HAFFERMAN ENGINEERING, INC.

Timbrshor Homeowners Association

Water System Development Progress Report

Prepared for the

Timbrshor Homeowners Association Board of Directors

February 18, 2019

Prepared by

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Executive Summary

During work with the State of Montana Department of Environmental Quality (MDEQ) the THOA Board was given a determination that water system within the subdivision is not in compliance with the 1977 Condition of Subdivision Approval (COSA) and would need to be made complaint to withdraw the building moratorium. Hafferman Engineering Inc. (HEI) was contracted to design and obtain MDEQ approval for a public water supply groundwater well system that meets state regulations and to rewrite and file the THOA COSA to reflect the final approved system.

HEI has completed a feasibility analysis, determined potential well locations, developed a preliminary pipeline and distribution system, and completed a preliminary cost analysis. HEI determined the feasibility of systems with a minimum of three (3), a maximum of sixteen (16) and ultimately eleven (11) well locations. Criteria for a well location was a central location between two (2) to eleven (11) units, a reasonable distance from each unit to the pipeline system, adequate room for a 40-ton drill rig, adequate separation distance from waste water treatment systems and separation from other natural and manmade impacts detailed in the State required well control zone (WCZ). The eleven (11) well locations submitted to the MDEQ for review resulted in five (5) well locations recommended by the local MDEQ office. All will require a deviation from the WCZ regulations. Groundwater flow rates must be less than 35 gpm on the CSKT Reservation.

HEI completed the preliminary cost that includes the wells, storage, pump control infrastructure and the pipeline distribution system. At the request of the Board, HEI developed a phasing plan for the Well #4 system and developed an alternative for individuals or multi users to use a hauled water cistern. The Well #4 phasing proposes initial development by existing units with future repayment from new units and existing units that transition from surface water. The average cost for the service connection between the main pipeline and the unit are provided as well as construction and materials cost estimates for hauled water cisterns.

As directed by the THOA Board, the water plan outlined herein includes a State approved ground water connection for all 47 developable sites. If a unit owner would prefer a cistern over a ground water connection that can be included in the plan, but the unit owner would need to elect that option in writing by the date specified by the THOA Board after a discussion of the issues and options at a member meeting . Unit owners may also opt out of the water plan by so advising the THOA Board in writing by the date specified by the THOA Board. Assuming that all unit owners remain in the plan with either State approved ground water or cistern connections, then the final plan will be submitted to the MDEQ for its review and approval. Once approved, all unit owners are obligated to follow the plan unless they obtain approval from the THOA Board to apply to the MDEQ to rewrite the COSA to show a State approved source of water different than that approved in the plan (e.g., a unit owner might utilize a cistern rather than a groundwater connection or vice versa).

The contemplated final plan will have State approved ground water or cistern connections for the 13 existing COSA non-compliant and for the 17 grandfathered units and 17 undeveloped units when they choose to connect or when they develop their lots, as applicable. The THOA is subject to compliance enforcement action and a possible fine of $10,000 per day until a new water plan is developed and approved. Unit owners subject to the provisons in the COSA who refuse to utilize the approved water source and unit owners who opt out of the plan could individually face MDEQ enforcement that can include a deed restriction placed on their property by the MDEQ, fines and eventually, civil penalties.

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A. Introduction:

The Timbrshor Homeowners Association (THOA) Board has been making continual attempts to withdraw the building moratorium imposed by Lake County in 2011. In December of 2017, Lake County and the State of Montana Department of Environmental Quality (MDEQ) advised the THOA Board that the current water system cannot be brought into compliance with the original certificate of subdivision approval (COSA) and that they needed to develop a groundwater well system to be compliant with current State law[1]. The MDEQ stated that a groundwater supply would need to serve, at a minimum, the thirteen (13) existing COSA non-compliant units and the seventeen (17) future units. Seventeen (17) units constructed before the 1977 COSA was approved are exempt from the MDEQ compliance order.

Hafferman Engineering Inc. (HEI) was contracted by the THOA Board to design and obtain MDEQ approval of an appropriate public water supply (PWS) groundwater well system for all of the forty-seven (47) units associated to the Timbrshor Subdivision. HEI started work in June of 2018 to develop several well locations that considered both State regulation, well development potential and the accessibility of the location for each well. HEI has completed a feasibility analysis, determined potential well locations, and developed a preliminary pipeline and distribution system and storage for one of the well systems.

The THOA Board also asked HEI to complete a preliminary construction cost analysis for the well systems. Costs include all known costs such as the wells, storage, pump control infrastructure and the pipeline distribution system. Also at Board request, HEI developed a phasing plan for the Well #4 system and developed an alternative for individuals or multi users to use a hauled water cistern. The Well #4 phasing proposes initial development by existing units with repayment from new units and existing units that transition from surface water. The average cost for the service connection between the main pipeline and the unit are provided as well as construction and materials cost estimates for the hauled water cisterns.

The THOA Board has requested that they and the individual unit owners approve the final well locations and water distribution system proposals and as such the overall plan needs to be reviewed before proceeding to State approval. To facilitate the approval, the Board requested that HEI complete this report. This report will provide the criterisa, including regulations, used to determine well locations and their associated control structures, storage facilities and pipeline systems.

The conclusions to this report will request the THOA Board and the individual unit owners approve of the final well locations and water distribution system proposed and approve HEI to submit the proposed plan to the MDEQ and proceed toward final design. To finalize the plan that that will be submitted to the MDEQ and complete the COSA rewrite, any unit owner that wishes to withdraw from the plan or wishes to use a cistern in lieu of a ground water source, must advise the THOA Board in writing by the date specified by the THOA Board. Once that information has been received, a final plan can be developed with the THOA Board and filed with the MDEQ

[1] Memorandum from Emily Gillespie, PE, MDEQ Timbrshor Association - Water systems compliance memo 1-9-18

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B. Well Locations:

HEI has completed the feasibility analysis to determine all of the potential well locations within the THOA subdivision. The criteria used for the design of groundwater supply systems is from the Design Circular MDEQ 3, Standards for Small Water Systems, August 8, 2014 Edition. Locations for wells are addressed in Chapter 3 in section 3.2.3 Well location, in which it requires that MDEQ must be consulted on the location prior to design and construction as the location relates to required separation between existing and potential sources of contamination and ground water development. Wells must be located at least 100 feet from sewer lines, septic tanks, holding tanks, and any other structures used to convey or retain industrial, storm, or sanitary waste and state or federal highway rights-of-way. Chapter 6, part 6.1 Location, requires that "The pumping station must be located to ensure that the proposed site will meet the requirements for sanitary protection of water quality, hydraulics of the system, and protection against interruption of service by fire, flood, or any other hazard".

The MDEQ design standards used by HEI for a THOA subdivision water supply connections followed the Design Circular MDEQ 3 and considered the Montana Department of Natural Resources and Conservation (DNRC) water rights standards The design standards required a groundwater well system that included a minimum of three (3) wells with a maximum of eleven (11) unit connections per well[2].

The feasibility analysis reviewed a maximum of sixteen (16) well locations and eventually defined eleven (11) well locations that could be reviewed by the local MDEQ; ten (10) new locations and the McCarthy well. The eleven (11) well locations were submitted to the MDEQ for an initial review which resulted in five (5) well locations that are recommended for approval by the local MDEQ office. A map of the original sixteen (16) wells, the eleven (11) wells that were submitted to the Board and the MDEQ and a map showing the location of the COSA compliant and COSA non-compliant units are included in Appendix 1. A drawing of the plan for each of the final five (5) wells recommended for approval is provided in Appendix 2.

The initial feasibility study criteria used to determine the location of a well that could be reviewed by MDEQ and eventually resulted in the five (5) wells that could be approved was;

[2] MDEQ Pers Cons Emily Gillespie, P.E., MDEQ allows 3 gpm per ERU as the lowest average daily flow they will accept. An ERU is defined as an equivalent residential unit (ERU) with an *average* (emphasis added) occupancy of 2.5 persons. MDEQ assumes each unit in Timbrshor is 1-ERU. The Timbrshor subdivision is located with the boundaries of the CSKT Reservation therefore groundwater filings with the State of Montana are restricted to filing a DNRC Form 602 Notice of Completion of Groundwater Development. The maximum flow rate than can be filed on the DNRC Form 602 is 35 gpm. To stay under the 35 gpm, the maximum number of units that can be associated to one well is eleven (11) as eleven time 3 is 33. To add a 12th unit would cause it to be 36 gpm which would exceed the DNRC Form 602 filing allowance of 35 gpm. (*Confederated Salish and Kootenai Tribes v. Clinch, 1999 MT 342, 297 Mont. 448, 992 P.2d 244, and The Confederated Salish And Kootenai Tribes Of The Flathead Reservation, State Of Montana, Petitioners, V. Jack Stults, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation; Bud Clinch, Director, Montana Department of Natural Resources Conservation; Montana Department of Natural Resources and Conservation; Donald D. MacIntyre, Special Assistant Attorney General, Montana Department of Natural Resources and Conservation; Reginald C. Lang, Respondents. No. 01-415. Decided: December 06, 2002)*

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B.1 Drill Rig Access:
It is HEI's experience that access for the drill rig is the most important criteria within the THOA subdivision. If access to the site because of the width, length, height or weight of the drill rig is not feasible, if access for the drill rig requires considerable disturbances such as land leveling or road construction, or if there is no area for the drilling operation and associated mess then it is likely that site cannot be economically accessed by a drill rig and cannot be used as a well site.

B.2 Well Control Zones:
The State of Montana Department of Environmental Quality (MDEQ) has specific rules on the separation distance from a Public Water Supply. They have established the Well Control Zone (WCZ) (a.k.a., Well Isolation Zone) which is a 100-foot radius around a well, that requires specific distances from, in this case, septic tanks, gravity fed sewer lines from the units to the septic tank, the effluent lines that go from the septic tanks to the individual drainfields, the drainfields and distance from the mixing zones that are down gradient from the drain fields. The setback distances are addressed in the Administrative Rules of Montana (ARM) 17.36.323 Table 2 Setback Distances. The THOA subdivision water supply wells will all be a public, multi-user drinking water well, so the separation distances for these components are all 100 feet.

The MDEQ is receptive to considering a request for deviations from the 100-foot distance within the WCZ, but not all deviations are granted. Deviations are usually granted if the number of deviations is minimal and if extraordinary construction standards, such as double grouted interior casing and concrete protections on the outside of the casing, are used. Other deviation solutions considered were potentially moving effluent lines, excavating existing effluent lines and grading and placing them in free draining gravel to make sure any leakage flows outside of a well control zone and leak testing septic tanks within the WCZ.

B.3 Flow Rate Restrictions:
There are regulations that will govern the capacity of the well at a given location. On the CSKT Reservation the Montana Department of Natural Resources and Conservation (DNRC) is prevented by the Montana Supreme court from granting permission for any groundwater uses greater than 35 gpm or any new surface water[3]. Existing DNRC rules allow you to drill a well, even on the reservation, and if your well withdraws less than 35 gpm and consumes less than 10 acre-feet (AF) of water per year, you may put the water to beneficial use and the DNRC will accept and record a Notice of Completion of Groundwater Development within the DNRC database. The DNRC has, and will continue to, except the notice of completion forms until the CSKT Compact is ratified by the US Congress; which has not occurred to date[4]. By this process, individuals on the reservation are following the law in existence today until the Compact is ratified. Language in the compact requires that the DNRC and CSKT process

[3] Ibid 1: Confederated Salish and Kootenai Tribes v. Clinch, 1999 MT 342, 297 Mont. 448, 992 P.2d 244, and The Confederated Salish And Kootenai Tribes Of The Flathead Reservation, State Of Montana, Petitioners, V. Jack Stults, Administrator, December 06, 2002
[4] Pers cons Kurt Hafferman and Kathy Olsen, Manager DNRC WRD, Kalispell RO, October 23, 2018

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all the forms in the DNRC files in which the applicant has followed the law, paid their fee and the DNRC has accepted the form[5].

The well development standard that will set the limit on the number of connections on one well, is the MDEQ peak design flow requirement for a minimum of three (3) gpm average daily flow rate per unit[6]. By limiting the number of connections on one well to eleven (11) connections, the average flows will be less than 35 gpm and assure the DNRC water rights process is not exceeded[7]. Therefore, the maximum connections that can be developed within this project on one well is eleven (11). When the number of connections needs to be exceeded, which it is on this project for Well #4, then storage tanks must be developed between the well and the units. Storage will allow the well to pump to storage at less than 35 gpm. Peak demand can then be met from larger pumps in the storage tanks. Staying under the 35 gpm DNRC rules allow you to drill a well and file for water rights on the reservation.

B.4 Unit Connection Distances:
Before the start of construction, unit owners will be given the opportunity to specify where they want the water service connection on the main distribution pipeline. At the conclusion of the project the owners will be provided with the plans and specifications for the induvial connections from the unit and will be required to connect at the location chosen. The pipeline distribution systems are intended to be located approximately 30 ft. from any given unit to control the individual connection costs. Each unit owner will bear the cost of connecting a service pipeline from their unit to their main distribution pipeline or well.

C. Results

Once HEI had selected and investigated the eleven (11) well locations using the site specific and MDEQ criteria, HEI developed a list of deviations that would be required as well as the names of the adjacent landowners with a well or WCZ on their property. HEI presented the wells selected to the THOA Board and the MDEQ to obtain their opinion about the locations and the MDEQ potential for granting of deviations and approvals. The eleven (11) locations were reviewed and three (3) were eliminated by the MDEQ due to difficultly in granting deviations in conjunction with comment and input from individual unit owners with concerns about specific well locations. Two (2) wells were eliminated when requests to adjoining property owners to allow well development on their property were denied.

The final five (5) well locations are locations that met all the criteria and were not otherwise denied by the involved parties. Following final review by the MDEQ and the Board, it was decided to pursue the approval of five (5) wells labeled as Well #4, Well #5, Well #8, Well #9 and the McCarthy well. The

[5] Small Domestic Household Water Right Exceptions: Recommendations for the CSKT Water Compact Negotiation August 31, 2010 Ethan Mace, DNRC, Water Resources Division Hydrologist Prepared in support of the CSKT Water Compact Negotiation
[6] Ibid 1, and Pers. Cons. Kurt Hafferman and Emily Gillespie, MDEQ, acceptable design standard for Timbrshor, September,2018, MDEQ 250 gpd/unit/1.33hrs/day=3.1328 gpm
[7] Ibid 1: MDEQ Pers Cons Emily Gillespie, P.E., MDEQ allows 3 gpm per ERU as the lowest average daily flow they will accept. An ERU is defined as an equivalent residential unit with an average of 2.5 persons.

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exhibit for each of these wells including the location of the proposed pipeline and pump control house is also provided in Appendix 2. A cross section of the proposed well construction is also included in Appendix 2. Also included in this appendix is the list of the units planned to be connected to each well system and the units COSA compliance status.

All of the five (5) wells are located on the THOA subdivision property and all but the McCarthy well have a WCZ that encroaches on to the neighboring properties. The MDEQ requires that a WCZ agreement be signed when the WCZ cross over to an adjacent property. A deviation can be granted when a WCZ cannot be negotiated. Two of the five wells will also require deviations from sanitary components, Well #8 and the McCarthy well. HEI continues to work with the adjacent landowners to obtain WCZ agreements but to date, have not been successful. Three of the adjoining property owners associated to Well #4, Well #5 and Well #9 have stated to HEI that they will not grant the WCZ. HEI continues to work with the WCZ for Well #8.

Most of the wells except the existing McCarty well will require that we obtain a flow rate between 15 gpm and 33 gpm to meet the system demand and MDEQ peak domestic water flow rates[8]. HEI cautions that it is difficult to develop groundwater wells that will produce a specific flow rate and 33 gpm is a significant amount of water. To accomplish this, wells may have to be developed deeper using larger casings and have longer screened intervals[9].

The current status for each of the wells and criteria for the cisterns are as follows;

C.1 Timbrshor Well #4:

Timbrshor Well #4 is located on the southern side of the subdivision. It is in a location that can be separated from drain field D, drain field E and drain field C but the well control zone crosses on two adjacent properties to the south. This well location offers the least disturbance to the subdivision and also the least disturbance from and encumbrance to the neighboring properties. Unfortunately, the adjacent property owners have refused to sign a WCZ agreement. Because a WCZ was attempted and cannot be negotiated, the documentation of that effort will allow the MDEQ to grant a deviation for the WCZ requirements so a deviation for the WCZ agreement based on a denial must be submitted. Well #4 must serve twenty (20) individual units and will require the installation of a storage tank system with a secondary pumping system to meet peak demand. If the Well #4 system is constructed in phases, the timing and installation of the storage system will be dependent on the number of units on the system. The preliminary design of the pump control structure and the proposed storage system for a full build out system is also shown in the Appendix 2 drawings.

[8] It is to be noted these wells will not include lawn and garden watering and are for interior domestic use only. It is assumed that lawn and garden water, where needed, will need to be developed from or continued to be used from, the existing Flathead Lake surface water diversions. It is also noted that the McCarthy well produces 15 gpm and is sufficient to meet the McCarthy well system demand.

[9] When sources of groundwater located in fractured bedrock aquifers are insufficient or a second, isolated, groundwater source needs to be located, it is recommended to drill to deeper depths looking for other fracture zones that contain isolated groundwater sources. Methods for flow increases typically include a longer screen interval within the aquifer.

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C.2 Timbrshor Well #5 and Well #9:
Timbrshor Well #5 and Timbrshor Well #9 are in the southeast corner of the subdivision near to the entrance. Well #5 is within the subdivision boundaries on the north side of the entrance road and the WCZ crosses onto the south neighbor's property. As of the date of this report the neighbor has not expressed a willingness to allow the WCZ from Well #5 to encroach. Timbrshor Well #9 was planned to be located on the same southeast neighbor's property and required permission to drill on the property, an easement, right of way to the well and a WCZ agreement. As of the date of this report permission to drill Well #9 on any locations on the property has not been granted. Therefore Well #9 will be planned to be developed on the THOA property. The well is near the neighboring property and requires a WCZ. Initial indications are the WCZ agreement may not be granted therefore Well #5 and Well #9 will likely require a MDEQ deviation from the WCZ standard based on a denial.

Placement of both wells near each other in the southeast corner by the entrance raises a concern that these wells will be developed in the same source of water and will interfere with each other during pumping cycles. If so, it may require drilling one of the wells deeper until another source of water is located[10]. HEI will continue to try to convince the neighbors to allow Well #9 to be developed on a portion of their property, and grant an easement, right of way and WCZ but is ready to prepare the deviations.

