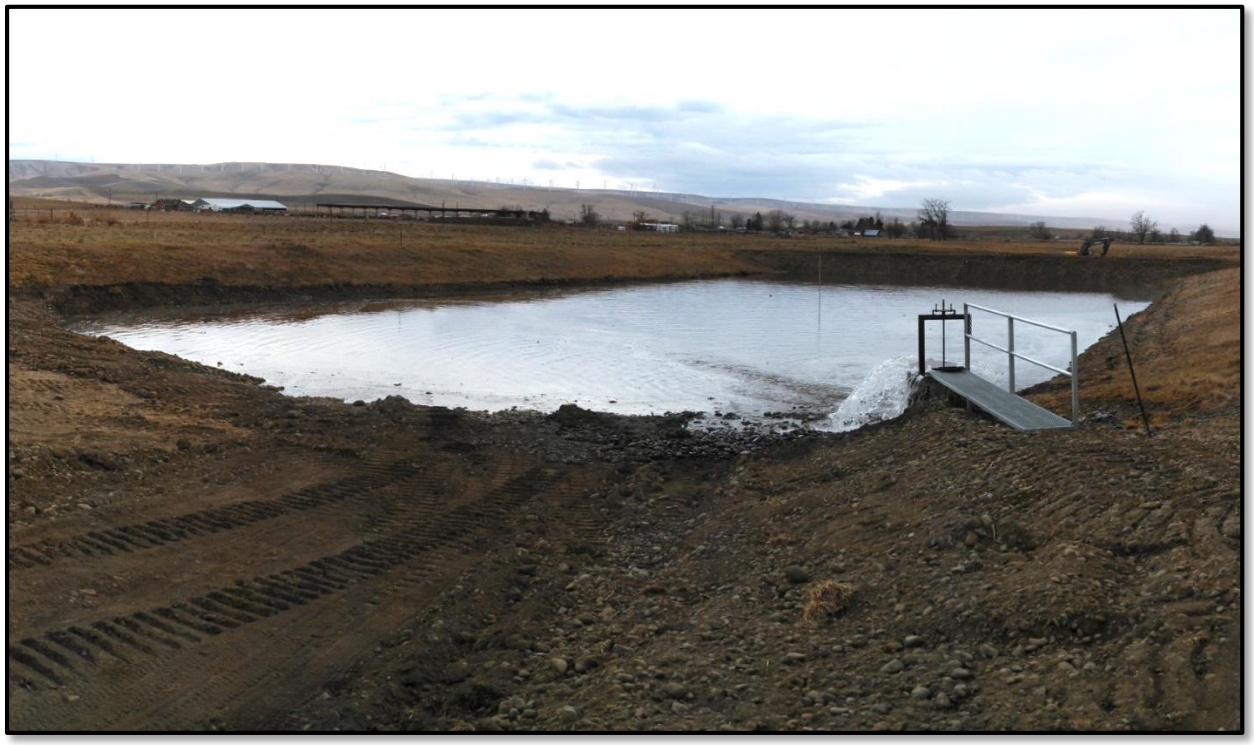
Surface water and Groundwater Monitoring and Reporting Plan

For Limited License Application LL1621



MAY 2016

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INTRODUCTION

This document was prepared to fulfill certain requirements in Oregon Administrative Rules (OAR) 690-350-0110 through 0130 in support of the application for artificial recharge (AR) Limited License LL1621. The aquifer recharge projects included in this plan will be managed by the Walla Walla Basin Watershed Council (WWBWC) and Hudson Bay District Improvement Company (HBDIC). The application for Limited License LL1621 was submitted to the Oregon Water Resources Department (OWRD) in December 2015. The program includes seventeen aquifer recharge projects located at different sites. Because of the unique nature of this program with distributed recharge sites, as well as the availability of a body of information from other related or nearby recharge projects, OWRD staff requested that the applicant provide a summary compilation of the hydrogeologic information relevant to the overall program area and specific recharge sites (See Appendix C), as well as a monitoring plan for the AR project.

The objectives of the document are three-fold: (1) present a proposed source water and groundwater monitoring plan, (2) present a proposed water level monitoring plan (groundwater and surface water) and (3) present a proposed reporting regime for the program. All of these document elements were prepared in support of the Limited License application.

The recharge sites included in this project are referred to as Anspach, Barrett, Chuckhole, County Road, East Trolley Lane, Fruitvale, Gallagher, Johnson, LeFore Road, Locust Road, Mud Creek, NW Umapine, Sunquist, Triangle Road, Triangle Station, Trumbull and West Ringer Road (Figure 1). At this time five of these sites (Johnson, Anspach, Trumbull, NW Umapine and Barrett) are active under Limited License LL1433, which will be superseded by Limited License LL1621. Upon receipt of Limited License LL1621 operations at the other sites will be initiated as the WWBWC is able to complete infrastructure improvements necessary to operate the sites. Current information regarding each of the seventeen sites, including recharge sites and proposed monitoring, are summarized in this document (hydrogeology information is included in Appendix C).

Water quality data collected at seven active sites (Johnson, Anspach, Trumbull, Barrett, NW Umapine, Stiller Pond and Locher Road) and one inactive site (Hall-Wentland) in the greater Walla Walla Basin have shown that AR activities conducted in the Walla Walla Basin have not lead to degradation of the alluvial groundwater system (GSI, 2009a, 2009b, WWBWC 2010). Moreover, water quality monitoring in support of Limited License LL1433 indicates groundwater quality improvements in response to AR activities (WWBWC, 2014a). Given these observations, the dispersed nature of the individual AR sites, and the common source water for the proposed AR program, the monitoring approach described herein focuses on evaluating the effects of each recharge season on water quality using a dispersed, but integrated, monitoring network.

The balance of this document includes the following:

1. Program goals and a summary of AR sites to be covered under LL1621.
2. The scope of the proposed monitoring effort, including:
    a. Proposed number, locations, and physical characteristics of monitoring points.
    b. Constituents to be monitored for.
    c. Sample collection frequency.
    d. Quality assurance and quality control (QA/QC) elements.
3. Reporting methods.

PROGRAM GOALS

The overarching goal of the proposed aquifer recharge program is to restore and maintain the shallow alluvial aquifer for the benefit of people, the environment and wildlife. Specific goals of the projects include: (1) stopping and reversing the water level declines observed in the shallow alluvial aquifer system throughout the Walla Walla Valley, (2) reducing the hydraulic gradient away from streams and creeks in the valley to reduce surface water seepage, especially during dry summer months, and (3) restoring flows to spring creeks.

AQUIFER RECHARGE SITES

Recharge to be conducted under Limited License LL1621 will occur at the seventeen sites shown in Table 1 and Figure 1. The Anspach, Barrett, Johnson, NW Umapine and Trumbull sites are currently operated and monitored under Limited License LL1433. Recharge volumes estimates and estimated conveyance losses between the point of diversion and the recharge site are provided in Table 2. This section summarizes the basic physical layout and operation of each of the seventeen sites (Figure 1).

Table 1. Aquifer recharge sites included in Limited License LL1621.

Site Name	GPS Coordinates	Section, Township & Range	Site Type
Anspach	45.945540, -118.411043	NW ¼, NW ¼, Sec. 30, T6N, R35E	Gallery
Barrett	45.948009, -118.421811	SW ¼, SE ¼, Sec. 34, T6N, R35E	Gallery
Chuckhole	45.941074, -118.419149	SW ¼, NE ¼, Sec. 3, T5N, R35E	Basin
County Road	45.951563, -118.428188	NE ¼, SW ¼, Sec. 34, T6N, R35E	*Gallery*
East Trolley Lane	45.993006, -118.423812	SW ¼, SE ¼, Sec. 15, T6N, R35E	Gallery
Fruitvale	45.987780, -118.444852	NE ¼, NW ¼, Sec. 21, T6N, R35E	Gallery
Gallagher	45.967480, -118.485502	SE ¼ & SW ¼ of Sec. 30, T6N, R35E	*Gallery & Basin*
Johnson	45.956690, -118.439271	SE ¼, SW ¼, Sec. 33, T6N, R35E	Gallery & Basin
LeFore Road	45.951187, -118.377397	NE ¼, SW ¼, Sec. 36, T6N, R35E	Gallery
Locust Road	45.957360, -118.392845	SE ¼, NE ¼, Sec. 35, T6N, R35E	*Gallery*
Mud Creek	45.973630, -118.430493	NW ¼, NW ¼, Sec. 27, T6N, R35E	Basin
NW Umapine	45.979884, -118.503350	SW ¼, SE ¼, Sec. 24, T6N, R34E	Basin
Sunquist	45.982522, -118.445141	NE ¼, SW ¼, Sec. 21, T6N, R35E	*Gallery*
Triangle Road	45.973104, -118.425618	NE ¼, NW ¼, Sec. 27 T6N, R35E	*Gallery*
Triangle Station	45.975587, -118.436832	NE ¼, NE ¼, Sec. 28, T6N, R35E	*Basin*
Trumbull	45.962171, -118.428849	NW ¼, SW ¼, Sec. 27, T6N, R34E	Gallery
West Ringer Road	45.971661, -118.499919	SW ¼, NE ¼, Sec. 25, T6N, R34E	Gallery

Table 2. Aquifer Recharge sites with recharge rates, recharge volumes (low/high) and conveyance loss estimates (low/high) for LL1621

Site Name	Recharge Rate	Recharge Volume (Low/High)	Conveyance Loss (Low/High)
Anspach	3-5 cfs	445/1130 AF/year	145/295 AF/year
Barrett	4 cfs	555/1130 AF/year	145/295 AF/year
Chuckhole	*1-3 cfs*	*90/530 AF/year*	*90/180 AF/year*
County Road	*2-4 cfs*	*310/1260 AF/year*	*145/295 AF/year*
East Trolley Lane	*1-2 cfs*	*100/375 AF/year*	*100/375 AF/year*
Fruitvale	*2-4 cfs*	*200/750 AF/year*	*145/185 AF/year*
Gallagher	*2-6 cfs*	*315/1,900 AF/year*	*220/600 AF/year*
Johnson	18 cfs	1,350/4,650 AF/year	700/1425 AF/year
LeFore Road	*1 cfs*	*60/190 AF/year*	*0/0 AF/year*
Locust Road	*1.5 cfs*	*140/300 AF/year*	*90/185 AF/year*
Mud Creek	*1-2 cfs*	*100/375 AF/year*	*75/200 AF/year*
NW Umapine	3 cfs	450/950 AF/year	150/375 AF/year
Sunquist	*1-3 cfs*	*95/565 AF/year*	*100/185 AF/year*
Triangle Road	*1-2 cfs*	*100/375 AF/year*	*70/140 AF/year*
Triangle Station	*1 cfs*	*100/190 AF/year*	*70/140 AF/year*
Trumbull	2 cfs	300/630 AF/year	100/225 AF/year
West Ringer Road	*1-2 cfs*	*100/630 AF/year*	*150/450 AF/year*
Estimated Totals (Low/High)		**4,720/15,930 AF/year**	**2,495/5,550 AF/year**

NOTE: Italicized recharge rates are estimates because the site has not operated yet.

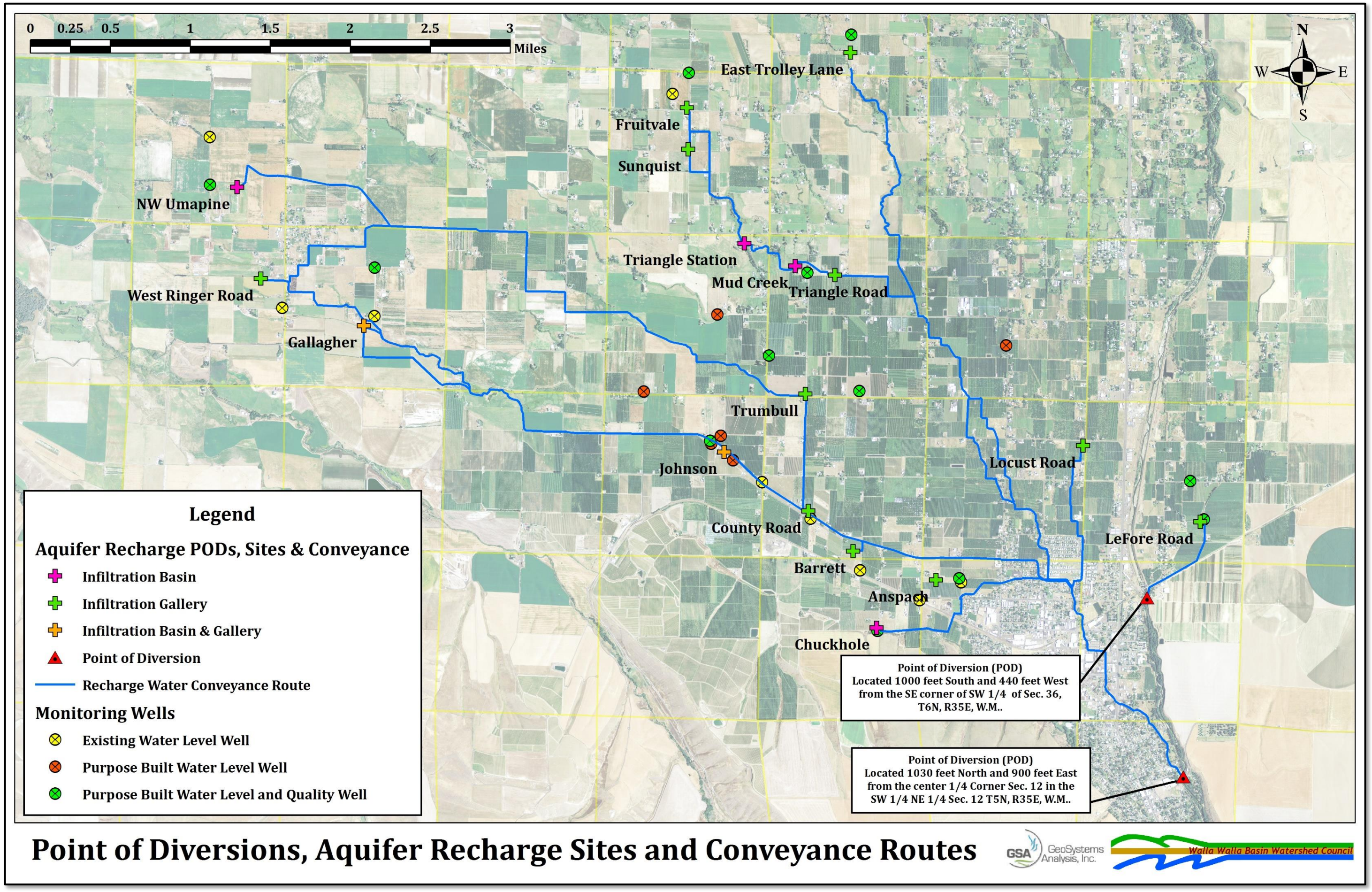

Figure 1 - Points of diversion (PODs), aquifer recharge sites and conveyance systems for limited license LL1621.

ANSPACH

The Anspach site is an operational infiltration gallery constructed in 2012 and expanded in 2015. The infiltration gallery is located immediately northwest of Milton-Freewater, OR and east of Winsap Road in NW ¼, NW ¼, Sec. 30, T6N, R35E (Figures 1, 2, and 3). Recharge capacity at the Anspach site has ranged from 0.5 to 1 cubic feet per second (cfs). After the expansion, the site is expected to increase to approximately 4 cfs. This site was built in a field that has been fallow for at least 14 years. Prior to this, the land was utilized as an apple orchard.

There are two onsite wells (GW135 and GW141). GW135 is an abandoned irrigation well located at the up-gradient, southeastern corner of the site and GW141 is a purpose built monitoring well at the up-gradient, northeastern corner of the site. Another well (GW23) is located generally down gradient of, and west southwest of, the site. GW135 and GW23 are water wells that have been adapted for use in the WWBWC water level monitoring network.

Recharge source water is diverted from the Hudson Bay District Improvement Company (HBDIC) White Ditch canal west of its intersection with the Old Milton Highway/Lamb Street. At a weir structure, water is diverted south through a pipeline to the project. HBDIC and the WWBWC manage the diversion of recharge water from the canal to the recharge site. The Anspach site will continue to be operated under the existing Limited License LL1433 until issuance of Limited License LL1621.

Figure 2 - Photograph of the Anspach aquifer recharge site during construction. Photo is looking west from the up-gradient end of the project.

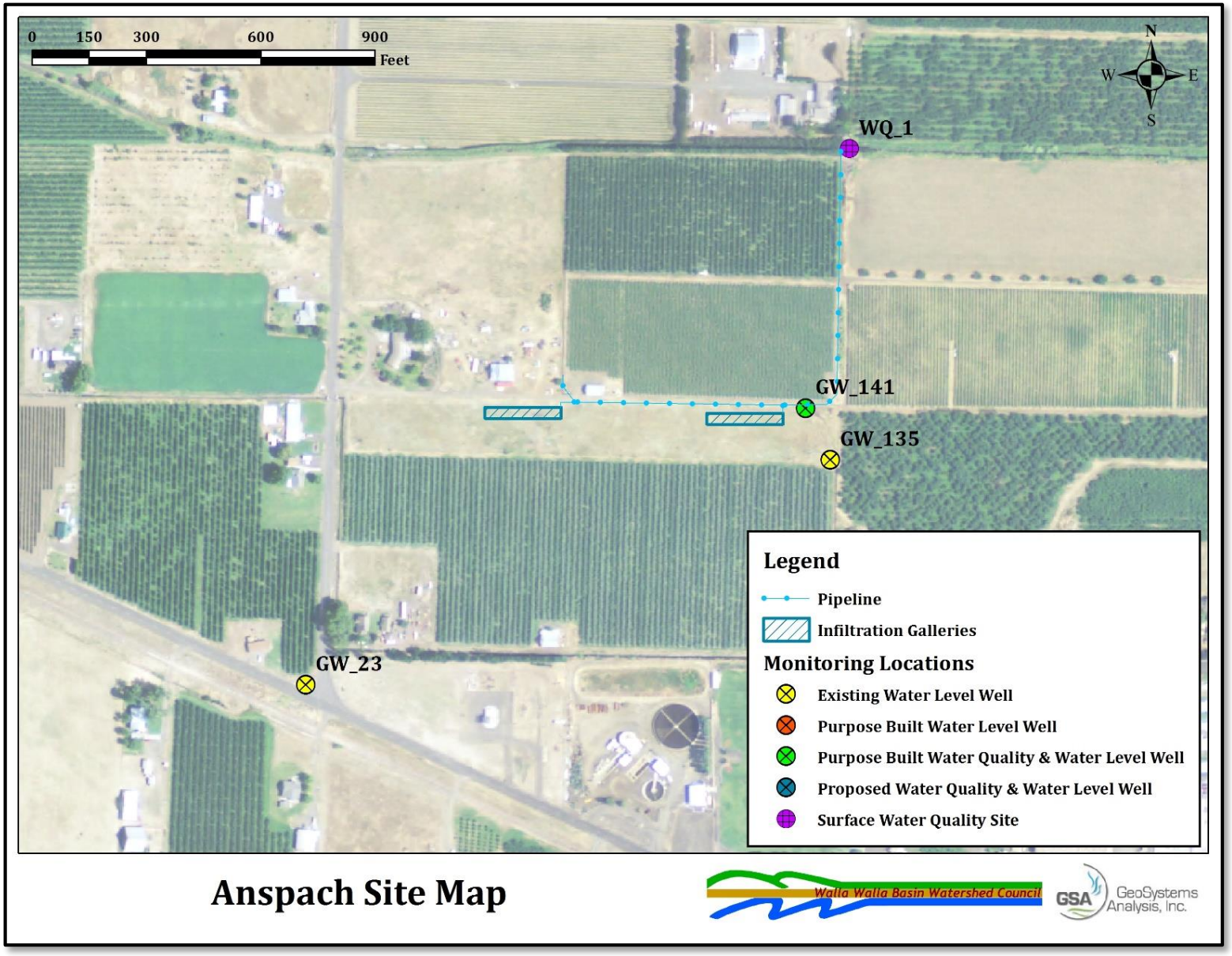

Figure 3 - Anspach aquifer recharge site and monitoring map.

BARRETT

The Barrett site is an operational infiltration gallery constructed in January 2014. The site is located approximately 1.5 miles northwest of Milton-Freewater, OR between County Road and Chuckhole Lane in SW ¼, SE ¼, Sec. 34, T6N, R35E (Figures 1, 4, and 5). Recharge capacity at the Barrett site is 3-4 cfs. This site was built in a field that has been fallow since the early 1990s.

One well is in the immediate vicinity of this site, well GW_62, which is located up gradient of the facility. Another existing well, GW_150, is located down-gradient of the site. These wells are water wells adapted for use in the WWBWC water level monitoring network.

Recharge source water is delivered from the Barrett pipeline to the infiltration gallery. HBDIC manages the diversion of water to the site.

The Barrett site will continue to be operated under the existing Limited License LL1433 until issuance of Limited License LL11621.

Figure 4 - Photograph of the Barrett aquifer recharge site during construction. Photo is taken near the middle of the site looking east.

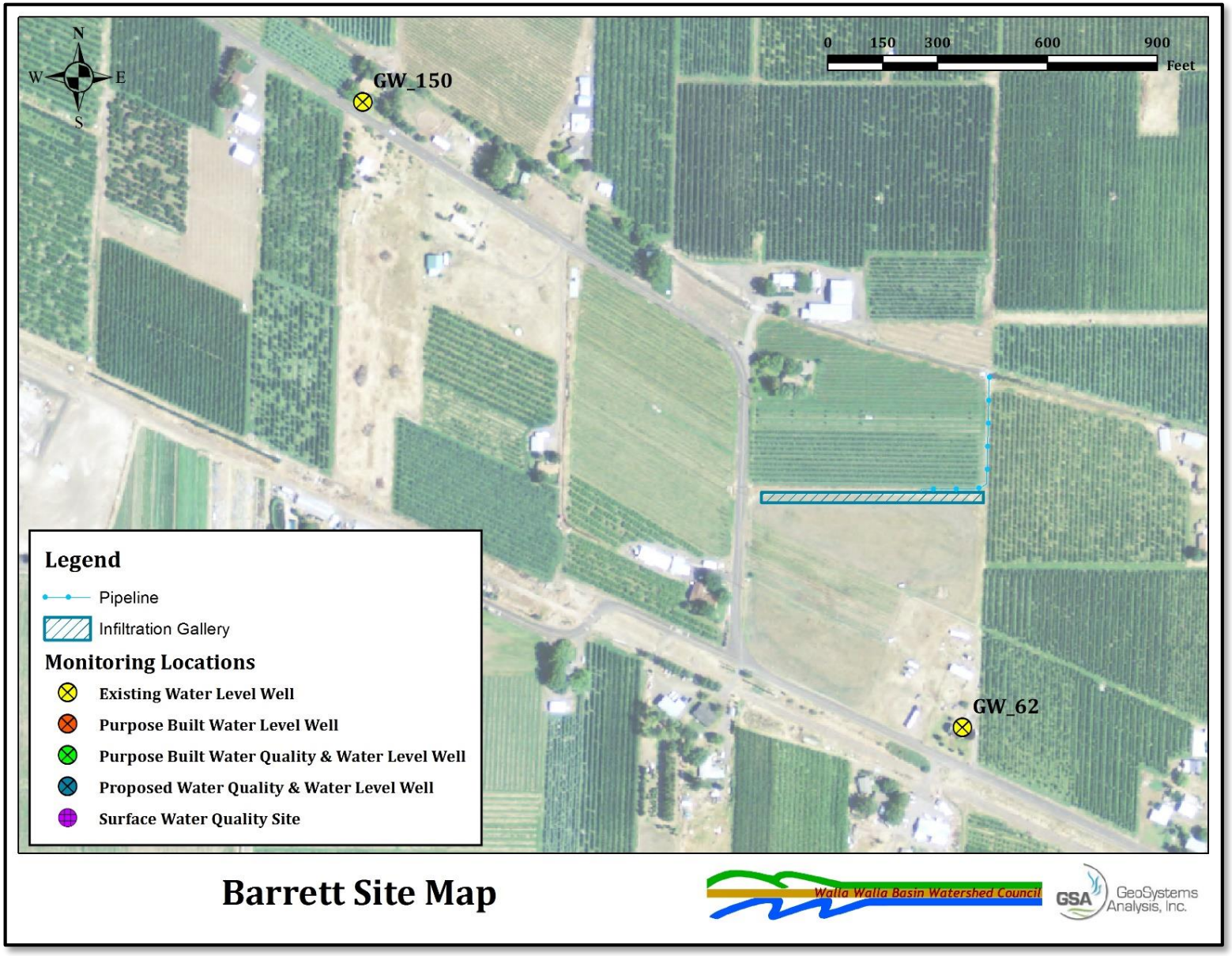

Figure 5 - Barrett aquifer recharge site and monitoring map.

