PROVIDING PUBLIC WATER SERVICE TO HIGH ELEVATION POTENTIAL DEVELOPMENT AREAS

Village of Cross Plains, Wisconsin

August 2009

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1. Introduction

1.1 Study Objectives

Development has been proposed for a high elevation area on the northern side of the Village of Cross Plains. This area, commonly known as the "Weber farm" area, is located along and on top of a hillside west of Brewery Road and to the north of the existing developed portion of the Village. The proposed development is called the "Sundance" development. The ground elevations within this proposed development are too high to be serviced by the Village's existing water storage tanks. There are additional high elevation areas north of and adjacent to the proposed Sundance development and also along the eastern and southeastern portions of the Village that have also been identified as potential expansion areas for future growth. These areas are also outside of the serviceable elevation range of the existing water system.

The primary objective of this study is to determine how public water service could be provided to the Sundance development area and to other potential growth areas which are currently above the elevation that can be served by the existing water system. A secondary objective is to determine the inter-relationship between a pressure zone that would serve the Sundance area and other pressure zones necessary to serve other high elevation areas. And a third objective is to define "order of magnitude" costs as a basis for the Village to determine if the facilities to serve high elevation areas are economically feasible.

This study is a sequel to the January 2001 Long Range Planning Study – Water System Analysis. That study anticipated that a second pressure zone would be required to fully service potential high elevation development areas east of the Village. However, the Sundance development area was not included in that study and is at a higher elevation than the areas addressed in that study.

This report is not intended to indicate whether the Sundance area and other high elevation areas should be developed. That is a planning/political decision that has many corollary effects. Rather, this report is limited to technical considerations in providing public water service to high elevation areas adjacent to the existing Village of Cross Plains.

1.2 Study Area

The topography within and surrounding the Village of Cross Plains consists of relatively flat to mildly sloping lower areas surrounded by steep hillsides along the north, south, and east sides of the Village.

The study area for this report includes the hillsides to the north and to the east of the Village, but not to the south of the Village. The study area is roughly confined to Sections 25, 26, 27, 34, 35, and 36 of the Town of Berry and Sections 1 and 2 of the Town of Cross Plains, although some parts of these sections may be outside of the Village's long-term planning area.

The major focus of this study is on the area containing the proposed Sundance development. This proposed development is mostly located within the east half of Section 34 of the Town of Berry, and is bounded by Brewery Road to the east and properties fronting on County Highway KP to the west.

To the east of Brewery Road is a valley created by Brewery Creek. This valley and the hills on either side are commonly called the Brewery Creek watershed. Brewery Creek is the lowest elevation in the study area, at an elevation of about 900 feet above mean sea level.

East and southeast of the Brewery Creek watershed is another valley, with Airport Road passing it. This area is commonly called the Enchanted Valley watershed. The Enchanted Valley drainageway itself generally ranges in elevation from 900 to 960 feet. The Enchanted Valley watershed is a secondary consideration in this study because the possibility of joining two high elevation areas into a single pressure zone must be explored.

The steepest portions of the hillsides within the study area are generally within the 960 to 1020 feet elevation range, and the maximum elevation at the top of the hills in the study area is about 1180 feet.

The entire study area is shown in Figure 1-1. This map also shows the part of the existing Cross Plains water distribution system that is within the study area.