C.3 Timbrshor Well #8:
Timbrshor Well #8 is located in the northeast corner of the THOA subdivision on THOA property and the WCZ crosses onto the neighbor property. Well #8 also requires a deviation for the septic tank, gravity sewer line and pressure effluent line in the WCZ associated to Unit 216. HEI has made initial contact with the adjacent landowner who is willing to continue a discussion but has not given permission for a WCZ to date. As with Well #4, if the WCZ is attempted and cannot be negotiated, the documentation of that effort will allow the MDEQ to grant a deviation for the WCZ requirements. HEI will continue to work with the adjacent landowner but is ready to prepare the deviations. It is to be noted that even if a WCZ deviation is granted by neighbor denial, access to the site must be granted by the same neighbor.

C.4 McCarthy Well:
The McCarthy well is located within the THOA subdivision and currently serves one unit. With minor modifications and a having deviations granted from the MDEQ for separation from sanitary components, the McCarthy well is intended to serve four (4) units, the existing unit and three others. HEI has prepared deviations and is prepared to request the MDEQ approval of the location and unit connections.

[10] Ibid 7 above.

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C.5 Water Storage Cisterns:

The THOA Board also asked HEI to address alternatives to connecting to the groundwater well system and HEI has developed an alternative recommended by the local MDEQ for use of individual or multi user water storage cisterns with hauled water. MDEQ Circular DEQ 17 has been developed for designing cisterns and storage tanks for individual systems[11]. NSF/ANSI-61-certified potable water cisterns are primarily constructed out of reinforced concrete, fiberglass or polyethylene plastic. The larger sizes of multi user cisterns tend to be poured-in-place due to hauling difficulties. HEI can provide guidance to those individuals in the placement, construction, operation, maintenance, cleaning, filling, and disinfection of cisterns on their property or guidance can be obtained from the cistern manufacturers and contractors.

MDEQ regulations require cisterns to be located 10 feet from any foundation and have positive drainage away from it so as to prevent any surface water from contaminating the interior of the cistern or its water supply. The cistern is required to be 50 feet from wastewater treatment drainfields and 25 feet from septic tanks. Precautions must be taken to assure that water cisterns and their accessories will not freeze if used during winter months so the top of the cistern, excluding the access lid, must be installed below the frostline a minimum of 2'deep. HEI also recommends the use of PolyCor HDPE or insulated pipe from the cistern to the unit if a shallow burial less than 5 ft. is used.

A copy of MDEQ Design Circular 17 and examples of injection-molded polypropylene tanks that can be approved for individual cisterns has been included in Appendix 5.

C.6 Time Frame for MDEQ Compliance

HEI has also been asked to address who is required to be connected to the water system and the time frame required for connecting to meet MDEQ compliance. As stated above, the list of unit owners, their COSA compliance standing and the well they are assumed to be connected to is provided in Appendix 2 to this report. The time frame as governed by their COSA compliance standing is as follows;

1. The unit owners that developed before 1977 are considered COSA compliant and can continue to use surface water. These COSA compliant units that choose to have a groundwater well connection can connect at a time they choose.
2. The thirteen (13) unit owners that developed after 1977 are considered COSA non-compliant and will need to decide on a groundwater or cistern water supply. Once a decision is made, HEI will attempt to get MDEQ to approve a five (5) year time period in which to develop the groundwater well system and make a connection or install a cistern. MDEQ is recommending three (3) years for completion.
3. The owners of undeveloped lots seeking to develop a site in the future can choose to connect to the groundwater well system, install a cistern or can choose not to develop. If the unit owner

[11] Multiple user cisterns may be utilized when a potable water source is available for hauling within a reasonable distance from the cistern or the water is supplied by an on-site well or other source approved by the department and the cistern meets department regulations. The onsite well developed by this project will meet the criteria of MDEQ and unit owners can develop multi user cisterns and haul from on-site wells.

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chooses not to develop, the MDEQ will place a sanitary restriction on the deed stating the lot cannot be used for any purpose that requires sanitary service; e.g. using water is assumed to require a sanitary means of disposal, thus a sanitary restriction. There is no time frame required to construct their unit, but they will have to follow this plan when they choose to develop the lot.

C. Cost Analysis:

The five well multi users will be responsible for the costs of their wells and associated infrastructure (e.g., pump houses, holding tanks, etc.), and it is HEI's understanding that cost sharing methods for a well system will be determined by the effected owners and users of those wells. HEI has divided the cost per well by the number of connections. In order to provide all the pertinent information at the same time, HEI has also provided the cost per unit for the entire project. These costs are construction costs and don't include the THOA group costs which are limited to the preparation and approval of this plan that results in a State approved source of ground water or a cistern for all 47 units.

HEI has completed the preliminary construction cost analysis for the systems that are most likely going to be approved by the MDEQ including the wells, pump control infrastructure and the pipeline distribution system. The project costs are shown in Table 1 below and provided in Appendix 3 to this report. HEI investigated piping systems that would allow for shallow bury to avoid bedrock excavation and existing sewer lines. HEI discovered several insulated HDPE and PVC dual walled pipes that can used on the surface or buried. HEI is currently working with Thermacore's PolyCor piping system. The information and specifications for the PolyCor pipe are included in Appendix 3 and can be found on the international web at the site http://www.thermacor.com/polycor-hdpe/. The HEI cost analysis includes the PolyCor pipeline and distribution system costs per foot as recently obtained from Thermacore. An average cost of the individual connections from the pipeline system to the unit is also provided and is in Appendix 4.

The cost estimate includes the wells that are to be developed at each location with the depth of the wells estimated to be near to 400 ft. and is modeled to be similar in depth to the McCarthy well while taking into account the elevation at the well location. Wells need to be constructed to the standard in Design Circular MDEQ 3, section 3.2.5 General well construction. The key features are exterior concrete grouting, an 8-inch steel casing drilled at least 25 ft. below ground surface, grouted into the bedrock contact and lined with 6-inch PVC from the ground surface to the bottom of the well.

The Well #4 phasing plan proposes that the COSA non-compliant units associated to Well #4 will complete the initial development required to meet their water supply. Once intital development costs are known, the existing COSA non-compliant units would develop future repayment agreements that define connection repayment costs for new units and the existing COSA compliant units that elect to transition from surface water.

HEI has also developed the preliminary cost estimate for the cisterns which include an individual tank, pump and associated wiring and a reasonable installation cost. Total cost for cisterns will depend on

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how many cisterns will be used, how or where they will be installed, and if there will be multi-user cisterns. The MDEQ design cistern requirements, cistern examples and cistern costs are in Appendix 5.

It is important to note that the costs estimates are preliminary and will change. Once the final decision on who will connect or not connect to the groundwater well system or who will use a cistern is known to HEI, plans and costs may need to be reevaluated. In some cases, lesser users of groundwater may drive individual costs up, in other cases, lesser users may allow reduced system sizes; either way costs will change.

Table 1 below provides a summary of the preliminary well system costs. Details for the well and pipeline distribution construction costs, the storage and pump control building cost, the phasing plan for the Well #4 users and the individual connection and cistern cost estimates are provided in Appendix 3 to this report.

Table 1 Preliminary Construction Cost Summary

Total Project Costs Summary		Units Served	Cost Per Unit
Project Costs Well #4	$ 119,908	20	$ 5,995
Project Costs Well #5	$ 53,892	6	$ 8,982
Project Costs Well #9	$ 58,915	8	$ 7,364
Project Costs Well #8	$ 65,973	9	$ 7,330
Project Costs McCarty	$ 25,467	4	$ 6,367
	Total Project Costs	$ 324,155	
	Average Cost Per User	$ 6,897	
Individual Connections Cost Estimate		$ 1,308	
Installed Cistern Cost Estimate		$ 4,960	

E. Conclusions:

HEI has prepared a plan that provides an opportunity for all 47 units to receive groundwater from a State approved source. Assuming no one elects to use a cistern and nothing in the HEI plan changes, and the plan is approved by the members and the Board and eventually the MDEQ, HEI will rewrite the THOA COSA to reflect the new water system design, the COSA will get filed at Lake County in 2019, it will become the plan of record and the building moratorium can be terminated. All seventeen (17) existing COSA compliant (grandfathered) units, the thirteen (13) COSA non-compliant and seventeen (17) future units will have a plan to follow to connect to a groundwater source. For COSA non-compliant units, a 5-year plan to become COSA compliant. If some unit owners opt for cisterns instead of a ground water source, the plan will be rewritten to include such choices and a cistern location and design for each applicable unit will be provided.

It is to be noted that THOA members will retain the right to individually modify the plan in the future as it applies to them (e.g. use a cistern or stay on surface water) provided that they obtain Board approval

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and independently file a revised COSA with the MDEQ. A revision of the COSA would be at the expense of the THOA member and not the THOA. HEI estimates those costs could be approximately $1,000 if an amendment were completed by the THOA memeber and if it were to occur in 2019.

It is also to be noted that the MDEQ has stated that the THOA is not responsible if an individual owner simply refuses to cooperate and continues to use a non-State approved water source[12]. If an existing owner refuses to cooperate the means of enforcement is MDEQ will issue an order for compliance and will place a sanitary restriction on the deed of the existing COSA non-compliant unit saying the unit is not safe for occupancy as it does not have a means for providing potable water, and there will be a daily fine.

If the THOA fails to submit a plan to the MDEQ, ultimately the MDEQ Enforcement Division will again issue an order demanding compliance. The THOA is subject to compliance enforcement action and a possible fine of $10,000 per day until a new water plan is developed and approved[13]. Unit owners subject to the provisons in the COSA who refuse to utilize the approved water source and future unit owners who opt out of the plan could individually face MDEQ enforcement that can include a deed restriction placed on their property by the MDEQ, fines and eventually, civil penalties.

It is the conclusion of HEI that the MDEQ will grant deviations from the WCZ agreement for Well #4, Well #5, Well #8 and Well #9 because they will be designed to be constructed with superior sanitary seals at the surface, have been placed away from and up gradient from any adjacent drainfields and wastewater components and all other health impacts are known and controlled. The sanitary component deviations for Well #8 will also be addressed by the larger diameter outer casing that is sealed with a cement grout and the McCarthy well will need a concrete cap at the surface. Therefore, it is also the conclusion of HEI that the sanitary deviations for the Well #8 and the McCarthy well also will be granted.

F. Recommendations

HEI recommends that all unit owners advise the THOA Board by the date specified by the THOA Board whether they wish to (1) use a cistern in lieu of a ground water source; and (2) whether they wish to be removed from the plan. HEI recommends that the THOA Board approve this water plan and instruct HEI to complete the remaining steps. With that information, HEI will be in a position to finalize the plan with the THOA Board and submit it to the MDEQ.

HEI recommends that the THOA Board complete this plan approval as soon as possible to avoid any p ossible MDEQ enforcement action.

[12] Pers. Cons Kurt Hafferman PE, HEI with Emily Gillespie, PE, MDEQ, Friday February 8, 2019

[13] Montana Code Annotated (MCA) 75-6-110 and 75-6-111 Enforcement response. MCA 75-6-104 and 75-6-109 Issuance of an order pursuant to bringing a judicial action as authorized by 75-6-111. MCA 75-6-109, 75-6-113, and 75-6-114. Seeking administrative or judicial penalties. MCA 75-1-1001 Penalty factors.

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710

APPENDIX

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710

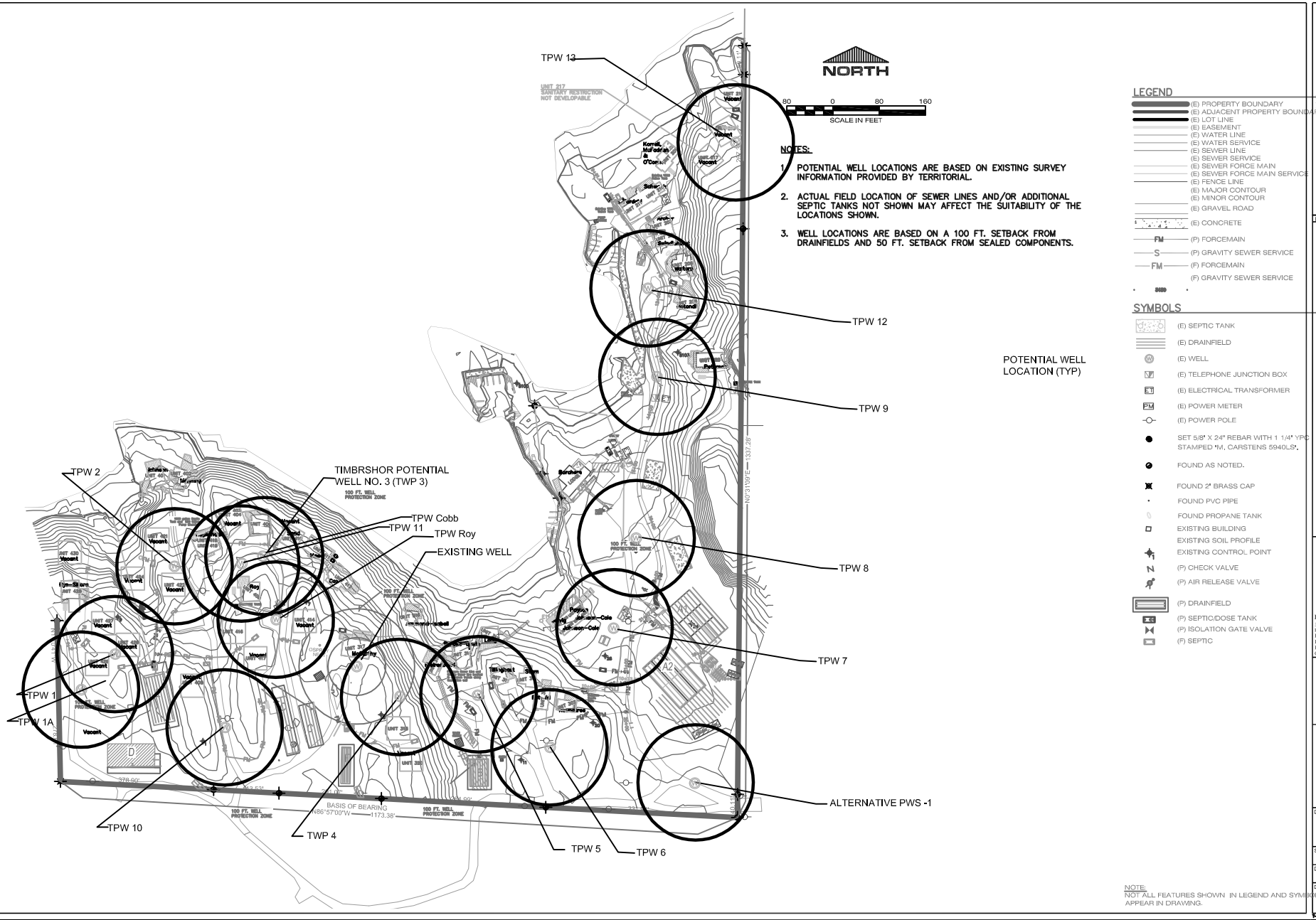
Appendix 1

Proposed Well Locations and Mapping

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710

Original Sixteen Well Sites Investigated by HEI

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710



NOTES:

1. POTENTIAL WELL LOCATIONS ARE BASED ON EXISTING SURVEY INFORMATION PROVIDED BY TERRITORIAL.
2. ACTUAL FIELD LOCATION OF SEWER LINES AND/OR ADDITIONAL SEPTIC TANKS NOT SHOWN MAY AFFECT THE SUITABILITY OF THE LOCATIONS SHOWN.
3. WELL LOCATIONS ARE BASED ON A 100 FT. SETBACK FROM DRAINFIELDS AND 50 FT. SETBACK FROM SEALED COMPONENTS.

LEGEND

- (E) PROPERTY BOUNDARY
- (E) ADJACENT PROPERTY BOUNDARY
- (E) LOT LINE
- (E) EASEMENT
- (E) WATER LINE
- (E) WATER SERVICE
- (E) SEWER LINE
- (E) SEWER SERVICE
- (E) SEWER FORCE MAIN
- (E) SEWER FORCE MAIN SERVICE
- (E) FENCE LINE
- (E) MAJOR CONTOUR
- (E) MINOR CONTOUR
- (E) GRAVEL ROAD
- (E) CONCRETE
- FM (P) FORCEMAIN
- S (P) GRAVITY SEWER SERVICE
- FM (F) FORCEMAIN
- (F) GRAVITY SEWER SERVICE

SYMBOLS

- (E) SEPTIC TANK
- (E) DRAINFIELD
- (E) WELL
- (E) TELEPHONE JUNCTION BOX
- (E) ELECTRICAL TRANSFORMER
- (E) POWER METER
- (E) POWER POLE
- SET 5/8" X 24" REBAR WITH 1 1/4" YPC STAMPED "M. CARSTENS 5940LS".
- FOUND AS NOTED.
- FOUND 2" BRASS CAP
- FOUND PVC PIPE
- FOUND PROPANE TANK
- EXISTING BUILDING
- EXISTING SOIL PROFILE
- EXISTING CONTROL POINT
- (P) CHECK VALVE
- (P) AIR RELEASE VALVE
- (P) DRAINFIELD
- (P) SEPTIC/DOSE TANK
- (P) ISOLATION GATE VALVE
- (F) SEPTIC

NOTE:
NOT ALL FEATURES SHOWN IN LEGEND AND SYMBOLS APPEAR IN DRAWING.