CHUCKHOLE

The Chuckhole site is located approximately one mile northwest of Milton-Freewater, OR near the south end of Chuckhole Lane in SW ¼, NE ¼, Sec. 3, T5N, R35E (Figures 1, 6 and 7). The site consists of two basins: a sediment trap basin and an infiltration basin. The site is expected to have a total recharge capacity of 1 to 3 cfs. The Chuckhole site was constructed in the fall of 2015 and will be brought into use pending issuance of a new limited license. This site was constructed in a vacant corner of a vineyard. The land has not been utilized for at least 20 years. The adjacent field has been cultivated as a vineyard for approximately 10 years and before that it was apple orchard (at least to the early 1990s).

Existing wells in the area include GW_23 and GW_62. A planned well, GW_169, will be a purpose built monitoring well to be installed up-gradient of the site.

Recharge source water will be delivered from the Milton Pipeline into the project. WWBWC will be responsible for operating the diversion into the site.

Figure 6 - Photograph of the Chuckhole aquifer recharge site during construction. Photo is taken at the north end of the project looking south.

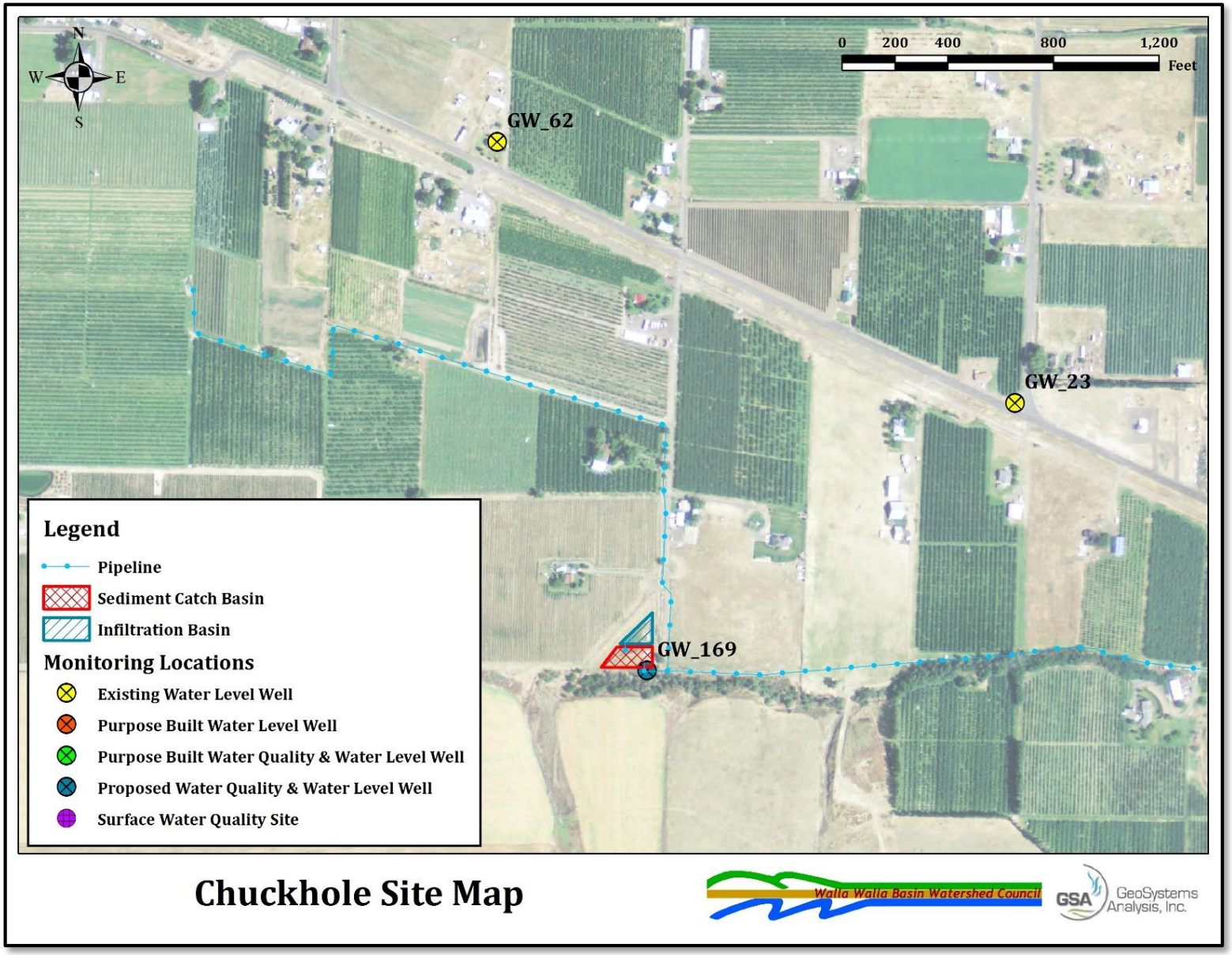

Figure 7 – Chuckhole aquifer recharge site and monitoring map.

COUNTY ROAD

The County Road site is proposed to be located approximately 2.25 miles northwest of Milton-Freewater, OR, just north of County Road and east of Prunedale Road in NE ¼, SW ¼, Sec. 34, T6N, R35E (Figures 1 and 8). The site is planned to be an infiltration gallery with a recharge capacity of 2-4 cfs. The County Road project is scheduled to be constructed in 2016 or 2017. The site will be built on land that has been used as an apple orchard since the mid-1990s.

There is a single existing well in the immediate area, GW_150. This well is utilized for water level monitoring. There are purpose built monitoring wells up and down-gradient from the site (GW_141 and GW_45-48) as well as additional water level monitoring wells (GW_40, GW_62 and GW_135).

Recharge source water will be delivered down the HBDIC system and diverted into the proposed infiltration gallery. HBDIC will be responsible for operating the diversion into the site.

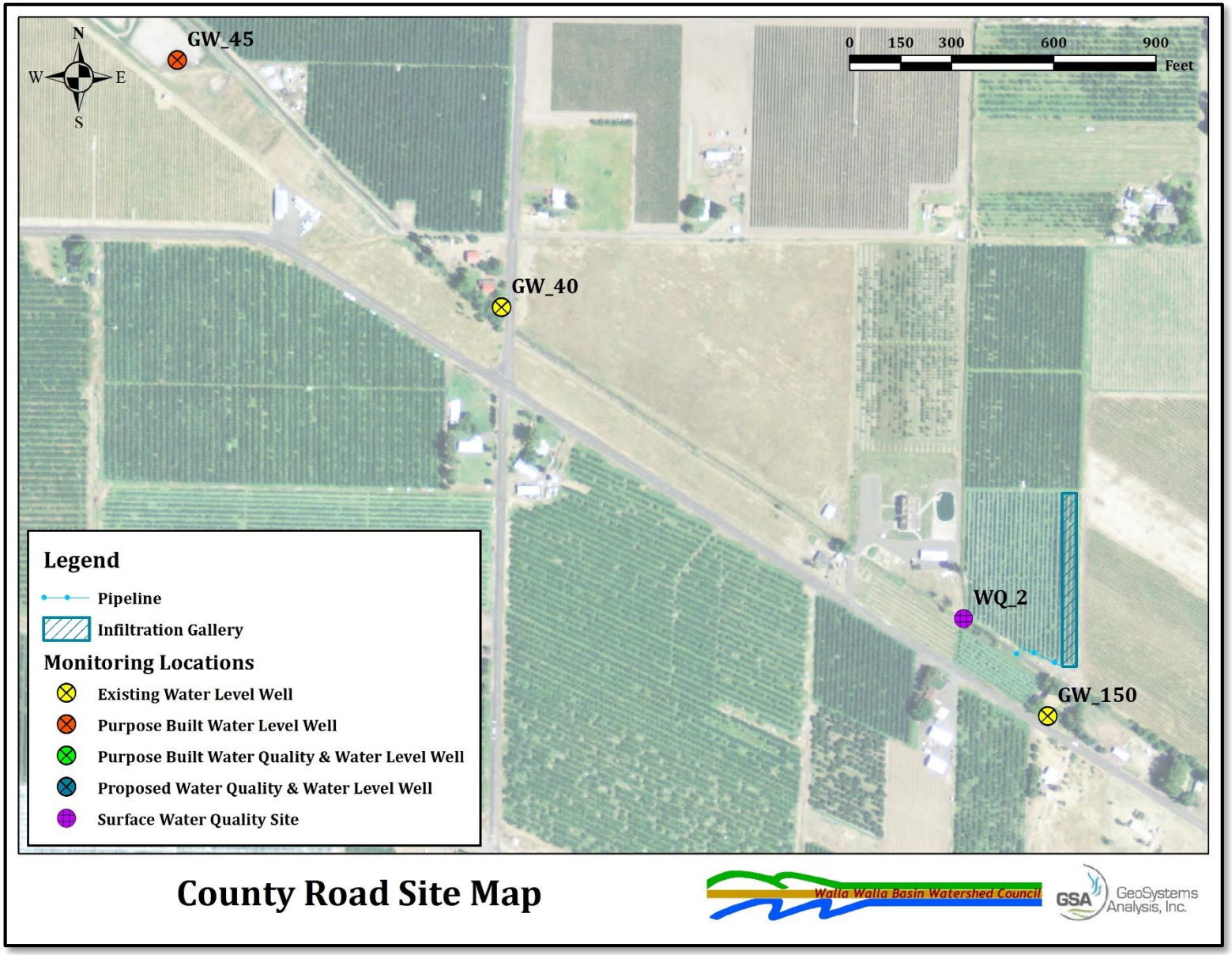

Figure 8 - County Road aquifer recharge site and monitoring map.

EAST TROLLEY LANE

The East Trolley Lane site is an infiltration gallery constructed in late 2013 and will be brought into use pending issuance of a new limited license. The site is located east of Trolley Lane and approximately 0.5 miles south of the Oregon/Washington border in SW ¼, SE ¼, Sec. 15, T6N, R35E (Figures 1, 9 and 10). Recharge capacity at the site is expected to range from approximately 1-2 cfs. The infiltration gallery was built between an apple orchard and the county road. This field has been used as an apple orchard since at least the early 1990s.

A purpose built monitoring well, GW_151, is located immediately north (down-gradient) of the infiltration gallery, approximately down-gradient of the site. Additional down gradient wells exist on the Washington side of the border.

Recharge water will be delivered down the Ford branch to the West Little Walla Walla River and then diverted down the Trolley Lane pipeline to the project. WWBWC staff will manage the Trolley Lane diversion.

Figure 9 - Photograph of the East Trolley Lane aquifer recharge site during construction. Photo is taken near the northern end of the project looking northwest.

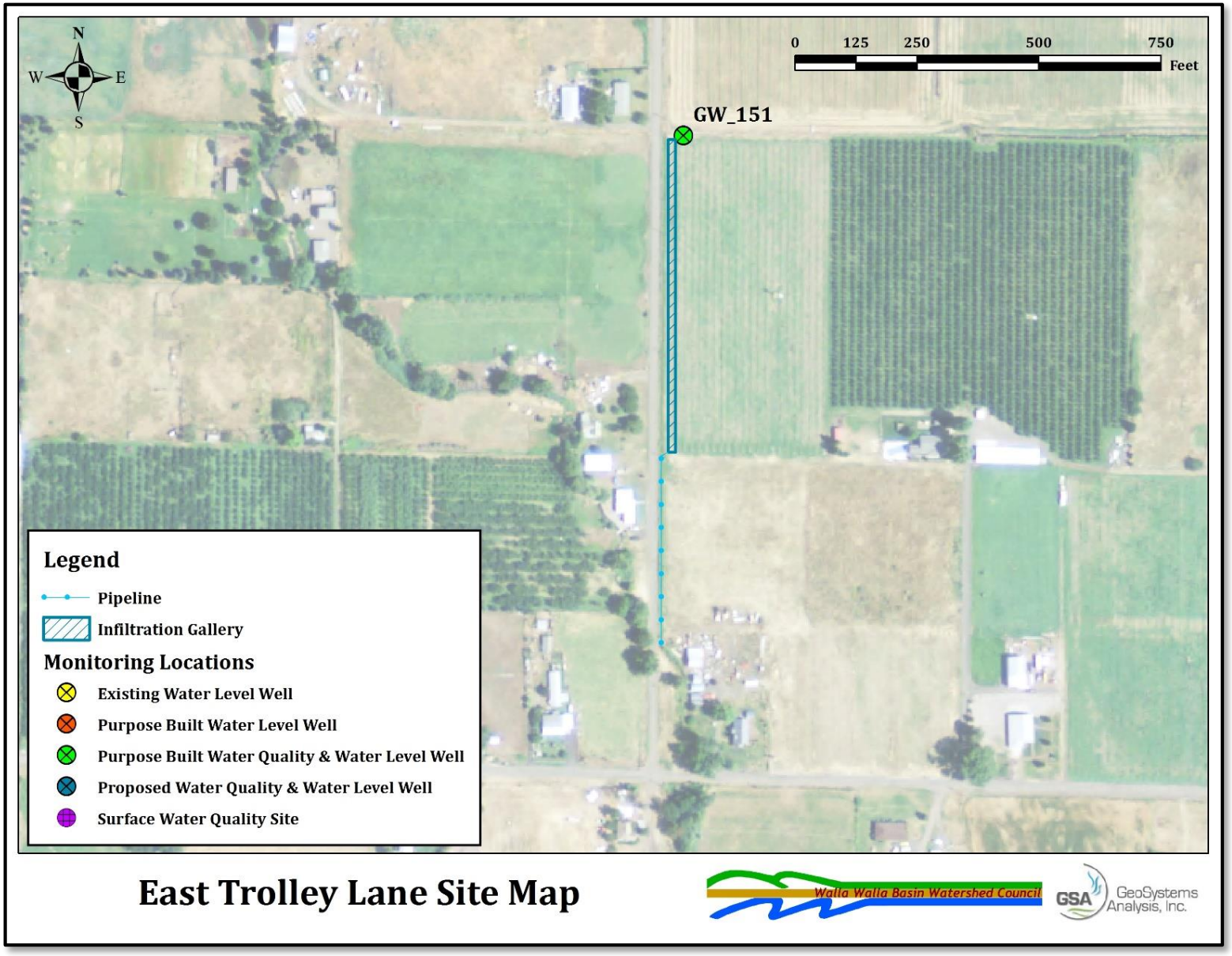

Figure 10 - East Trolley Lane aquifer recharge site and monitoring map.

FRUITVALE

The proposed Fruitvale recharge site will be located approximately 3.5 miles northwest of Milton-Freewater, OR near the intersection of Sunquist Road and Fruitvale Road in NE ¼, NW ¼, Sec. 21, T6N, R35E (Figures 1 and 11). The site is planned to be an infiltration gallery, with the potential for a sediment settling pond, with a recharge capacity of 2 to 4 cfs. The Fruitvale site will be constructed in the fall of 2015 and will begin operations pending issuance of a new limited license. The site will be constructed in an existing wheat/alfalfa field. The land has historically (since the early 1990s) been in a wheat/alfalfa rotation, however there have been times when a portion of the land was planted in corn. In 2015, the land was planted with peas for the winter with buckwheat to follow in the late spring/summer.

There is one existing well in the area, GW_33, a water well adapted for use in the WWBWC water level monitoring network. An additional planned purpose built monitoring well will be installed near the site, GW_171.

Recharge source water will be delivered from the Fruitvale ditch into the proposed infiltration gallery. WWBWC will be responsible for operating the diversion into the site.

Figure 11 - Photograph of the Fruitvale aquifer recharge site during construction. Photo is taken near the southern end of one of the infiltration gallery looking north.

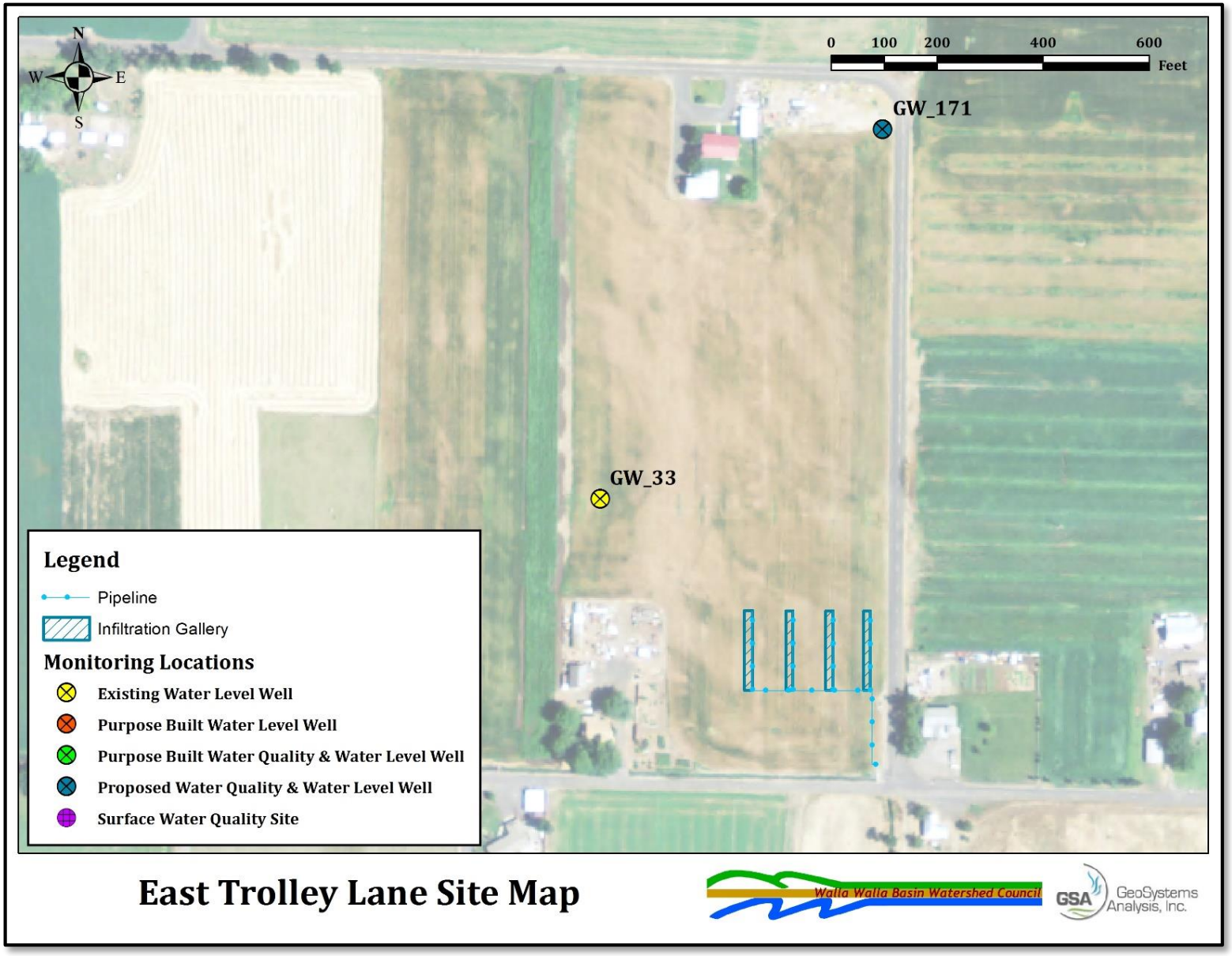

Figure 12 – Fruitvale aquifer recharge site and monitoring map.

GALLAGHER

The proposed Gallagher recharge site will be located approximately 0.75 miles southeast of Umapine, OR in SE ¼ and SW ¼ of Sec. 30, T6N, R35E (Figures 1 and 12). The site is planned to be a combination of infiltration galleries and infiltration basins with an expected recharge capacity of 3-6 cfs. The Gallagher site will likely be constructed in phases starting with a single infiltration basin currently scheduled for construction in 2016, and then incorporating additional basins and the infiltration galleries in future years. The site consists of land that has been fallow and used as a horse pasture and farm equipment storage since the 1990s.

There are two existing wells in the area, GW_36 and GW_119. GW_36 is an irrigation well used to monitor water levels and GW_119 is a purpose built monitoring well used for water quality and water level monitoring. Down-gradient of the site is an additional well, GW_66. This well is used for water level monitoring in the WWBWC water level monitoring network.

This site will be connected to the White pipeline (currently the White ditch) and fed from the HBDIC system. Prior to the installation of the White pipeline, water will be delivered down HBDIC's system, routed into Dugger Creek and diverted into the Gallagher ditch. WWBWC and HBDIC will co-manage the diversion for this site.

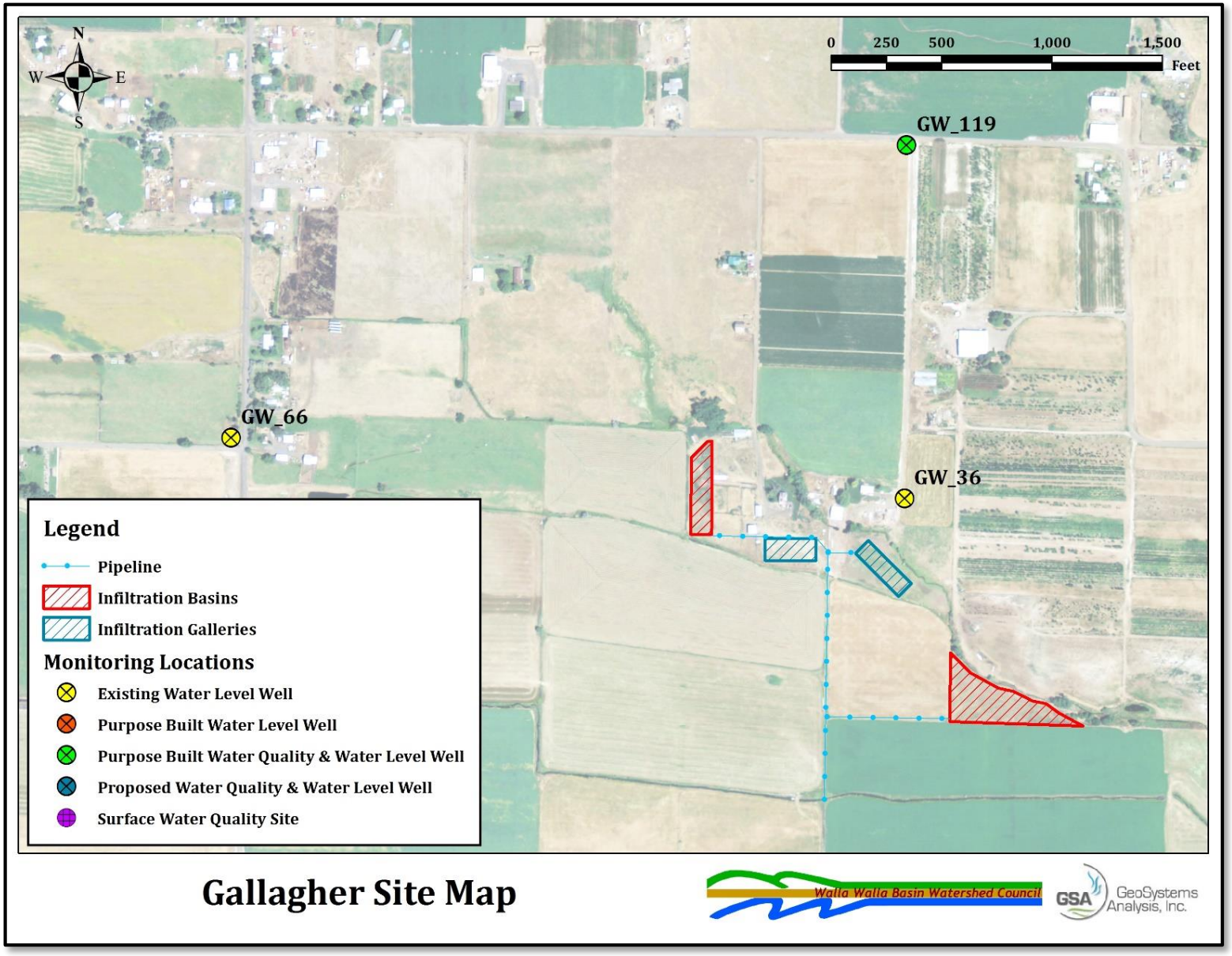

Figure 13 - Gallagher aquifer recharge site and monitoring map.