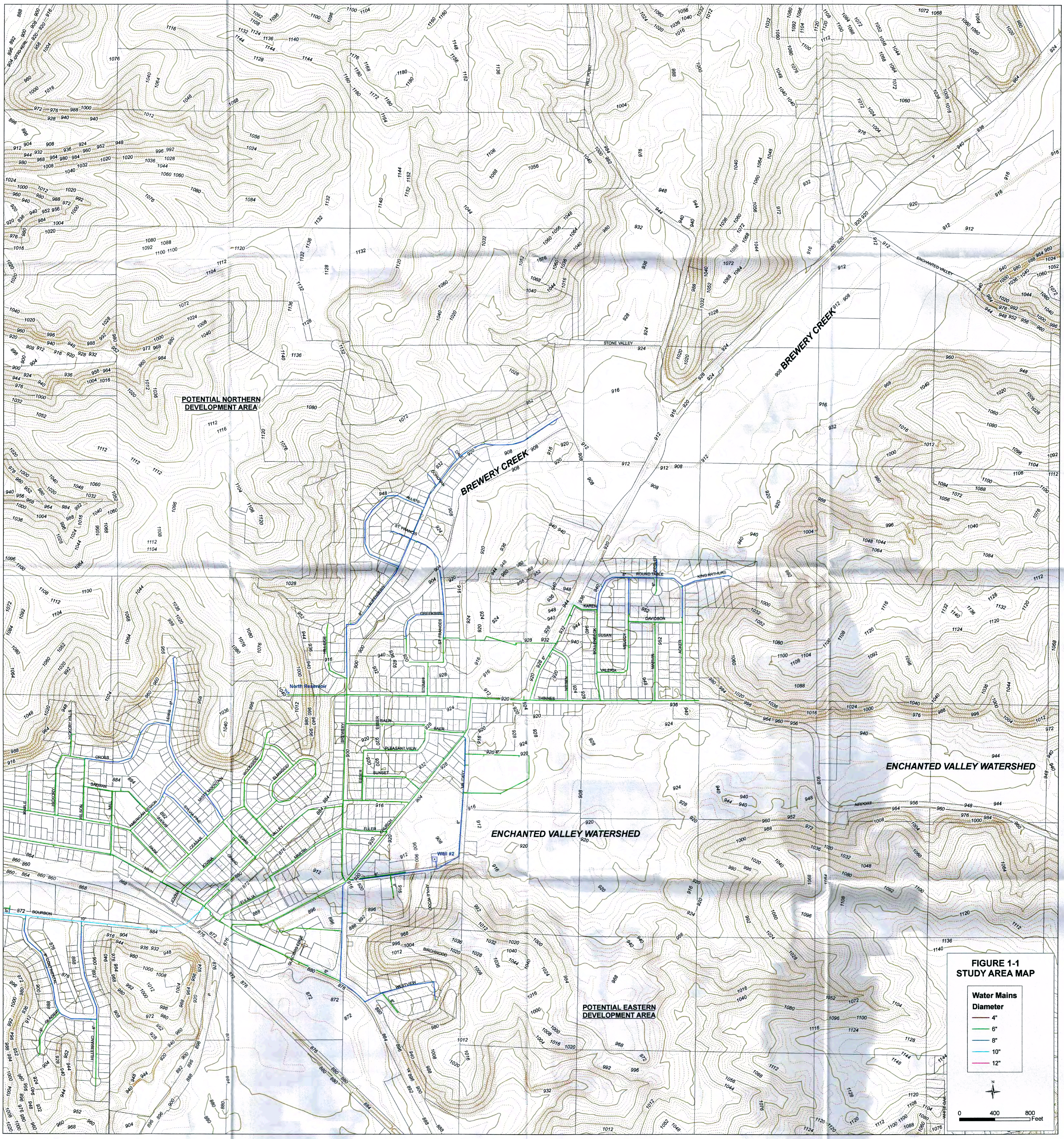


FIGURE 1-1
STUDY AREA MAP
Water Mains
Diameter
4"
6"
8"
10"
12"
N
0
400
800
Feet
POTENTIAL NORTHERN DEVELOPMENT AREA
POTENTIAL EASTERN DEVELOPMENT AREA
ENCHANTED VALLEY WATERSHED
ENCHANTED VALLEY WATERSHED
BREWERY CREEK
BREWERY CREEK
North Reservoir
Well #2
OTTO KERL
HILL POINT
STONE VALLEY
ENCHANTED VALLEY
AIRPORT
ROUND TABLE
KING ARTHURS
ZIEGLER
KAREN
DAVIDSON
SUSAN
BOLLENBECK
MELODY
MARVIN
ACKER
VALERIA
NIESEN
THINNES
DALE
DONOVAN
ALLIE'S
ST FRANCIS
LAUFENBERG
CREEKSIDE
ST FRANCES
HILLSIDE
STUMPF
BREWERY
ESSER
BAER
PLEASANT VIEW
SUNSET
MILITARY
EILER
CHURCH
LEWIS
CROSS
HICKORY HILLS
SAEMAN
MAPLE
HICKORY
WILSON
MILL
AMERICAN LEGION
JULIUS
SYLVIA PINE
MISTY MOUNTAIN
WOODSIDE
ELMWOOD
VALLEY
PARK
CEASAR
JOVINA
GRAND
MARTIN
MAIN
EULALIA
BOURBON
CONTINENTAL
GLACIER
HILLEBRAND
GLACIERS EDGE
APPLE WOOD
BIRCHWOOD
WESTVIEW
WHITE OAK

2. Pressure Criteria for Public Water Distribution Systems

2.1 Desirable Pressure Ranges within a Public Water Distribution System

Table 2-1 shows the pressure requirements of Wisconsin Administrative Code for public water systems. This report recommends that the minimum static pressure that the Village of Cross Plains should provide in its public water distribution system at point of use is 40 psi at the ground surface, which is a little higher than the minimum shown in Table 2-1. This is because two story homes have lower pressures in upper story bathrooms, and experience has shown that below 40 psi pressure complaints start to arise about inadequate water pressure in such homes. Similarly, this report recommends that the maximum static water pressure that is advisable in the Village of Cross Plains public water distribution system at points of use be 90 psi at the ground surface. This is about 10 psi lower than specified in State code, but 10 psi higher than is experienced in the existing Cross Plains water distribution system. This recommendation is made because experience has shown that above 90 psi individual building plumbing systems may tend to develop leaks, and complaints are often received that the pressures are so high that drinking glasses are "blown out of the hand" when a faucet is opened, or that showers are too forceful for comfort. The State plumbing code requires that pressure reducers be placed upon building plumbing systems when the system pressure is above 80 psi at the point of service.