BY	DESCRIPTION	DATE
	REVISIONS	

DRAWN BY: NJF | APPROVED BY: KMF

TIMBRSHOR WASTEWATER TREATMENT SYSTEM IMPROVEMENTS

FOR

TIMBRSHOR HOMEOWNERS ASSOCIATION

SECTION 7, T.23N., R.19W., P.M., M., LAKE COUNTY, MONTANA

HAFFERMAN ENGINEERING, INC.
35 SOUTH MAIN, SUITE B
KALISPELL, MT. 59901
PHONE: (406) 257-8708
FAX: (406) 257-8710
EMAIL: info@hilmsurveyer.com
ONLINE: http://www.hilmsurveyer.com

DRAWING TITLE:
MAXIMUM POTENTIAL WELL LOCATIONS

SCALE: AS SHOWN

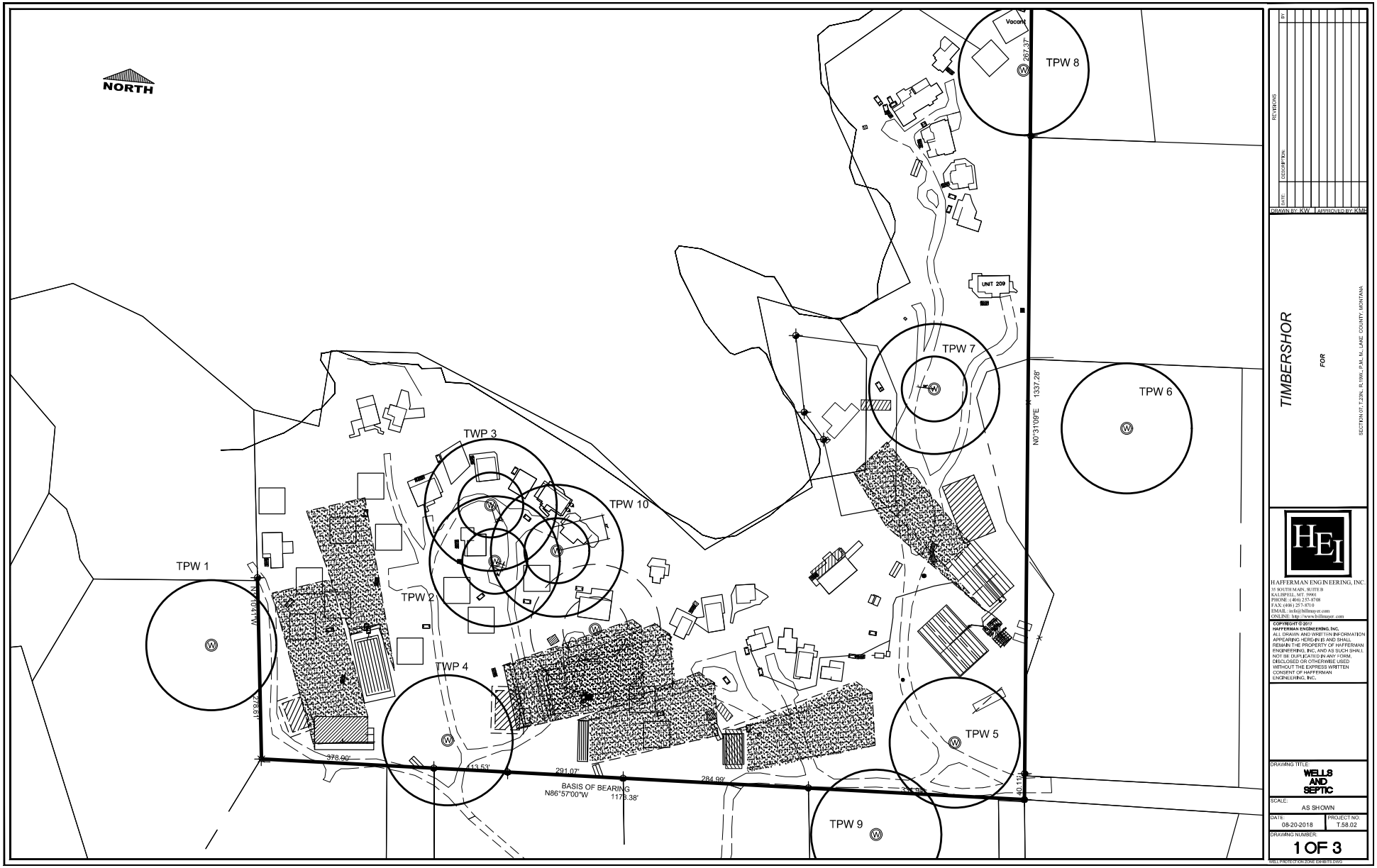
DATE: July 2018 | PROJECT NO: T.58.1

DRAWING NUMBER: **1 OF 1**

T:\58-04-MSTR AS NSH 6_12_2018 ALL WELLS.dwg

Eleven Well Site Submitted for Review

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710



REVISIONS

DATE	DESCRIPTION	BY

DRAWN BY: KW | APPROVED BY: KMH

TIMBERSHOR

FOR

SECTION 07, T.23N., R.19W., P.M., N., LAKE COUNTY, MONTANA

HAFFERMAN ENGINEERING, INC.
35 SOUTH MAIN, SUITE B
KALISPELL, MT. 59901
PHONE: (406) 257-8708
FAX: (406) 257-8710
EMAIL: mike@hillmayer.com
ONLINE: http://www.hillmayer.com

DRAWING TITLE:
WELLS AND SEPTIC

SCALE: AS SHOWN

DATE: 08-20-2018 | PROJECT NO: T.58.02

DRAWING NUMBER:
1 OF 3

WELL PHOTO FOR ZONE EXHIBITS.DWG

Five Well Sites including McCarthy Well with Preliminary Approval

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710

NOTE:
NOT ALL FEATURES SHOWN IN LEGEND AND SYMBOLS APPEAR IN DRAWING.

NO.	DESCRIPTION:	DATE:	BY
	REVISIONS		

DRAWN BY: NJF | APPROVED BY: KMH

TIMBRSHOR WASTEWATER TREATMENT SYSTEM IMPROVEMENTS

FOR

TIMBRSHOR HOMEOWNERS ASSOCIATION

SECTION 17, T 22N., R 19W., P.M., M., LAKE COUNTY, MONTANA

HAFFERMAN ENGINEERING, INC.
35 SOUTH MAIN, SUITE B
KALISPELL, MT. 59901
PHONE: (406) 257-8708
FAX: (406) 257-8710
EMAIL: info@hilmayer.com
ONLINE: http://www.hilmayer.com

DRAWING TITLE:
POTENTIAL WELL LOCATIONS

SCALE: AS SHOWN

DATE: APRIL 2014 | PROJECT NO: T.58.1

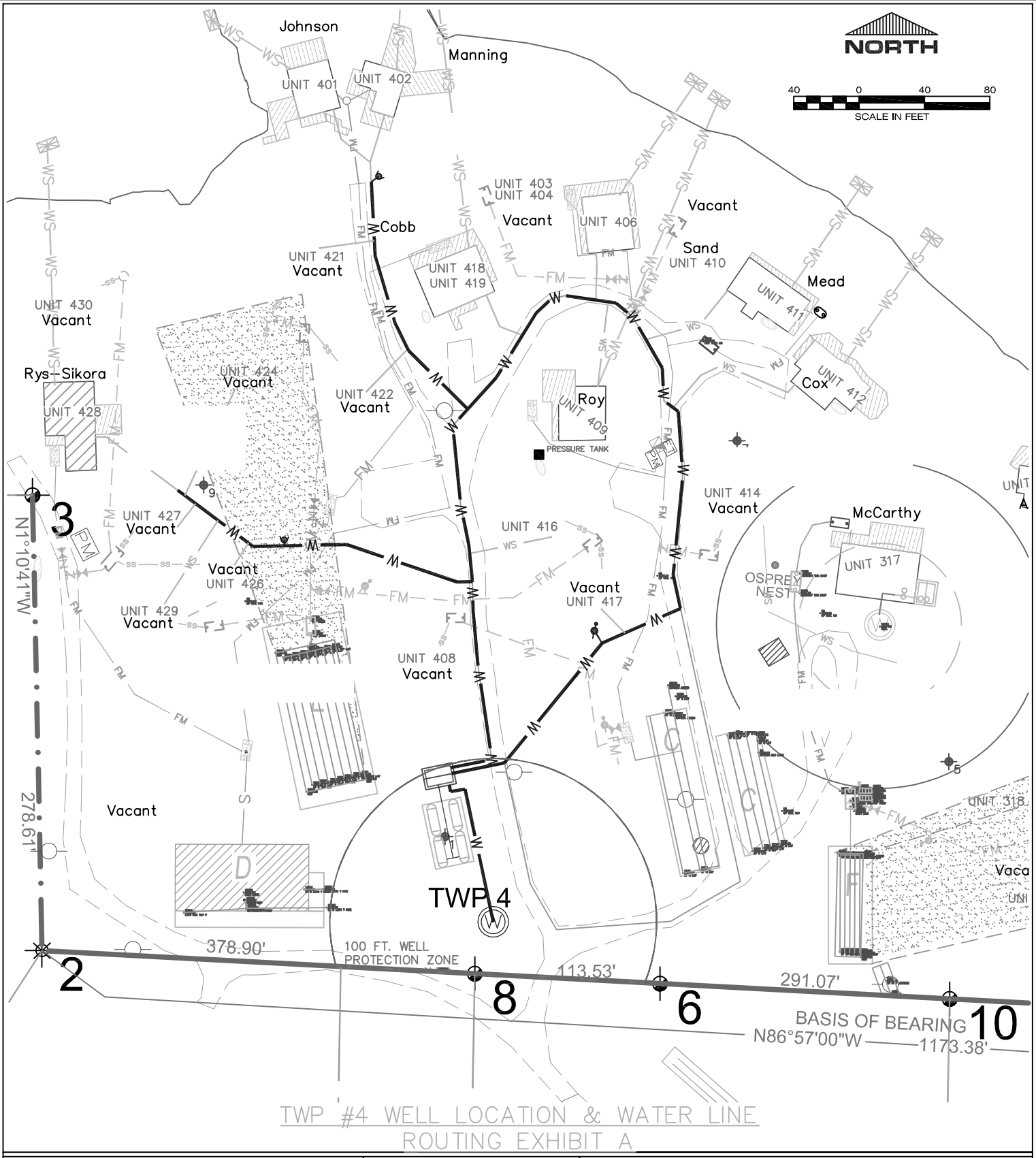
DRAWING NUMBER:
1 OF 1

T-58-02-WSTR-ALL WELLS-XCAD_REVISED-NJF.DWG

Appendix 2

Planned Well Location Maps and Unit Owners List

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710



TWP #4 WELL LOCATION & WATER LINE ROUTING EXHIBIT A

HAFFERMAN ENGINEERING, INC.
P.O. BOX 1891
KALISPELL, MT 59901-1891
PHONE: 406-257-8708
FAX: 406-257-8710
EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:

TIMBRSHOR WELL #4

FOR

TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
NOV 19, 2018	T.58.2	AS SHOWN	1 OF 4
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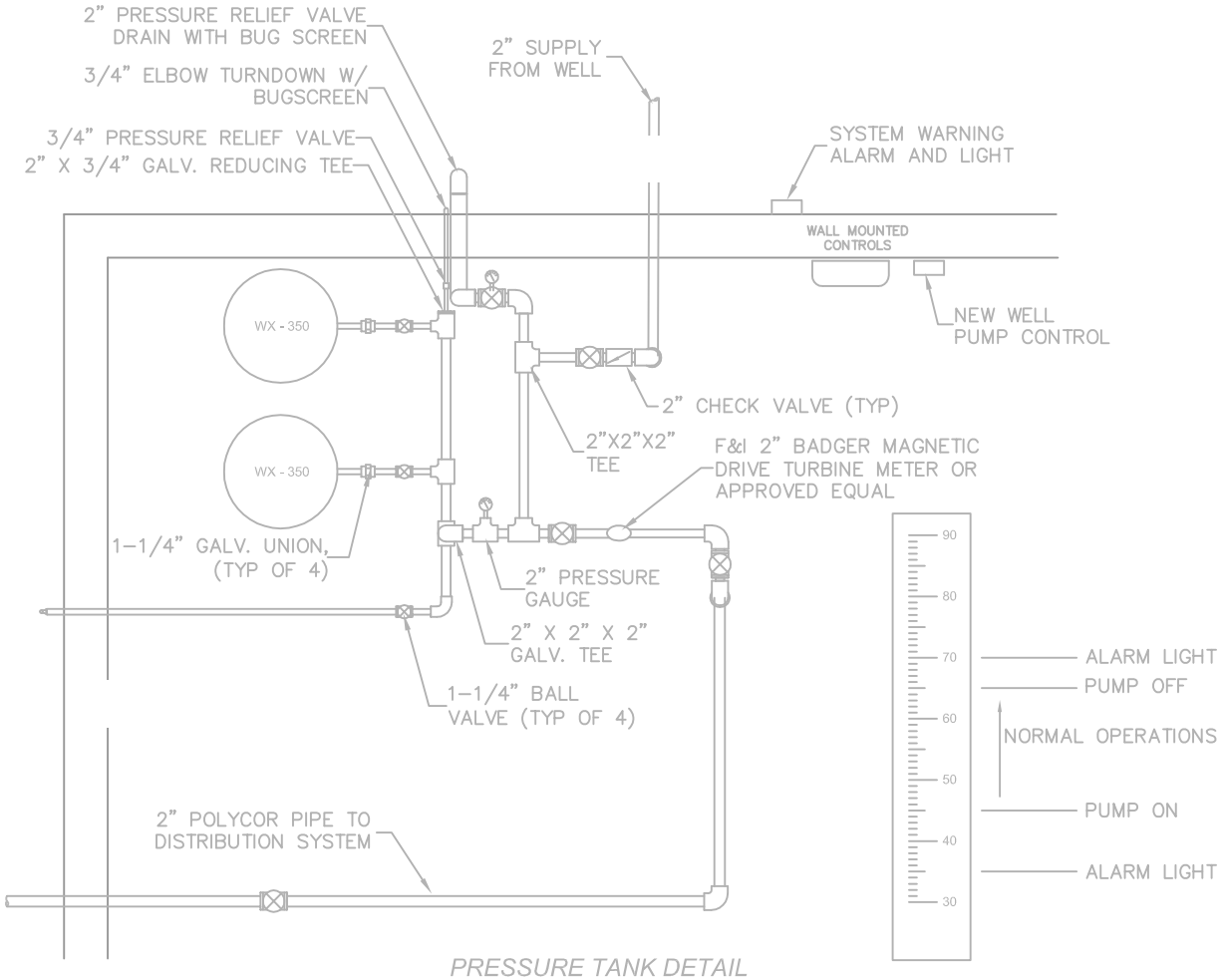
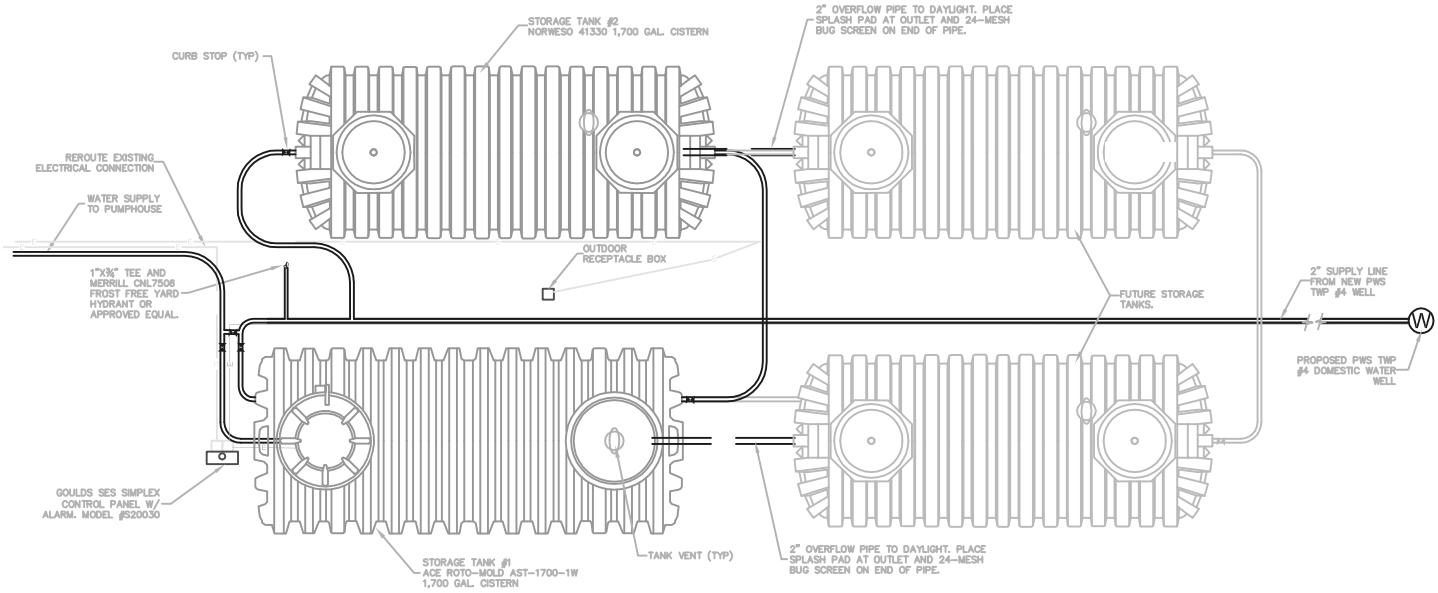


PRESSURE TANK DETAIL

NTS



WATER STORAGE LAYOUT DETAIL

NTS

TWP #4 EQUIPMENT ROOM DETAIL EXHIBIT C

HAFFERMAN ENGINEERING, INC.
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EMAIL: info@billmayer.com
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DRAWING TITLE:

