT



Shelby Water System Model

Date: 1/22/2014

To: File

Copy to: Julie Titchbourne (Missoula-KLJ)
Brad Koon (Helena-KLJ)
Tyrel Clark (Billings-KLJ)
Doug Whitney (Billings-KLJ)
Mark Peterson (Helena-AE2S)

From: Jason Crawford (Helena-KLJ)

RE: NCMRWA Cut Bank to Shelby



PURPOSE

A WaterCAD model was prepared for the City of Shelby's water system. The model will be used to analyze the operations of the components of the City's system during the various demands that the system experiences and to determine if the system can handle additional demands at various locations. The purpose of this report is to document the strategies used to model the different components of the system.

MODELED OPERATIONS

The critical components of the system were included for modelling purposes. Those critical components include the well pumps, clear well, clear well booster station, south tank, shop tank, airport tank, prison tank booster station, prison tank, and water mains connecting the critical components. A schematic of the modeled operations is included in Exhibit A. The critical components are all placed at surveyed elevations. The pipe sizes, types, and lengths included in the model are all representative of actual conditions. Specific components of the system (i.e individual hydrants, services, and distribution pipes, etc.) have been excluded from this model.

Well Pumps

Pump testing was recently completed on the well field indicating that during the summer months the well field is capable of producing a maximum of 2,079 gpm. Instead of



modeling each of the wells and well pumps separately the well field was modeled as a reservoir with the water elevation set to the average static water elevation of the wells (3,055.00'). A single pump with a maximum operating point of 2,079 gpm was used in place of the 11 separate well pumps. The pump was set at the same elevation as the reservoir water level (3,055.00'). The well pumps are controlled by the water level of the clear well.

Clear Well

The 11 wells pump to a central 12" pvc water main. The 12" water main is approximately 400' long and delivers water to the 100,000 gallon clear well. The clear well is 34' in diameter which equates to 6,791 gallons per foot. The clear well has the ability to operate between 3,112.81' and 3,125.81'. The well field pump has been modeled to turn on when the clear well reaches a water level of 3,122.81' and off at 3,124.81'.

Clear Well Booster Station

The clear well booster station (CWBS) is situated adjacent to the clear well at an elevation of 3,106.31'. The CWBS pumps water from the clear well to the south tank, the shop tank, and the airport tank through approximately 7 miles of 16" asbestos concrete pipe. The CWBS consists of 4 constant speed pumps. The pumps have each been included in the model along with the corresponding constant speed pump curves. The booster station pump curves are included in Exhibit B. The CWBS pumps are controlled by the water level of the south tank, shop tank, and airport tank.

South Tank, Shop Tank, and Airport Tank(Low Pressure Zone)

The 1,000,000 gallon south tank is 67' in diameter which equates to 26,372 gallons per foot. The south tank has the ability to operate between 3,452.03' and 3,478.96'.

The 100,000 gallon airport tank is 28' in diameter which equates to 4,606 gallons per foot. The airport tank has the ability to operate between 3,450.41' and 3,478.96'.

The 1,500,000 gallon shop tank shop tank is 80.5' in diameter which equates to 38,070 gallons per foot. The shop tank has the ability to operate between 3,439.96' and 3,478.96'.

The total storage for the Low Pressure Zone is 2,600,000 gallons, based on the above mentioned tank diameters a fluctuation of 1' equates to 69,048 gallons.



CWBS Pump 1 is set to turn on when the water level of the tanks drops to 3,475.96', CWBS Pump 2 is set to turn on only if CWBS Pump 1 is on and the water level of the tanks drops to 3,475.46', CWBS Pump 3 is set to turn on only if CWBS Pumps 1 & 2 are on and the water level of the tanks drops to 3,474.96', CWBS Pump 4 is set to turn on only if CWBS Pumps 1, 2, & 3 are on and the water level of the tanks drops to 3,474.46'. CWBS Pumps 1, 2, 3, and 4 all turn off when the water level of the tanks reaches 3,477.96'.

Prison Tank Booster Station

The prison tank booster station (PTBS) is situated adjacent to the south tank at an elevation of 3,456.79'. The PTBS draws water from the south tank and pumps water into the 500,000 gallon prison tank through approximately 2 miles of 12" PVC pipe. The PTBS is made up of 3 constant speed pumps. The pumps have each been included in the model along with corresponding constant speed pump curves. The pumps were pump tested in September of 2013. The pump tests results were as follows:

- 1 Pump = 365 gpm, 91 psi

The pump curve used to define each of the pumps was created based on the pump test information. The PTBS pumps are controlled by the water level of the Prison Tank.

Prison Tank(High and Middle Pressure Zones)

The 500,000 gallon prison tank is 49.5' in diameter which equates to 14,395 gallons per foot. The prison tank has the ability to operate between 3,637.53' and 3,663.38'. PTBS Pump 1 is set to turn on when the water level drops to 3,660.38, PTBS Pump 2 is set to turn on only if PTBS Pump 1 is on and the water level drops to 3,659.88', and PTBS Pump 3 is set to turn on only if PTBS Pumps 1 & 2 are on and the water level drops to 3,659.38'.