JOHNSON

The Johnson site is an operational recharge site consisting of a combination of infiltration basins and infiltration galleries. The site is located approximately 2.5 miles northwest of Milton-Freewater, OR between County Road and Prunedale Road in SE ¼, SW ¼, Sec. 33, T6N, R35E (Figures 1, 13 and 14). Originally constructed in 2004, the site has undergone two expansion phases to provide a recharge capacity ranging between 15 to 18 cfs. The site was constructed on fallow ground (since at least the mid-1990s) but historically was used to grow cherry tree starts.

There are 6 wells on or very near the site, including: 1 up-gradient well (GW_40), one mid-site well (GW_45), and 4 down-gradient wells (GW_46, GW_47, GW_48, and GW_118). Wells GW_45, GW_46, GW_47, and GW_48 are purpose-built monitoring wells drilled and constructed as part of the original operation of the site and have been used at various times for water quality monitoring. GW_118 is also a purpose built monitoring well. All wells are included in the basin-wide WWBWC water level monitoring network.

Recharge source water is delivered to the site from the White Ditch. Water delivery and infiltration basin operation is managed by the HBDIC. The infiltration galleries are managed by the WWBWC.

The Johnson site will continue to be operated under the existing Limited License LL1433 until issuance of Limited License LL1621.

Figure 14 - Photograph of the Johnson AR site showing the infiltration basins at the site. Photo is looking northwest from the most up-gradient basin.

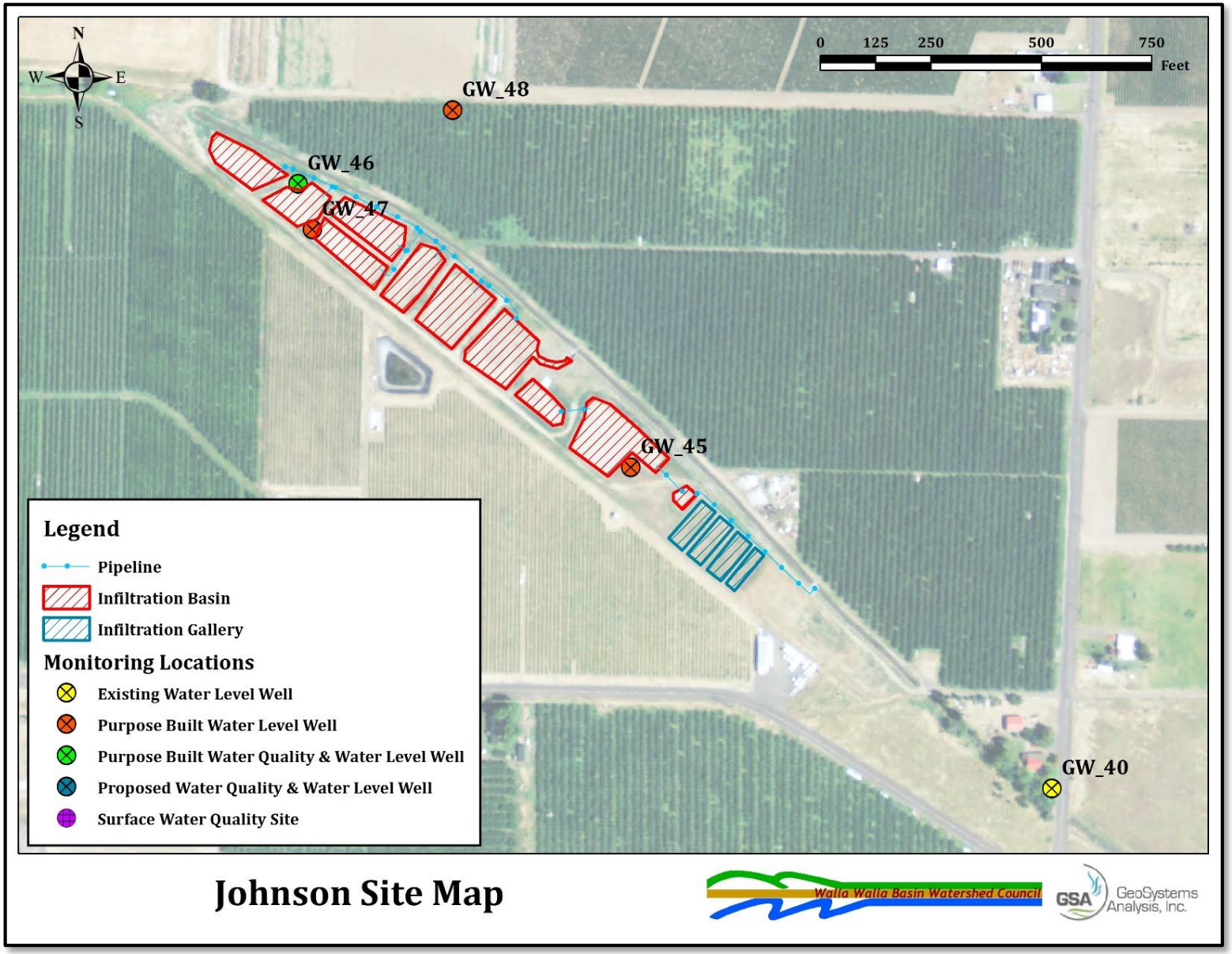

Figure 15 - Johnson aquifer recharge site and monitoring map.

LeFore Road

The LeFore Road recharge site is located immediately northeast of Milton-Freewater, OR and north of LeFore Road in NE ¼, SW ¼, Sec. 36, T6N, R35E (Figures 1, 15 and 16). The site is an infiltration gallery with an expected recharge capacity of 1-2 cfs. The LeFore Road site was constructed in October 2014 and will brought into use in 2015 pending issuance of a new limited license. The site was built between an apple and cherry orchard. The land has been utilized as apple/cherry orchards since at least the early 1990s.

There are two purpose built monitoring wells in the immediate area. GW_152 is immediately up-gradient of the site and GW_160 is down-gradient of the site. Additional monitoring wells in the general area were installed in the mid-2015.

Recharge source water will be delivered from a private pipeline into the infiltration gallery. WWBWC will be responsible for operating the diversion into the site.

Figure 16 - Photograph of the LeFore Road aquifer recharge site during construction. Photo was taken near the up-gradient end of the project looking west.

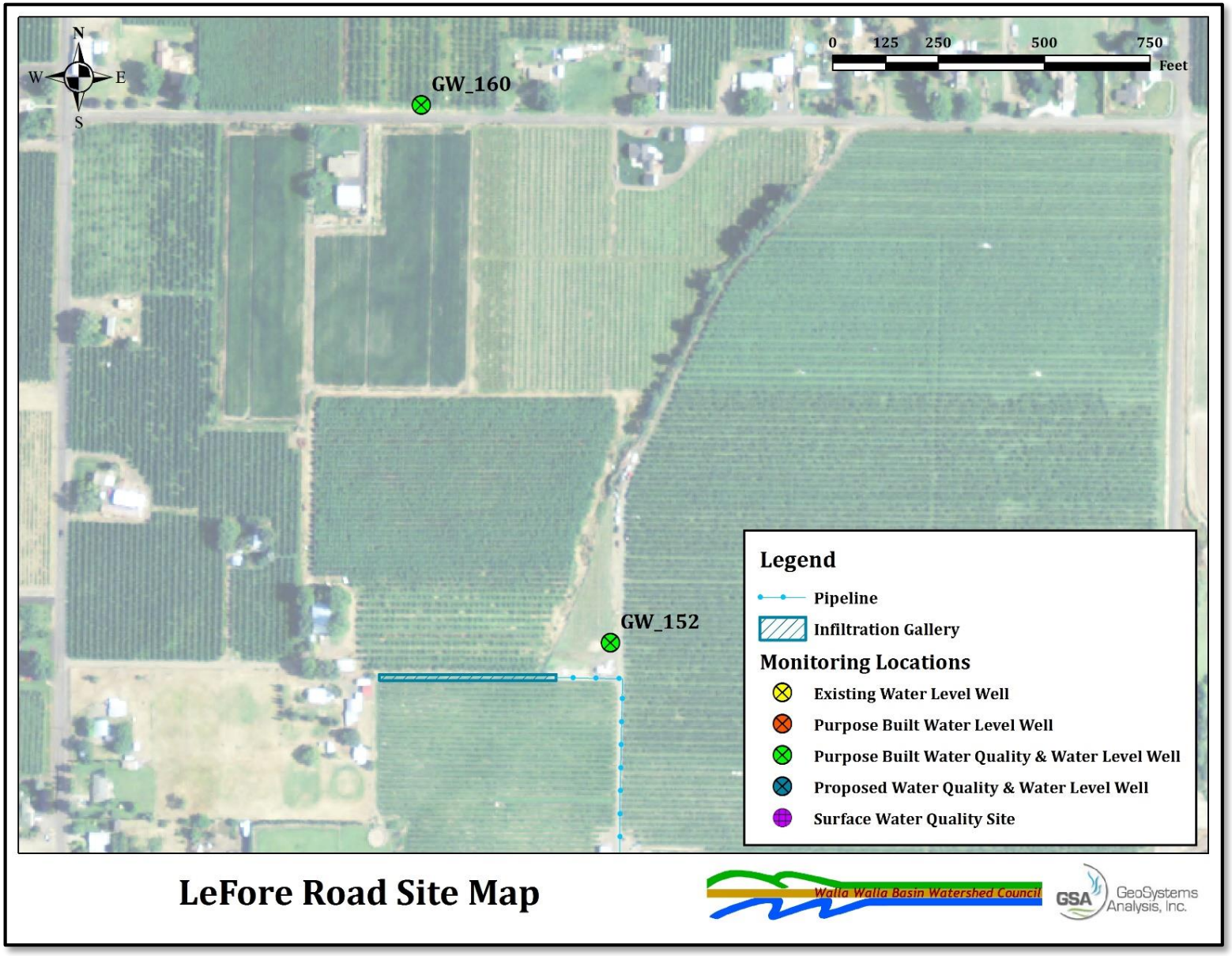

Figure 17 - LeFore Road aquifer recharge site and monitoring map.

LOCUST ROAD

The proposed Locust Road recharge site will be located approximately 1.0 mile north of Milton-Freewater, OR in SE ¼, NE ¼, of Sec. 35, T6N, R35E (Figures 1 and 17). The site is planned to be an infiltration gallery with an expected recharge capacity of 1-2 cfs. The Locust Road site will likely be constructed in early 2016. The site consists of land that has been used as a cherry orchard since at least the early 1990s.

There are two existing wells in the area, GW_14 and GW_116. GW_14 is an existing water well used to monitor water levels and GW_116 is a purpose built monitoring well built in 2009. These wells are used for water level monitoring in the WWBWC water level monitoring network.

Recharge source water will be delivered from the East Branch Crockett ditch into the proposed infiltration gallery. WWBWC will be responsible for operating the diversion into the site.

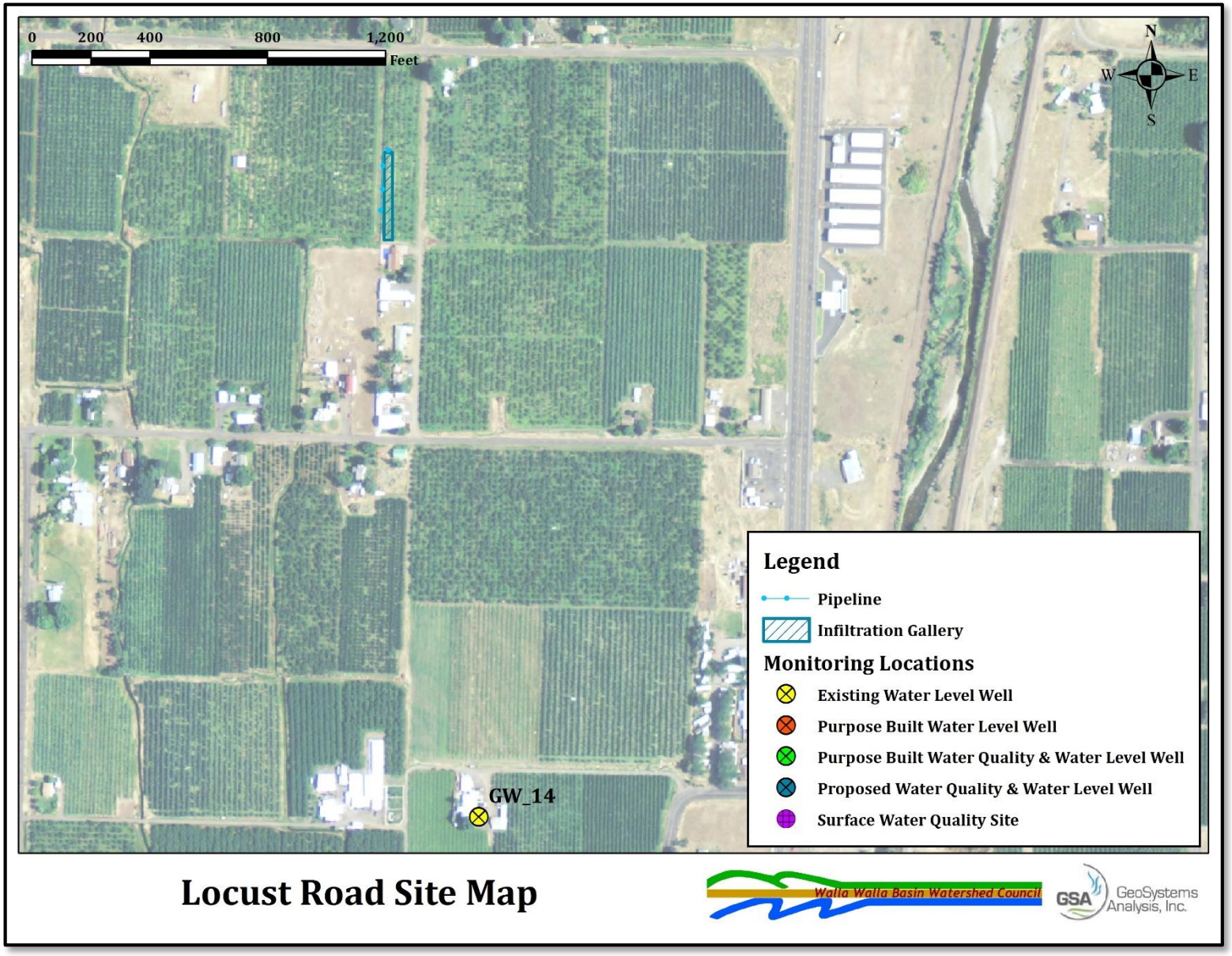

Figure 18 – Locust Road aquifer recharge site and monitoring map.

MUD CREEK

The Mud Creek site is located approximately 2.5 miles northwest of Milton-Freewater, OR between State Route 332 and Triangle Road in NW ¼, NW ¼, Sec. 27, T6N, R35E (Figures 1, 18 and 19). The site consists of one infiltration basin with a total expected recharge capacity of 1 to 2 cfs. The Mud Creek site was constructed in the fall of 2015 and will be brought into use pending issuance of a new limited license. The site was constructed in a pasture. The land has been in pasture grass since at least the early 1990s.

Existing wells in the area include an up-gradient well, GW_117. An additional planned purpose built monitoring well will be installed near the site (GW_170).

Recharge source water will be delivered from the Fruitvale ditch into the infiltration basins. WWBWC will be responsible for operating the diversion into the site.

Figure 19 - Photograph of the Mud Creek aquifer recharge site during construction. Photo is taken from the east side of the project looking west.

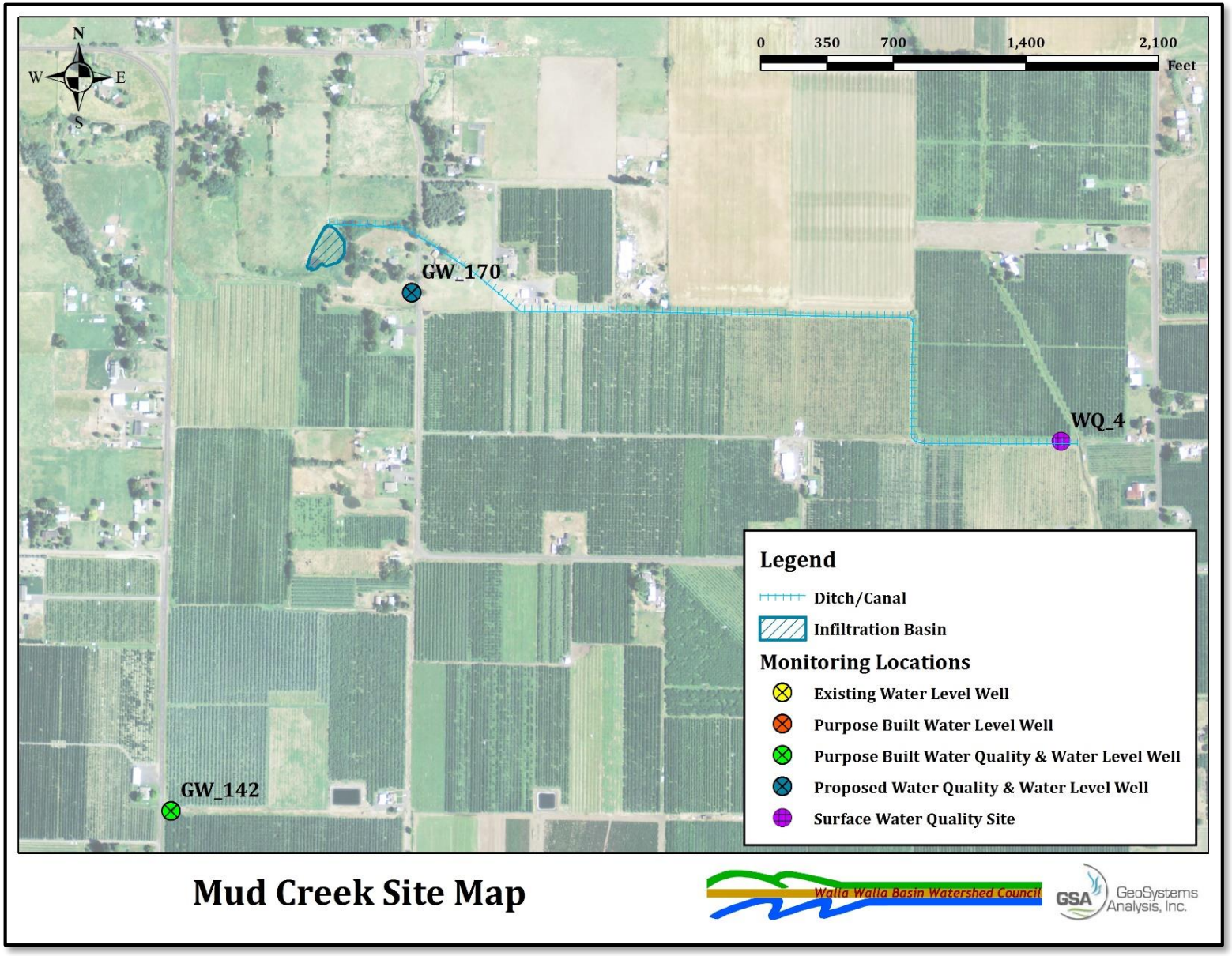

Figure 20 - Mud Creek aquifer recharge site and monitoring map.

NW UMAPINE

The NW Umapine site is an operational infiltration basin constructed in 2013. The site is located approximately 0.5 miles northwest of Umapine, OR and the intersection of Umapine-Stateline Road with State Road 332 in SW ¼, SE ¼, Sec. 24, T6N, R34E just (Figures 1, 20 and 21). Recharge capacity at the NW Umapine site ranges from 2 to 3 cfs. This site was constructed in a pasture field. The land has been used as pasture for at least the last 5 years. Prior to that it was farmed with a wheat/alfalfa rotation.

There is a single purpose built monitoring well (GW_144) on the site. Wells in the general area of the site include GW_34, GW_36, GW_66 and GW_119, all of which are part of the WWBWC water level monitoring network. GW_119 is a purpose built monitoring well and the other wells are water wells that have been adapted for use in the water level monitoring network.

Recharge source water is diverted from the Richartz pipeline to the basin. HBDIC manages the diversion of water to the site by a turn out from the Richartz pipeline.

The NW Umapine site will continue to be operated under the existing Limited License LL1433 until issuance of Limited License LL1621.

Figure 21 - Photograph of the NW Umapine aquifer recharge site during operations. Photo is taken from the northeast corner of the basin looking southwest.

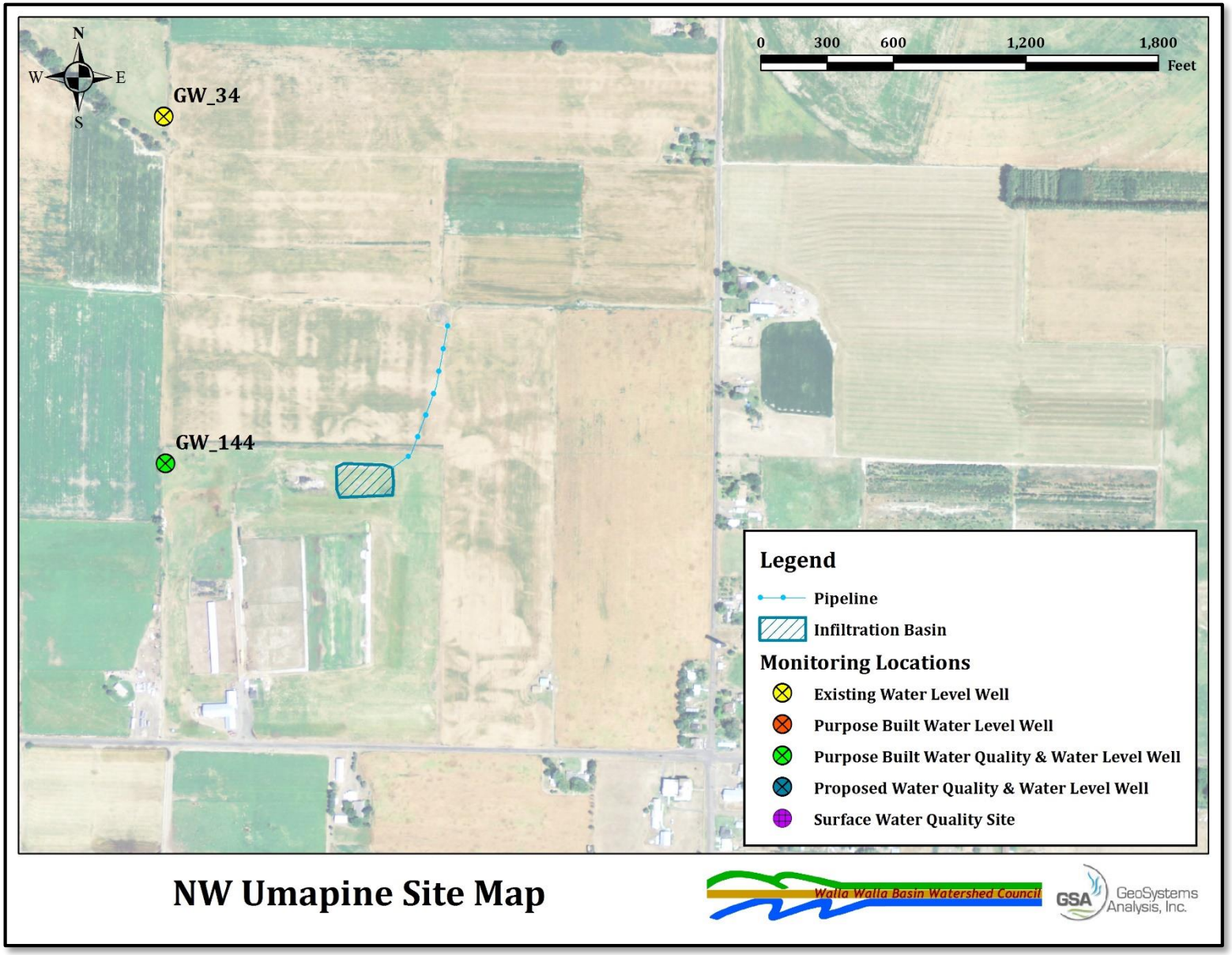

Figure 22 - NW Umapine aquifer recharge site and monitoring map.