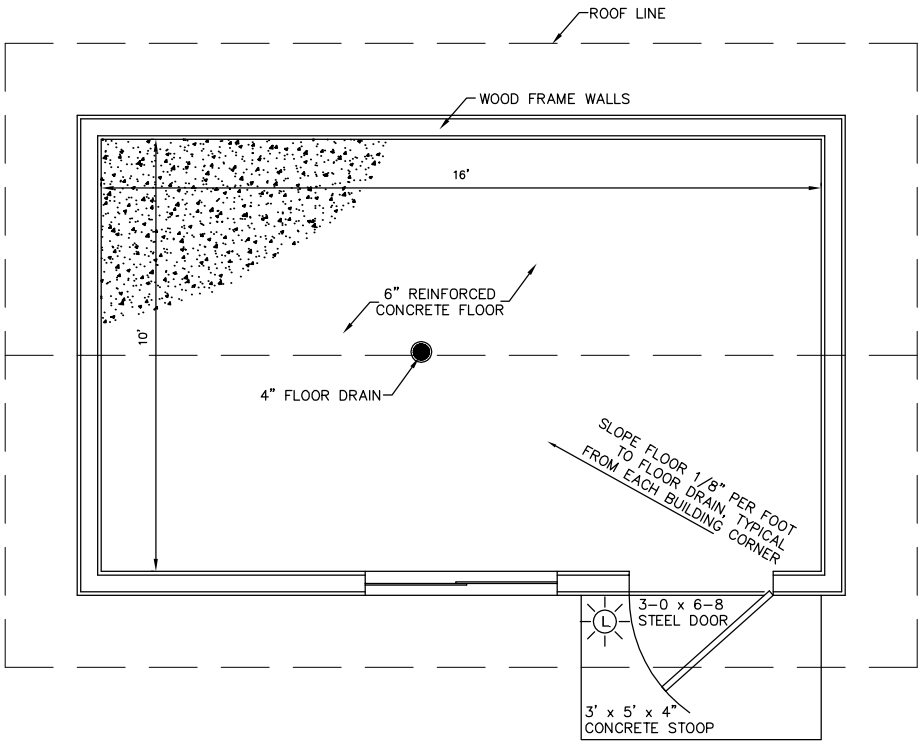
TWP#4 STORAGE AND PIPING DETAILS

FOR

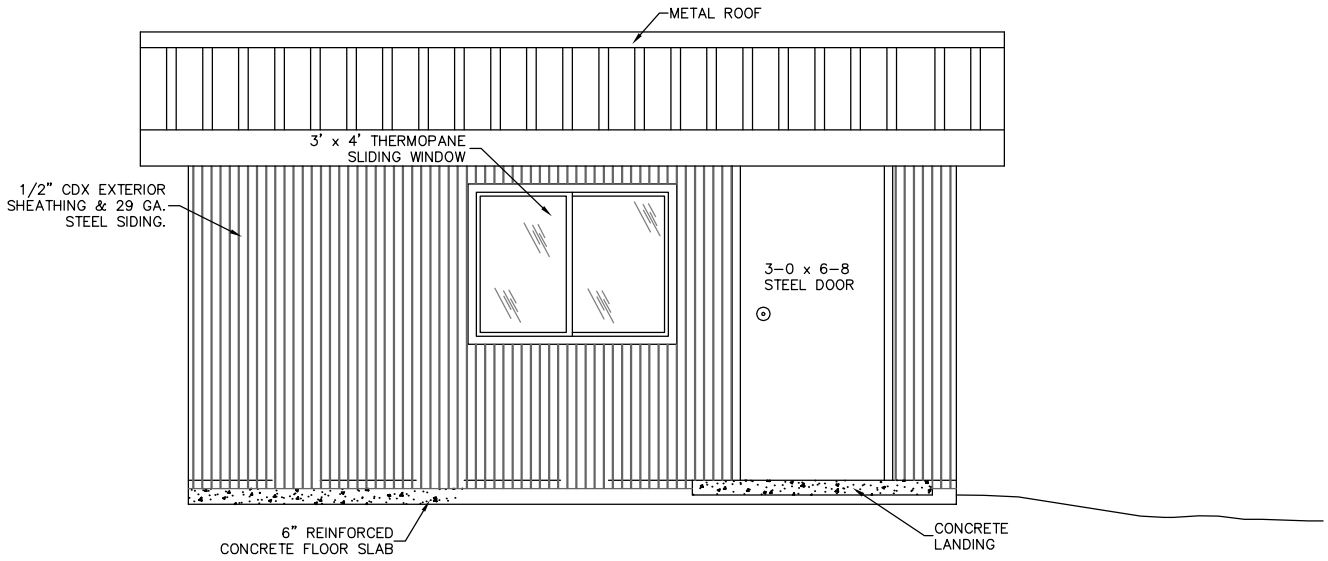
TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
NOV 19, 2018	T.58.2	AS SHOWN	3 OF 4
FILE LOCATION: S:LAND PRO...\T.58.2\DWG	DRAWN BY: NJF	APPROVED BY: KMH	



PUMPHOUSE FLOOR PLAN
NTS



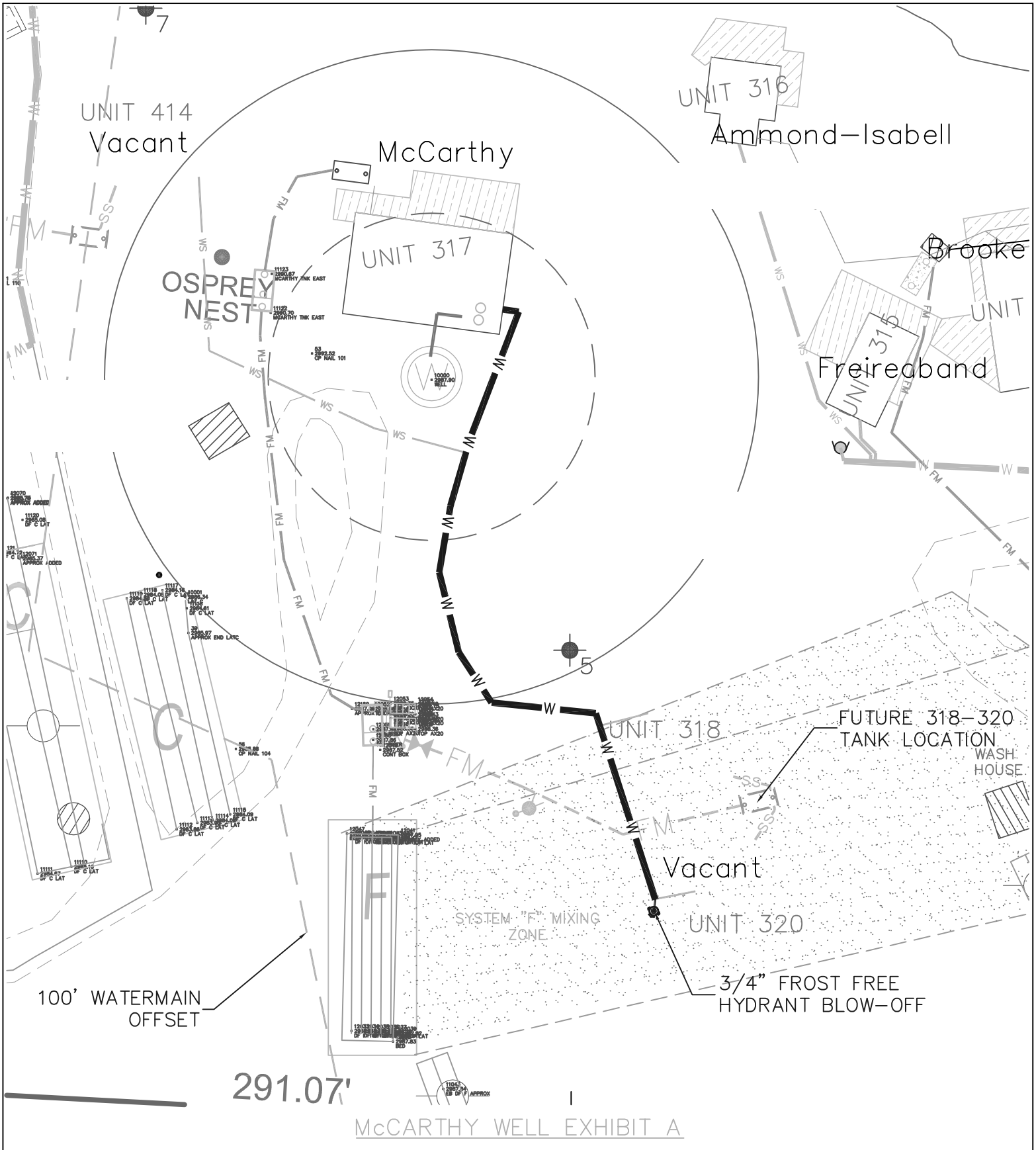
PUMPHOUSE ELEVATION
NTS

TWP #4 PUMPHOUSE DETAIL EXHIBIT D

HAFFERMAN ENGINEERING, INC.
P.O. BOX 1891
KALISPELL, MT 59901-1891
PHONE: 406-257-8708
FAX: 406-257-8710
EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:
TIMBRSHOR PUMPHOUSE TWP #4
FOR
TIMBRSHOR HOA
SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
NOV 19, 2018	T.58.2	AS SHOWN	4 OF 4
FILE LOCATION: S:LAND PRO...\T.58.2\DWG	DRAWN BY: NJF	APPROVED BY: KMH	



HAFFERMAN ENGINEERING, INC.
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KALISPELL, MT 59901-1891
PHONE: 406-257-8708
FAX: 406-257-8710
EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:

McCARTHY WELL PROTECTION ZONE

FOR

TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
NOV 19, 2018	T.58.2	AS SHOWN	1 OF 2
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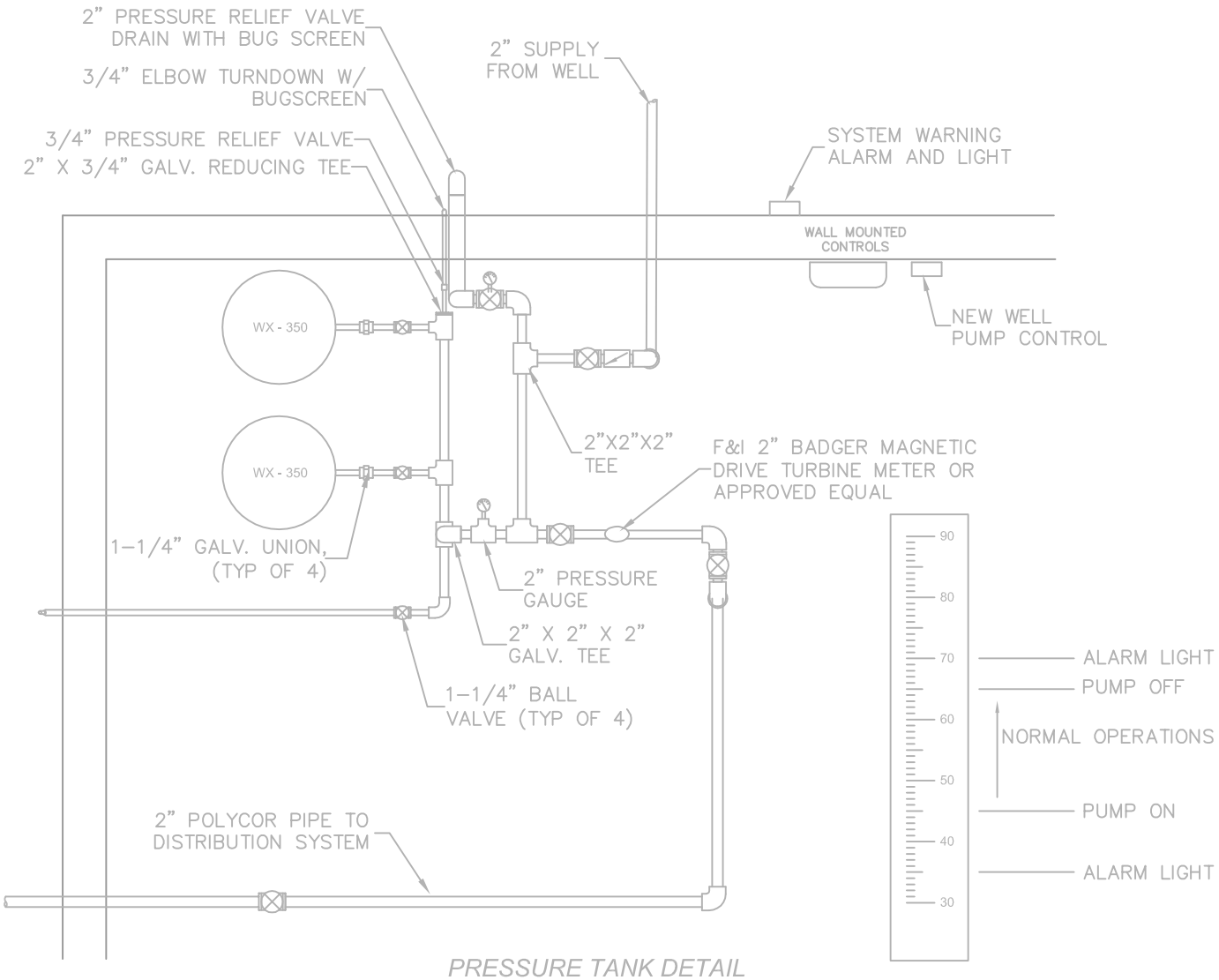

PRESSURE TANK DETAIL

NTS

GENERAL NOTES

1. THE CONTRACTOR SHALL EXCAVATE THE EXISTING DOMESTIC WATER WELL AND INSPECT THE CONDITION OF THE PITLESS ADAPTER.

2. THE CONTRACTOR SHALL REPACK WELL CASING WITH BENONITE/SOIL MIXTURE TO SEAL THE CASING.

McCARTHY WELL EXHIBIT D
DETAILS AND NOTES

HAFFERMAN ENGINEERING, INC.
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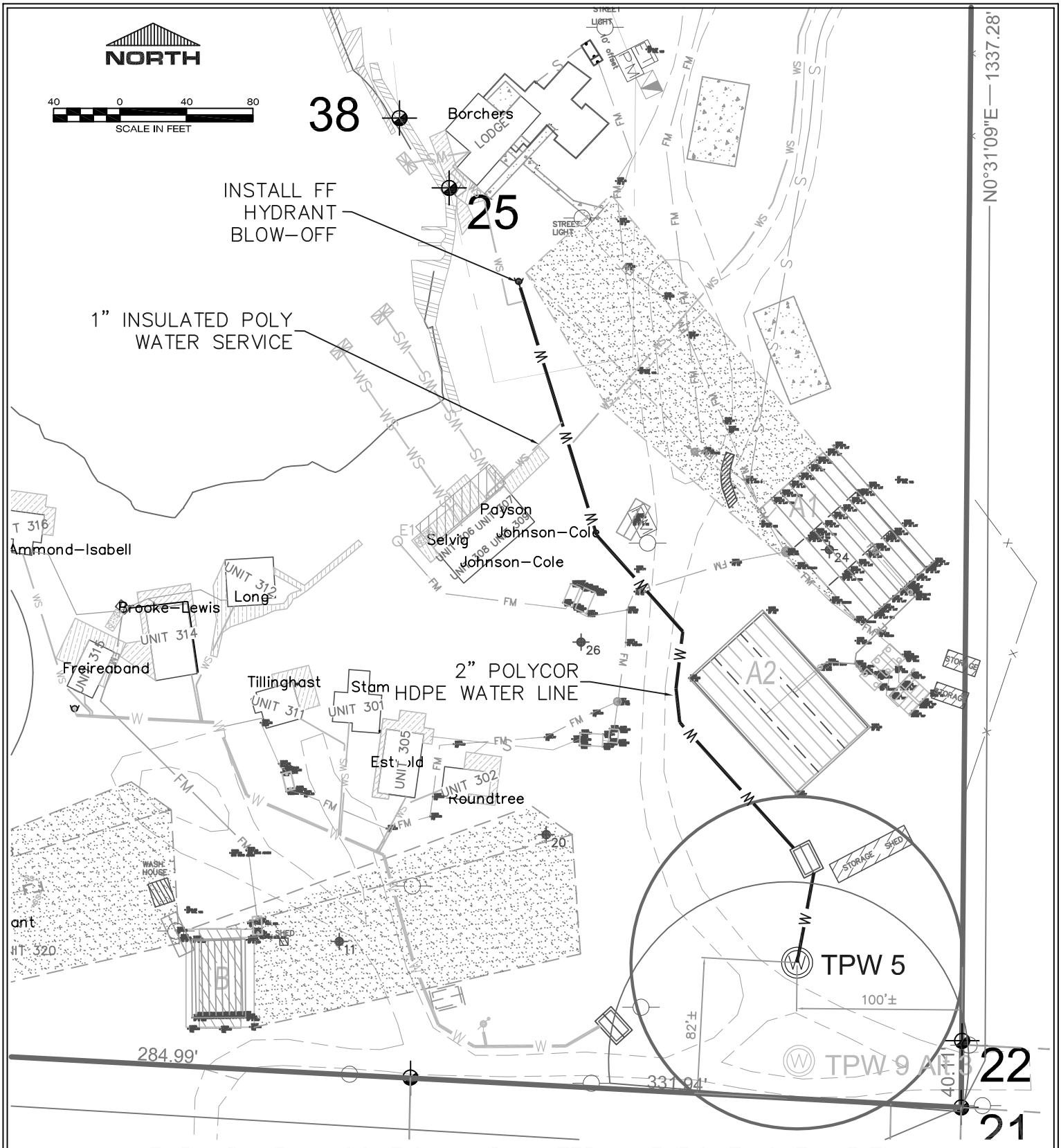
PHONE: 406-257-8708
FAX: 406-257-8710
EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:
McCARTHY WELL CONTROLS
FOR
TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
NOV 19, 2018	T.58.2	AS SHOWN	2 OF 2
FILE LOCATION: S:LAND PRO...\T.58.2\DWG	DRAWN BY: NJF	APPROVED BY: KMH	



TWP #5 WELL LOCATION AND WATER LINE ROUTING EXHIBIT A

HAFFERMAN ENGINEERING, INC.
P.O. BOX 1891
KALISPELL, MT 59901-1891
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EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:

TIMBRSHOR WELL #5 PROTECTION ZONE

FOR

TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
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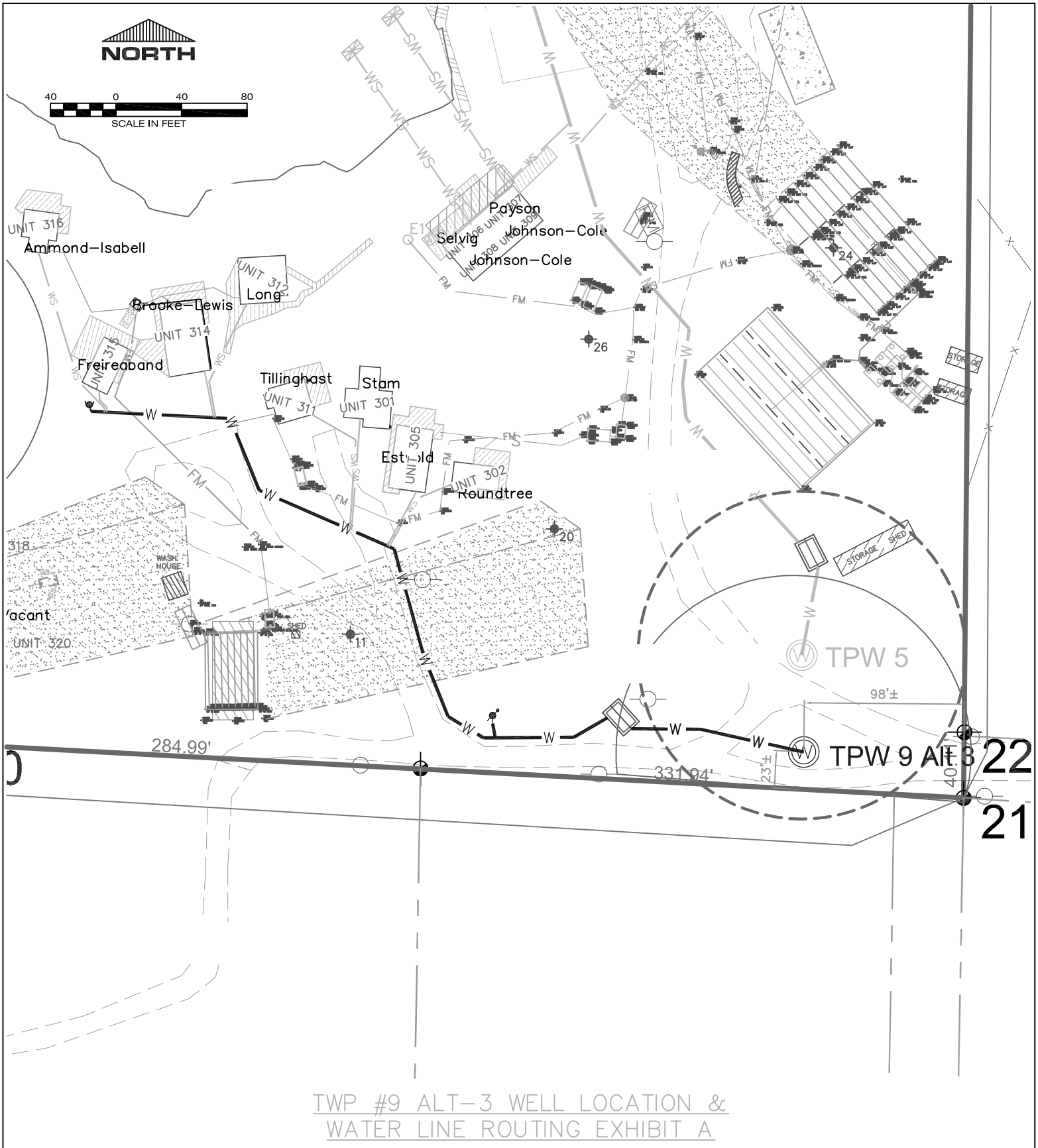

TWP #9 ALT–3 WELL LOCATION &
WATER LINE ROUTING EXHIBIT A

HAFFERMAN ENGINEERING, INC.
P.O. BOX 1891
KALISPELL, MT 59901-1891
PHONE: 406-257-8708
FAX: 406-257-8710
EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:
TIMBRSHOR WELL #9 PROTECTION ZONE
FOR
TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
DEC 7, 2018	T.58.2	AS SHOWN	1 OF 2
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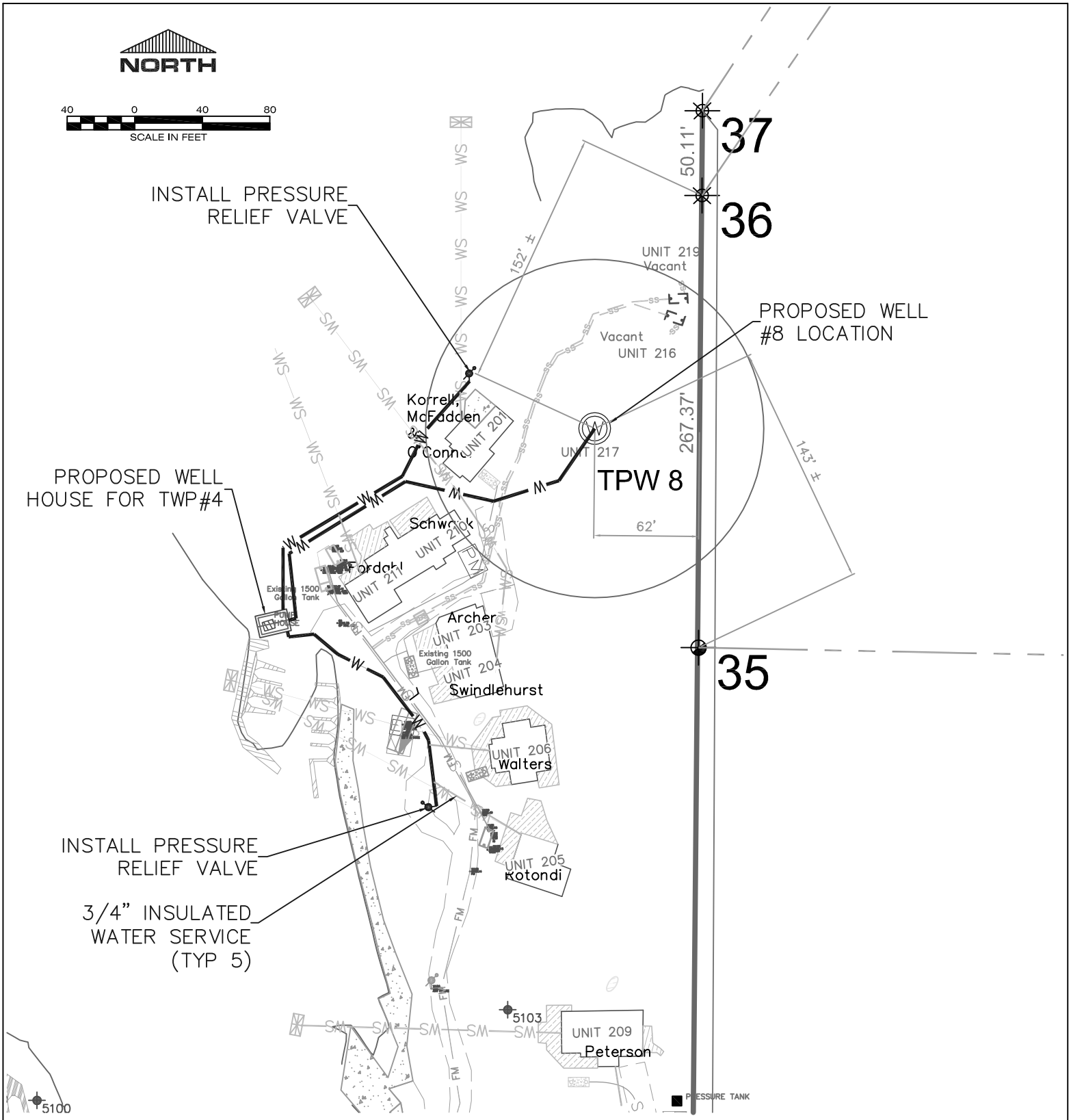


TWP #8 WELL LOCATION & WATER LINE ROUTE EXHIBIT A

HAFFERMAN ENGINEERING, INC.
P.O. BOX 1891
KALISPELL, MT 59901-1891
PHONE: 406-257-8708
FAX: 406-257-8710
EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:
TIMBRSHOR WELL #8 PROTECTION ZONE
FOR
TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
DEC 6, 2018	T.58.2	AS SHOWN	1 OF 2
FILE LOCATION: S:LAND PRO...\T.58.2\DWG	DRAWN BY: NJF	APPROVED BY: KMH	

HAFFERMAN ENGINEERING, INC.

Project: Timbrshor
Project #: T.58.1
File: S:/…/Water Rights/DEQ 2018
Assignment Hafferman

Revision Date

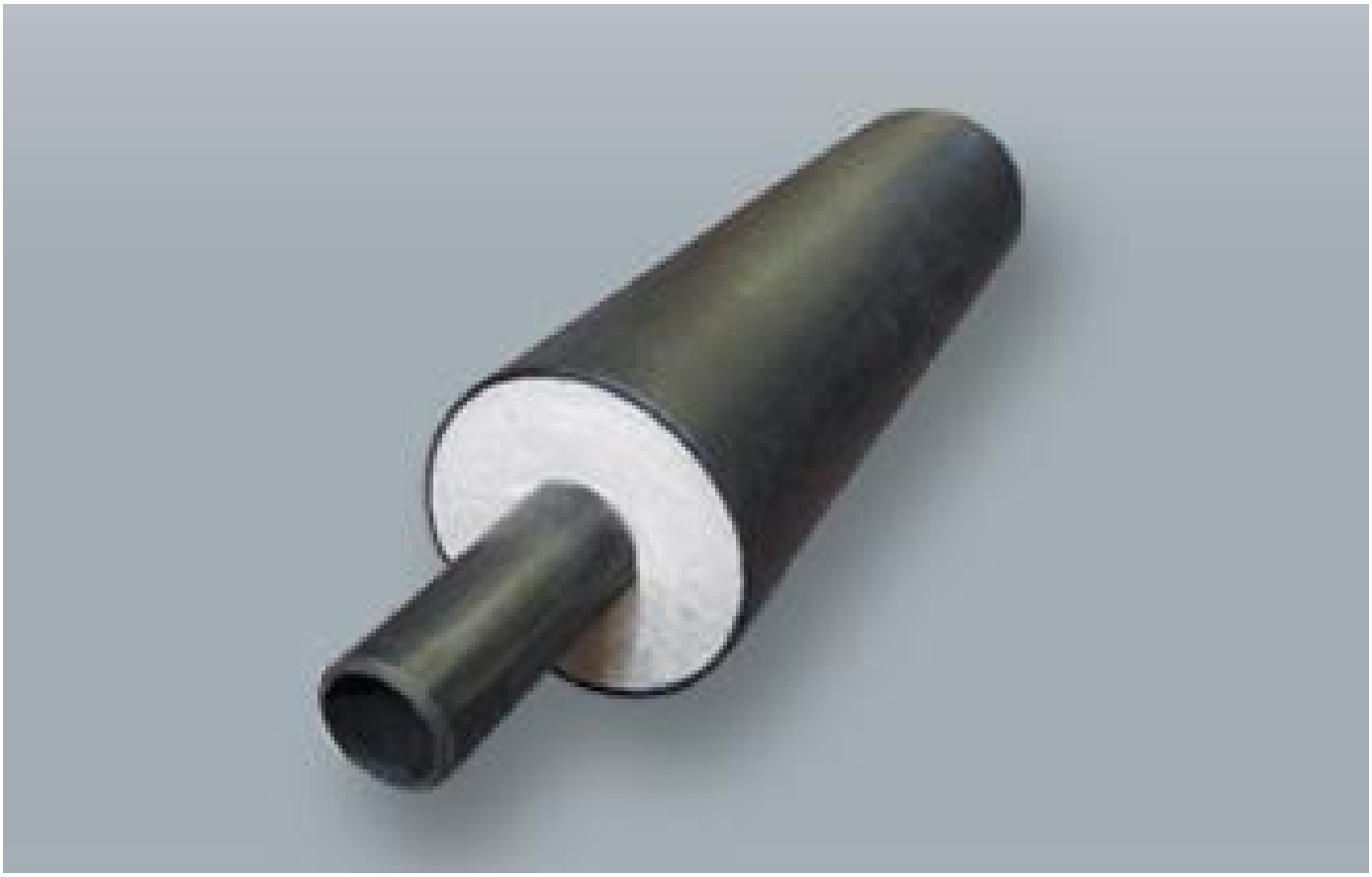
Water System Complaince

DEQ Key
COSA Compliant COM
Not COSA Compliant NCOM

Unit#	Owner	Status D=developed-#bdrms ND = not developed	DEQ Water Supply Status	TWP Assignment
201	Rose	DEVELOPED	NCOM	8
203	Acher	DEVELOPED	COM	8
204	Swindlehurst	DEVELOPED	COM	8
205	Rotondi	DEVELOPED	COM	8
206	Walters	DEVELOPED	NCOM	8
209	Peterson	DEVELOPED	NCOM	5
210	Schwank	DEVELOPED	COM	8
211	Fordahl	DEVELOPED	COM	8
216	Rotondi, M	NOT DEVELOPED	NCOM	8
219	Borchers-Michione	NOT DEVELOPED	NCOM	8
301	Karpstein	DEVELOPED	NCOM	9
302	Rountree	DEVELOPED	NCOM	9
305	Estvold	DEVELOPED	NCOM	9
306	Nichols (Trustee Selvig 4-plex)	DEVELOPED	COM	5
307	Payson (4-plex)	DEVELOPED	COM	5
308	Cole (4-plex)	DEVELOPED	COM	5
309	Cole (4-plex)	DEVELOPED	COM	5
311	Tillinghast	DEVELOPED	COM	9
312	Novinski	DEVELOPED	COM	9
314	Brooke-Lewis	DEVELOPED	COM	9
315	Feieraband Partnership	DEVELOPED	COM	9
316	Carney	DEVELOPED	COM	9
317	McCarthy	DEVELOPED	NCOM	McCarthy
318	McCarthy	NOT DEVELOPED	NCOM	McCarthy
320	McCarthy	NOT DEVELOPED	NCOM	McCarthy
401	Johnson	DEVELOPED	COM	4
402	Manning	DEVELOPED	COM	4
406	Armstrong	DEVELOPED	NCOM	4
408	Caraway,Dasinger	NOT DEVELOPED	NCOM	4
409	Roy	DEVELOPED	NCOM	4
410	Sand	NOT DEVELOPED	NCOM	4
411	Mead	DEVELOPED	NCOM	4
412	Cox	DEVELOPED	NCOM	4
414	McCarthy	NOT DEVELOPED	NCOM	McCarthy
416	Manning	NOT DEVELOPED	NCOM	4
417	Manning	NOT DEVELOPED	NCOM	4
421	Johnson	NOT DEVELOPED	NCOM	4
422	Johnson	NOT DEVELOPED	NCOM	4
424	Johnson	NOT DEVELOPED	NCOM	4
426	Borchers, B	NOT DEVELOPED	NCOM	4
427	Maxwell	NOT DEVELOPED	NCOM	**4**
428	Rys-Sikora	DEVELOPED	NCOM	4
429	Manning	NOT DEVELOPED	NCOM	4
430	Rys-Sikora	NOT DEVELOPED	NCOM	4
403/404	Cobb	NOT DEVELOPED	NCOM	4
418/419	Cobb	DEVELOPED	NCOM	4
Lodge	Rose	DEVELOPED	COM	5

HT/SEH

POLYCOR HDPE



THERMACOR'S POLYCOR HDPE is a factory-fabricated, pre-insulated piping system for distribution of chilled water, sewer, water main, force main, waste heat, etc.... POLYCOR is designed with high density polyethylene (HDPE) carrier pipe, closed cell polyurethane foam insulation, and a high density polyethylene jacket.

Carrier Pipe:

• High Density Polyethylene

Insulation:

• Polyurethane foam

Pre-insulated Polyethylene Piping Systems

Part 1 - General

1.1 Pre-insulated Piping - Furnish a complete system of factory pre-insulated polyethylene piping for the specified service. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the Pre-insulated Piping System manufacturer.

1.2 The system shall be **POLYCOR HDPE** manufactured by **Thermacor Process Inc.** of Fort Worth, Texas.

Part 2 - Products

2.1 Carrier pipe shall be high density polyethylene (HDPE), conforming to ASTM D-3350 and the specification standards listed below. Pipe and fittings are manufactured from extra high molecular weight polyethylene compound and fabricated to Standard Dimensional Ratio (SDR) wall thickness in standard IPS sizes. Available pressure ratings range from 50 psi (SDR-32.5) to 255 psi (SDR-7.3) at 73°F, with operating temperatures from -50°F and lower, to +140°F by applying an appropriate design factor.

2.2 Insulation shall be polyurethane foam either spray applied or injected with one shot into the annular space between carrier pipe and jacket with a minimum thickness of one inch. Insulation shall be rigid, 90-95% closed cell polyurethane with a 2.0 to 3.0 pounds per cubic foot density and coefficient of thermal conductivity (K- Factor) of 0.16 and shall conform to ASTM C-591. Maximum operating temperature shall not exceed 250°F. Insulation thickness shall be specified by calling out appropriate carrier pipe and jacket size combinations, and shall not result in less than 1” thickness.

2.3 Jacketing material shall be extruded, black, high density polyethylene (HDPE), having a minimum wall thickness of 100 mils for jacket sizes less than or equal to 12”, 125 mils for jacket sizes larger than 12” to 24”, and 150 mils for jacket sizes greater than 24”. The inner surface of the HDPE jacket shall be oxidized by means of corona treatment, flame treatment (patent pending), or other approved methods. This will ensure a secure bond between the jacket and foam insulation preventing any ingression of water at the jacket/ foam interface.

2.4 Straight run joints are butt fusion welded and field insulated using urethane foam to the thickness specified and jacketed with heat shrink tape. Joints can be made beside the trench or inside the trench.

2.5 Carrier pipe fittings shall be butt fusion- welded to adjacent pipe sections. Fittings that are butt fusion welded in the field are not insulated. End seals at uninsulated fittings shall be field-applied mastic moisture barriers. If fittings are factory manufactured, fittings are pre-insulated using factory PE fitting covers welded to the jackets.

Part 3 - Execution

3.1 Field-engineered piping systems shall be fabricated from factory insulated sections of straight pipe and fittings. When practical, piping shall be provided in 40-foot double-random lengths. All HDPE piping shall have ends cut square in preparation for butt fusion welding.

3.2 Carrier pipe joining shall be accomplished using an authorized butt fusion welding machine preheated to the correct pipe temperature for fusion welding. All heating surfaces shall be clean and free of dirt and residue before applying to ends of pipe to be joined. After heating, the softened ends are pressed together by the machine and held until the joint has hardened. Improperly accomplished, uneven, or joints with questionable appearance shall be cut out and re-accomplished. Transitions to other piping materials shall be accomplished using suitable flanged or mechanical adapters.

3.3 Underground systems shall be buried in a trench of not less than two feet deeper than the top of the pipe and not less than eighteen inches wider than the combined O.D. of all piping systems. A minimum thickness of 24 inches of compacted backfill over the top of the pipe will meet H-20 highway loading.

(Continued)

3.4 Trench bottom shall have a minimum of 6” of sand, pea gravel, or specified backfill material as a cushion for the piping. All field cutting of the pipe shall be performed in accordance with the manufacturer’s installation instructions.