PTBS Pumps 1, 2, and 3 all turn off at a water level of 3,662.38.

MODELED DEMANDS

The demands that have been modeled are the annual peak day demands for Shelby and Cut Bank. The Shelby demands have been calculated based on 2012 meter information from various metered locations throughout Shelby's system. The meter results and demand calculations are included in Exhibit C. The modeled Cut Bank demands include a peak day demand of 1 MGD. The demands were applied at appropriate locations and elevations throughout the model. The daily pattern applied to the demands was determined based on the Prison Tank Level monitoring equipment for 8/5/2013 - 8/12/2013. The output from the Prison Tank Level monitoring equipment has been included in Exhibit D. Model results of the system at peak day demands with Cut Bank



have been included in Exhibit E. It is important to note that when reviewing the “System Pressures @ Peak Day Demand Plus Cut Bank” reports that the following junctions are situated near the base of the various tanks around town: J21, J385, J551, J572, J577, J580-J585, J594, J597, J599.

The City is divided into three different pressure zones: high, middle and low. The high and middle pressure zones are controlled by the prison tank and are separated by a PRV. The low pressure zone is controlled by the south tank, the airport tank, and the shop tank.

High & Middle Pressure Zone (Prison Tank)

The high pressure zone is made up of Ethridge and the Prison, both of which are metered and the middle pressure zone is made up of Shelby Heights. To determine the demands of Shelby Heights, the Ethridge demands plus the Prison demands were subtracted from the total number of gallons pumped to the prison tank. Following are the high and middle pressure zone 2012 calculated demands:

- Ethridge (High Press. Zone)
 - o Avg Day - 13,345 gallons (9.27 gpm)
 - o Peak Day - 35,304 gallons (24.52 gpm)
- Prison (High Press Zone)
 - o Avg Day - 65,682 gallons (45.61 gpm)
 - o Peak Day - 173,755 gallons (120.66 gpm)
- Shelby Heights (Middle Press. Zone)
 - o Avg Day - 83,710 gallons (58.13 gpm)
 - o Peak Day - 221,446 gallons (153.78 gpm)

Low Pressure Zone (South Tank, Airport Tank, and Shop Tank)

The low pressure zone is made up of the remainder of the town. To determine the demands of the low pressure zone the total number of gallons pumped to the prison tank were subtracted from the total number of gallons pumped to town. Following are the low pressure zone 2012 calculated demands:

- Remainder of Shelby (Low Press. Zone)
 - o Avg Day - 472,326 gallons (328.00 gpm)
 - o Peak Day - 1,249,494 gallons (867.70 gpm)