SUNQUIST

The Sunquist site will be located approximately 4.5 miles northwest of Milton-Freewater, OR in NE ¼, SW ¼, Sec. 21, T6N, R35E (Figures 1 and 22). The site is planned to be an infiltration gallery with a recharge capacity of 1-2 cfs. The Sunquist site is scheduled to be constructed in 2016. The site will be built on land that has been fallow since the early 1990s. A portion of the land, down-gradient of the proposed recharge site, was planted as a vineyard in 2012.

A planned purpose built monitoring well (GW_170) will be constructed up-gradient of this site. Two wells exist down gradient, GW_33 (water level well) and GW_171 (purpose built water quality and water level well).

Recharge source water will be delivered from the Fruitvale ditch into the proposed infiltration gallery. WWBWC will be responsible for operating the diversion into the site.

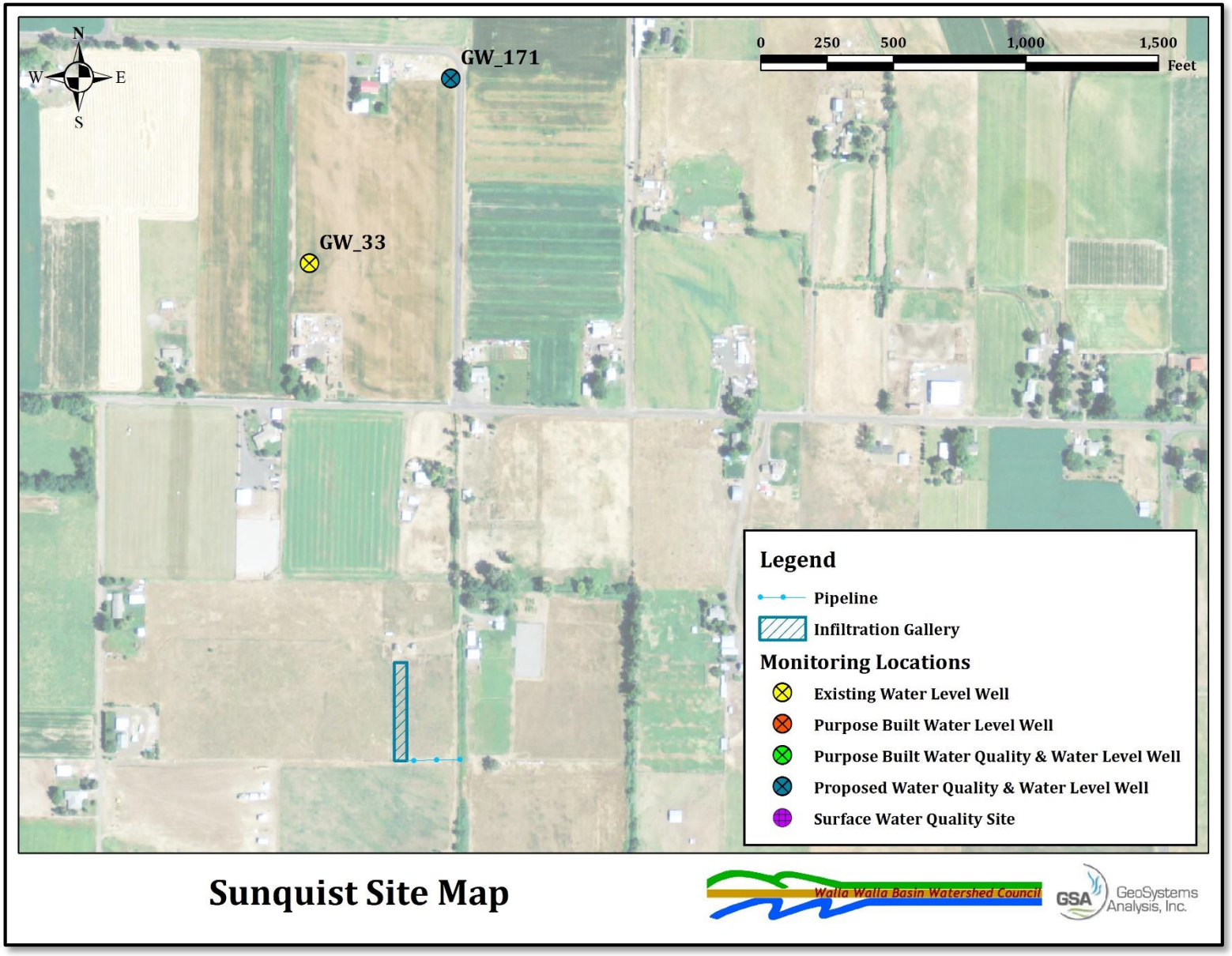

Figure 23 - Sunquist aquifer recharge site and monitoring map.

TRIANGLE ROAD

The Triangle Road site will be located approximately 3.5 miles northwest of Milton-Freewater, OR in NE ¼, NW ¼, Sec. 27 T6N, R35E (Figures 1 and 23). The site is planned to be an infiltration gallery with a recharge capacity of 1-2 cfs. The site is scheduled for construction in 2016 or 2017. The site will be built on land that has been an orchard lane/fruit box storage area. Historically the land has been utilized as an orchard since the early 1990s with a few years of fallow ground.

Two purpose built monitoring wells (GW_170 and GW_171) will be installed down-gradient of this site. A purpose built monitoring well is up-gradient of the site (GW_117 and another purpose built well is cross-gradient to the site (GW_143).

Recharge source water will be delivered from the Fruitvale ditch into the proposed infiltration gallery. WWBWC will be responsible for operating the diversion into the site.

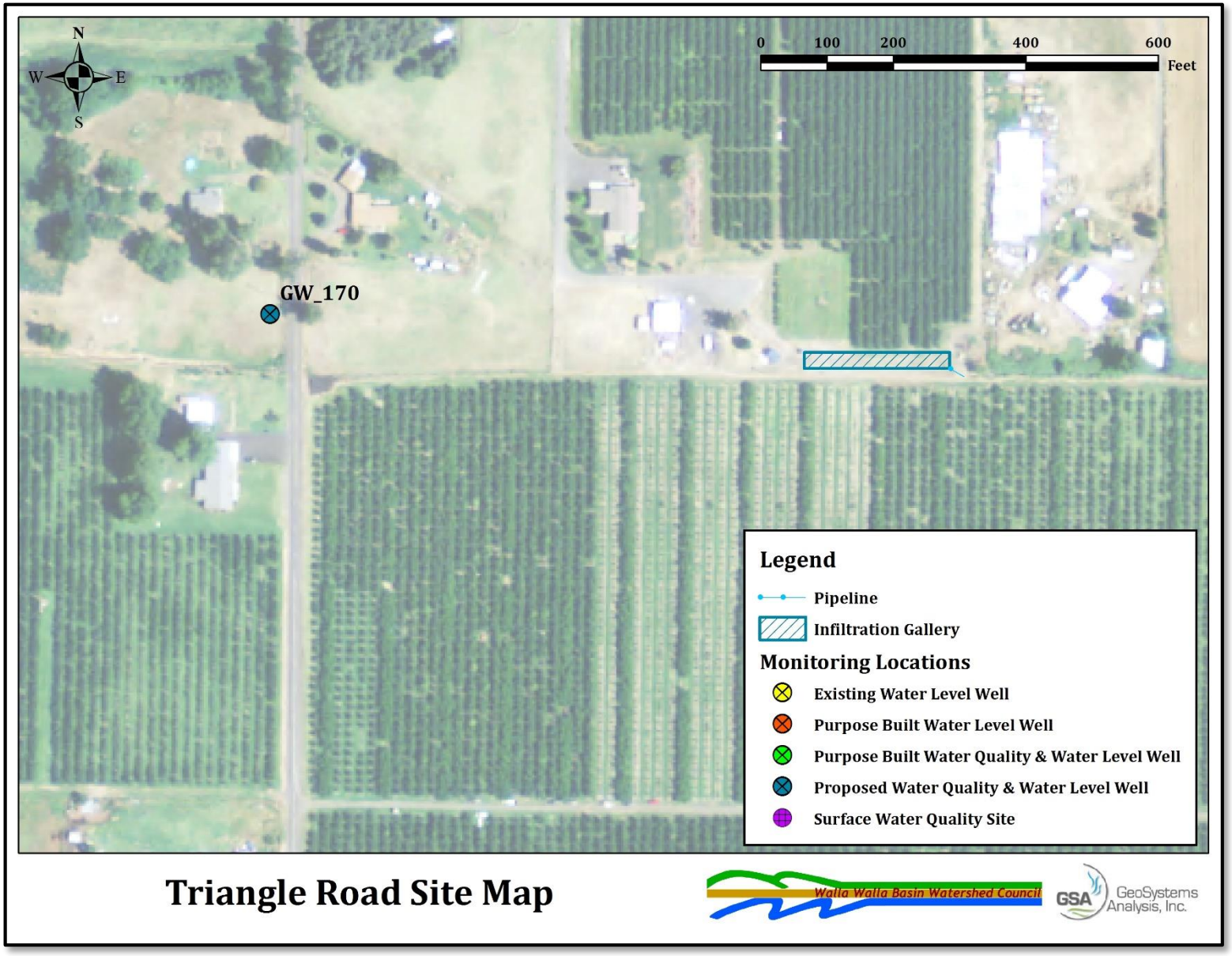

Figure 24 - Triangle Road aquifer recharge site and monitoring map.

TRIANGLE STATION

The Triangle Station site will be located approximately 3.75 miles northwest of Milton-Freewater, OR in NE ¼, NE ¼, Sec. 28, T6N, R35E (Figures 1 and 24). The site is planned to be an infiltration basin with a recharge capacity of 0.5 to 1 cfs. The Triangle Station site is planned to be constructed in 2016 or 2017. The site will be built on land that has been used as pasture and grass hay since the early 1990s.

Two purpose built monitoring wells (GW_142 and GW_143) exist near the site and a planned purpose built monitoring well (GW_170) will be installed up-gradient of the site and another built down-gradient of the site (GW_171).

Recharge source water will be delivered from the Fruitvale ditch into the proposed infiltration basin. WWBWC will be responsible for operating the diversion into the site.

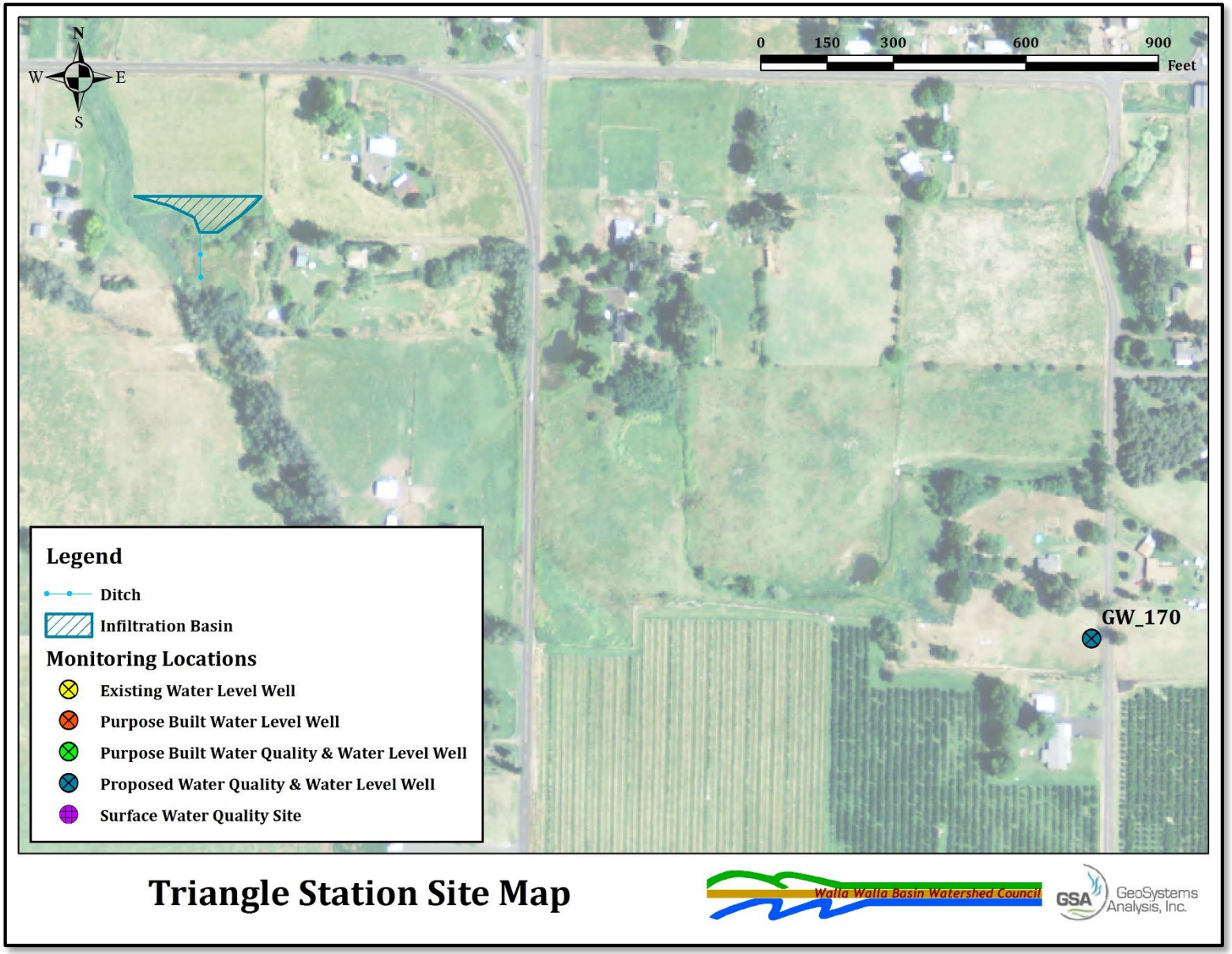

Figure 25 - Triangle Station aquifer recharge site and monitoring map.

TRUMBULL

The Trumbull site is an infiltration gallery constructed in late 2012 and operational since 2013. The site is located approximately 2.5 miles northwest of Milton-Freewater, OR between the Umapine Highway and Trumbull Road in NW ¼, SW ¼, Sec. 27, T6N, R34E (Figures 1, 25 and 26). Recharge capacity at the Trumbull site ranges from 1.5 to 2.5 cfs. The site was built in a fallow field that has since been converted to a vineyard. Historically this land was utilized as cherry/apple orchards. The current vineyard is approximately 50 yards away from the infiltration gallery.

There are no monitoring wells located at the site, however, an existing purpose-built monitoring well (GW117) that is included in the WWBWC water level monitoring network is located approximately 0.3 miles east and up-gradient of the site. Two purpose built wells, GW142 and GW143, are located approximately 0.3 to 0.75 miles to the west and northwest of the Trumbull site, respectively. These locations are generally down gradient of the site.

Recharge source water is delivered to the site from the HBDIC Canal. HBDIC manages the diversion of water to the site.

The Trumbull site will continue to be operated under the existing Limited License LL1433 until issuance of Limited License LL1621.

Figure 26 - Photograph of the Trumbull aquifer recharge site during construction. Photo is looking north from the up-gradient end of the project.

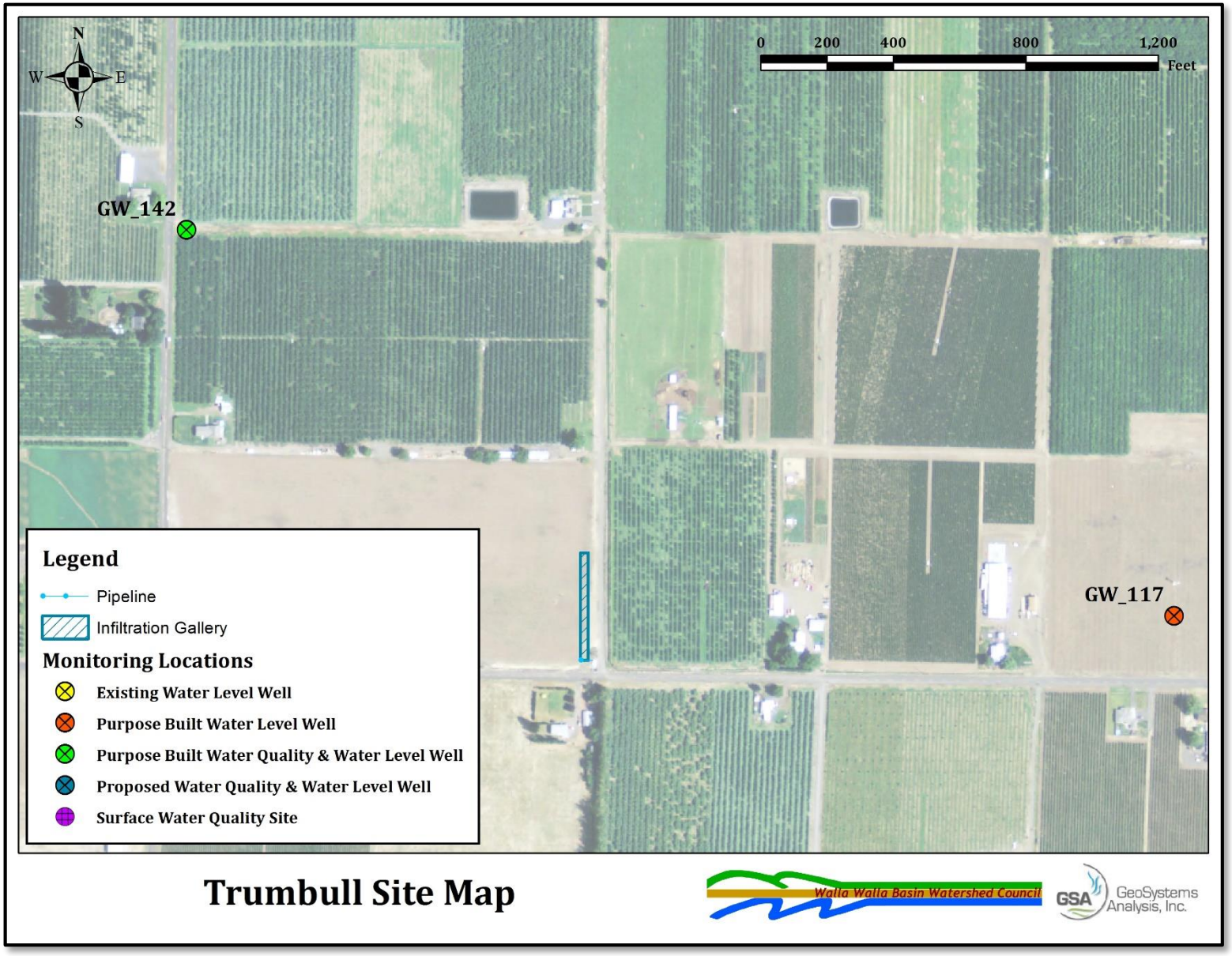

Figure 27 - Trumbull aquifer recharge site and monitoring map.

WEST RINGER ROAD

The West Ringer Road site is a modified infiltration gallery that utilizes storm water chambers instead of perforated pipes. The site is located west of Ringer Road, just south of the community of Umapine in SW ¼, NE ¼, Sec. 25, T6N, R34E (Figures 1, 27 and 28). The infiltration gallery was constructed in late 2013 and will be brought into use pending issuance of a new limited license. The site is expected to have a capacity of 1 to 2 cfs. This project was built along the edge of and under a portion of a field that has had a wheat/alfalfa rotation since the 1990s.

Wells in the general area of the site include GW_36, GW_66, GW_119 and GW_144. GW_119 and GW_144 are purpose built monitoring wells that are part of the WWBWC water level monitoring network. The remaining wells are water wells adapted for use in the water level monitoring network.

Water will be delivered to this project in one of two routes. The primary route will be down the HBDIC's Richartz canal and then into Dugger ditch via the pipeline overflow. The secondary route will be down the White ditch, into Dugger Creek and then into Dugger ditch. WWBWC will be responsible for operating the diversion at this site.

Figure 28 - Photograph of the West Ringer Road aquifer recharge site during construction. Photo was taken near the middle of the site looking east.

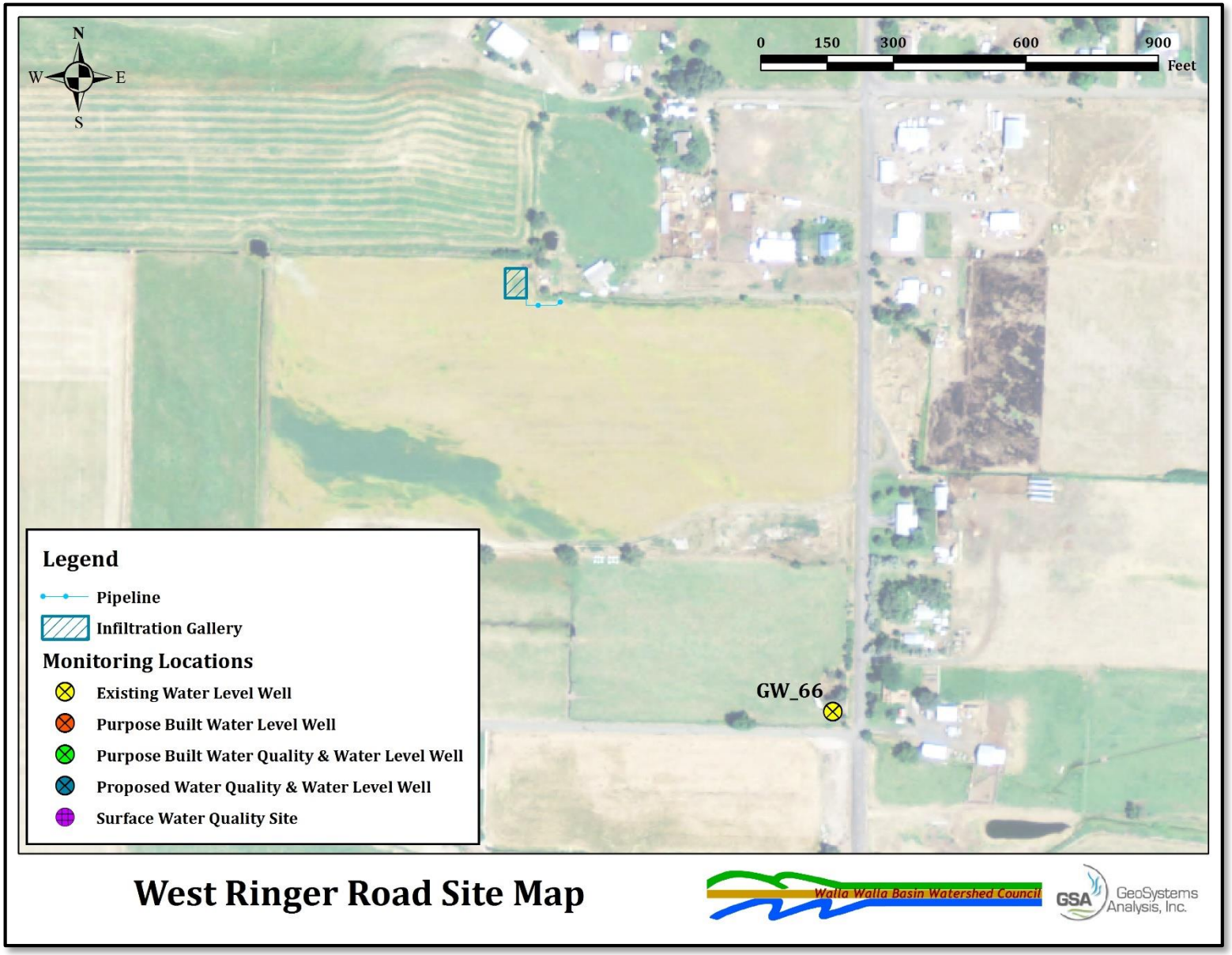

Figure 29 - West Ringer Road aquifer recharge site and monitoring map.