TABLE 2-1
PUBLIC WATER DISTRIBUTION SYSTEMS
PRESSURE REQUIREMENTS SET BY WISCONSIN ADMINISTRATIVE CODE

NR 811.08	"The distribution system shall be operated to maintain a minimum of 35 pounds per square inch at ground level at all locations ... under normal operation conditions including maximum day demand averaged over a 24 hour period... The system shall be operated so that under fire flow conditions the residual pressure in the distribution system is not less than 20 pounds per square inch at ground level."
NR 811.60	"The minimum and maximum pressure in service areas shall be 35 and 100 psi respectively at ground level."
PSC 185.82	"Under conditions of normal heavy system demand the residual pressure at the meter outlet shall not be less than 20 psig. For typical residential customers, normal conditions of use shall mean a flow rate of not less than 12 gallons per minute ... This standard shall ordinarily require that the distribution main pressure at the corporation stop connection be at least 35 p.s.i.g.... The maximum pressure at the meter shall not exceed 125 p.s.i.g. The maximum pressure at the meter shall not exceed 100 p.s.i.g. for new systems and, to the extent practical, major additions to existing systems."

Because one psi represents 2.307 vertical feet of water column the 50 psi difference between 40 psi and 90 psi can be calculated to represent a theoretical elevation difference within a single pressure zone of about 115.35 feet. (For the code minimum and maximum of 35 psi and 100 psi, respectively, the theoretical range would be about 150 feet.)

The water levels in municipal water storage tanks normally fluctuate by several feet. Pumps are activated by controls sensing tank water level at the low end of the operating range and are turned off by controls sensing tank water level at the high end of the range. Allowing some distance between the low end of the range and the high end of the range avoids too frequent activation of well pumps, which increases the wear on the pump motors and shafts. Using the 40 psi desirable minimum pressure and the 90 psi desirable maximum pressure recommended above, the resulting range would extend from about 92 feet below the lowest planned operating water level in the water storage tank providing pressure to the zone, to about 208 feet below the highest planned operating water level. Using the 40 psi and 90 psi criteria, the actual elevation range within a single pressure zone is 115.35 feet minus the fluctuation allowed.

2.2 Existing Cross Plains Pressure Zone

The existing water system contains two groundwater wells pumping into the distribution system, one 500,000 gallon above-ground water storage reservoir at the southwestern portion of the Village, and one older 50,000 gallon below-ground concrete tank at the north edge of the Village. The elevation at the reservoir overflow is about 1040.6 feet. At present the Cross Plains utility staff actually uses a maximum water level elevation in the 500,000 gallon tank about two feet below the overflow elevation because higher elevations can cause the older 50,000 gallon tank to overflow. In the future the old 50,000 gallon tank will probably be abandoned, and this will no longer be a consideration. Ideally, the high level shut-off point will be about ½ to 1 foot below the overflow elevation. For purposes of this report a desirable high level overflow elevation of 1040.0 will be used.

Recognition must be given to the fact that the water level in any storage tank will fluctuate with use. Ideally, the minimum desirable pressures (that is, the highest serviceable elevations) should be calculated from the lowest elevation in the operating range of the water levels in the storage tank. Conversely, the maximum desirable pressures (that is, the lowest serviceable elevations) should be calculated from the highest elevation in the operating range of the storage tank. At present the Cross Plains utility staff allows a fluctuation of only 2.5 feet in the 500,000 gallon tank, again because of the effects in the older 50,000 gallon tank. The utility staff would ideally prefer the ability to allow a somewhat greater fluctuation, perhaps of five feet.

The 2001 study assumed an average hydraulic grade line in the water storage tanks of 1037.3, and used the maximum allowable code range of 35 psi, minimum, to 100 psi, maximum, to project a second pressure zone. This study will be more rigorous in its approach and will analyze both high and low end operating levels in the 500,000 water storage tank, and will give precedence to desirable maximum and minimum pressures rather than code allowable maximum and minimum pressures.

Using the low end of an assumed 5-foot tank water level operating range and the recommended minimum static pressure of 40 psi, the existing water system will serve a maximum elevation of about (1035 – 92.28 =) 942.72 feet. (Using the Code minimum of 35 psi the highest serviceable elevation would be 954 feet.) There are areas within the Melody Acres part of the existing Village water distribution system which are at ground surface elevations as high as 962. With any new zoned pressure system, it would be advantageous to increase the water pressure and improve the available fire flow capacity within the Melody Acres area.