EXHIBIT A

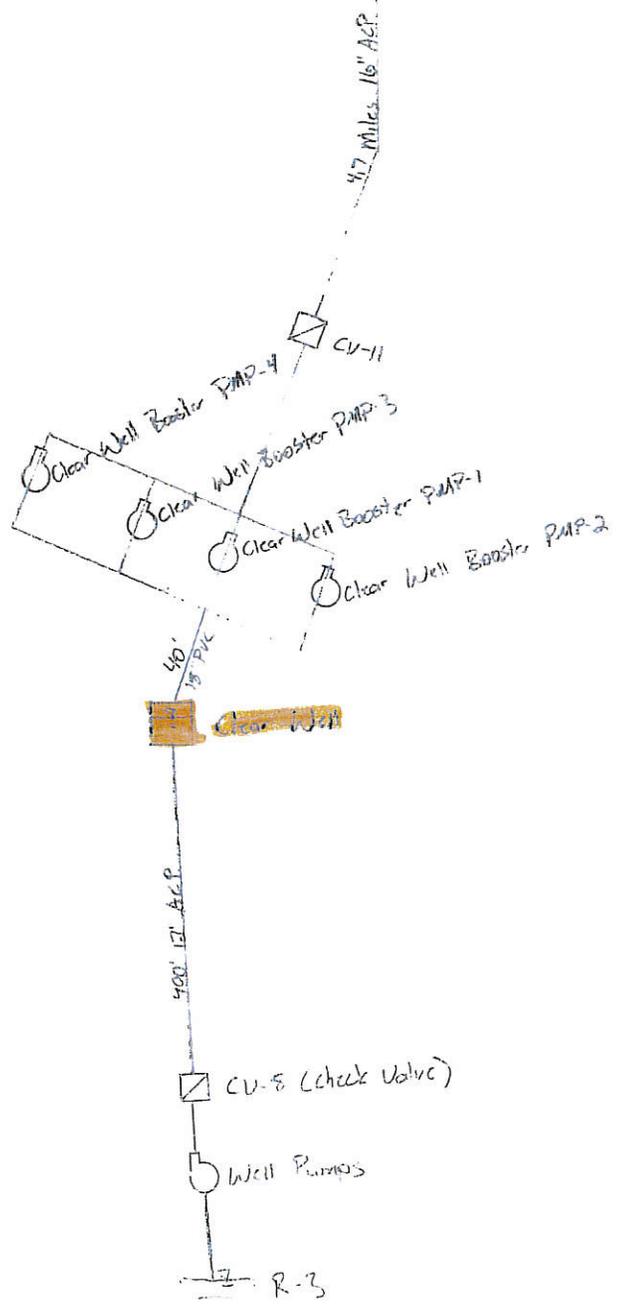
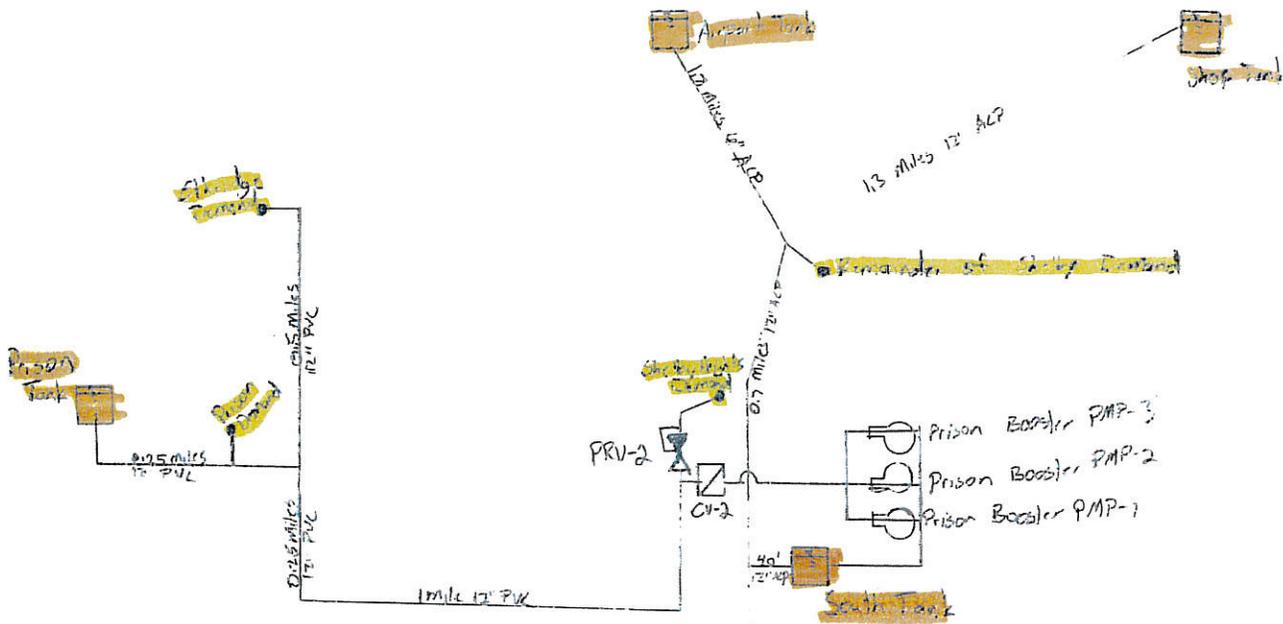
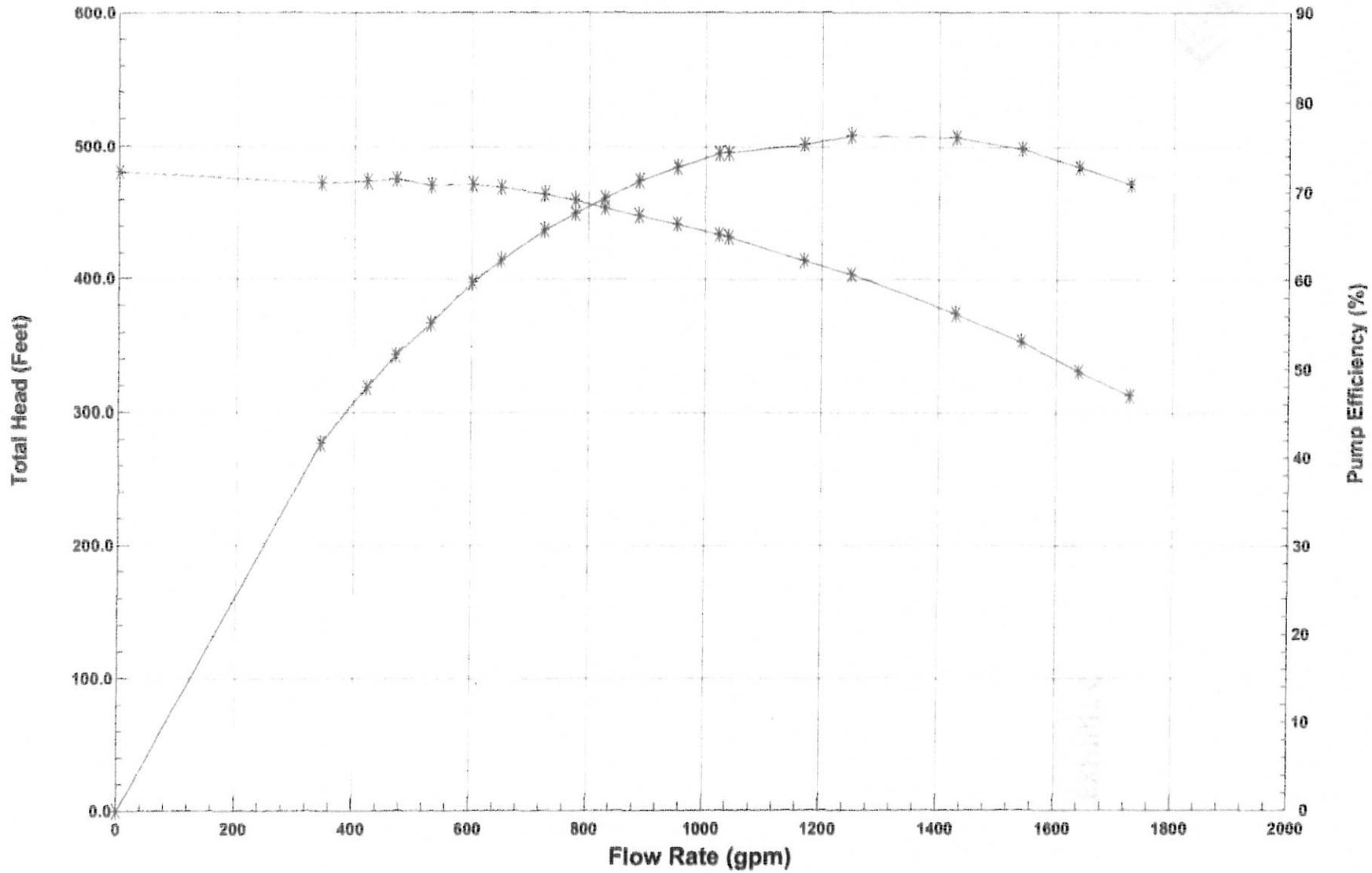