MONITORING PLAN

This section describes water quality and water level monitoring to be performed in support of the AR program. All monitoring will follow the WWBWC Watershed Monitoring Program Standard Operation Procedures provided in Appendix B.

WATER QUALITY MONITORING

Water quality monitoring for this multi-site AR program will integrate source water quality data from several locations in the canal delivery system with groundwater quality data collected from multiple locations to assess the impacts on the entire AR program area. Under this programmatic approach individual AR facilities will be monitored to a greater or lesser extent in support of the entire program. This proposed programmatic approach was developed from evaluation of data from recharge projects in the region using similar source waters (GSI, 2012). Water quality sampling will be done for field parameters, basic water quality parameters (cations, anions, metals, etc.) and synthetic organic compounds (SOC).

Recharge source water and groundwater will be sampled twice during each recharge season for analysis of a select list of indicator constituents considered to be most representative of the potential for AR degradation of alluvial aquifer groundwater quality, based on recharge water sources, adjacent land uses and a review of AR data collected to date at several sites in the Walla Walla Basin. The list of proposed analytes was assembled using data from previous and on-going AR operations in the region that use similar source water (see below for complete list of analytes).

WATER QUALITY SAMPLING SCHEDULE

Samples will be collected at monitoring points listed in the following sections twice each recharge season. The first sampling event will occur within one (1) week of the start of recharge operations (Typically in early November). The second sampling event will occur within one (1) week after termination of each recharge season (typically in mid-May).

A single SOC sample will be taken at two down-gradient monitoring wells (GW_144 and GW_171) at the end of season sampling event (typically in mid-May).

WATER QUALITY SAMPLING LOCATIONS

GROUNDWATER LOCATIONS

Groundwater quality monitoring will be conducted at monitoring points located to evaluate overall AR program impacts on up-gradient and down-gradient water quality for the multi-site AR program and also provide site-specific water quality data for specific AR locations to be operated under the proposed limited license.

Data from these wells, when combined with the source water data collected at the five locations named in the following section, will be used to interpret water quality impacts of the entire AR program. As the AR program continues to develop it is anticipated that these monitoring locations will be periodically re-evaluated and potentially modified. The number of monitoring locations could increase or decrease as the number of AR sites changes, such as when new sites are added or old sites are decommissioned.

Refer to Table 2 and Figure 30 for groundwater quality site locations and their proximity to AR sites.

Table 2. Groundwater quality sampling locations in Limited License LL1621.

Monitoring ID	Well ID Tag #	Well Log #	GPS Coordinates	Proximity to sites
GW_141	97758	UMAT 57169	45.945663, -118.408360	**Up-gradient**: Program, Anspach, Barrett, Johnson, Chuckhole **Mid-gradient**: None **Down-gradient**: None
GW_46	63869	UMAT 55114	45.957821, -118.441180	**Up-gradient**: Gallagher **Mid-gradient**: Program, Johnson **Down-gradient**: Barrett, Anspach, Chuckhole, County Road
GW_117	91062	UMAT 56444	45.962511, -118.421880	**Up-gradient**: Trumbull, Mud Creek, Triangle Road, Triangle Road **Mid-gradient**: Program **Down-gradient**: None
GW_142	97760	UMAT 47171	45.965550, -118.433400	**Up-gradient**: Triangle Station and Sunquist **Mid-gradient**: Program **Down-gradient**: Trumbull
GW_170	*N/A*	*N/A*	*45.973074, -118.428844*	**Up-gradient**: Mud Creek, Fruitvale, Triangle Station, Sunquist **Mid-gradient**: Program **Down-gradient**: Triangle Road, Locust Road
GW_119	91065	UMAT 56447	45.972883, -118.485125	**Up-gradient**: NW Umapine, West Ringer **Mid-gradient**: Gallagher **Down-gradient**: Johnson
GW_144	97761	UMAT 57172	45.980159, -118.506767	**Up-gradient**: None **Mid-gradient**: None **Down-gradient**: NW Umapine, West Ringer Rd, Gallagher
GW_171	*N/A*	*N/A*	*45.991032, -118.444754*	**Up-gradient**: None **Mid-gradient**: None **Down-gradient**: Program, Fruitvale, Sunquist, Triangle Station
GW_151	111667	UMAT 57435	45.994728, -118.423728	**Up-gradient**: None **Mid-gradient**: None **Down-gradient**: Program, East Trolley
GW_152	111668	UMAT 57434	45.951427, -118.376960	**Up-gradient**: Program, LeFore Rd **Mid-gradient**: None **Down-gradient**: None
GW_160	*111671*	N/A	45.954846, -118.378992	**Up-gradient**: Locust Road **Mid-gradient**: None **Down-gradient**: Program, LeFore Rd

GW_169	*N/A*	*N/A*	*45.940828, -118.418978*	**Up-gradient**: Program, Barrett, Chuckhole **Mid-gradient**: None **Down-gradient**: None

NOTE: Italicized entries indicate proposed new groundwater monitoring locations.

SURFACE WATER LOCATIONS

Source water quality sampling will be conducted at several locations within the canal and pipeline recharge water conveyance system. Source water monitoring sites will be in the distribution system at select locations up-stream of AR facilities.

- Source water monitoring location WQ-1 is in the White Ditch canal up-stream of the diversion to the Anspach site. Samples from this location represent source water diverted to the Anspach, Barrett, Chuckhole, County Road and Locust Road sites. This location is also representative of the source water delivered to the Chuckhole site from the Milton pipeline. Additionally, this location is up-stream of all recharge sites and is considered representative of incoming source water conditions.
- Source water monitoring location WQ-2 is at the Duff Weir (White Ditch & Hudson Bay Canal split) upstream of the diversion for the Johnson, Gallagher and Trumbull sites.
- Source water monitoring point WQ-3 is at the Huffman-Richartz Weir (start of Huffman & Richartz pipelines) upstream of the NW Umapine and West Ringer Road sites.
- Source water monitoring point WQ-4 is at the Fruitvale Weir upstream of the Mud Creek, Fruitvale, Triangle Road, Triangle Station, Sunquist and East Trolley Lane sites.
- Source water monitoring point WQ-5 is at the Eastside diversion upstream of the LeFore Rd site.

Refer to Table 3 and Figure 30 for source water quality site locations and their proximity to AR sites.

Table 3. Source water quality sampling locations in Limited License LL1621.

Monitoring ID	GPS Coordinates	Source Water Monitoring Sites
WQ-1 Zerba	45.947580, -118.408015	Anspach, Barrett, County Road, Chuckhole, Locust Road
WQ-2 Duff	45.951665, -118.428920	Johnson, Trumbull, Gallagher
WQ-3 Huffman-Richartz	45.976577, -118.475888	NW Umapine, West Ringer Rd
WQ-4 Fruitvale	*45.971173, -118.414991*	Mud Creek, Fruitvale, Triangle Road, Triangle Station, Sunquist, East Trolley Lane
WQ-5 Eastside	*45.945233, -118.383753*	LeFore Rd

NOTE: Italicized entries indicate proposed new surface water monitoring locations.

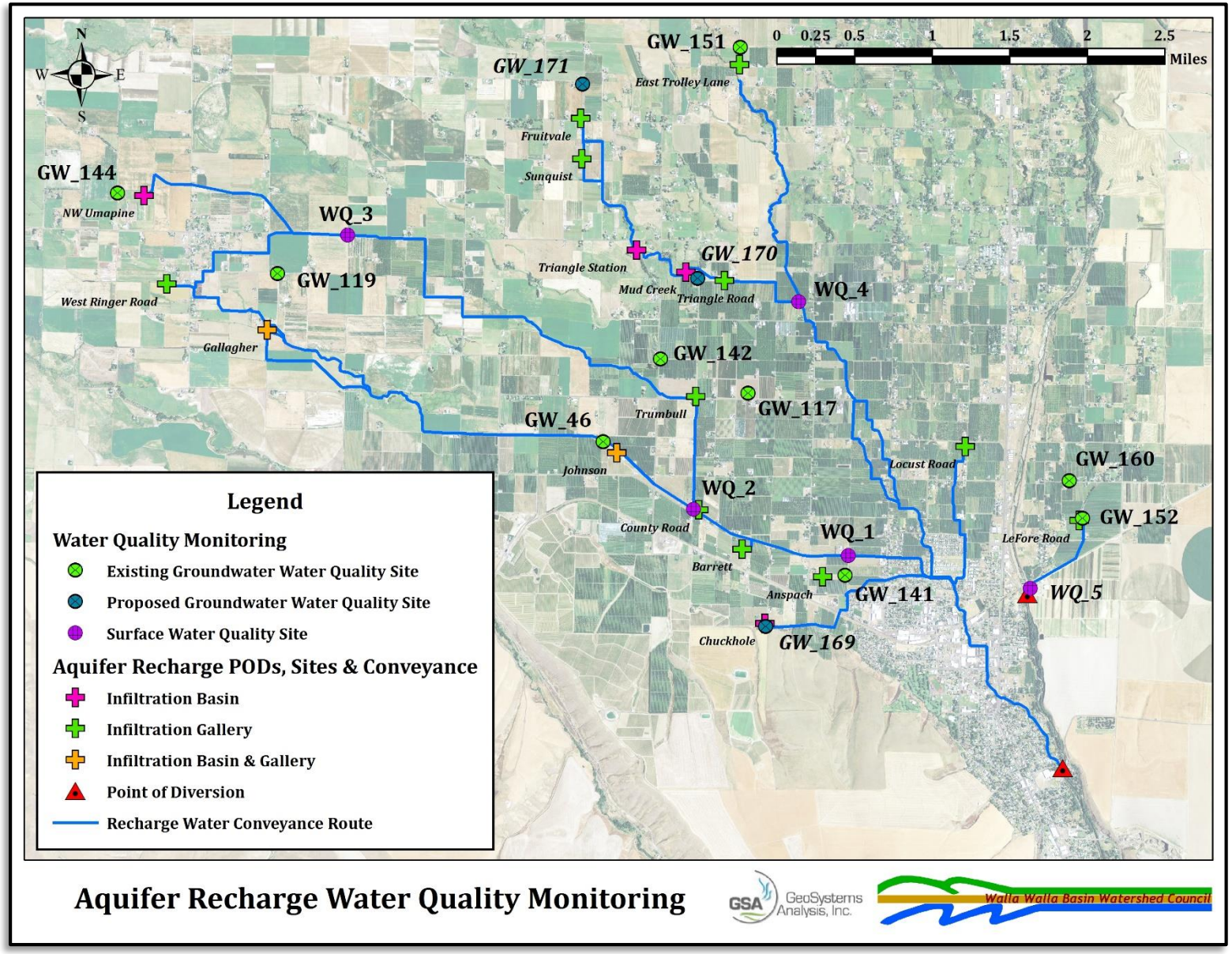

Figure 30 - Water quality sampling sites, aquifer recharge sites and conveyance system.

WATER QUALITY PARAMETERS

FIELD COLLECTED PARAMETERS

Table 4. Field collected water quality parameters in Limited License LL1621.

Analyte	Sample Matrix	Analytical Method	Sampling Occurrence
Water Temperature	Surface Water & Groundwater	YSI 30 / Orion 5-Star	Pre & Post Operations
Specific Conductance	Surface Water & Groundwater	YSI 30 / Orion 5-Star	Pre & Post Operations
pH	Surface Water & Groundwater	Orion 5-Star	Pre & Post Operations
Dissolved Oxygen	Surface Water & Groundwater	Orion 5-Star	Pre & Post Operations

LAB PARAMETERS

Table 5. Grab sample/lab analyzed water quality parameters in Limited License LL1621.

Analyte	Sample Matrix	Analytical Method	Sampling Occurrence
Potassium	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Sulfur	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Phosphorus	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
NO3-N	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
NH4-N	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Calcium	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Magnesium	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Sodium	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Manganese	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Iron	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Zinc	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Copper	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Lead	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Mercury	Surface Water & Groundwater	Ag Manager (Unibest)	Pre & Post Operations
Chlorphyrifos	Groundwater	EPA Method 8141	Post Operations @ GW_144 & GW_F3
Diuron	Groundwater	EPA Method 532	Post Operations @ GW_144 & GW_F3
Malathion	Groundwater	EPA Method 8141	Post Operations @ GW_144 & GW_F3
Azinphosmethly	Groundwater	EPA Method 8141	Post Operations @ GW_144 & GW_F3

SAMPLING PROCEDURES & EQUIPMENT (EXTRACTED FROM WWBWC'S SOP)

WATER QUALITY SAMPLING (GROUNDWATER)

Groundwater sampling is conducted utilizing the following procedures. The general overview of groundwater sampling includes gathering equipment, measuring the initial water level, installing a submersible pump in the well, purging the well at a low flow rate, collecting and labeling all required samples and delivering them to the lab or shipping company. Details on parameters sampled for each site can be found in its monitoring and reporting plan.

Note: this procedure is modified from:

Marti, 2011. Standard Operating Procedure for Purging and Sampling Monitoring Wells. Washington State Department of Ecology – Environmental Assessment Program. EAP078.

Equipment

- Sampling field data sheets (see below) or field notebook
- Chain of Custody form
- Water level measuring equipment (e-tape)
- Water quality meters and probes (Temperature, Specific Conductance, pH & Dissolved Oxygen)
- Submersible pump
- Pump controller
- Tubing and connectors
- Sample bottles/containers
- Cooler
- Ice
- Deionized water
- Diluted Bleach solution
- Non-phosphate soap
- Nitrile or latex gloves
- First aid kit
- Well keys
- Camera
- Paper towels or clean rags
- Plastic sheet for keeping equipment clean
- Buckets (5-gallon or similar for purge volumes)
- 1 liter container (for purge volumes)
- Socket set
- Screwdriver(s)

Purging and Sampling

1. Check well for any changes or potential hazards.
2. Make sure equipment has been cleaned and decontaminated (see below for details). Spread plastic or other material if needed to keep equipment clean.
3. Wear clean disposable gloves (latex or Nitrile) while performing purging and sampling. If gloves become contaminated or dirty replace with new gloves.

4. Make sure field water quality meters are calibrated according to the manufacturer's instructions.
5. If well is equipped with a pressure transducer, note how it is installed and its position to replace it after sampling. Remove the pressure transducer from the well. Note the time the pressure transducer was removed from the well on the data sheet or in the field notebook.
6. Measure the static water level in the well (see Groundwater Level and Temperature protocol below for details).
7. Measure the depth of the well or refer to the well log to determine the depth of the well.
8. Calculate the length of the water column. Calculate the volume of water in the well using the following values: 2" well = 0.1631 gallons per linear foot, 4" = 0.6524 gallons per linear foot (Equation used for water volume calculation – Volume (gal/ft) = πr^2 (7.48 gal/ft^3) where *r* is the radius of the well and 7.48 is the conversion factor).
9. Install the submersible pump into the well. Be sure to slowly lower the pump into the well and through the water to avoid stirring up particulates. Place the pump in the middle of the screen section of the well (refer to well log to determine the open interval for pump placement).
10. Once the pump is installed correctly re-measure the static water level to monitor during purging.
11. Start purging. Set the pump controller to the desired pumping rate (~1 liter/minute). See notes from previous sampling for pumping rate.
12. Ideally, wells should be purged and sampled at flow rates at or less than the natural flow conditions of the aquifer in the screen interval to avoid drawing down the water level in the well. Use water level measurements to help adjust pumping rates to prevent well drawdown. Purging should not cause significant drawdown (considered to be 5% of the total height of the water column). If drawdown is significant, reduce pumping rate until water levels stabilize at an appropriate level.
13. Record pumping rate on the data sheet or field notebook.
14. Discharge evacuated water as far as possible from the wellhead and work area.
15. During purging and sampling water flow should be smooth and consistent without bubbles in the tubing.
16. Once pumping rate has been determined and flow has stabilized, start collecting field parameters (water temperature, specific conductance, pH and dissolved oxygen) at regular intervals. The measurement interval will depend upon the pumping rate (typically 2-5 minutes between measurements).
17. Record field parameters, water level measurement, and estimated amount of water purged. Note any changes in purged water's appearance (clear, turbid, odor, etc.).
18. Continue purging well until field parameters stabilize. Parameters should be considered to be stabilized when 3 consecutive measurements fall within the following ranges (see Table 6):

Table 6. Field collected water quality parameters in Limited License LL1621.

Field Parameter	Stabilized Range
Temperature	± 0.1 ° Celsius
Specific Conductance <1000 µs/cm	± 10 µs/cm
Specific Conductance >1000 µs/cm	± 20 µs/cm
Dissolved Oxygen < 1 mg/L	± 0.05 mg/L
Dissolved Oxygen > 1 mg/L	± 0.2 mg/L
pH	± 0.1 pH units

19. Collect samples once field parameters have stabilized. Do not stop or change pumping rate during the final phase of purging and sampling.
20. Collect most sensitive analytes first (i.e. organics) followed by less sensitive analytes (i.e. nutrients). This order can be modified if using sulfuric or nitric acid preservatives to prevent contamination of sulfate and/or nitrogen samples.

Collect any duplicate or quality control samples (see below for details).

21. Place samples in an ice-cooled cooler for delivery to the lab or shipping company. Make sure samples do not freeze during transport.
22. Complete chain of custody form. Record sample date and time, final water level and estimated total purge volume on the data sheet or in the field notebook. Also record any comments or observations regarding the purging and sampling process.
23. Replace pressure transducer if the well was equipped with one. Note re-install time on the data sheet or in the field notebook.
24. Clean and disinfect sampling equipment for next sampling event.

Decontamination

All non-disposable field equipment that may potentially come in contact with any soil or water sample shall be decontaminated in order to minimize the potential for cross-contamination between sampling locations. Thorough decontamination of all sampling equipment shall be conducted prior to each sampling event. In addition, the sampling technician shall decontaminate all equipment in the field as required to prevent cross-contamination of samples collected in the field. The procedures described in this section are specifically for field decontamination of sampling equipment.

At a minimum, field-sampling equipment should be decontaminated following these procedures:

- Wash the equipment in a solution of non-phosphate detergent (Liquinox® or equivalent) and distilled or deionized water. All surfaces that may come in direct contact with the samples shall be washed. Use a clean Nalgene and/or plastic tub to contain the wash solution and a scrub brush to mechanically remove loose particles. Wear clean latex, plastic, or equivalent gloves during all washing and rinsing operations.
- Rinse twice with distilled or deionized water.
- Dry the equipment before use, to the extent practicable.

WATER QUALITY SAMPLING (SURFACE WATER)

Surface water sampling is conducted utilizing the following procedures.

Note: this procedure is a modified from:

Anderson, 2011. Standard Operating Procedure for Sampling of Pesticides in Surface Waters. Washington State Department of Ecology – Environmental Assessment Program. EAP003.

Equipment

- Sampling field data sheets (see below) or field notebook
- Chain of Custody form
- Water quality meters and probes (Temperature, Specific Conductance, pH & Dissolved Oxygen)
- Sample bottles/containers
- Cooler
- Ice
- Deionized water
- Diluted Bleach solution
- Non-phosphate soap (Liquinox or similar)
- Nitrile gloves
- First aid kit
- Camera
- Paper towels or clean rags
- Plastic sheet for keeping equipment clean
- Screwdriver(s)

Sampling

1. Check for any changes or potential hazards.
2. Make sure equipment has been cleaned and decontaminated (see below for details). Spread plastic or other material if needed to keep equipment clean.
3. Wear clean disposable gloves (Nitrile) while performing purging and sampling. If gloves become contaminated or dirty replace with new gloves.
4. Make sure field water quality meters are calibrated according to the manufacturer's instructions.
5. Collect required field water quality parameters and record on data sheet. Also note weather conditions
6. Fill out labels on each sample bottle with all necessary information.
7. Samples will be collected using the "Grab Sample" method described in EAP 003.
8. Take sample bottles and sampling equipment to the sample site and put on nitrile gloves.
9. Carefully collect samples by filling each container with water from the site. Note marked fill lines or preservatives to prevent over or under filling of the sample bottle.
10. Collect any duplicate or quality control samples (see below for details).
11. Place samples in an ice-cooled cooler for delivery to the lab or shipping company. Make sure samples do not freeze during transport.
12. Complete chain of custody form. Record sample date and time on the data sheet or in the field notebook. Also record any comments or observations regarding the sampling process.
13. Clean and disinfect sampling equipment for next sampling event.

Decontamination

All non-disposable field equipment that may potentially come in contact with any soil or water sample shall be decontaminated in order to minimize the potential for cross-contamination between sampling locations. Thorough decontamination of all sampling equipment shall be conducted prior to each sampling event. In addition, the sampling technician shall decontaminate all equipment in the field as required to prevent cross-contamination of samples collected in the field. The procedures described in this section are specifically for field decontamination of sampling equipment.