Using the high end of the assumed 5-foot operating range, the existing maximum pressure will occur at the Black Earth Creek water main crossing at the west end of the Village, which is at an elevation of approximately 856. This maximum pressure, assuming a full tank at hydraulic grade line elevation = 1040.00, would be about 80 psi. If the assumed maximum pressure of 90 psi were used, the elevation served could be as low as 832.37. However, no elevations this low exist in the Village.

Because of the 5-foot operating water level fluctuation allowed, the actual serviceable elevation range becomes (942.72 – 832.37 =) 110.35 feet, not the theoretical 115.35 feet.

3. IDEAL ELEVATION RANGES FOR MULTIPLE PRESSURE ZONES

Desirable elevation ranges for multiple pressure zones in the Cross Plains area can be determined by starting at the hydraulic grade lines in the 500,000-gallon Village reservoir, and using an assumed overlap between zones. A desirable overlap of 20 feet (8.67 psi water column pressure) will be assumed. Then, by using the highest computed desirable elevation for one zone and subtracting 20 feet, one can determine the lowest desirable elevation for the next zone. And by using the lowest desirable elevation thus determined and adding the 110.35 feet of desirable range within a single zone, the highest desirable elevation of that zone can be computed. The results are shown in Table 3-1, with elevations rounded to the nearest tenth of a foot. However, the natural topography may not allow for ideal, overlapping pressure zones. Rather, the pressure zones must be selected to fit the topography of developable areas. A pressure zone that covers only steep undevelopable hillsides makes no practical sense. If a steep hillside exists, it may be advisable to abandon the overlapping arrangement.

If a pressure zone has all of the required water supply and storage facilities, it may be independent and unconnected to any other pressure zone. Therefore, as a next step, it is desirable to determine what supply and storage facilities should exist in any pressure zone. This will establish the criteria under which pressure zones can be considered independent.

TABLE 3 - 1
VILLAGE OF CROSS PLAINS
IDEAL WATER PRESSURE ELEVATION ZONES

	Zone 1 (Existing)		
	High Hydraulic Grade Line	1040.0	
Highest Pressures and Lowest Elevations	90 psi	832.4	(Desirable)
	100 psi	809.3	(Allowed by Code)
	Low Hydraulic Grade Line	1035.0	
Lowest Pressures and Highest Elevations	35 psi	954.3	(Allowed by Code)
	40 psi	942.7	(Desirable)
DESIRABLE OVERLAP BETWEEN ZONES 1 AND 2		20.0 vertical feet	
	Zone 2		
	Assumed High Hydraulic Grade Line	1130.3	
Highest Pressures and Lowest Elevations	90 psi	922.7	(Desirable)
	100 psi	899.6	(Allowed by Code)
	Assumed Low Hydraulic Grade Line	1120.3	
Lowest Pressures and Highest Elevations	35 psi	1039.6	(Allowed by Code)
	40 psi	1028.1	(Desirable)
DESIRABLE OVERLAP BETWEEN ZONES 2 AND 3		20.0 vertical feet	
	Zone 3		
	Assumed High Hydraulic Grade Line	1215.7	
Highest Pressures and Lowest Elevations	90 psi	1008.1	(Desirable)
	100 psi	985.0	(Allowed by Code)
	Assumed Low Hydraulic Grade Line	1205.7	
Lowest Pressures and Highest Elevations	35 psi	1125.0	(Allowed by Code)
	40 psi	1113.5	(Desirable)
DESIRABLE OVERLAP BETWEEN ZONES 3 AND 4		20.0 vertical feet	
	Zone 4		
	Assumed High Hydraulic Grade Line	1301.1	
Highest Pressures and Lowest Elevations	90 psi	1093.5	(Desirable)
	100 psi	1070.4	(Allowed by Code)
	Assumed Low Hydraulic Grade Line	1291.1	
Lowest Pressures and Highest Elevations	35 psi	1210.4	(Allowed by Code)
	40 psi	1198.9	(Desirable)

4. SUGGESTED CRITERIA FOR SEPARATE PRESSURE ZONES

4.1 Water Supply

If a pressure zone serves many homes or businesses, measures should be taken to minimize the risk of being without water service. A common requirement and one that is recommended herein is that any pressure zone serving more than a certain number of residential or commercial units should be serviced by two independent sources of supply. The number of units is somewhat arbitrary and depends upon the governing body's risk tolerance for its constituents being without water. For purposes of this report, a limit of 75 residential or commercial units served by one supply source is used. (Note: The exact number should be debated and fixed by the Village Public Facilities Committee and a firm policy established.) The two sources of supply may be two wells, or one well and a pump drawing water from a separate zone with an independent well and storage system.

Physically it may be possible to provide redundancy in the water supply to a low elevation pressure zone by use of a pressure-reducing valved connection from a higher elevation zone to the low elevation zone. However, pressure reducing arrangements tend to be more difficult to operate and maintain, and failure of a pressure-reducing valve may have serious effects to both zones. For a community the size of Cross Plains, it is recommended that pressure-reducing valved connections not be recognized as a separate supply source. This limits supply sources to wells or to pumps with standby power that draw from lower elevation pressure zones.