3.5 A hydrostatic pressure test shall be performed before insulating the field joints or burying the system, and shall be performed per the Engineer’s specifications. The factory recommended pressure test consists of an expansion phase and a test phase. Care shall be taken to insure all trapped air is removed from the system prior to the test. The expansion phase consists of an initial pressurization period of three hours at one and one-half times the normal system operating pressure. Make-up water shall be added to the system during this period to maintain the desired pressure. The test shall commence immediately after the expansion phase. The pressure shall be reduced by 10 psi and the test clock started. System pressure remaining within 5% of the target test pressure for one hour indicates no leakage has occurred. If the entire test procedure cannot be completed within eight hours of the initial pressurization, the system shall be depressurized and allowed to relax for a minimum of eight hours before another test is attempted. The piping system shall be restrained from uncontrolled movement in the event of a failure. *Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.*

3.6 Field service, if required by project specifications, will be provided by a certified manufacturer’s representative or company field service technician. The technician will be available at the job to check unloading, storing, and handling of pipe, joint installation, pressure testing, and backfilling techniques. This service will be added into the cost as part of the project technical services required by the pre-insulated pipe manufacturer.

POLYCOR HDPE
Specification Guide

POLYURETHANE FOAM IN HDPE JACKET

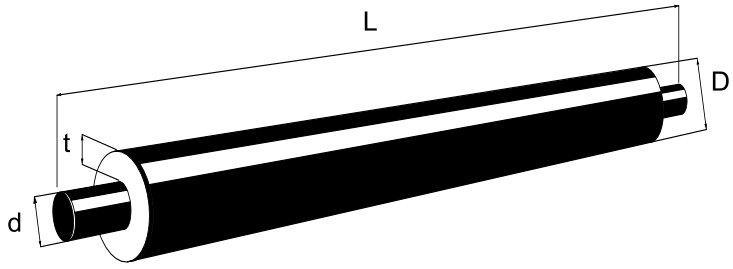
PCSG
10.103

11.19.16

Carrier Pipe:
- High Density Polyethylene (HDPE)
- SDR 32.5 - SDR 7.3

Jacketing Material:
High Density Polyethylene (HDPE)

Insulation:
Polyurethane Foam



Pipe Size	Jacket Size	Standard Length L	Insulation Thickness t	External Diameter D	Weight Per Foot (lbs.)
2”	5.40”	40’	1.41”	5.40”	1.87
3”	6.68”	40’	1.49”	6.68”	2.78
4”	8.68”	40’	1.99”	8.68”	4.20
6”	10.85”	40’	2.01”	10.85”	7.11
8”	12.85”	40’	1.99”	12.85”	9.97
10”	14.12”	40’	1.56”	14.12”	13.81
12”	16.14”	40’	1.57”	16.14”	18.61
16”	20.28”	40’	2.02”	20.28”	32.17
18”	22.25”	40’	2.00”	22.25”	35.24
20”	24.38”	40’	2.04”	24.38”	42.13
24”	28.25”	40’	1.98”	28.25”	58.08
28”	32.25”	40’	1.98”	32.25”	78.20
30”	36.60”	40’	3.15”	36.60”	90.84

* Other sizes are available
* Weights given with SDR 17 HDPE pipe

Appendix 3

Project Cost Estimates

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18
Subject: Water System Development Costs

	Well #4		Units =		20	
	Item	**Unit**	**Quantity**	**$/Unit**	**Cost**	**Comment**
	Trench and Backfill	LF	950	$ 5.00	$ 4,750	Excavation and Backfill
	Bedding Sand	CY	55	$ 48.00	$ 2,640	In place PolyCor pipe bedding
	Rock Excavation	LF	200	$ 30.00	$ 6,000	Rock excavation across ridge
	2" PolyCor Piping	LF	1150	$ 28.00	$ 32,200	Water Distribution Pipe
	3/4"Water Service	EA	20	$ 425.00	$ 8,500	Corpstop at each connect
	1" water service	EA	1	$ 475.00	$ 475	Corpstop at well for frost free hydrant
	Pressure Relief valve	EA	1	$ 525.00	$ 525	Installed
	Frost Free Hydrant	EA	1	$ 375.00	$ 375	Blow off
Pump, pump controls and Installation		EA	1	$ 11,303.00	$ 11,303	25 gpm pump installed at 200 ft. btc with controls, wiring and plumbing
	Pump House	EA	1	$ 4,700.00	$ 4,700	Exterior Pump House
	Well X-Troll 350 Tanks	EA	4	$ 950.00	$ 3,800	Pressure tanks installed
	Storage Tanks 4 (ea)	EA	4	$ 4,900.00	$ 19,600	Tanks, piping, controls, floats alarms, Excavation backfill and 2-pumps
8-inch well developed in bedrock to 400 ft, bgs		EA	1	$ 14,139.00	$ 14,139	8-inch casing with 6-inch PVC liner
				Subtotal	$ 109,007	
				10% Contingency	$ 10,901	
				Total Project Costs	$ 119,908	
				Cost Per User	$ 5,995	

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18

Well #5 **Units =** 6

Item	Unit	Quantity	$/Unit	Cost	Comment
Trench and Backfill	LF	410	$ 5.00	$ 2,050	Excavation and Backfill
Bedding Sand	CY	20	$ 48.00	$ 960	In place PolyCor pipe bedding
2" PolyCor Piping	LF	410	$ 28.00	$ 11,480	Water Distribution Pipe
3/4"Water Service	EA	6	$ 425.00	$ 2,550	Corpstop at each connect
1" water service	EA	1	$ 475.00	$ 475	Corpstop at well for frost free hydrant
Frost Free Hydrant	EA	1	$ 375.00	$ 375	Blow off
Pump, pump controls and Installation	EA	1	$ 11,428.00	$ 11,428	25 gpm pump installed at 200 ft. btc with controls, wiring and plumbing
Well X-Troll 350 tank installed	EA	2	$ 950.00	$ 1,900	Pressure tanks
Pump House	EA	1	$ 4,700.00	$ 4,700	Exterior Pump House
8-inch well developed in bedrock to 400 ft, bgs	EA	1	$ 14,139.00	$ 13,075	8-inch casing with 6-inch PVC liner
			Subtotal	$ 48,993	
			10% Contingency	$ 4,899	
			Total Project Costs	$ 53,892	
			Cost Per User	$ 8,982	

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18

Well #9 **Units =** 8

Item	Unit	Quantity	$/Unit	Cost	Comment
Trench and Backfill	LF	450	$ 5.00	$ 2,250	Excavation and Backfill
Bedding Sand	CY	22	$ 48.00	$ 1,056	In place PolyCor pipe bedding
Rock Excavation	LF	45	$ 30.00	$ 1,350	
2" PolyCor Piping	LF	450	$ 28.00	$ 12,600	Water Distribution Pipe
3/4"Water Service	EA	8	$ 425.00	$ 3,400	Corpstop at each connect
1" water service	EA	1	$ 475.00	$ 475	Corpstop at well for frost free hydrant
Frost Free Hydrant	EA	1	$ 375.00	$ 375	Blow off
Pump, pump controls and Installation	EA	1	$ 11,428.00	$ 11,428	25 gpm pump installed at 200 ft. btc with controls, wiring and plumbing
Well X-Troll 350 tank installed	EA	3	$ 950.00	$ 2,850	Pressure tanks
Pump House	EA	1	$ 4,700.00	$ 4,700	Exterior Pump House
8-inch well developed in bedrock to 400 ft, bgs	EA	1	$ 14,139.00	$ 13,075	8-inch casing with 6-inch PVC liner
			Subtotal	$ 53,559	
			10% Contingency	$ 5,356	
			Total Project Costs	$ 58,915	
			Cost Per User	$ 7,364	

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18

Well # 8 **Units =** 9

Item	Unit	Quantity	$/Unit	Cost	Comment
Trench and Backfill	LF	550	$ 5.00	$ 2,750	Excavation and Backfill
Bedding Sand	CY	20	$ 48.00	$ 960	In place PolyCor pipe bedding
Rock Excavation	LF	45	$ 30.00	$ 1,350	
2" PolyCor Piping	LF	340	$ 28.00	$ 9,520	Water Distribution Pipe
2" PolyCor (Well PH)	LF	255	$ 35.00	$ 8,925	Water distribution from Pump House to Loop
3/4"Water Service	EA	9	$ 425.00	$ 3,825	Corpstop at each connect
Pressure relief valve	EA	1	$ 525.00	$ 525	Corpstop at well for frost free hydrant
Frost Free Hydrant	EA	1	$ 375.00	$ 375	Blow off
Pump, pump controls and Installation	EA	1	$ 11,148.00	$ 11,148	25 gpm pump installed at 200 ft. btc with controls, wiring and plumbing
Well X-Troll 350 tank installed	EA	3	$ 950.00	$ 2,850	Pressure tanks
Pump House	EA	1	$ 4,700.00	$ 4,700	Exterior Pump House
8-inch well developed in bedrock to 400 ft, bgs	EA	1	$ 14,139.00	$ 13,047	8-inch casing with 6-inch PVC liner
			Subtotal	$ 59,975	
			10% Contingency	$ 5,998	
			Total Project Costs	$ 65,973	
			Cost Per Unit	$ 7,330	

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18

McCarthy well **Units =** **4**

Item	Unit	Quantity	$/Unit	Cost	Comment
Trench and Backfill	LF	225	$ 5.00	$ 1,125.00	Excavation and Backfill
Bedding Sand	CY	12	$ 48.00	$ 576.00	In place PolyCor pipe bedding
2" PolyCor Piping	LF	237	$ 28.00	$ 6,636.00	Water Distribution Pipe
3/4"Water Service	EA	3	$ 425.00	$ 1,275.00	Corpstop at each connect
Pressure relief valve	EA	1	$ 525.00	$ 525.00	Corpstop at well for frost free hydrant
Frost Free Hydrant	EA	1	$ 375.00	$ 375.00	Blow off
Existing Well Modifications	EA	1	$ 5,500.00	$ 5,500.00	Inspect pitless install superior bentonite seal
Pump, pump controls relocation	EA	1	$ 1,040.00	$ 1,040.00	25 gpm pump installed at 200 ft. btc with controls, wiring and plumbing
Well X-Troll 350 tank installed	EA	2	$ 950.00	$ 1,900.00	Pressure tanks
Pump House	EA	1	$ 4,200.00	$ 4,200.00	Exterior Pump House
				$ -	

Subtotal	$ 23,152.00
10% Contingency	$ 2,315.20
Total Project Costs	$ 25,467.20
Cost Per Unit	$ 6,366.80

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18

Total Project Costs Summary		Units Served	Cost Per Unit
Project Costs Well #4	$ 119,908	20	$ 5,995
Project Costs Well #5	$ 53,892	6	$ 8,982
Project Costs Well #9	$ 58,915	8	$ 7,364
Project Costs Well #8	$ 65,973	9	$ 7,330
Project Costs McCarty	$ 25,467	4	$ 6,367
	Total Project Costs	$ 324,155	
	Average Cost Per User	$ 6,897	

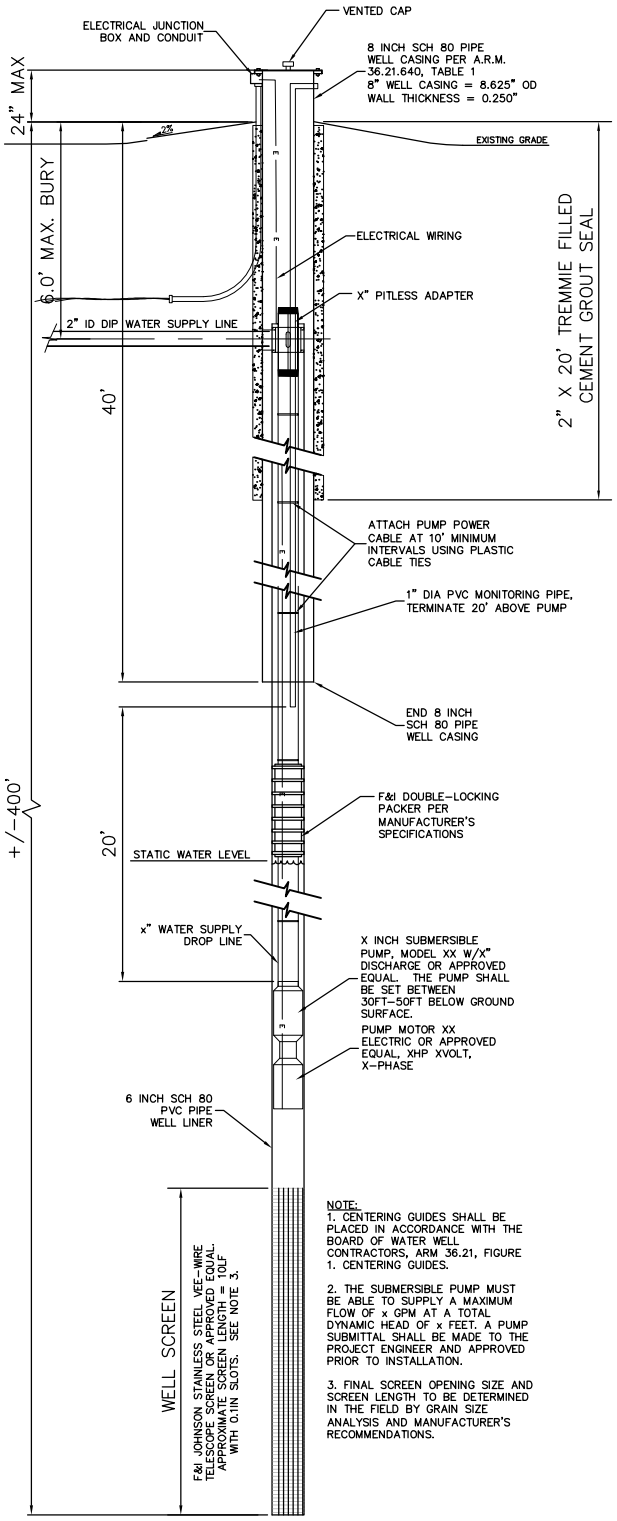
HAFFERMAN ENGINEERING, INC.

ient Name: Timbrshor HOA
ob File No.: T.58.2
oject Type: Water System Design
Date: 14-Dec-18
Subject: Water System Development Costs Incremental Development Well #4

Well #4 Phase I		Units = 10			418/419, 404/404, 406,408, 410,411,412, 416, 417 and 409
Item	Unit	Quantity	$/Unit	Cost	Comment
Trench and Backfill	LF	500	$ 5.00	$ 2,500	Excavation and Backfill
Bedding Sand	CY	35	$ 48.00	$ 1,680	In place PolyCor pipe bedding
2" PolyCor Piping	LF	863	$ 28.00	$ 24,150	Water Distribution Pipe
3/4"Water Service	EA	10	$ 425.00	$ 4,250	Corpstop at each connect
1" water service	EA	1	$ 475.00	$ 475	Corpstop at well for frost free hydrant
Frost Free Hydrant	EA	1	$ 375.00	$ 375	Blow off
Pump, pump controls and Installation	EA	1	$ 11,303.00	$ 11,303	25 gpm pump installed at 200 ft. btc with controls, wiring and plumbing
Pump House	EA	1	$ 4,700.00	$ 4,700	Exterior Pump House
Well X-Troll 350 Tanks	EA	2	$ 950.00	$ 1,900	Pressure tanks installed
Storage Tanks 4 total	EA	2	$ 4,900.00	$ 9,800	Tanks, piping, controls, floats alarms, Excavation backfill and 2-pumps
8-inch well developed in bedrock to 400 ft, bgs	EA	1	$ 14,139.00	$ 14,139	8-inch casing with 6-inch PVC liner
			Subtotal	$ 75,272	
			10% Contingency	$ 7,527	
			Total Well #4 Phase 1	$ 82,799	
			Cost Per User	$ 8,280	
Well #4 Phase 1 Repayment			Phase II Repayment	$ 10,905	
			Phase III Repayment	$ 10,905	
			Well #4 Phase I Cost after Repayment	$ 60,989	
			Cost Per Phase I User After Repayment	$ 6,099	

Well # 4 Phase II		Units = 5			425, 429, 427, 428, 430
Item	Unit	Quantity	$/Unit	Cost	Comment
Trench and Backfill	LF	225	$ 5.00	$ 1,125	Excavation and Backfill
Bedding Sand	CY	5	$ 48.00	$ 240	In place PolyCor pipe bedding
2" PolyCor Piping	LF	225	$ 28.00	$ 6,300	Water Distribution Pipe
3/4"Water Service	EA	5	$ 425.00	$ 2,125	Corpstop at each connect
Well X-Troll 350 Tanks	EA	1	$ 950.00	$ 950	Pressure tanks installed
Storage Tanks 4 (ea)	EA	1	$ 4,900.00	$ 4,900	Tanks, piping, controls, floats alarms, Excavation backfill and 2-pumps
Share to Phase 1 for 8-inch well developed in bedrock to 400 ft, bgs	EA	1	$ 6,360.00	$ 6,360	Well repayment
Pipeline repayment	EA	1	$ 4,545.00	$ 4,545	Pipeline Repayment
			Subtotal	$ 26,545	
			10% Contingency	$ 2,655	
			Total Project Costs	$ 29,200	
			Cost Per User	$ 5,840	

Well #4 Phase III		Units = 5			425, 429, 427, 428, 430
Item	Unit	Quantity	$/Unit	Cost	Comment
Trench and Backfill	LF	225	$ 5.00	$ 1,125	Excavation and Backfill
Bedding Sand	CY	5	$ 48.00	$ 240	In place PolyCor pipe bedding
2" PolyCor Piping	LF	225	$ 28.00	$ 6,300	Water Distribution Pipe
3/4"Water Service	EA	5	$ 425.00	$ 2,125	Corpstop at each connect
1" water service	EA	1	$ 475.00	$ 475	Corpstop at well for frost free hydrant
Well X-Troll 350 Tanks	EA	1	$ 950.00	$ 950	Pressure tanks installed
Storage Tanks 4 (ea)	EA	1	$ 4,900.00	$ 4,900	Tanks, piping, controls, floats alarms, Excavation backfill and 2-pumps
Share to Phase 1 for 8-inch well developed in bedrock to 400 ft, bgs	EA	1	$ 6,360.00	$ 6,360	Well repayment
Pipeline Repayment	EA	1	$ 4,545.00	$ 4,545	Pipeline repayment
			Subtotal	$ 27,020	
			10% Contingency	$ 2,702	
			Total Project Costs	$ 29,722	
			Cost Per User	$ 5,944	



PRODUCTION WELL DETAIL

SCALE : N.T.S.