At a minimum, field-sampling equipment should be decontaminated following these procedures:

- Wash the equipment in a solution of non-phosphate detergent (Liquinox® or equivalent) and distilled or deionized water. All surfaces that may come in direct contact with the samples shall be washed. Use a clean Nalgene and/or plastic tub to contain the wash solution and a scrub brush to mechanically remove loose particles. Wear clean latex, plastic, or equivalent gloves during all washing and rinsing operations.
- Rinse twice with distilled or deionized water.
- Dry the equipment before use, to the extent practicable.

www.wwbwc.org
Walla Walla Basin Watershed Council
541-938-2170 or 7086 P.O.Box 68, Milton-Freewater, OR 97862

Aquifer Recharge Water Quality Field Datasheet

Date:_____ **Time:**_____ **Sampler:**_____ **Recharge Site Name:**_____ **Sample: Beginning Middle End**

Up Gradient Well

Well #:_____ Water Level (Feet bmp):_____ ± _____ Time:_____

Well Depth (From Well Log or Measure):_____

Water Column (Well Depth - Water Level) = _____

Water Colum Volume (Water Column x volume per linear foot) = _____

(0.1631 per linear foot for 2" well or 0.6524 per linear foot for 4" well)

Water Level Measurement After Installing Pump

(Feet below measurement point):_____ Time:_____

Approximate Pump Flow Rate:_____ units:_____

Time	Temp (°C)	Conductivity (µs/cm)	DO (mg/L)	pH

Comments/Notes:

Down Gradient Well (Close)

Well #:_____ Water Level (Feet bmp):_____ ± _____ Time:_____

Well Depth (From Well Log or Measure):_____

Water Column (Well Depth - Water Level) = _____

Water Colum Volume (Water Column x volume per linear foot) = _____

(0.1631 per linear foot for 2" well or 0.6524 per linear foot for 4" well)

Water Level Measurement After Installing Pump

(Feet below measurement point):_____ Time:_____

Approximate Pump Flow Rate:_____ units:_____

Time	Temp (°C)	Conductivity (µs/cm)	DO (mg/L)	pH

Comments/Notes:

Aquifer Recharge Water Quality Field Datasheet

Walla Walla Basin Watershed Council
www.wwbwc.org
541-938-2170 or 7086 P.O.Box 68, Milton-Freewater, OR 97862

Down Gradient Well (Distal)

Well #:_____ Water Level (Feet bmp):_____ ± _____ Time:_____

Well Depth (From Well Log or Measure):_____

Water Column (Well Depth - Water Level) = _____

Water Colum Volume (Water Column x volume per linear foot) = _____

(0.1631 per linear foot for 2" well or 0.6524 per linear foot for 4" well)

Water Level Measurement After Installing Pump

(Feet below measurement point):_____ Time:_____

Approximate Pump Flow Rate:_____ units:_____

Time	Temp (°C)	Conductivity (µs/cm)	DO (mg/L)	pH

Comments/Notes:

Source Water

Source Water #:_____ Flow Rate (or Staff Gage):_____ Time:_____

Weather Conditions:_____

Field Parameters

Time	Temp (°C)	Conductivity (µs/cm)	DO (mg/L)	pH

Duplicate Samples:_____

Comments/Notes:

General Sampling Notes

WATER LEVEL MONITORING

GROUNDWATER LOCATIONS

The WWBWC currently maintains a water level monitoring program in the area of this aquifer recharge program. Groundwater level monitoring locations provide useful information on aquifer recharge influences to the shallow aquifer. Wells were located to capture up-gradient to down-gradient influences from individual recharge projects (Figure 31). However, based upon limited funding and the spatial nature of the aquifer, it is not possible to have wells at every desired location. Wells in the water level network provide year round data for analysis of groundwater changes during recharge activities and also for longer term analysis of groundwater recovery (i.e. changes to groundwater storage). Many of the wells used for monitoring have secondary hydraulic influences other than aquifer recharge. For example, wells located near the White Ditch show responses to ditch activity. A few wells may show draw down caused by pumping from other wells. See Appendix A for details on well locations (GPS coordinates) Well ID Tag #'s and UMAT numbers (when available). Groundwater level data will be included in digital format with the written annual report. Additional groundwater level data can be found on the WWBWC's website.

SURFACE WATER LOCATIONS

Flow monitoring will be done in the canals or pipelines feeding each individual AR site. The objective of flow monitoring is to document the volumes of water delivered to each AR site during its operations. Each aquifer recharge site will have either a rated intake structure (such as the Johnson site) or have a flow meter installed at the diversion from the irrigation canal (such as the Anspach site). Water volume delivered to each site will be collected and stored by the WWBWC and reported to OWRD in a written annual report which will include applicable digital data. WWBWC will also conduct flow monitoring in the canals to estimate seepage losses during aquifer recharge operations. A total diversion from the Walla Walla River (in acre-feet) will be included in the annual report.

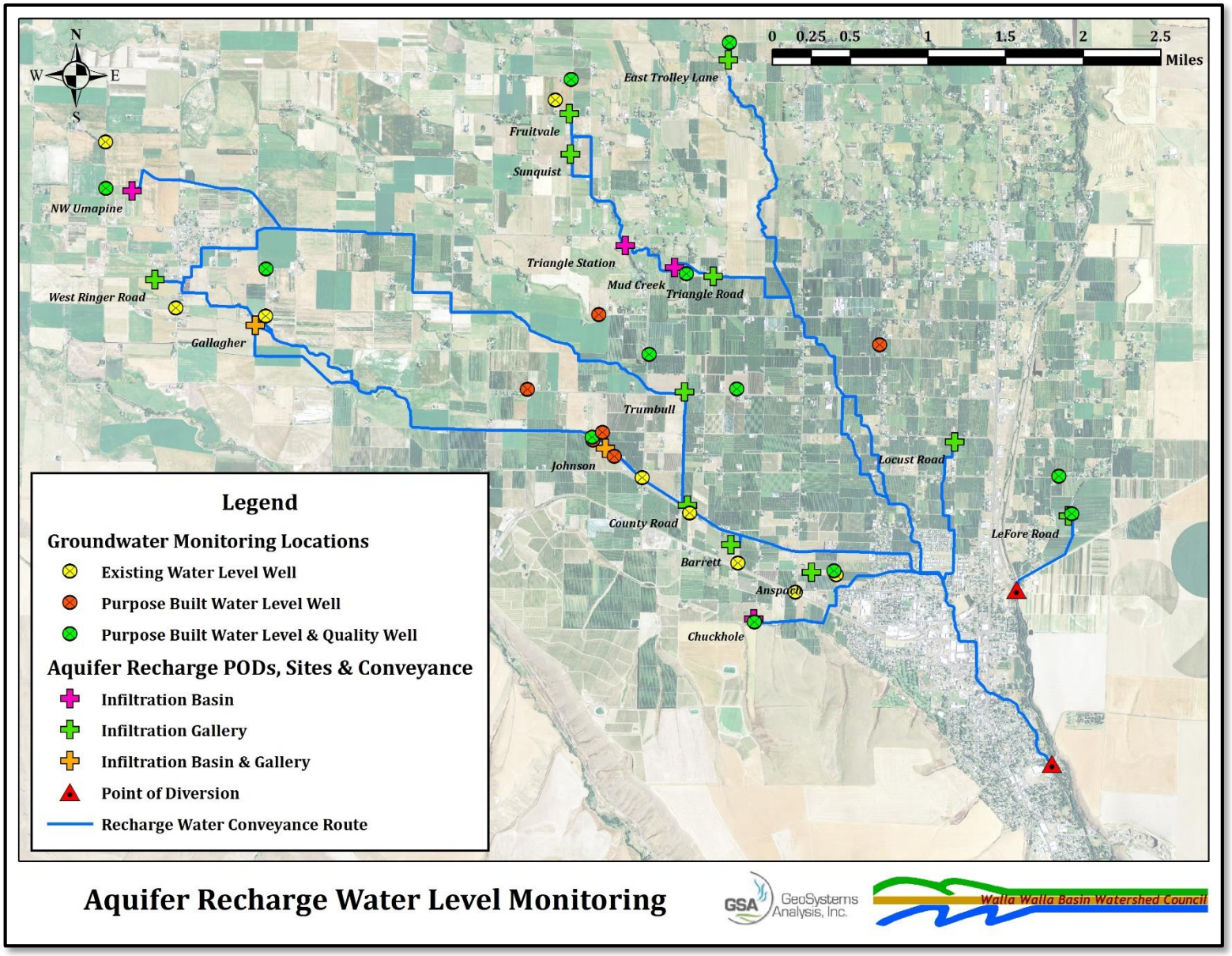

Figure 31 - Aquifer recharge sites and groundwater monitoring locations.

Quality Assurance and Quality Control (QA/QC)

Field Records

All field notes, analytical results and other pertinent data associated with the program should be maintained in a secure location and be archived for at least a five year period. Maintaining records will also facilitate tracking of environmental trends for the program.

Data Validation

Data validation for both field and lab QA/QC can be performed using a checklist. All pertinent information with respect to QA/QC will be checked. The following items will be included in the checklist:

- Completeness of field data sheets and observation
- Completeness of chain-of-custody
- Holding times for all constituents
- Completeness of laboratory quality controls

Specific QA/QC Guidance

A field duplicate will be conducted once per season. Field duplicates are two samples collected at the same time and location and analyzed in the same batch.

A field blank will be conducted once per season. Field blanks will be transfer blanks created using deionized water with sample bottles filled at the monitoring site.

Reporting

Primary reporting for this monitoring plan will focus on annual reports completed following the end of each recharge season, per OWRD requirements for the limited license. The basic goals of the annual reports will be to: (1) report water quantity diverted and quantity delivered to each recharge site, (2) analyze the data to evaluate how trends related to AR operations are influencing groundwater quality and quantity and (3) based on the results of that analysis provide recommendations (if any) for adjustments to the monitoring program and AR operations. In addition to written annual report, monitoring data collected under this monitoring plan will be provided to OWRD and ODEQ with the annual report.

REFERENCES

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WWBWC, 2014b. Shallow Aquifer Monitoring in the Walla Walla Basin 2012-2013, March 2014.

APPENDIX A – SHALLOW AQUIFER WELL INFORMATION

Monitoring ID	Well ID Tag #	Well Log #	GPS Coordinates	Well Depth	Well Type
GW_23	N/A	UMAT 3941	45.943675, -118.413545	N/A	WL
GW_33	N/A	UMAT 5977	45.989199, -118.446713	105’	WL
GW_34	N/A	UMAT 4135	45.984507, -118.506733	50’	WL
GW_36	N/A	UMAT 4882	45.968440, -118.484942	412’	WL
GW_40	N/A	N/A	45.954077, -118.434295	N/A	WL
GW_45	63871	UMAT 55115	45.956028, -118.438109	71’	WL
GW_46	63869	UMAT 55114	45.957821, -118.441180	67’	WL & WQ
GW_47	63870	UMAT 55116	45.957464, -118.440980	60’	WL
GW_48	63872	UMAT 55117	45.958222, -118.439737	61’	WL
GW_62	N/A	N/A	45.946135, -118.421334	N/A	WL
GW_66	N/A	N/A	45.969092, -118.496930	N/A	WL
GW_116	91061	UMAT 56442	45.966867, -118.402901	70’	WL
GW_117	91062	UMAT 56444	45.962511, -118.421880	70’	WL & WQ
GW_118	91064	UMAT 56445	45.962173, -118.449890	70’	WL
GW_119	91065	UMAT 56447	45.972883, -118.485125	40’	WL & WQ
GW_135	N/A	N/A	45.945290, -118.408257	N/A	WL
GW_141	97758	UMAT 57169	45.945663, -118.408360	55’	WL & WQ
GW_142	97760	UMAT 57171	45.965550, -118.433400	36’	WL & WQ
GW_143	97759	UMAT 57170	45.969233, -118.440530	25’	WL
GW_144	97761	UMAT 57172	45.980159, -118.506767	36’	WL & WQ
GW_150	N/A	N/A	45.950802, -118.427652	N/A	WL
GW_151	111667	UMAT 57435	45.994728, -118.423728	52’	WL & WQ
GW_152	111668	UMAT 57434	45.951427, -118.376960	82.5’	WL & WQ
GW_160	111671	N/A	45.954846, -118.378992	57’	WL & WQ
GW_169	97776	N/A	45.940828, -118.418978	65’	WL & WQ
GW_170	97778	N/A	45.973074, -118.428844	40’	WL & WQ
GW_171	97777	N/A	45.991032, -118.444754	45’	WL & WQ

APPENDIX B – WWBWC WATERSHED MONITORING PROGRAM STANDARD OPERATING PROCEDURES

Click here to download the WWBWC's Standard Operating procedures

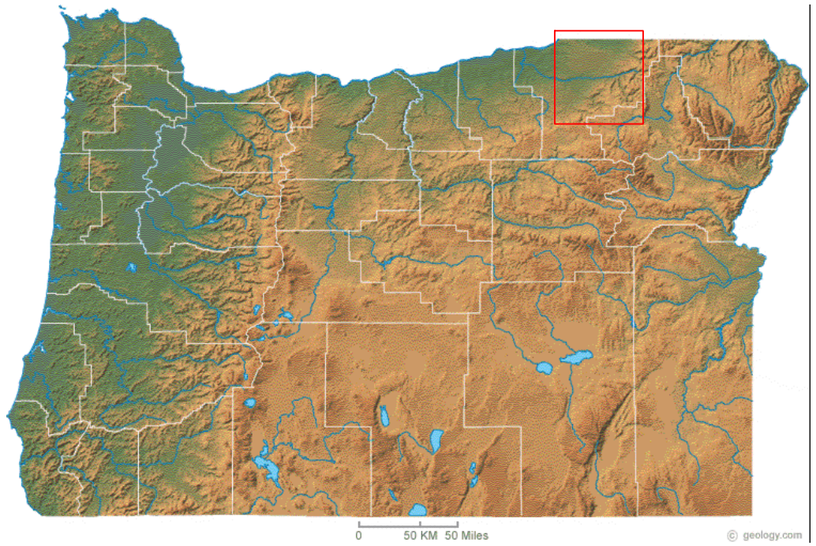
http://wwbwc.org/images/Monitoring/SOP/WWBWC_SOP.pdf

APPENDIX C – HYDROGEOLOGIC SETTING

Click here to download the Hydrogeologic Setting Report

http://www.wwbwc.org/images/Projects/AR/Reports/2015_LL_Hydrogeology_5-17-16_sp.pdf

APPENDIX D – AQUIFER RECHARGE SITE DESIGNS



LOCATION MAP

White Ditch
Pipe Replacement/SAR Project
Walla Walla Basin Watershed Council

INDEX OF DRAWINGS

GENERAL NOTES

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4. Construction activities will be conducted in a manner consistent with all safety regulations for work activities necessary for this installation.
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Review and Acceptance

I have reviewed the Drawings and Construction specifications provided and find them to be acceptable for installation. I also acknowledge that any modifications shall be approved by the Engineer prior to installation. I also acknowledge that I have received a copy of this plan.

Owner _____ Date _____

Cover Sheet

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

White Ditch Pipe Repalcement/SAR
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 1

SHEET NO. 1 OF 5

Plan View

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

DESIGNED BY: _____
DRAWN BY: _____
CHECKED BY: _____
APPROVED BY: _____
REVISED BY: _____
SCALE: _____
DATE: _____
REVISED DATE: _____

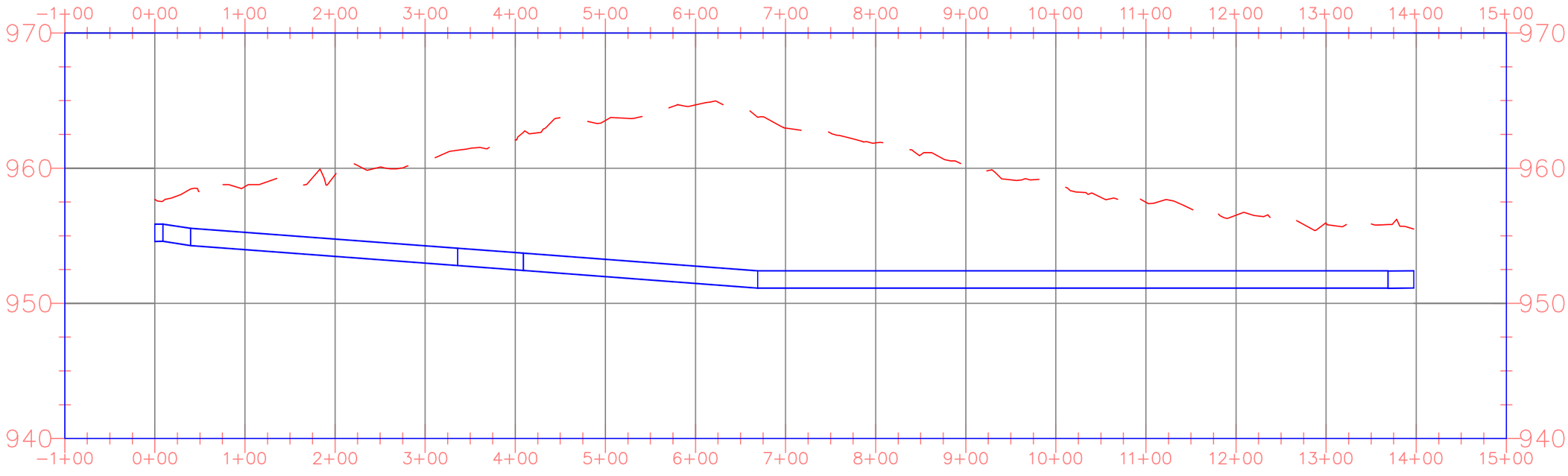
White Ditch Pipe Repalcement/SAR
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 2

SHEET NO. 2 OF 5

PIPELINE PROFILE



Profile Sheet

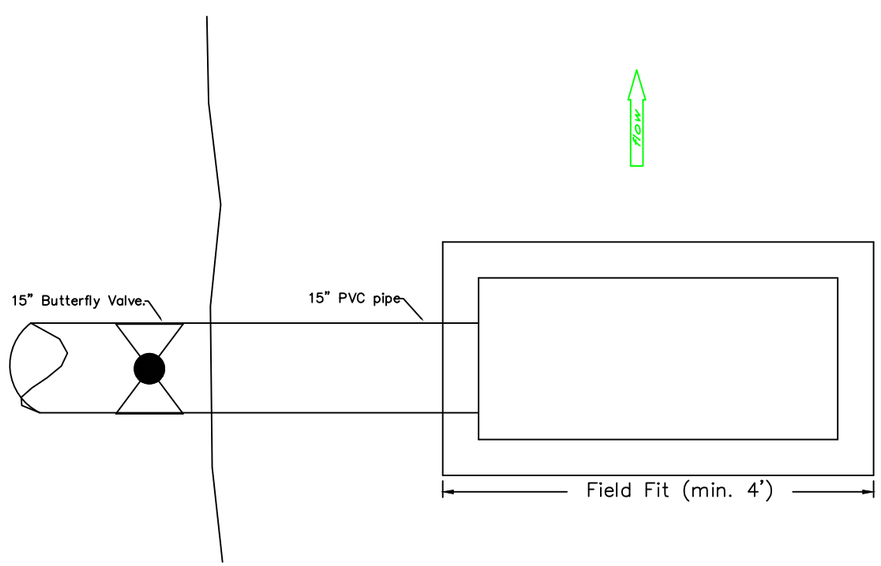
Lance Horning
Engineering
Corvallis, OR 97333
(509) 595−8990

DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

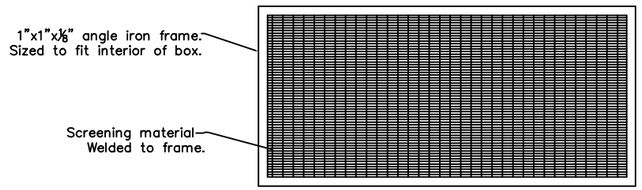
White Ditch Pipe Repalcement/SAR
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

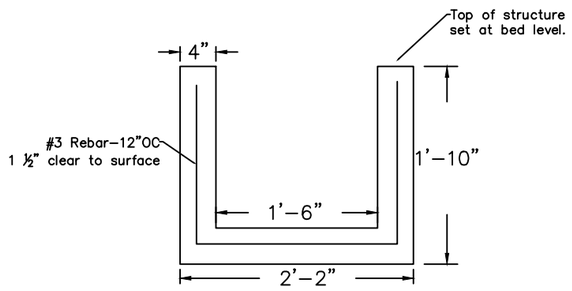
SHEET: 3



Intake Box– Plan



Screen



Intake Box– Section

Details 1

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

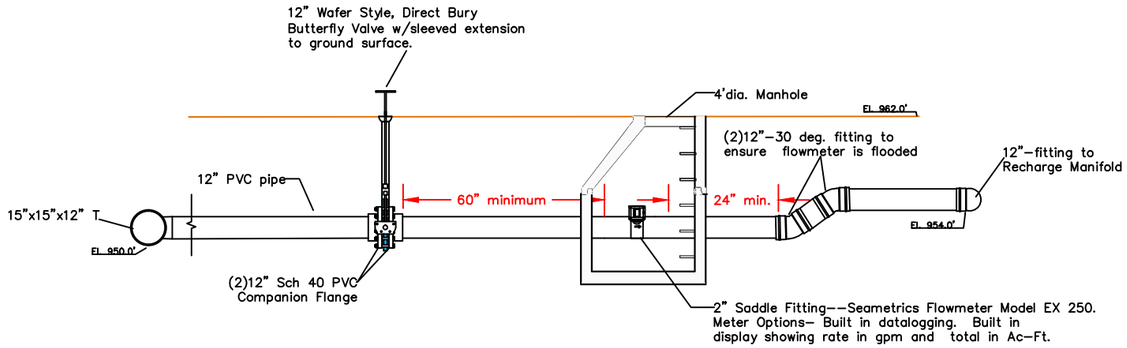
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

White Ditch Pipe Repalcement/SAR
Walla Walla Basin Watershed Council
Milton Freewater, OR

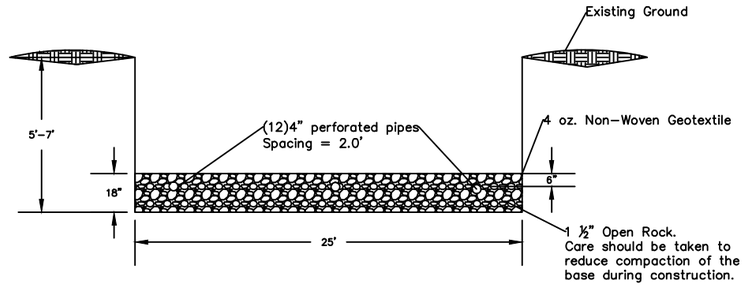
SIGNATURE: _____

SHEET: 4

SHEET NO. 4 OF 5



Flowmeter Vault



Recharge Area– Trench

Construction Notes

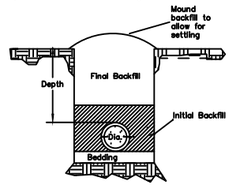
1) Bedding shall be used on foundations containing materials larger than ¾" inch.

2) The initial backfill material shall consist of soil or granular material that is free from rocks greater than ¾" in diameter.

3) The final backfill shall be free from material larger than 3 inches.

4) All exposed pipe and pipe within 12 inches of the ground surface shall be galvanized.

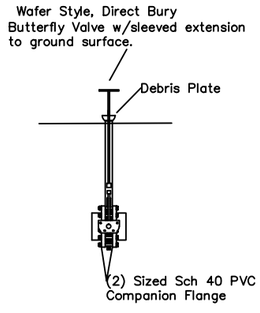
5) Pipe will be installed with no reverse grades unless unavoidable.



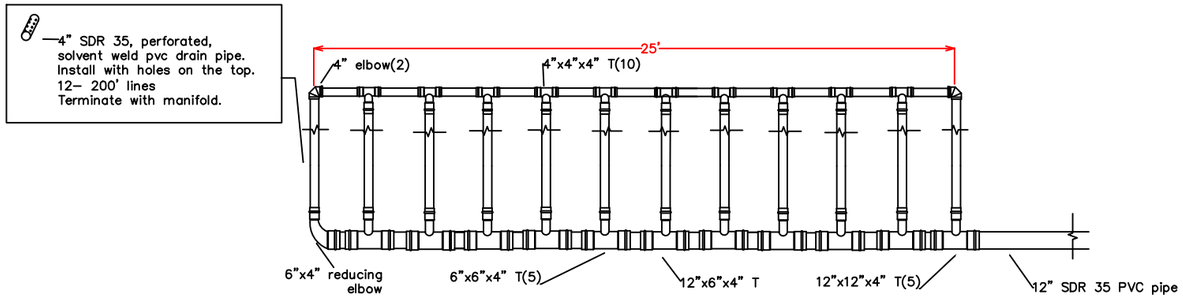
Pipe Specifications:
Diameter (Dia.) = 15"& 12" PVC
Min. Pressure Rating 80 psi

Drawing is not to Scale.