EXHIBIT B

5AE12 S/N: RH-9927017069A



Date: 11/30/10

International Center for Water Technology



EXHIBIT C

PRISON TANK	HIGH PRESSURE ZONE	Ethridge - 2012	
		Month	Usage (gal)
		January	198,900
		February	128,800
		March	165,800
		April	204,200
		May	654,800
		June	470,000
		July	906,400
		August	731,100
		September	883,500
		October	246,900
		November	120,600
	December	160,100	
	Prison - 2012		
	Month	Usage (gal)	
	January	2,082,400	
	February	1,827,600	
	March	1,887,800	
	April	2,208,700	
	May	2,142,000	
	June	2,057,700	
	July	1,779,800	
	August	2,011,900	
	September	1,995,800	
	October	2,059,300	
November	1,882,800		
December	2,038,100		
MIDDLE PRESSURE ZONE	Shelby Heights - 2012		
	Month	Usage (gal)	
	January	788,700	
	February	950,600	
	March	1,058,400	
	April	1,879,100	
	May	2,933,200	
	June	2,305,300	
	July	6,423,800	
	August	6,696,000	
	September	3,178,700	
	October	1,473,800	
	November	1,498,600	
December	1,367,800		

Avg Day - 13,345 gallons
9.27 gpm
Peak Day - 35,304 gallons
24.517 gpm

Avg Day - 65,682 gallons
45.61 gpm
Peak Day - 173,755 gallons
120.66 gpm

Avg Day - 83,710 gallons
58.13 gpm
Peak Day - 221,446 gallons
153.78 gpm

LOW PRESSURE ZONE - ALL OTHER TANKS	Remainder of Town - 2012	
	Month	Usage (gal)
	January	10,251,000
	February	7,194,000
	March	7,552,000
	April	12,490,000
	May	17,728,000
	June	16,357,000
	July	28,493,000
	August	27,344,000
	September	18,644,000
	October	11,679,000
November	7,230,000	
December	7,437,000	

Avg Day - 472,326 gallons
328.00 gpm
Peak Day - 1,249,494 gallons
867.70 gpm

TOTAL PUMPED TO TOWN - 2012	Total to Town - 2012		
	Month	Usage (gal)	Max Day (gal)
	January	13,321,000	457,000
	February	10,101,000	793,000
	March	10,664,000	638,000
	April	16,782,000	872,000
	May	23,458,000	1,303,000
	June	21,190,000	817,000
	July	37,603,000	1,680,000
	August	36,783,000	1,659,000
	September	24,702,000	903,000
	October	15,459,000	889,000
November	10,732,000	519,000	
December	11,003,000	662,000	