4.2 Water Storage

Water storage facilities in a public system have several functions, usually including maintaining system pressure. Although pressure can be maintained mechanically by using a constantly running "booster" pump drawing water from a lower elevation zone or a booster pumping system connected to a pressurized, diaphragm-type tank, the most reliable method of maintaining pressure is to have an elevated water storage tank or a reservoir located high enough above the pressure zone that the difference in ground elevation maintains the pressure.

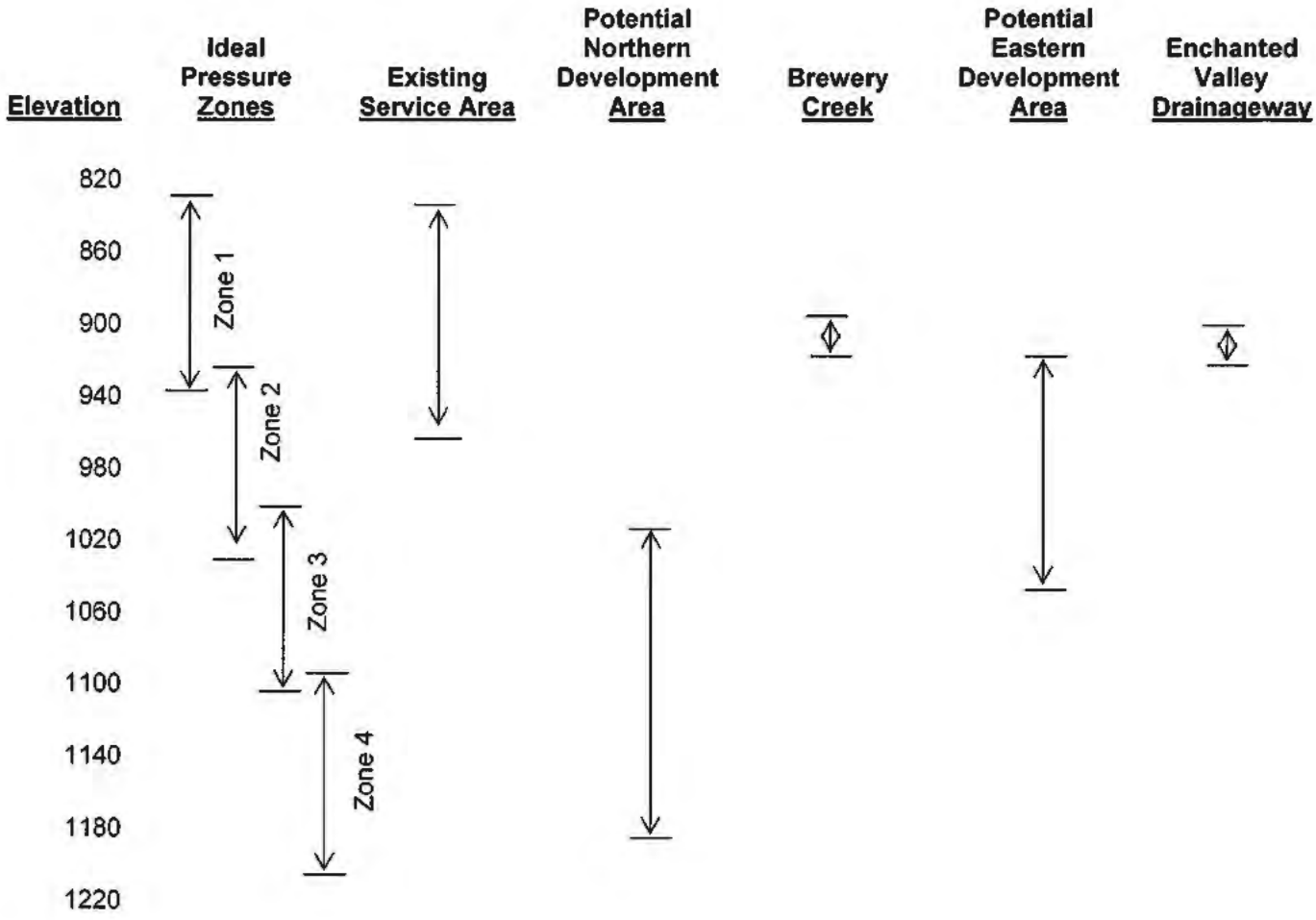
Wisconsin Administrative Code does not limit the number of units that can be served by a booster pump arrangement. However, for better reliability, it is assumed herein that for service areas with greater than 75 residential or commercial units, an elevated water storage tank or an appropriately placed ground reservoir will be required. For service areas with less than 75 residential or commercial units, a booster pumping station can be used provided that the water storage facilities in the next lower elevation zone

can maintain "positive" pressure within the boosted zone. (Again, the Village Public Facilities Committee should debate this number and establish a firm policy.) Wisconsin Department of Natural Resources policy is that in any zone served only by a booster pumping station, it must be possible to maintain a positive pressure, defined as 3 psi at the ground surface, from the low operating level in the water storage tank in the lower elevation zone from which the booster pump draws its water.