Trench Detail



Butterfly Valve



Recharge Manifold

Details 2

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

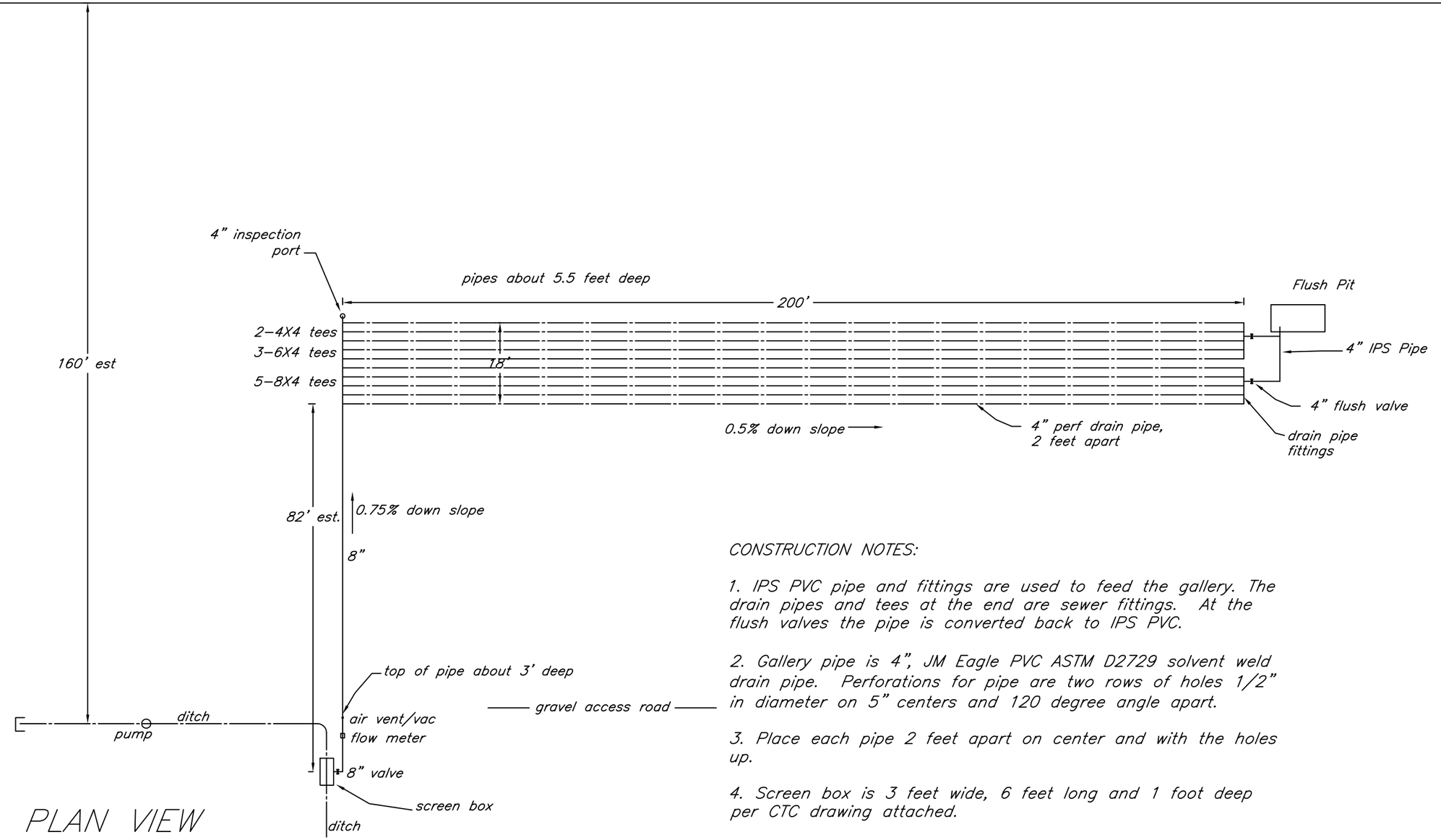
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

White Ditch Pipe Repalcement/SAR
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE:

SHEET: 5

SHEET NO. 5 OF 5



CONSTRUCTION NOTES:

1. IPS PVC pipe and fittings are used to feed the gallery. The drain pipes and tees at the end are sewer fittings. At the flush valves the pipe is converted back to IPS PVC.

2. Gallery pipe is 4", JM Eagle PVC ASTM D2729 solvent weld drain pipe. Perforations for pipe are two rows of holes 1/2" in diameter on 5" centers and 120 degree angle apart.

3. Place each pipe 2 feet apart on center and with the holes up.

4. Screen box is 3 feet wide, 6 feet long and 1 foot deep per CTC drawing attached.

5. Flush pit is earthen and deep enough so that the flush pipe daylights in the pit. Sediment accumulated in the flush pit can be removed using a front end bucket. Initial flushing is suggested at startup, middle and end of infiltration season.

6. Buried PVC pipe needs to be bedded with gravel or soils with no rocks larger than 2 inches.

7. Position screen box so that air vent is on north side of access drive.

FOR REVIEW

		DATE
DESIGN	jaf	8/12
DRAWN	jaf	9/12
CHECKED		
APPROVED		
TITLE		

File: InfGalleries.dwg

FAZIO ENGINEERING
P.O. BOX 246
MILTON–FREEWATER, OR 97862
(541) 938–6084

SITE LAYOUT

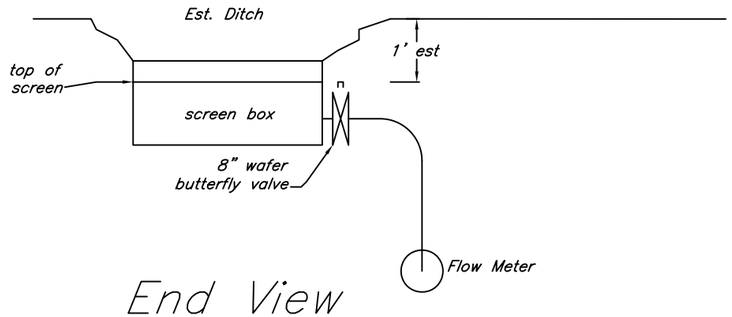
Anspach Recharge
MILTON–FREEWATER, OR

CONSTRUCTION NOTES:

1. The gallery requires 2,000 feet of drian pipe as noted. Cover drain pipe about 2" with gravel, with drain holes up.

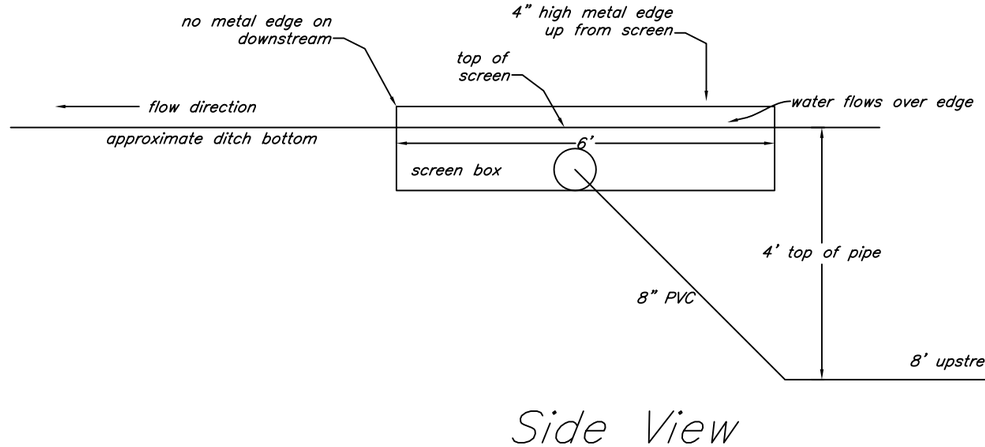
2. Proposed gravel material is 1–1/2" to 3/4" "Switch Yard", Koncrete Industries, or similar angular crushed rock with minimal fines. About 272 yards needed assuming 24' X 204' X 1.5' volume.

3. Filter fabric is a nonwoven geotextile, Mirafi MSCAPE or equivalent. About 544 square yards required, assume 24' X 204'.

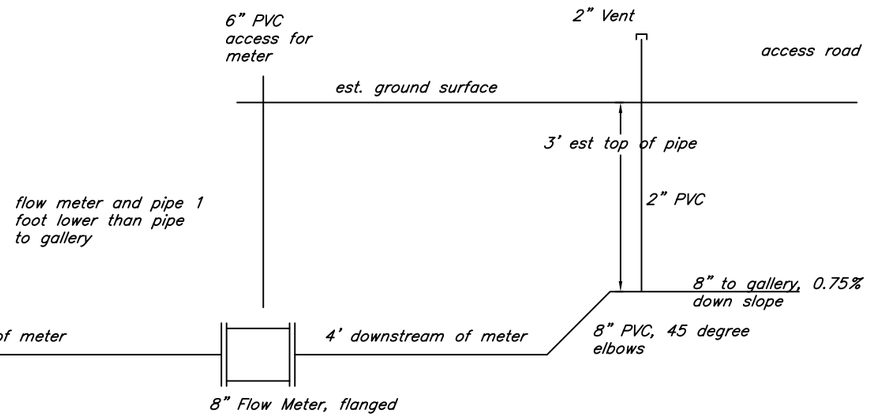


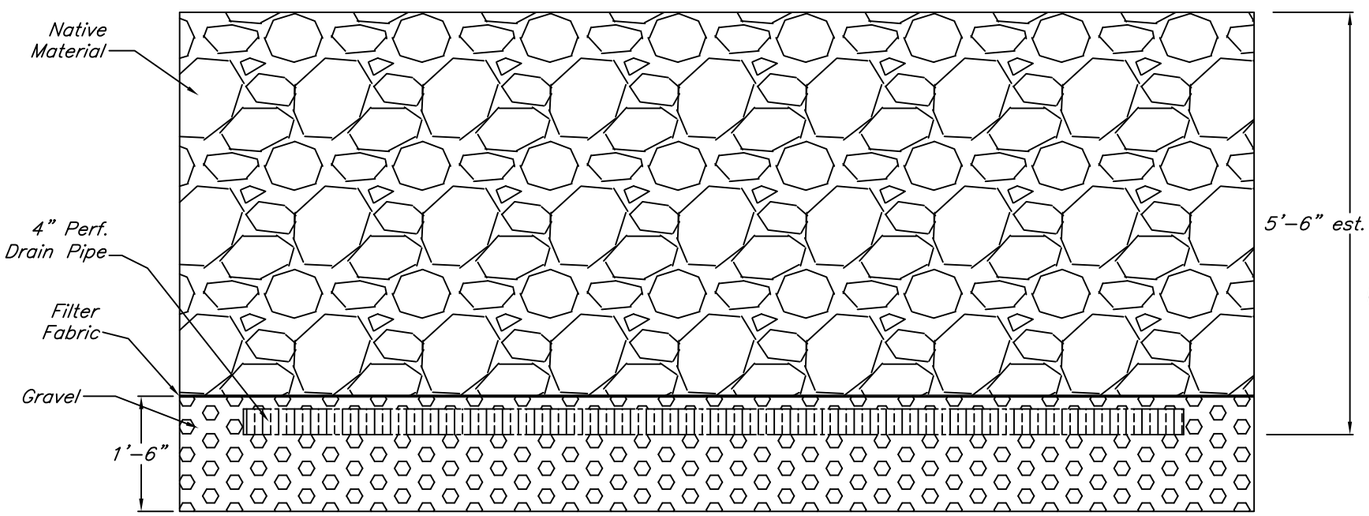
End View

Screen Box Area Details



Side View





Gallery Profile

FOR REVIEW

DESIGN	jaf
DRAWN	jaf
CHECKED	
APPROVED	
TITLE	
DATE	8/12 9/12

File: InfGalleries.dwg

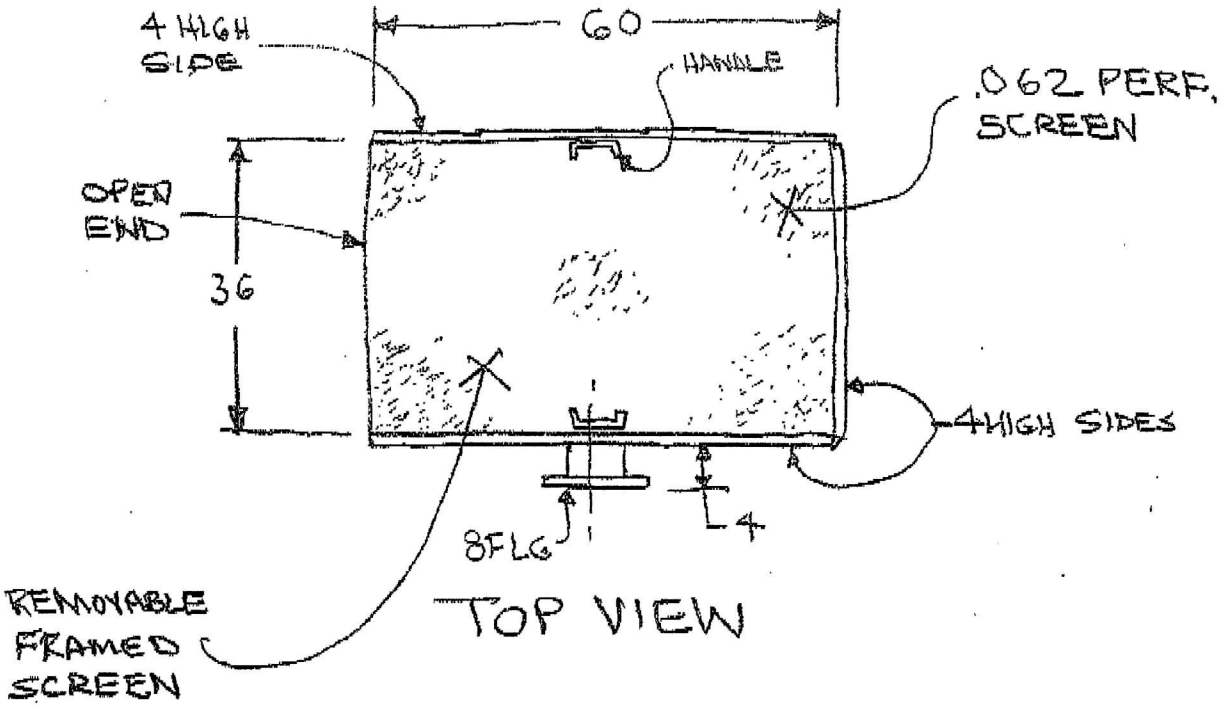
FAZIO ENGINEERING
P.O. BOX 246
MILTON–FREEWATER, OR 98762
(541) 938–6084

DETAILS
Anspach Recharge
MILTON–FREEWATER, OR

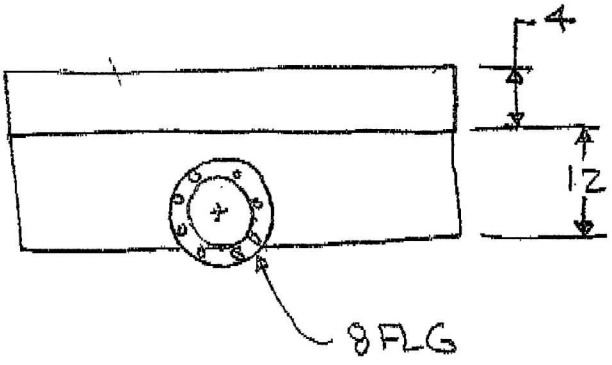
SHEET 2 OF 2

460 McLaughlin Road
Yakima, WA 98908 USA
INNOVATIVE ENGINEERING AND MANUFACTURING

PROJECT JOHN FAZIO SHT 1 OF 1
SCREEN BOX DATE 4SEPT 12
BY B.L.B. JOB NO. ~

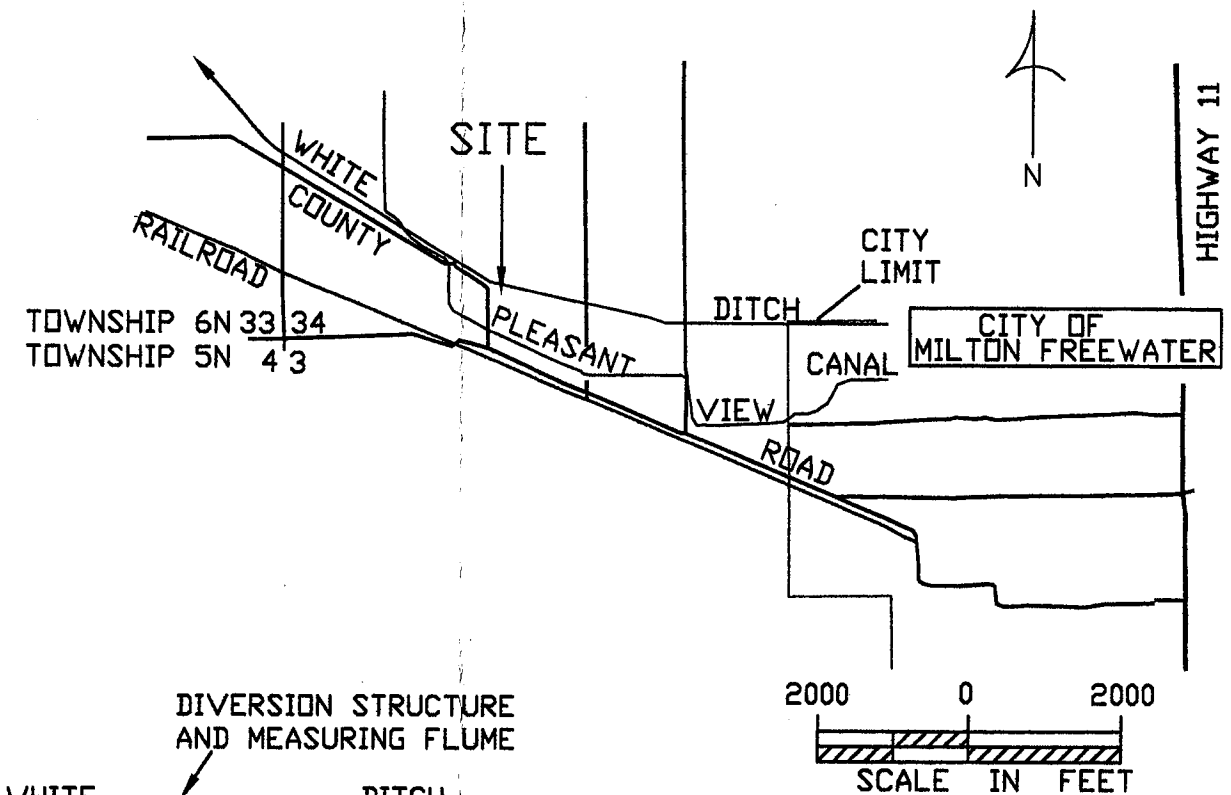


TOP VIEW



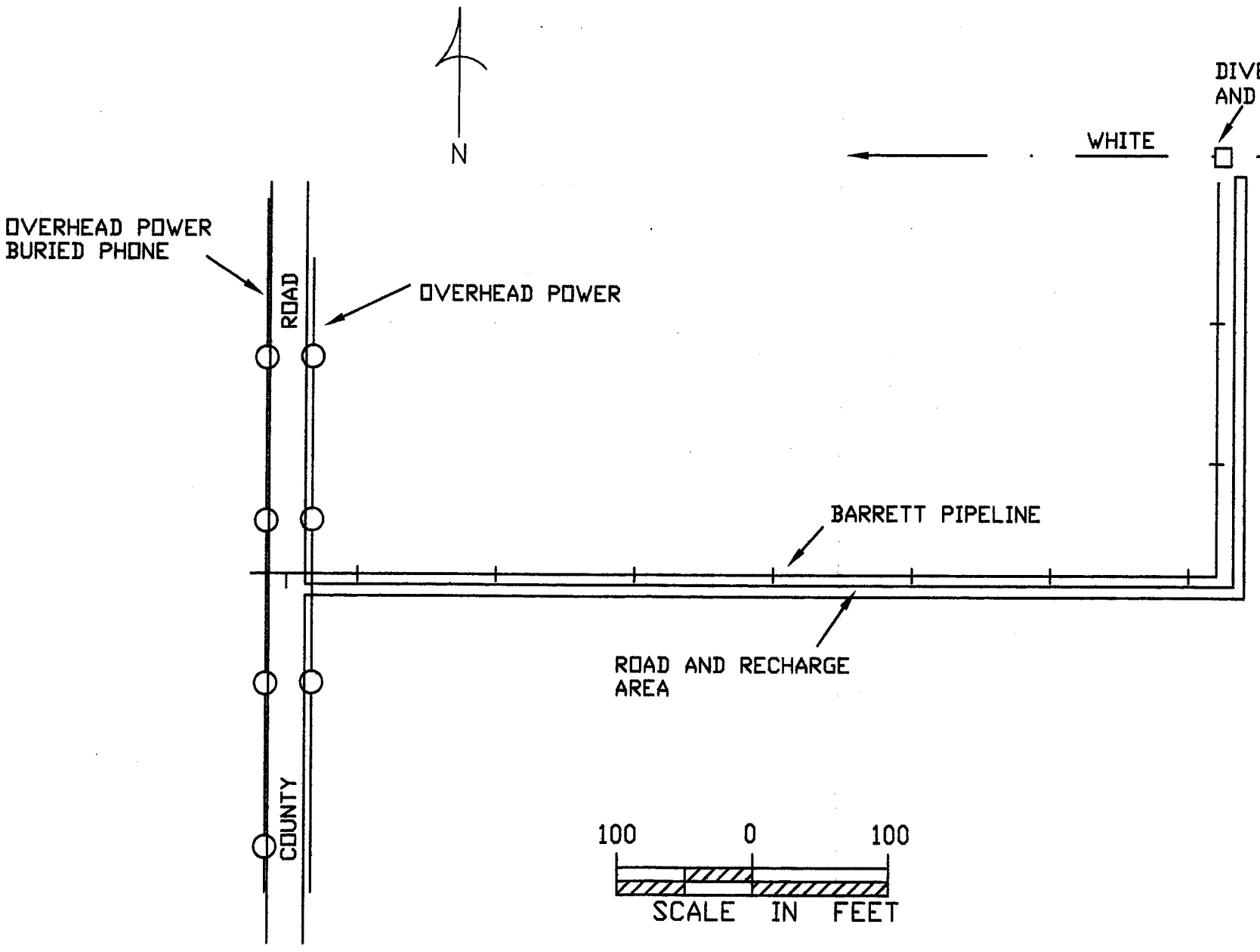
SIDE VIEW

LOCATION MAP



RANGE 35 E

PIPELINE PLAN VIEW



AS BUILT

COMPLETED
CONTRACTOR

REGISTERED PROFESSIONAL ENGINEER
6476
Bernard J. Hewes
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2013

Bernard Hewes, BHES/29/2012 145 Pbarrechgsite.dwg

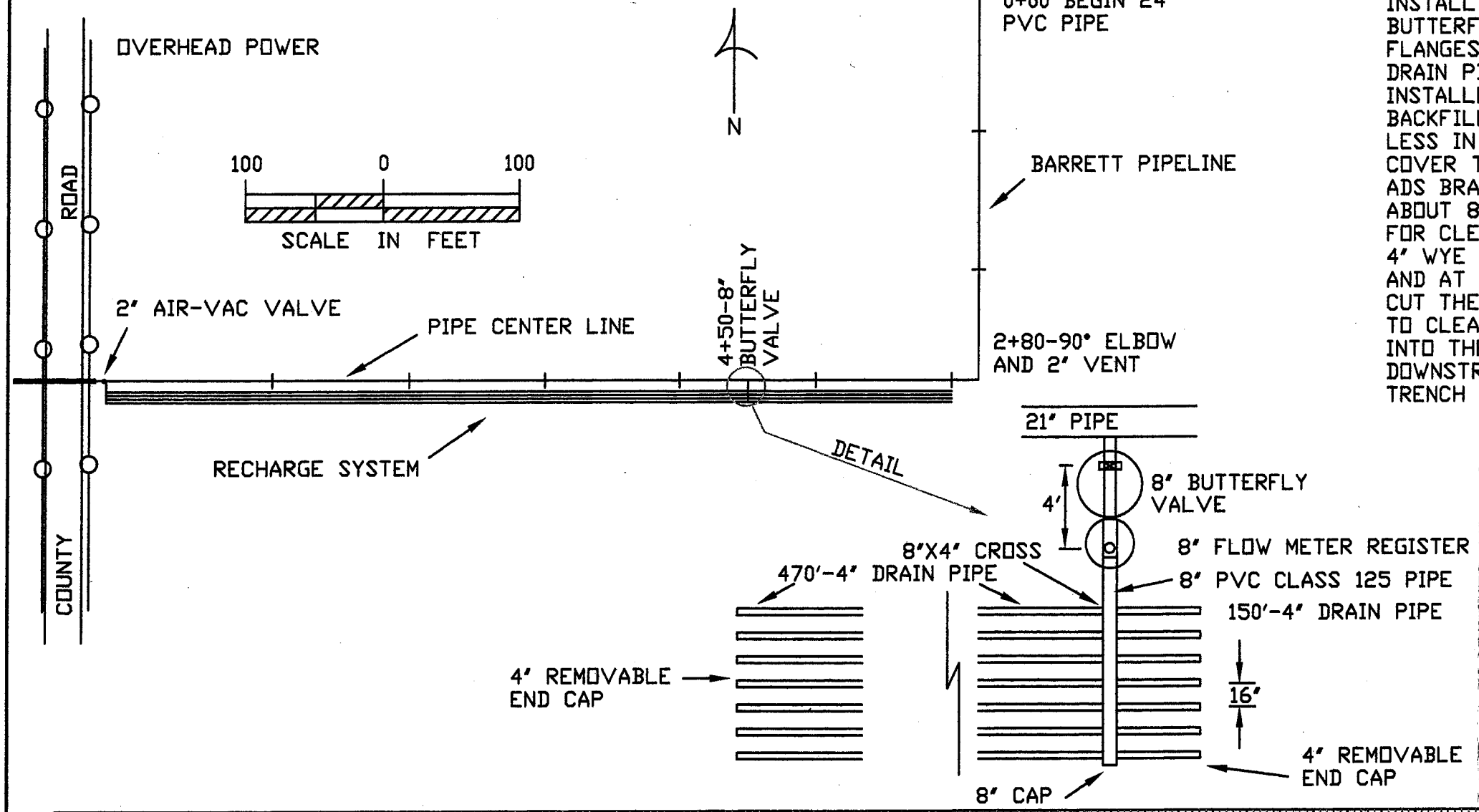
DESIGNED B. HEWES DATE 10/11
CHECKED
APPROVED

WWBWC/HBDIC BARRETT RECHARGE
LOCATION MAP & SITE PLAN
UMATILLA COUNTY, OREGON

R. H. ENGINEERING

CAD FILE
barrechgsite

SHEET 1
OF 2



NOTES

INSTALL AN 8" FLOW METER A MINIMUM OF 4' FROM THE BUTTERFLY VALVE, NEED 4-8" VAN STONE STYLE PVC FLANGES.