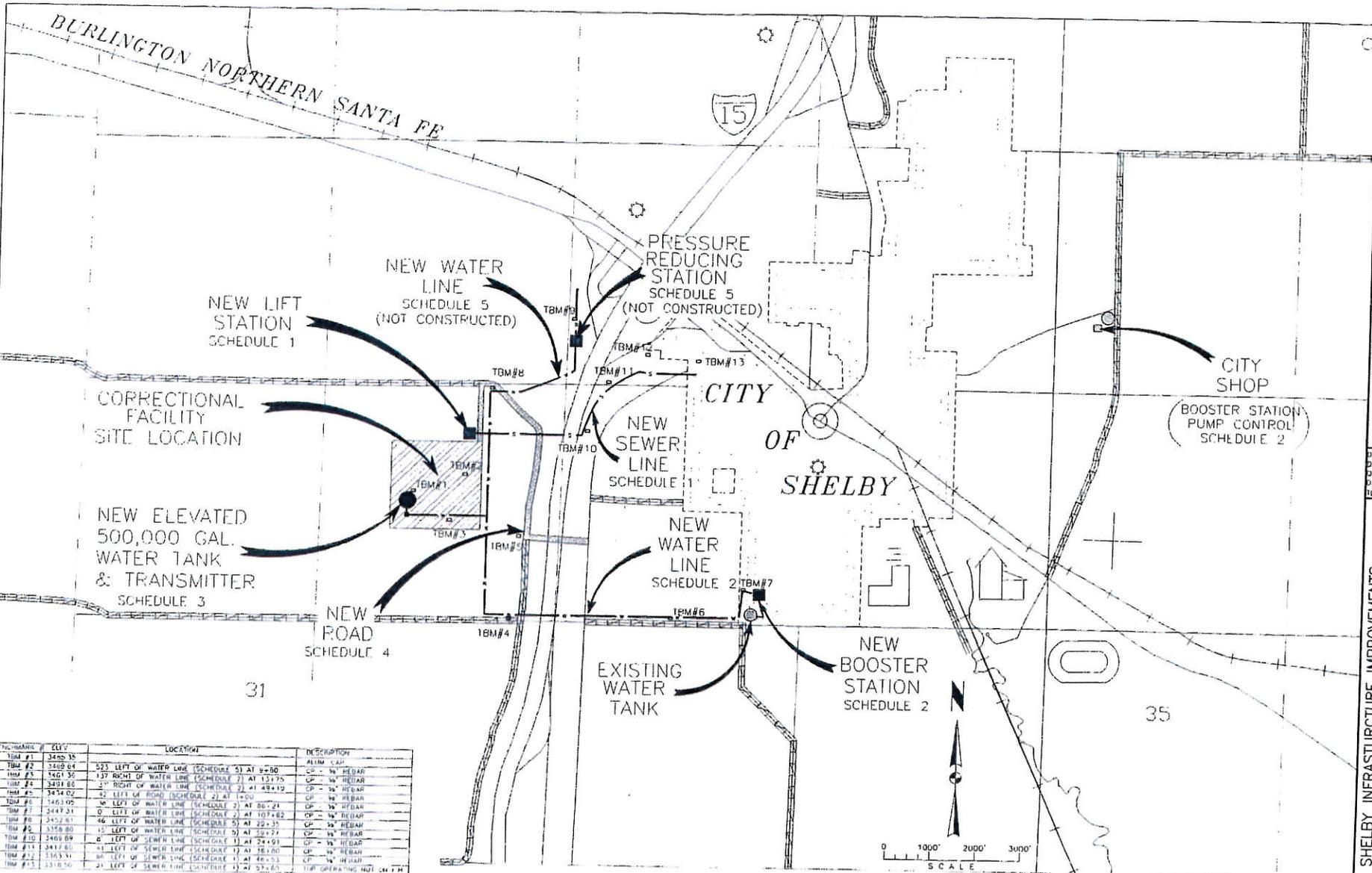
Avg Day - 635,063 gallons
441.02 gpm
Peak Day - 1,680,000 gallons
1166.67 gpm

TOTAL PUMPED TO PRISON TANK - 2012	Total to Prison Tank - 2012	
	Month	Usage (gal)
	January	3,070,000
	February	2,907,000
	March	3,112,000
	April	4,292,000
	May	5,730,000
	June	4,833,000
	July	9,110,000
	August	9,439,000
	September	6,058,000
	October	3,780,000
November	3,502,000	
December	3,566,000	

Water & Sewer Dept. - 2012 Annual Report

WATER SERVICE AREA DESIGN AND RECORD DRAWINGS

J:\1998\98-13\RECORD\SCH_109116.dwg, 04/24/2002 04:29:16 PM, tch, TDH Great Falls