5. SUGGESTED ELEVATION RANGES FOR MULTIPLE PRESSURE ZONES

The potential northern development area has relatively flat terrain ranging in elevation from about 1010 to 1180. The banks of Brewery Creek are at elevations in the neighborhood of 900 to 912. The potential eastern development area has relatively flat terrain ranging from 912 to 1040. The Enchanted Valley drainageway is at elevations ranging from 900 to 932. These areas fit into the ideal pressure zone scheme as shown in Figure 5-1:

FIGURE 5-1
Ideal Pressure Zone Scheme



From Figure 5-1 it can be seen that the potential northern development area elevation range does not overlap the existing service area elevation range (Zone 1). Therefore, to provide public water service to this area would either require connecting this area to a second zone built in the potential eastern development area, or handling this zone as a separate, independent zone with its own water

storage tank and wells, possibly using some type of booster pump from the existing service area in place of one well. From Figure 5-1 it can also be seen that the ranges in elevation for both the potential northern and eastern development areas exceed the 110-foot desirable range for a single pressure zone. This indicates that both the potential northern and eastern development areas will require more than one new pressure zone if full development is desired.

Development may occur within the potential northern development area sooner than development within the potential eastern development area. Under such a scenario, because the potential northern development area is physically separated from the potential eastern development area by both the Enchanted Valley drainageway and by Brewery Creek and because the most feasible locations for a new water storage tank to serve Zone 2 are on the far eastern side of the Village, it appears economically impractical to construct a new tank to serve a future Zone 2 and then boost the pressure created by that tank to serve Zone 3. (This could be done if an elevated storage tank, i.e. water tower, was used, but ground reservoirs are much less expensive than elevated tanks.) Therefore, this study recommends that the two potential development areas be considered separately from a water distribution system pressure zone perspective.

This decision allows the formation of a multiple zone service plan. This plan is summarized in Table 5-1. A map showing the suggested pressure zones and boosted areas is shown as Figure 5-2. (Because the map database has only four-foot contours, the zones are depicted on the map using the nearest available four-foot contour.)

In Figure 5-2 several simplifying assumptions have been made. The hillside/ hilltop between Brewery Creek and the Enchanted Valley drainageway is not shown as being served. This is because getting roads to this hilltop to serve the available development area does not appear to be cost-effective. Also, very small areas above elevation 1011 that are surrounded by Zone 2 are not shown as being served. Either such areas would be graded down to fit Zone 2 or parks without public water service could be placed there. And Zone 3 is shown as being cut off on the east side of the zone by Hillpoint Road. Little developable area exists east of Hillpoint Road.

As set forth in Table 5-1, the basic potential northern development area pressure zone, Zone 3, has no overlap with the existing pressure zone, Zone 1. This is because the areas on the north side of the Village that are between elevation 960 (served now by the existing system) and 1014 are, with very minor exceptions, steep hillsides on which no development is likely. Therefore, this steep hillside area can be skipped for purposes of public water service.

SUGGESTED FUTURE PRESSURE ZONES AND FACILITIES IF HIGH ELEVATION AREAS ARE DEVELOPED

Table 5 - 1

ZONE DESIGNATION	SERVICE AREA	LOW ELEVATION	HIGH ELEVATION	LOW WATER STORAGE TANK LEVEL	HIGH WATER STORAGE TANK LEVEL	HIGH PRESSURE (AT LOW ELEVATION), psi	LOW PRESSURE (AT HIGH ELEVATION), psi	WATER SOURCE NO.1	WATER SOURCE NO. 2	EXISTING AREA SERVED, acres	APPROX. NEW AREA SERVED, acres	RESIDENCES SERVED, acres	WATER STORAGE TANK DESCRIPTION
ZONES WITH GRAVITY WATER STORAGE FACILITIES													
ZONE 1	Existing Service Area	856	942	1035	1040	80	40	East Street Well	New Well in Cedar Glen	—	—	—	Existing 500,000 Gallon Reservoir
ZONE 2	Potential Eastern Development Area	900	1011	1103	1108	90	40	Baer Park Well	Pump from Zone 1	307	1107	566	New Reservoir Located at Approximate Elevation 1075, Minimum 325,000 Gallon Capacity
ZONE 3	Potential Northern Development Area	1014	1125	1217	1222	90	40	New Well	Pump from Zone 1	—	718	287	Minimum 200,000 Gallon Elevated Water Storage Tank (Elevation of 1170+ Required to Utilize Ground Reservoir)
BOOSTED PRESSURE ZONES WITHOUT GRAVITY STORAGE													
ZONE 2A	Potential Eastern Development Area	1011	1096	N/A	N/A	AS BOOSTED	AS BOOSTED	Booster Station Connected to Zone 2	N/A	—	18.8	8	N/A
ZONE 3A	Potential Eastern Development Area	1125	1210	N/A	N/A	AS BOOSTED	AS BOOSTED	Booster Station Connected to Zone 2	N/A	—	145.5	58	N/A