HAFFERMAN ENGINEERING, INC.
P.O. BOX 1891
KALISPELL, MT 59901-1891
PHONE: 406-257-8708
FAX: 406-257-8710
EMAIL: info@billmayer.com
ONLINE: www.billmayer.com

DRAWING TITLE:

TYPICAL PRODUCTION WELL DETAIL

FOR

TIMBRSHOR HOA

SECTION 7
T23N, R 19W, PM, M., LAKE COUNTY, MONTANA

DATE:	PROJECT NUMBER:	SCALE:	SHEET:
DEC 19,2018	T.58.2	AS SHOWN	1 OF 1
FILE LOCATION: S:\LAND PRO...\T.58.2\DWG	DRAWN BY: NJF	APPROVED BY: KMH	

Appendix 4

Individual Unit Connection Costs

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18
Subject: Water System Development Individual Connection Costs

Item	Unit	Quantity	$/Unit	Cost	Comment
Polycor pipe from pipeline to unit with installation	ft	30	$ 28.00	$ 840.00	Shallow bury and insulated pipe, material and installation
Polycor connections at pipeline and at unit	LS	2	$ 125.00	$ 250.00	Special conenctions from Polycor to water line
			Subtotal	$ 1,090	
			20% contingency	$ 218	
			Total Estimated Cistern Costs	$ 1,308.00	

Appendix 5

MDEQ Circular 17, Cistern Examples and Cistern Costs

860 North Meridian B-21 | P.O. Box 1891 | Kalispell, Montana 59903 | Phone: 406-257-8708 | Fax: 406-257-8710

HAFFERMAN ENGINEERING, INC.

Client Name: Timbrshor HOA
HEI Job File No.: T.58.2
Project Type: Water System Design
Date: 14-Dec-18
Subject: Water System Development Costs Cistern Costs

Item	Unit	Quantity	$/Unit	Cost	Comment
1000 gallon concrete cistern	LS	1	$ 1,845.00	$ 1,120.00	Assume GPC 1000 gallon tank with traffic rated lid
Tank excavation and installation	HR	6	$ 125.00	$ 750.00	Assumes excavtor cost to complete installation in one day
Myers 10 gpm submersible pump	LS	1	$ 650.00	$ 650.00	
Submersible pump casing and installation	LS	1	$ 250.00	$ 250.00	Assume submerisble will be in a standing well casing
Cable and Conduit from unit to cistern pump	ft	35	$ 15.00	$ 525.00	May require electrical permit
Traffic rate access hatch with installation	LS	1	$ 125.00	$ 125.00	If placed in driveway or road
Polycor pipe from cistern to unit with installation	ft	30	$ 28.00	$ 840.00	Another shllow bury and insulated pipe could be chosen
Polycor connections at pump and at unit	LS	2	$ 125.00	$ 250.00	
			Subtotal	$ 4,510	
			10% contingency	$ 451	
			Total Estimated Cistern Costs	$ 4,961.00	

CIRCULAR DEQ 17

MONTANA STANDARDS FOR CISTERNS (WATER STORAGE TANKS) FOR INDIVIDUAL NON-PUBLIC SYSTEMS

2002 edition

This circular can be used for designing cisterns and storage tanks for individual systems. For multiple user or public systems, please refer to Circulars DEQ-1 and DEQ-3. Cisterns may be utilized only if a potable water source is available for hauling within a reasonable distance from the cistern or the water is supplied by an on-site well or other source approved by the department and the cistern meets department regulations. A licensed water hauler must supply the water or the water supply must be from a public water system. All water hauled must be disinfected in accordance with department regulations.

Historically, water to be used for drinking and various household and family purposes was often hauled water or rainwater collected and stored in an underground tank known as a cistern. This water was then filtered, treated and used for general household purposes such as drinking and washing. In some areas, rainwater is still collected, stored in cisterns, and used by some families. Today, however most stored water used for drinking and common household purposes is hauled from a potable water source. Cisterns are also used today as storage capacity for wells or springs of low quantity. Cisterns used to be primarily constructed out of brick, concrete, or steel. They are now primarily constructed out of reinforced concrete, fiberglass or polyethylene plastic. Some steel tanks still exist but they are not as common. The concrete tanks can be either precast (poured and cured at a concrete plant and hauled to the location) or they can be formed and poured in place. The larger sizes of cisterns tend to be poured-in-place concrete or fiberglass rather than precast, due to expense and hauling difficulties.

The purpose of this circular is to provide guidance to those individuals who have limited access to on-site water supplies such as springs and wells. Specifically, this circular is to be used to assist individuals in the placement, construction, operation, maintenance, cleaning, filling, and disinfection of cisterns on their property and by cistern manufacturers and contractors.

PLACEMENT

The cistern must be located 10 feet from any foundation and have positive drainage away from it so as to prevent any surface water from contaminating the interior of the cistern or its water supply. The cistern is required to be 50 feet from wastewater treatment drainfields and 25 feet from septic tanks.

Precautions must be taken to assure that water cisterns and their accessories will not freeze during winter months. The top of the cistern (excluding the access lid(s)) must be installed below the frostline. Generally speaking, in areas where snow will cover the ground during freezing weather, the top of the cistern must be installed a minimum of 2' deep. The snow cover must not be compacted by foot or vehicular traffic, as it will lose its insulating qualities.

In areas where no dependable snow cover is expected, the top of the cistern must be insulated with a high-density insulation board. One inch of high-density insulation board is approximately equal to one foot of earth in insulation value.

CONSTRUCTION

Material: Water cisterns may be constructed of precast concrete, cast-in-place concrete, polyethylene or fiberglass. Cistern capacity, site topography, and the availability of the different types of cisterns will help determine the most economical type of water cistern for each application.

Usually, a local precast concrete company will manufacture each precast cistern "to order", casting-in the appropriate size(s) of connection fittings, access(es), overflow(s) and vent(s). The cistern will then be shipped to and installed at its final location.

Cast-in-place concrete contractors will also build cisterns "to order"; however, the cistern will be built in-place. Generally, cast-in-place concrete cisterns are most cost effective in capacities greater than 5000 gallons.

Polyethylene water cisterns can be cost effective for small capacities (less than 1500 gallons) and for applications in remote areas. Polyethylene cisterns are usually purchased locally; however, they are not made "to order".

Fiberglass cisterns are cost effective for large capacities (2000 gallon to 30,000 gallon) and can be made "to order".

General Construction: Water cisterns must be watertight and must be made of materials suitable for potable water. A water tightness test must be performed on each water cistern before the cistern is put into service.

The access(es) to all cisterns must be a minimum of 24" diameter to permit an average-sized person to enter and exit, for cleaning and maintenance purposes. NO CISTERN SHOULD BE ENTERED UNTIL APPROPRIATE MEASURES HAVE BEEN TAKEN TO INSURE THE CISTERN'S AIR QUALITY IS SAFE AS DIRECTED BY OSHA CONFINED SPACE RULES, CODE OF FEDERAL REGULATIONS, TITLE 29-LABOR. NO CISTERN SHOULD BE ENTERED UNLESS THE PERSON ENTERING THE TANK HAS BEEN TRAINED IN CONFINED SPACE ENTRY AND FOLLOWS THE APPROPRIATE SAFETY PROCEDURES FOR ENTRY. The access lid must extended at least 6" above the ground surface or above the expected snow level to prevent surface water from entering the cistern. The access lid must be securely fastened to prohibit unauthorized entry and must be designed to prohibit surface water, precipitation and insects from entering the

cistern. (See Figure 1). The roof of concrete cisterns with earthen cover must be sloped to facilitate drainage.

All cisterns must be vented to allow the free flow of air into and out of the cistern as the water level inside the cistern changes. The vent must extend to the surface and above the expected snow level. The vent opening must be turned down and must be screened with 24-mesh screencloth to prevent the entry of insects, birds and other animals. (See Figure 1)

It is convenient to have a drainpipe and a "Direct-Bury" rated valve to empty the cistern, especially for cleaning. (See Figure 1) Such a drain can be installed if there is sufficient slope to the ground so the drainpipe daylights to the surface, as for instance on a hillside or bank of a nearby coulee or ravine. This pipe must slope slightly away from the cistern, and must be at least 2" in diameter. It must be set so the cistern will drain completely. The drain or overflow pipes should discharge over a drainage inlet or splash pad to prevent erosion and promote proper drainage away from the cistern. No drain or overflow may be connected directly to a sewer or a storm drain. All overflow pipes shall be located so that any discharge is visible. The overflow pipe shall open downward and be screened with 24-mesh noncorrodable screen to prevent entry by insects, birds, and other animals.

Precast concrete & cast-in-place concrete construction: All cisterns must be structurally sound and be capable of withstanding loads created by 6 feet of burial. Precast concrete cisterns must be installed in accordance with their manufacturer's recommendations. The walls and floor of precast concrete cisterns must be at least 3 inches thick if adequately reinforced with steel rebar and at least 6 inches thick if not reinforced with rebar. Cast-in-place cisterns must have a minimum wall thickness of at least 6" and must be reinforced with steel rebar. Concrete for cisterns must have a water/cement ratio less than 0.45, a 28-day compressive strength of at least 4,000 psi, and must be made with cement conforming to ASTM C-150, Types I, I-II, II, III, or V.

All concrete cisterns must be constructed from materials approved for potable water, including form oil, gaskets and joint sealant. Many commercially available form oils are not approved for nor intended for use on potable water systems. The cistern manufacturer must keep on file information showing these materials are approved by their manufacturers for potable water applications. The cistern manufacturer (or contractor for cast-in-place) must guard against the use or accidental exposure to any toxic materials or substances during all phases of manufacturing, curing, testing and delivery operations.

Polyethylene and fiberglass cisterns: All polyethylene and fiberglass tanks used for cisterns must be specifically manufactured for potable water in accordance with FDA food-grade specifications, NSF standards or other nationally recognized standards for potable water. Documentation from the manufacturer stating that the cisterns are approved for potable water must be available for inspection.

Polyethylene and fiberglass cistern must be installed according to their manufacturers specific instructions. Particular attention must be paid to bedding material, backfill material, testing and operation.

OPERATION and MAINTENANCE

The cistern must be inspected periodically to insure that the lids and access hatch are operating properly and that no deterioration has occurred to any part of the cistern. Pumps, wiring, floats, and piping must also be checked periodically for indications of failure or leaking.

CLEANING and DISINFECTION

After initial construction of the cistern (or placement if cistern is precast, polyethylene or fiberglass) or after any maintenance, the cistern must be flushed to remove any sediment and thoroughly disinfected. This includes pump or float replacement or any plumbing work that has occurred within the cistern.

Prior to filling and using a cistern, it must first be cleaned and disinfected. Cleaning, of all types of cisterns, requires sweeping and removing all debris, dirt and dust from the inside of the cistern. If this requires entering the cistern, every precaution must be taken to prevent suffocation and breathing toxic fumes. NO CISTERN SHOULD BE ENTERED UNTIL APPROPRIATE MEASURES HAVE BEEN TAKEN TO INSURE THE CISTERN'S AIR QUALITY IS SAFE AS DIRECTED BY OSHA CONFINED SPACE RULES, CODE OF FEDERAL REGULATIONS, TITLE 29-LABOR. NO CISTERN SHOULD BE ENTERED UNLESS THE PERSON ENTERING THE TANK HAS BEEN TRAINED IN CONFINED SPACE ENTRY AND FOLLOWS THE APPROPRIATE SAFETY PROCEDURES FOR ENTRY. It is also recommended that the interior be cleaned with a pressure cleaner.

Disinfection of a cistern can be accomplished by using a solution of household bleach at a concentration of between 100-200 ppm. Common household bleach containing approximately 5% chlorine by weight may be used. Approximately 4 oz. Chlorine per 5 gallons of water will provide the proper concentration. All inside surfaces must be brushed with this solution. Allow a contact time of 12 to 24 hours.

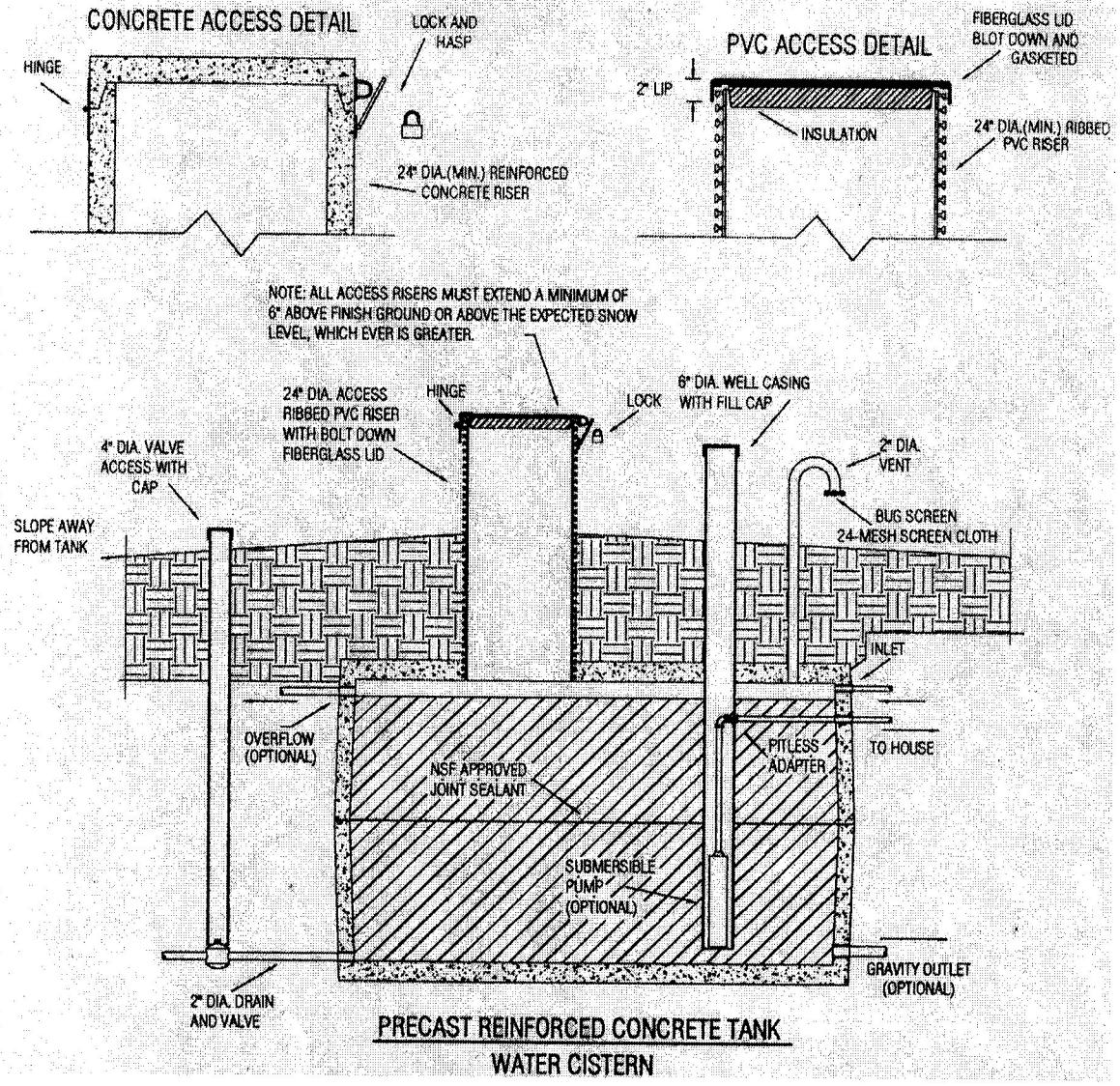
The cistern must now be filled with water from a potable water source. Faucets and water taps must be turned on in the dwelling. After the water has run for a few minutes, turn off all the faucets and taps and again let the water stand for 12 to 24 hours. This will disinfect all the water lines of the delivery system.

After the allotted time, the cistern must be emptied and the water lines drained. The chlorinated water used for disinfection must not be discharged to a stream, river or other waterway where damage to aquatic life may occur. The chlorinated water must not be drained to a sewer system. The cistern must now be filled a second time from a potable water source. This water should now be ready for use. If the cistern is constructed from concrete, it may be desirable to use at least 3 loads of water prior to drinking the water. The water may still have a "chalky" appearance and may also have a slight "cement taste".

It is highly recommended that cistern water be sampled annually for bacteriological contents. Other guidelines would be to drain, clean, and disinfect a cistern approximately every five years, especially if a water sample indicates contamination.

FILLING

The water supply used to fill the cistern must be a potable source that is hauled in a container that is properly constructed and has been cleaned and disinfected. The cistern must be filled from potable water sources provided by public water supplies and hauled by either a licensed water hauler or the owner in accordance with the water hauling regulations. Hoses as well as the water hauling tanks used for filling the cistern need to be cleaned and disinfected periodically to insure the water hauled remains potable. The disinfection guidelines outlined above describe the process to clean and disinfect hoses and hauling tanks. These hauling tanks must only be used for hauling potable water and must never be used for the hauling of any toxic chemicals or poisons. If the tanks are used regularly, only occasional disinfection is necessary. If the tanks are used periodically, then disinfection prior to each use must occur. The hose to fill the cistern must never be placed inside the cistern where the hose can be submerged in the water causing possible contamination.