TBM#	DATE	DESCRIPTION
TBM #1	3400.35	ALUM. CAP.
TBM #2	3400.64	523 LEFT OF WATER LINE (SCHEDULE 5) AT 9+90
TBM #3	3401.35	137 RIGHT OF WATER LINE (SCHEDULE 2) AT 13+75
TBM #4	3401.85	211 RIGHT OF WATER LINE (SCHEDULE 2) AT 148+12
TBM #5	3414.02	42 LEFT OF ROAD (SCHEDULE 2) AT 150+00
TBM #6	3403.05	50 LEFT OF WATER LINE (SCHEDULE 2) AT 86+21
TBM #7	3447.31	0 LEFT OF WATER LINE (SCHEDULE 2) AT 107+62
TBM #8	3452.61	46 LEFT OF WATER LINE (SCHEDULE 5) AT 22+35
TBM #9	3358.80	12 LEFT OF WATER LINE (SCHEDULE 5) AT 38+77
TBM #10	3408.69	0 LEFT OF SEWER LINE (SCHEDULE 1) AT 74+91
TBM #11	3417.60	11 LEFT OF SEWER LINE (SCHEDULE 1) AT 35+00
TBM #12	3363.51	80 LEFT OF SEWER LINE (SCHEDULE 1) AT 48+53
TBM #13	3318.50	21 LEFT OF SEWER LINE (SCHEDULE 1) AT 53+65