Assumptions: Maximum desirable pressure is 90 psi
Minimum desirable pressure is 40 psi
Boosted zones must have 3 psi at the ground surface created by storage facilities in zone from which water is drawn
Each zone with greater than 75 dwelling units must have two separate water sources to ensure supply reliability
Developed building unit density of 2.5 homes per acre serviceable
Developed population density of 2.5 persons per building unit
Water storage capacity = 180 gallons per person in service area, minimum of 200,000 gallons, with only 80% of the tank volume being considered effective

Comments: The Melody Acres part of the Village will be continued to be served from Zone 1 until such time as Zone 2 storage tank is constructed. Pressures in this area will continue to be lower than desirable until that time.

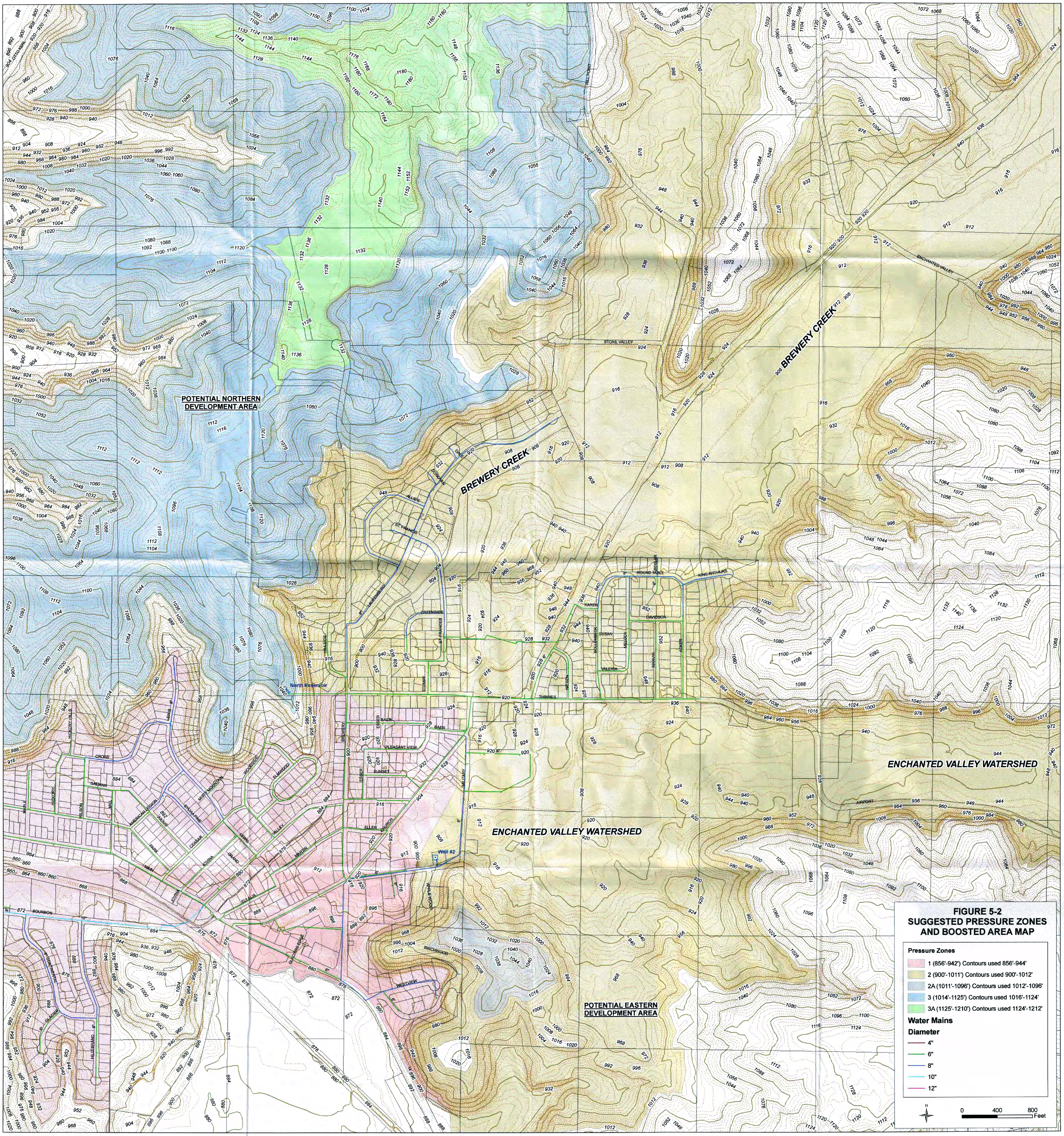


FIGURE 5-2
SUGGESTED PRESSURE ZONES
AND BOOSTED AREA MAP
Pressure Zones
1 (856'-942') Contours used 856'-944'
2 (900'-1011') Contours used 900'-1012'
2A (1011'-1096') Contours used 1012'-1096'
3 (1014'-1125') Contours used 1016'-1124'
3A (1125'-1210') Contours used 1124'-1212'
Water Mains
Diameter
4"
6"
8"
10"
12"
N
0 400 800 Feet
POTENTIAL NORTHERN DEVELOPMENT AREA
POTENTIAL EASTERN DEVELOPMENT AREA
ENCHANTED VALLEY WATERSHED
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BREWERY CREEK
North Reservoir
Well #2
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STONE VALLEY
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ST FRANCES
HILLSIDE
STUMPF
BREWERY
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PLEASANT VIEW
SUNSET
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ELLER
CHURCH
MARTIN
EULALIA
GLACIERS EDGE
WESTVIEW
BIRCHWOOD
APPLE WOOD
HICKORY HILLS
CROSS
LEWIS
WOODSIDE
ELMWOOD
SAEMAN
MAPLE
HICKORY
WILSON
MILL
AMERICAN LEGION
JULIUS
SYLVIA PINE
MISTY MOUNTAIN
VALLEY
CEASAR
PARK
JOVINA
GRAND
MAIN
BOURBON
CONTINENTAL
GLACIER
HILLEBRAND
OTTO KERL

To implement the suggested future pressure zone arrangements, several steps must be taken, including the following:

Zone 2

- To create Zone 2, a new well must be constructed in the existing service area (Zone 1) because the Baer Park well would become the primary source of water for the Zone 2 development.

- The existing system must be split by closing key valves, generally along the 942 contour. One possible split line would involve closing valves on Military Road west of the Baer Park Well, on Church Street just south of its north intersection with Military Road, on Baer Street just west of Church Street, and on Brewery Road just south of Thinnes Street. This would place all of the existing Village located from Thinnes Street to the north and east of Baer Park into the new Zone 2.

- Construct a new water reservoir somewhere to the east of the Village at a ground elevation of about 1075 to 1090 and install the water main connecting that tank to the distribution system.