PRECAST REINFORCED CONCRETE TANK

WATER CISTERN

INFILTRATOR® tanks

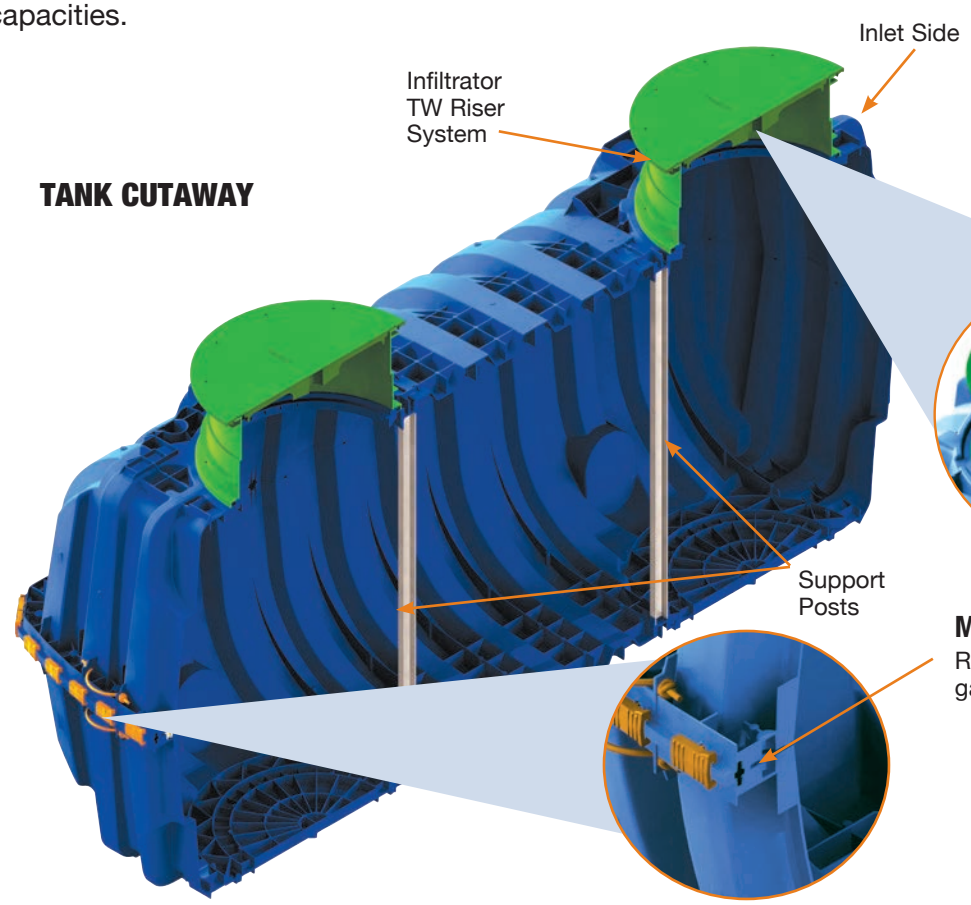
IM-SERIES POTABLE WATER TANKS

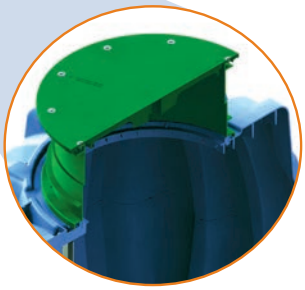
Features & Benefits

- Strong injection-molded polypropylene construction
- NSF/ANSI-61-certified for potable uses
- Lightweight plastic construction and inboard lifting lugs allow for easy delivery and handling
- Integral heavy-duty green lids that interconnect with TW™ risers and pipe riser solutions
- Structurally reinforced access ports eliminate distortion during installation and pump-outs
- Reinforced structural ribbing and fiberglass bulkheads offer additional strength
- Can be installed with 6” to 48” of cover
- Can be pumped dry
- Suitable for use as a potable pump tank, rainwater harvesting tank or water storage tank
- No special water filling requirements are necessary
- The tank may be backfilled with suitable native soil. See installation instructions for guidance.
- Available in 552-gallon, 1287-gallon and 1787-gallon capacities

The Infiltrator IM-Series Potable water tanks are lightweight, strong and durable. These potable, watertight tank designs are offered with Infiltrator’s potable heavy-duty lids. Infiltrator injection-molded tanks provide a revolutionary improvement in plastic tank design, offering long-term exceptional strength and watertightness. Infiltrator’s IM-Series Potable water tanks are available in 552-gallon, 1287-gallon and 1787-gallon capacities.

TANK CUTAWAY





HEAVY DUTY LID CUTAWAY
Reinforced 24” structural access port

MID-SEAM CUTAWAY
Reinforced water tight mid-seam gasketed connection

INFILTRATOR® systems inc.

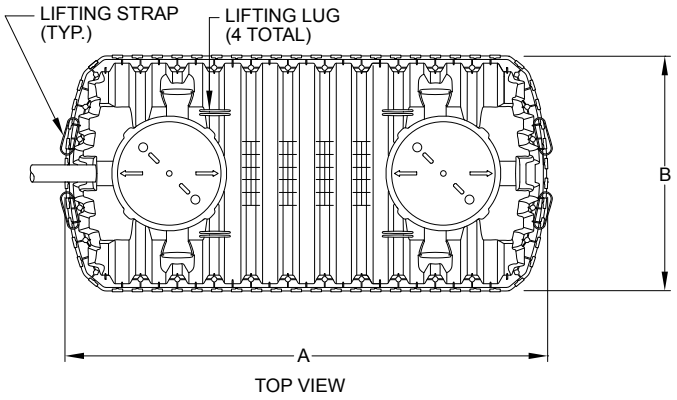
IM-Series Potable Water Tanks
General Specifications and Illustrations

The IM-Series Potable water tanks are injection-molded, two piece, mid-seam plastic tanks. The injection-molded plastic design allows for a mid-seam joint that has precise dimensions for accepting an engineered EPDM gasket. Infiltrator's gasket design utilizes technology from the water industry to deliver proven means of maintaining a watertight seal. The two-piece design is permanently fastened using a series of non-corrosive plastic alignment dowels and locking seam clips. The IM-Series Potable water tanks are assembled and sold through a network of certified Infiltrator distributors and are NSF/ASNI-61-certified for potable uses.

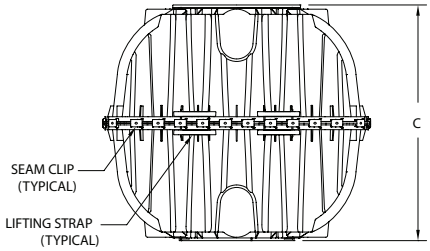
Must be backfilled and installed in accordance with Infiltrator Water Technologies, Infiltrator IM-Series Septic Tank General Installation Instructions and for shallow ground water conditions reference the Infiltrator IM-Series Tank Buoyancy Control Guidance.

Please visit www.infiltratorwater.com/images/pdf/ManualsGuides/TANK01.pdf for the latest information.

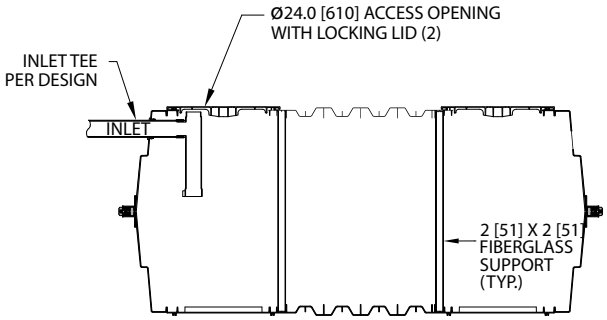
IM-Potable Water Tank Series			
Parameter	**IM-550C**	**IM-1280C**	**IM-1760C**
Total Capacity	552 gal (2089 L)	1287 gal (4872 L)	1787 gal (6765 L)
Length (A)	65 (1651 mm)	127" (3226 mm)	176" (4460 mm)
Width (B)	62 (1575 mm)	62 (1575 mm)	62 (1575 mm)
Height (C)	55 (1397 mm)	55 (1397 mm)	55 (1397 mm)
Fiberglass Supports	0	2	4
Maximum Burial Depth	48" (1219 mm)	48" (1219 mm)	48" (1219 mm)
Minimum Burial Depth	6" (152 mm)	6" (152 mm)	6" (152 mm)
Maximum Pipe Diameter	4" (100 mm)	6" (152 mm)	4" (100 mm)
Weight	191 (87 kg)	346 (157 kg)	501 (227 kg)



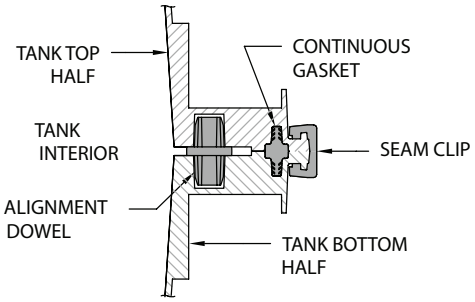
TOP VIEW



END VIEW



SIDE VIEW



MID-HEIGHT SEAM SECTION

INFILTRATOR® systems inc.

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Old Saybrook, CT 06475
860-577-7000 • Fax 860-577-7001
1-800-221-4436
www.infiltratorsystems.com

IM23 1116

NORWESCO (/)

Black or Dark Green Water Tanks

Our water tanks are manufactured using resins that meet FDA specifications to ensure safe storage of potable water. The black or dark green color limits light penetration which reduces the growth of water-borne algae. These tanks are rated at 9.2 pounds per gallon, which means that they are for WATER STORAGE ONLY! They should not be used for chemicals, fertilizers or any other product. Where applicable, the tanks will carry the NSF approval. Please contact your distributor for more specific information regarding NSF approval.

Black or Green Vertical Water Storage Tanks

Gallon Capacity	Diameter	Overall Height	Fill Opening	Bottom Fitting	Top Fitting	Color	Water Weight Part No.	Avail
120	38"	31"	5"- (63484)	2"- (63481)	1 1/2"- (63931)	Black CA Green Dark Green	43858 (/_site_components/uploads/pdfs/Vertical/120%20Gallon Vertical Tank.pdf) 43862 (/_site_components/uploads/pdfs/Vertical/120%20Gallon Vertical Tank.pdf) 43860 (/_site_components/uploads/pdfs/Vertical/120%20Gallon Vertical Tank.pdf)	D,E,G,L,T L D,E,G,T
165*	31"	56"	16"- (63485)	2"- (63481)	-	Black CA Green Dark Green	43864 (/_site_components/uploads/pdfs/Vertical/165%20Gallon Vertical Tank.pdf) 43868 (/_site_components/uploads/pdfs/Vertical/165%20Gallon Vertical Tank.pdf) 43866 (/_site_components/uploads/pdfs/Vertical/165%20Gallon Vertical Tank.pdf)	D,E,F,G,H,L,T L D,E,F,G,H,T
200*	30"	72"	8"- (63480)	2"- (63481)	-	Black CA Green	44107 (/_site_components/uploads/pdfs/Vertical/200%20Gallon Vertical Tank.pdf) 44109 (/_site_components/uploads/pdfs/Vertical/200%20Gallon Vertical Tank.pdf)	L L

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220	42"	44"	5"-(63484)	2"-(63481)	1 1/2"-(63931)	Black CA Green Dark Green	43870 (/_site_components/uploads/pdfs/Vertical/220%20Gallon Vertical Tank.pdf) 43874 (/_site_components/uploads/pdfs/Vertical/220%20Gallon Vertical Tank.pdf) 43872 (/_site_components/uploads/pdfs/Vertical/220%20Gallon Vertical Tank.pdf)	D,E,G,L,T L D,E,G,T
305	46"	50"	16"-(63485)	2"-(63481)	1 1/2"-(63931)	Black CA Green Dark Green	40702 (/_site_components/uploads/pdfs/Vertical/305%20Gallon Vertical Tank.pdf) 41362 (/_site_components/uploads/pdfs/Vertical/305%20Gallon Vertical Tank.pdf) 40863 (/_site_components/uploads/pdfs/Vertical/305%20Gallon Vertical Tank.pdf)	D,E,F,G,H,L,T L D,E,F,G,H,T
500	48"	73"	16"-(63485)	2"-(63481)	1 1/2"-(63931)	Black CA Green Dark Green	43101 (/_site_components/uploads/pdfs/Vertical/500%20Gallon Vertical Tank.pdf) 43103 (/_site_components/uploads/pdfs/Vertical/500%20Gallon Vertical Tank.pdf) 43105 (/_site_components/uploads/pdfs/Vertical/500%20Gallon Vertical Tank.pdf)	D,E,F,G,H,L,T L D,E,F,G,H,T
550	67"	44"	16"-(63485)	2"-(63481)	1 1/2"-(63931)	Black CA Green Dark Green	40703 (/_site_components/uploads/pdfs/Vertical/550%20Gallon Vertical Tank.pdf) 41364 (/_site_components/uploads/pdfs/Vertical/550%20Gallon Vertical Tank.pdf) 40864 (/_site_components/uploads/pdfs/Vertical/550%20Gallon Vertical Tank.pdf)	D,E,F,G,H,L,T L D,E,F,G,H,T
600	64"	50"	8"-(63480)	2"-(63481)	1 1/2"-(63931)	Black Dark Green	43800 (/_site_components/uploads/pdfs/Vertical/600%20Gallon Vertical Tank.pdf) 43802 (/_site_components/uploads/pdfs/Vertical/600%20Gallon Vertical Tank.pdf)	T T
1000	64"	80"	16"-(63485)	2"-(60405)	1 1/2"-(63931)	Black CA Green Dark Green	40892 (/_site_components/uploads/pdfs/Vertical/1000%20Gallon X 64 Vertical Tank.pdf) 43878 (/_site_components/uploads/pdfs/Vertical/1000%20Gallon X 64 Vertical Tank.pdf) 41686 (/_site_components/uploads/pdfs/Vertical/1000%20Gallon X 64 Vertical Tank.pdf)	E,H,L,T L E,H,T
1000	72"	66"	16"-(63485)	2"-(63481)	1 1/2"-(63931)	Black CA Green	44113 (/_site_components/uploads/pdfs/Vertical/1000%20Gallon X 72 Vertical Tank.pdf) 44115 (/_site_components/uploads/pdfs/Vertical/1000%20Gallon X 72 Vertical Tank.pdf)	L L

1075	87"	51"	16"-(63485)	2"-(60405)	1 1/2"-(63931)	Black Dark Green	43804 (/_site_components/uploads/pdfs/Vertical/1075%20Gallon Vertical Tank.pdf) 43806 (/_site_components/uploads/pdfs/Vertical/1075%20Gallon Vertical Tank.pdf)	T T
1100	87"	53"	16"-(63485)	2"-(60405)	1 1/2"-(63931)	Black CA Green Dark Green	40704 (/_site_components/uploads/pdfs/Vertical/1100%20Gallon Vertical Tank.pdf) 41365 (/_site_components/uploads/pdfs/Vertical/1100%20Gallon Vertical Tank.pdf) 40865 (/_site_components/uploads/pdfs/Vertical/1100%20Gallon Vertical Tank.pdf)	D,E,F,G,H,L,T L D,E,F,G,H,T
1350	71"	88"	16"-(63485)	2"-(60405)	1 1/2"-(63931)	Black Dark Green	40860 (/_site_components/uploads/pdfs/Vertical/1350%20Gallon Vertical Tank.pdf) 40858 (/_site_components/uploads/pdfs/Vertical/1350%20Gallon Vertical Tank.pdf)	H H
1525	93"	62"	16"-(63485)	2"-(60405)	1 1/2"-(63931)	Black Dark Green	43808 (/_site_components/uploads/pdfs/Vertical/1525%20Gallon Vertical Tank.pdf) 43810 (/_site_components/uploads/pdfs/Vertical/1525%20Gallon Vertical Tank.pdf)	T T
1550	87"	67"	16"-(63485)	2"-(60405)	1 1/2"-(63931)	Black CA Green Dark Green	40627 (/_site_components/uploads/pdfs/Vertical/1550%20Gallon Vertical Tank.pdf) 41368 (/_site_components/uploads/pdfs/Vertical/1550%20Gallon Vertical Tank.pdf) 40866 (/_site_components/uploads/pdfs/Vertical/1550%20Gallon Vertical Tank.pdf)	D,E,F,G,H,L,P,T L D,E,F,G,H,P,T

Black or Green Vertical Water Storage Tanks

Gallon Capacity	Diameter	Overall Height	Fill Opening	Bottom Fitting	Top Fitting	Color	Water Weight Part No.	Avail
2000	90"	84"	16"-(63485)	2"-(63683)	1 1/2"-(63931)	Black Dark Green	44129 (/_site_components/uploads/pdfs/Vertical/2000%20Gallon X 90 Vertical Tank.pdf) 44131 (/_site_components/uploads/pdfs/Vertical/2000%20Gallon X 90 Vertical Tank.pdf)	H H
2100	87"	89"	16"-(63485)	2"-(63683)	1 1/2"-(63931)	Black CA Green Dark Green	44411 (/_site_components/uploads/pdfs/Vertical/2100%20Gallon X 87 Vertical Tank.pdf) 44415 (/_site_components/uploads/pdfs/Vertical/2100%20Gallon X 87 Vertical Tank.pdf) 44413 (/_site_components/uploads/pdfs/Vertical/2100%20Gallon X 87 Vertical Tank.pdf)	D,E,F,G,L,T L D,E,F,G,T

NORWESCO (/)

Specialty Water Tanks

Horizontal Box Water Tank

The low profile design of this tank makes it ideal for use on trailers or in the back of a truck. The slosh reduction ribs provide excellent structural support. It can also be used as a stationary water storage tank.

Horizontal Box Water Tank							
Gallon Capacity	**Width**	**Overall Height**	**Length**	**Fill Opening**	**Outlet/Drain Specification**	**Water Only Weight Part No. White**	**Avail**
2400	90"	53"	150"	16"-(63485)	2"-(63683)	40912 (/_site_components/uploads/pdfs/Specialty%20Water/2400 Gallon Horizontal Bpx Tank.pdf)	B,C,T

Low Profile Water Tanks

The low profile tanks may be used for storage or transport. They are an excellent choice when height limitations are a factor and are the perfect height for putting under your cottage or cabin.

Low Profile Water Tanks							
Gallon Capacity	**Width**	**Overall Height**	**Length**	**Fill Opening**	**Outlet/Drain Specification**	**Water Only Weight Part No. White**	**Avai**
1250	81"	38"	130"	16"-(63485)	2"-(63683)	40756 (/_site_components/uploads/pdfs/Specialty%20Water/1250 Gallon Low Profile Water Tank.pdf)	E
1275	84"	36"	126"	16"-(63485)	2"-(63683)	43011 (/_site_components/uploads/pdfs/Specialty%20Water/1275 Gallon Low Profile Water Tank.pdf)	B,C
1500	81"	44"	130"	16"-(63485)	2"-(63683)	41392 (/_site_components/uploads/pdfs/Specialty%20Water/1500 Gallon Low Profile Water Tank.pdf)	E
1600	84"	42"	126"	16"-(63485)	2"-(63683)	43013 (/_site_components/uploads/pdfs/Specialty%20Water/1600 Gallon Low Profile Water Tank.pdf)	B,C

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Freestanding Tank

These tanks have been designed with residential and commercial applications in mind. The dimensions of the tanks allow them to fit through a conventional doorway. The design of the freestanding/self-supporting tanks eliminate the need for a steel support frame.

Freestanding Tanks									
Gallon Capacity	**Width**	**Overall Height**	**Length**	**Fill Opening**	**Outlet/Drain Specification**	**Premium Weight Part No. White**	**Avail**	**Water Only Weight Part No. White**	**Avail**
100	22"	45"	38"	8"-(63480)	1-1/4"-(60403)	44800	B,E,I		