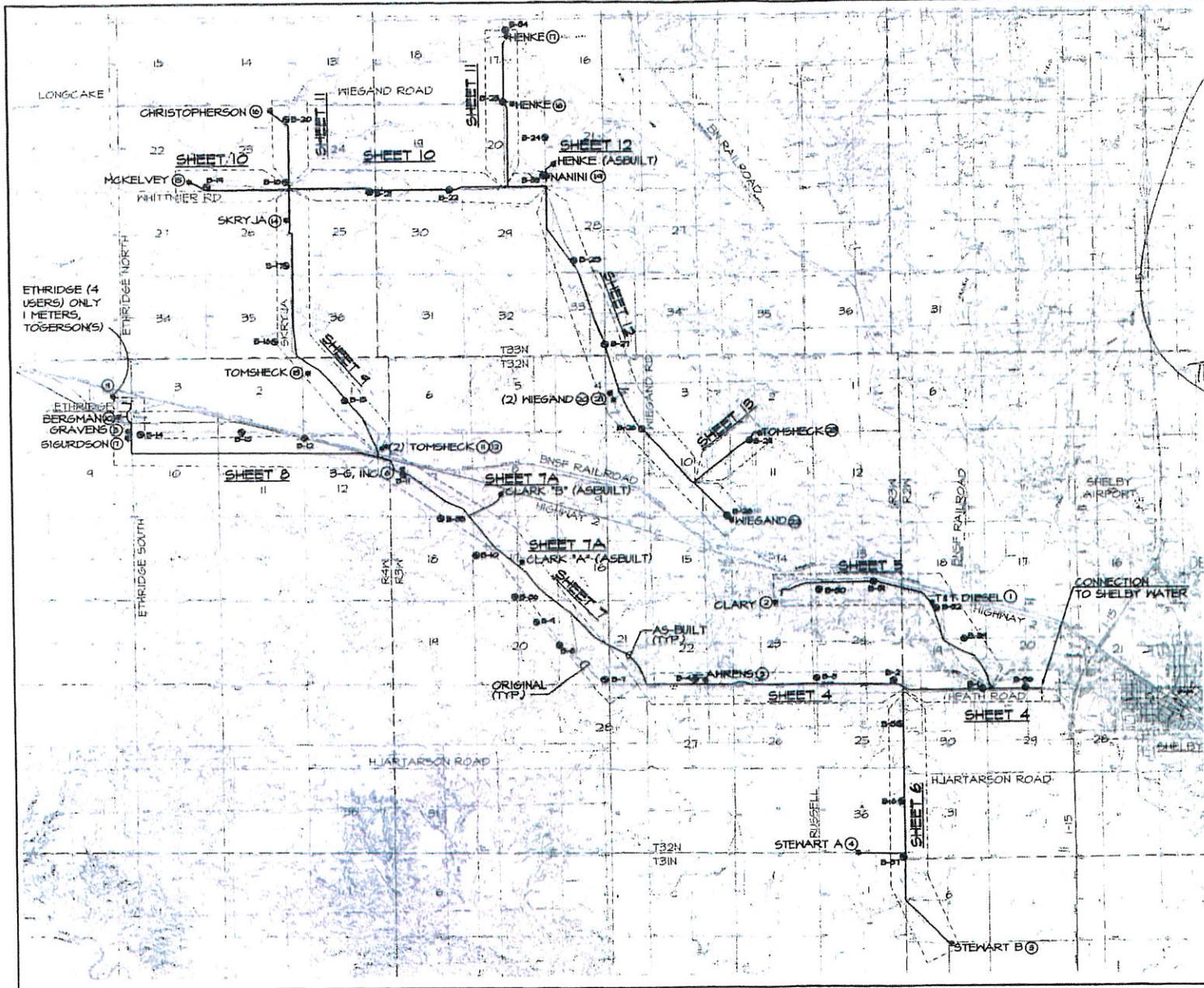
PROJECT LOCATION & SCHEDULING MAP



THOMAS DEAN & HOSKINS, INC.
 ENGINEERING CONSULTANTS
 1111 N. BRADLEY AVENUE
 SHELBY, MONTANA 59601

DRAWN BY: MML
 DESIGNED BY: KEW
 QUALITY CHECK: KEW
 DATE: 3/30/99
 TDH JOB NO. 98-136

SHELBY INFRASTRUCTURE IMPROVEMENTS
 SHELBY, MONTANA
 PROJECT LOCATION & SCHEDULING MAP



USERS - NAMES

- ① 14" DIESEL
- ② CLARY
- ③ STEWART B *
- ④ STEWART A
- ⑤ AHRENS
- ⑥ S-G, INC.
- ⑦ SIGURDSON
- ⑧ GRAVENS
- ⑨ TONGERSON/ETHRIDGE
- ⑩ BERGMAN/ETHRIDGE
- ⑪ TOMSHECK
- ⑫ SKRYJA
- ⑬ MCKELVEY *
- ⑭ CHRISTOPHERSON *
- ⑮ HENKE **
- ⑯ NANINI *
- ⑰ WEGAND
- ⑱ TONGHECK

This does not reflect any 26 + add 1-3

RECEIVED

NOV 17 2003

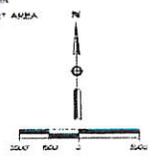
MONTANA
DEPT. OF ENVIRONMENTAL QUALITY
WATER DIVISION - SERVICE'S BUREAU

AS-RECORDED
SEPTEMBER 2003
SULLIVAN BROTHERS
CONSTRUCTION

POINT	NORTHING	EASTING	ELEVATION
1	14220.642	114204.091	3593.39
2	10000.000	200000.000	3444.09
3	10240.310	225617.001	3403.10
4	104026.011	187841.824	3531.71

LEGEND

- ▲ CONTROL POINTS (HALLOW)
- ⊙ BORE HOLE (B-30)
- ⊙ USER NAME
- WATER MAIN
- - - PLAN SHEET AREA



Revision	By	Date

File No.	Job No.
224.02	0207-02
Date	Scale
2/20/03	AS SHOWN



**ENGINEERS
PLANNERS
DESIGNERS**

NEIL CONSULTANTS, INC.

4599 North Star Boulevard
P.O. Box 4358
Great Falls, MT 59404
Phone 406-452-5478
Fax 406-452-3399

District

**ETHRIDGE
WATER
DISTRICT**

Project Title

**ETHRIDGE
RURAL WATER
DISTRIBUTION
SYSTEM**

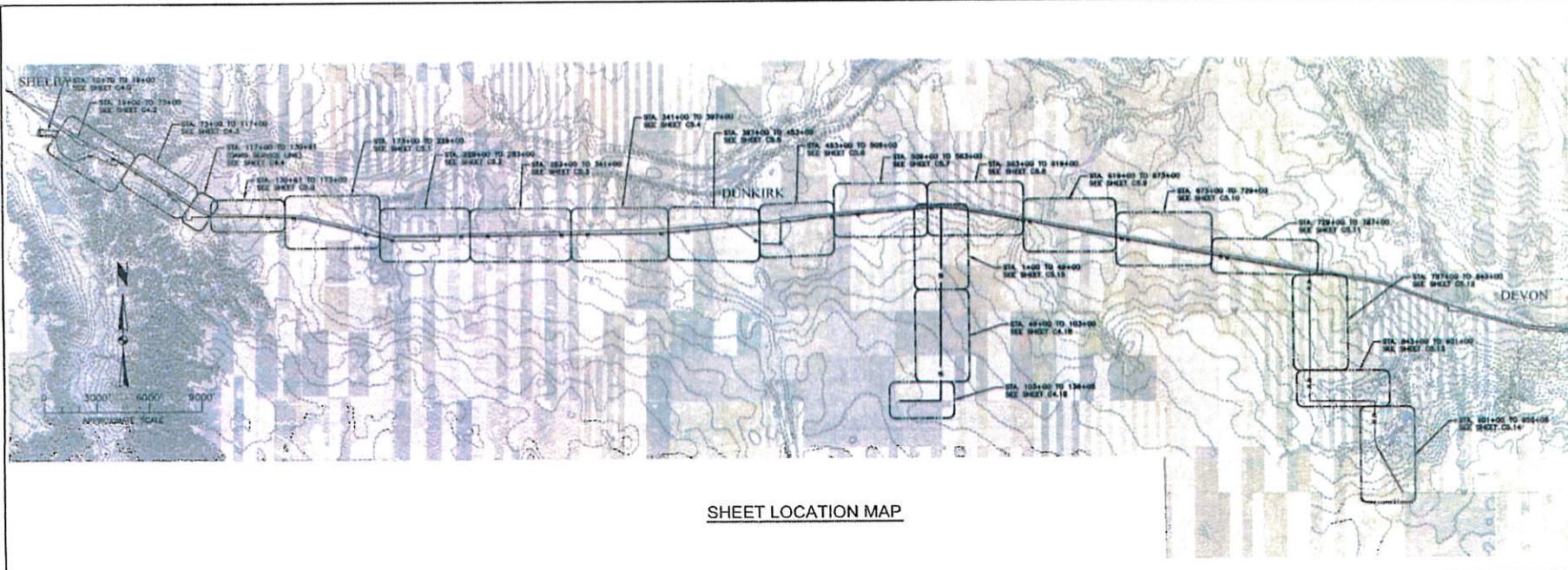
Sheet No.