This zone is similar to the second zone discussed in the January 2001 report.

Zone 3

- To create Zone 3, a new well must be drilled in the potential northern development area.

- A second new well or a pumping station somewhere on the existing system to act as a secondary water source for this zone would be required. A possible location for this station would be on Brewery Road somewhere near its intersection with Laufenberg Boulevard.

- A new water storage tank with a high water level of about 1222 must be constructed in the potential northern development area. Because ground reservoirs normally have a height limitation of 50 to 60 feet, either this tank must be an elevated tank (water tower) or it must be located at a high elevation in the Eugene Maier property (or further north), which is about 3000 feet north of the existing cul-de-sac of Brewery Road. Whether an elevated tank is built on the Sundance Property or a reservoir is built farther north may be an economic decision or an aesthetics decision, or both.

6. WATER SUPPLY AND STORAGE COST FACTORS FOR THE SUNDANCE DEVELOPMENT AREA; STAGING CONSIDERATIONS

In addition to the normal water distribution system of mains, valves and hydrants, the following three high-cost elements must be constructed in order for the Sundance development to proceed:

Element	Rough Cost
New Well	$1,500,000
New Water Storage Tank and Connecting Main	$ 700,000
New Pumping Station with Standby Power	$ 500,000

These costs are such that it will take many lots in order to make the development economically feasible. Such a situation does not lend itself to staging.

It is not possible from a water system standpoint to stage the development with a booster pump arrangement for an initial limited area. This is because boosted pressure zones without gravity water storage facilities are not allowed by DNR policy unless 3 psi pressure at the ground surface can be maintained by the water storage facilities which pressurize the main from which the booster pump draws the water. The existing Village water storage tanks, with an approximate low water level of 1035, will maintain this 3 psi pressure only up to an elevation of 1028. The entire potential northern development area is above this elevation. If Zone 2 were to be created first, such staging becomes physically feasible, although the elevation ranges shown in Table 5-1 in one or both zones would require some adjustment.

There is one other "staging" concern. When a water storage tank is constructed solely to serve a new development, sometimes wintertime freezing is a problem in the early stages of the development when there is insufficient water use to "turn over" the water in the storage tank at least once every six days. Therefore, during the early stages of the development some special arrangement for heating the water in the tank during the wintertime will be advisable.