OVERALL MAP

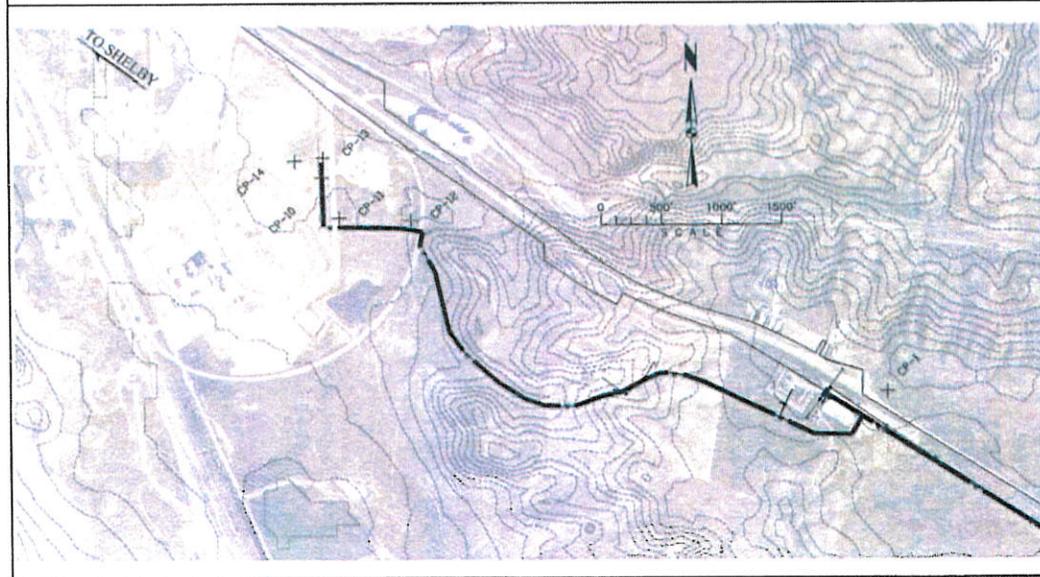
Sheet	Of
3	14

Copyright © 2002 NEI, All Rights Reserved
File # 22402

J:\2011\12-2811\2811\2811\2291\1000.0.dwg 3/20/15 11:49 AM mvc



SHEET LOCATION MAP



SURVEY CONTROL DATA

NOTE:
ALL CONTROL POINTS ARE LANCE NAILS (300) x 1/2" UNLESS OTHERWISE NOTED
(CONTRACTOR TO VERIFY FOR ELEVATION ACCURACY BEFORE USING)

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
CP-1	1504513.59	1407811.84	3421.10	HUB WITH NAIL ON NORTH SIDE OF HWY 2 ±300' EAST OF HISTORICAL INFORMATION SIGN ±1 MILE EAST OF SHELBY
CP-10	1556403.85	1402902.86	3276.86	3/8" REBAR WITH YPC MARKED 17784LS ON WEST SIDE OF MARIAS PARK RD ±855' SOUTH OF E HWY 2
CP-11	1556970.47	1402985.33	3277.27	3/8" REBAR WITH YPC MARKED 4038LS ON EAST SIDE OF MARIAS PARK RD ±1260' SOUTH OF E HWY 2
CP-12	1500852.00	1403574.23	3278.90	3/8" REBAR WITH YPC MARKED 4035LS ±620' EAST OF E MARIAS PARK RD AND ±775' SOUTH OF E HWY 2
CP-13	1506018.92	1402904.85	3277.30	3/8" REBAR WITH YPC MARKED 17784LS ON WEST SIDE OF MARIAS PARK RD ±715' SOUTH OF E HWY 2
CP-14	1556527.79	1402858.17	3277.34	3/8" REBAR WITH YPC MARKED 17784LS ±260' WEST OF E MARIAS PARK RD AND ±500' SOUTH OF E HWY 2

HORIZONTAL COORDINATES ARE GROUND, INTERNATIONAL FEET, AND WERE ESTABLISHED BY AN ALIGNMENT'S BEARING USING SURVEY QUALITY GPS TO CONVERT TO MONTANA STATE PLANE COORDINATES. MULTIPLY TIMES THE COMBINED SCALE FACTOR OF 0.9995639075, ABOUT AN ORIGIN OF (0,0).

BENCHMARK:

VERTICAL DATUM IS NAVD88, AND WAS PROJECTED BY SURVEY QUALITY GPS FROM THE NGS MARK 1433.



REVISIONS:
REV. 1 DATE: 02.27.15
REV. 2 DATE: 12.22.15



DRAWN BY: MVC
DESIGNED BY: MJD
QUALITY CHECK: MJD
DATE: 02.27.15
JOB NO: 12 221
FIELD NO:

DEVON WATER INC., IMPROVEMENTS
DEVON, MONTANA
SHEET LOCATION MAP
SURVEY DATA