DRAIN PIPE TO BE PVC PERFORATED LEACH FIELD PIPE INSTALLED WITH THE SLOTS FACING DOWN.

BACKFILL THE 4" PIPE WITH WASHED GRAVEL 2" OR LESS IN DIAMETER, ABOUT 300 CUBIC YARDS NEEDED.

COVER THE GRAVEL BACKFILL WITH GEOTEXTILE FABRIC ADS BRAND 4000 NON-WOVEN OR EQUIVALENT. NEED ABOUT 8000 SQUARE FEET.

FOR CLEANING SEDIMENT FROM THE 4" PIPE INSTALL A 4" WYE AT THE UPSTREAM END OF EACH OF THE PIPES AND AT 100' SPACING DOWNSTREAM. CAP EACH WYE AND CUT THE FILTER FABRIC TO FIT AROUND THE WYE.

TO CLEAN THE PIPE INSERT A HIGH PRESSURE HOSE INTO THE UPSTREAM WYE AND FLUSH THE SEDIMENT DOWNSTREAM. AT THE DOWNSTREAM END EXCAVATE A TRENCH TO COLLECT THE SEDIMENT.

Bernard Hewes, 10/5/2012 2:22 PM barrechg.dwg

DATE

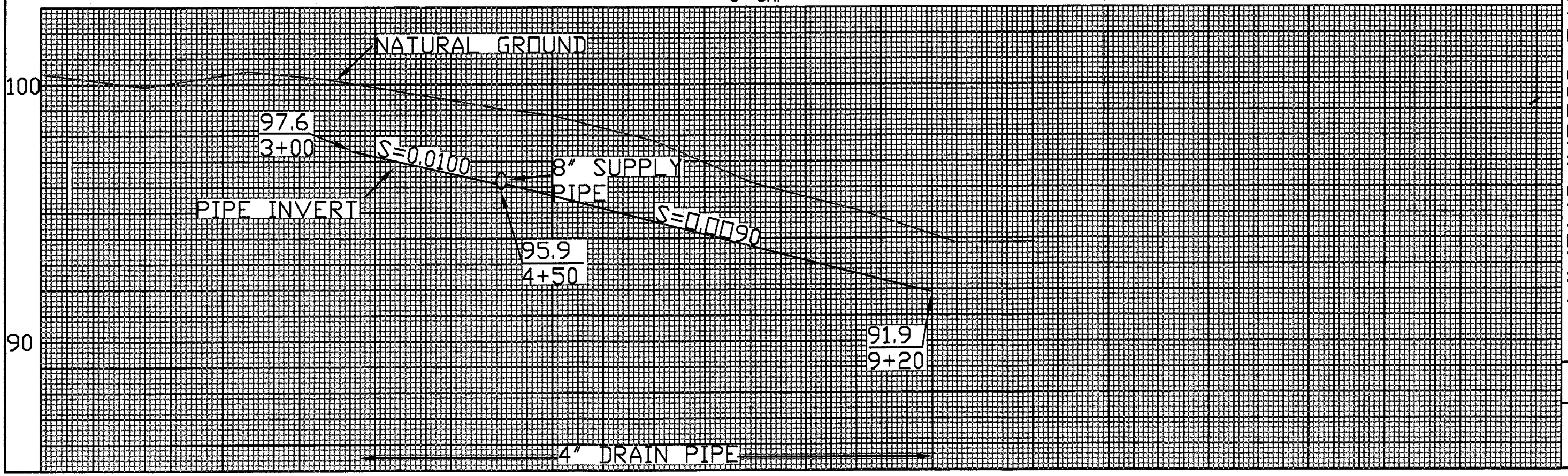
DESIGNED B. HEWES 10/11

PLOTTED

APPROVED

REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2013



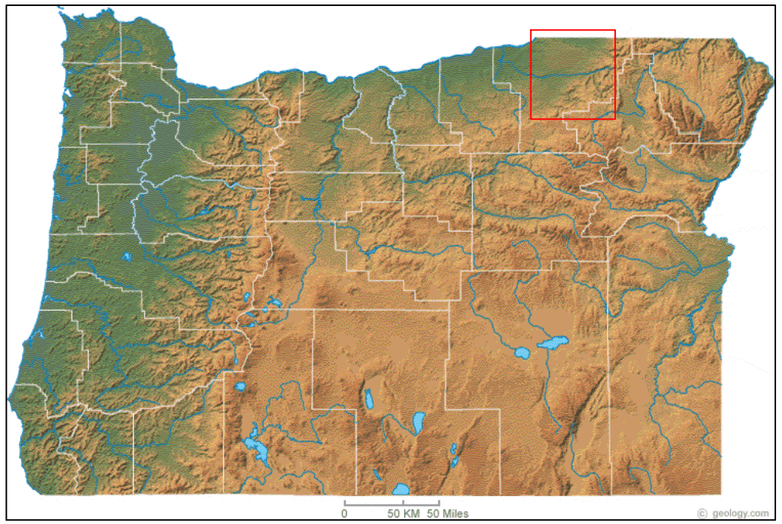
WWBWC/HBDIC BARRETT RECHARGE

PIPE PLAN & PROFILE

UMATILLA COUNTY, OREGON

CAD FILE barrechg

SHEET 2 OF 2



LOCATION MAP

Chuckhole
Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council

INDEX OF DRAWINGS

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Cover Sheet

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

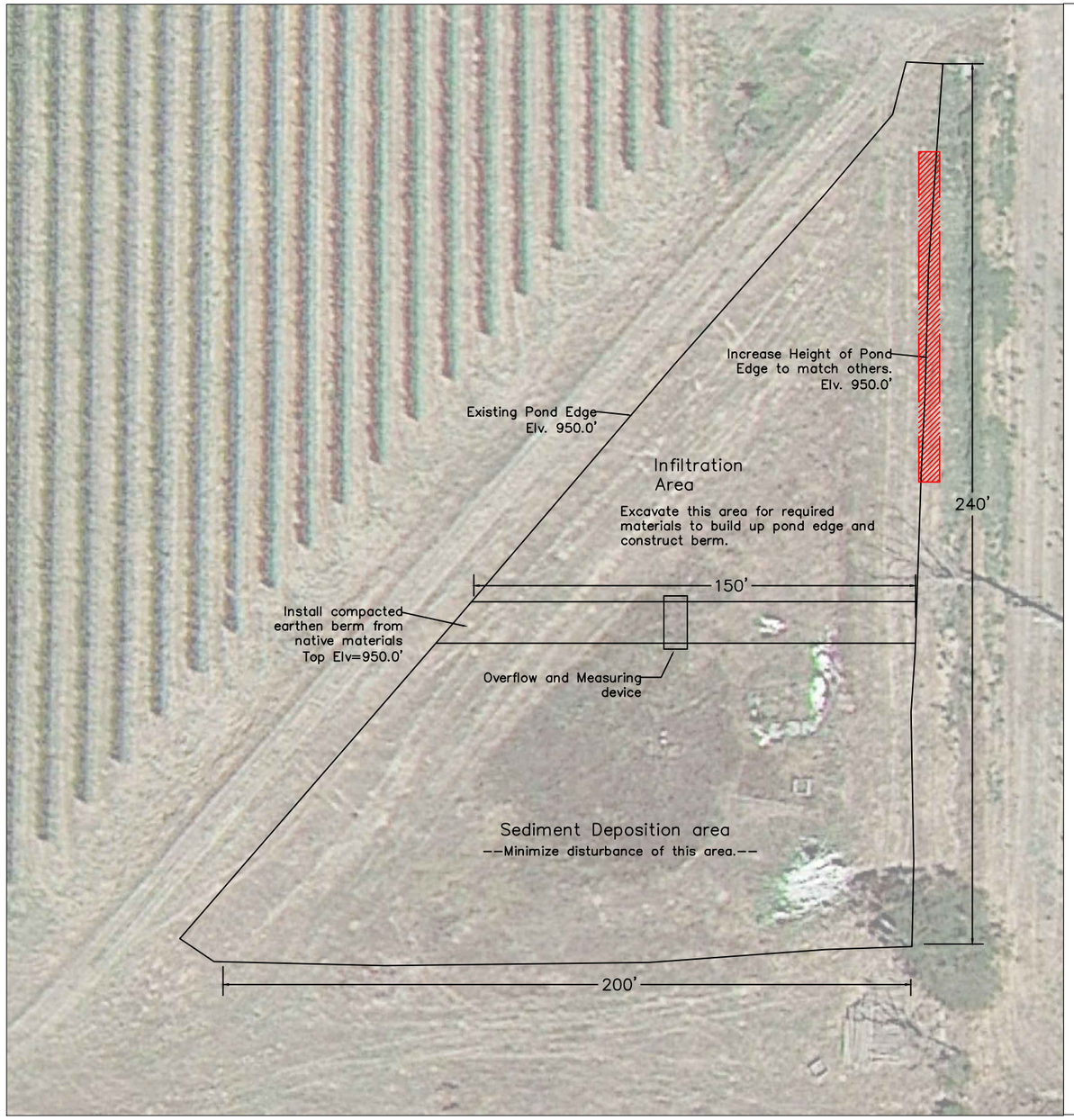
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

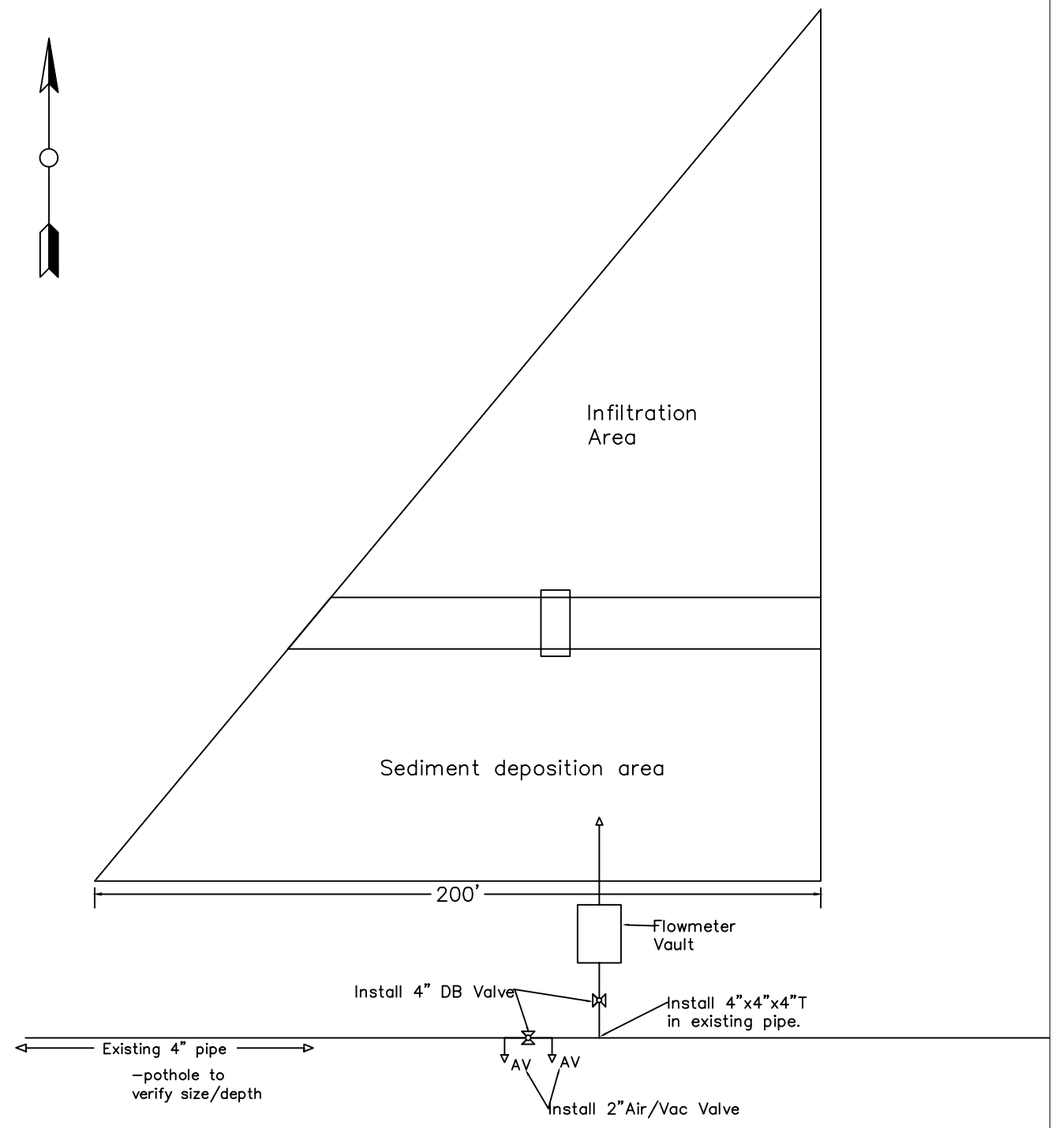
Chuckhole Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 1

SHEET NO. 1 OF 4





--All pipe, valves and fittings shall have at least the same pressure rating as existing materials.--

Plan View

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Milton Freewater, OR

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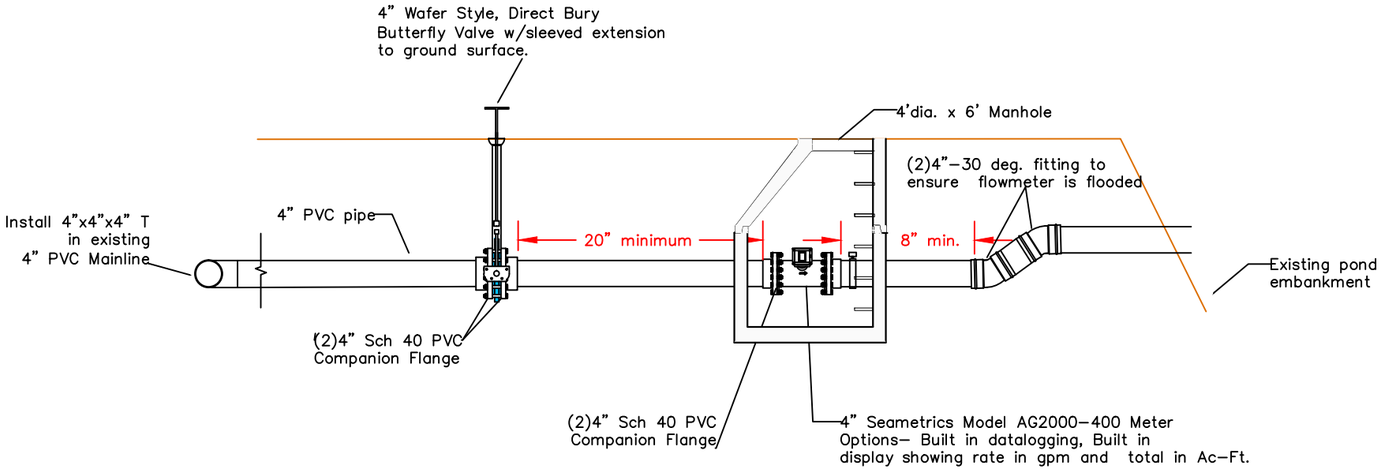
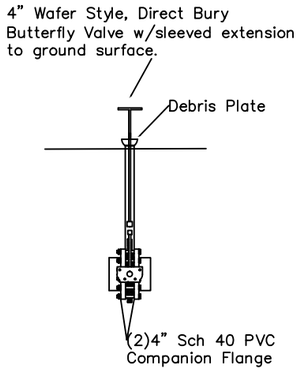
SHEET: 2

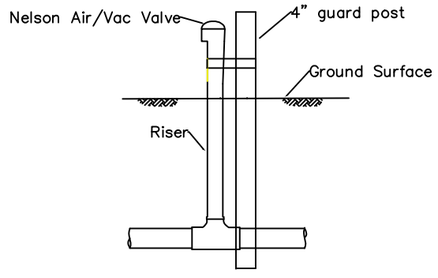
SHEET NO. 2 OF 4



Flowmeter Vault



Butterfly Valve



Air Vent

Details 1

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Milton Freewater, OR

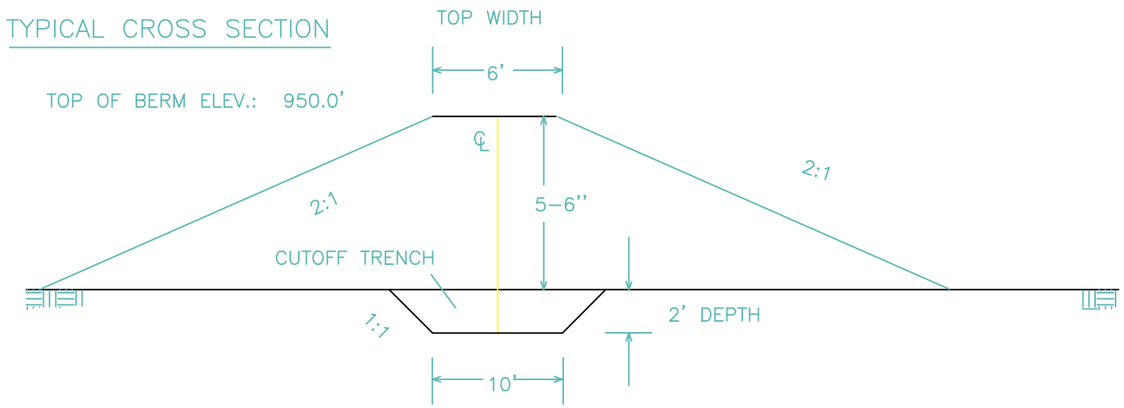
SIGNATURE:

SHEET: 3

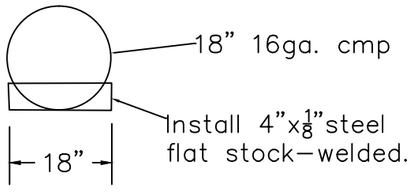
SHEET NO. 3 OF 4

Notes–

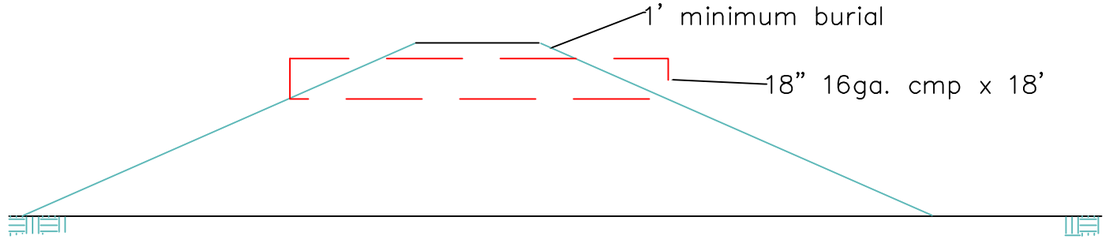
1) Organic materials shall not be used in the berm.
2) Berm shall be compacted in 6" lifts to 95% Proctor.
3) Contractor responsible to add water as required for compaction.



Berm– Section View



Overflow Culvert with Weir



Overflow– Section View

Details 2

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Corvallis, OR 97333
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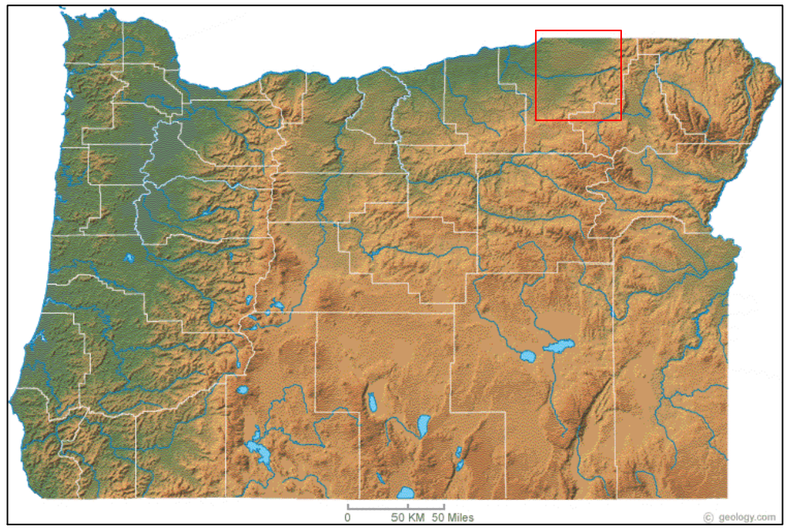
Milton Freewater, OR

SIGNATURE:

SHEET: 4

SHEET NO. 4 OF 4



LOCATION MAP

Trolley Lane
Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council

INDEX OF DRAWINGS

GENERAL NOTES

1. The attached Material and Installation Specifications are part of this plan and shall govern the installation of this project.
2. This installation shall be constructed to the lines and grades as shown on the drawings and detailed in the construction specificatoins.
3. Construction activities shall be performed in a manner that minimizes soil, water, and air pollution.
4. Construction activities will be conducted in a manner consistent with all safety regulations for work activities necessary for this installation.
5. No representation is made of any utilities, public or private. Absence of utilities on these drawings does not assure that no utilities are present. If buried utilities are shown, the location and depth are approximate. The exact location and depth of any utility must be determined by the utility company prior to any excavation.
6. Contractor is responsible for acquiring and complying with all permits.

UTILITIES

Oregon State Law requires Owners and Operators to notify utilities two business days before construction begins to have underground utilities located. To comply with the law call the Utilities Underground Location Center at: 1-800-332-2344

Review and Acceptance

I have reviewed the Drawings and Construction specifications provided and find them to be acceptable for installation. I also acknowledge that any modifications shall be approved by the Engineer prior to installation. I also acknowledge that I have received a copy of this plan.

Owner _____ Date _____

Cover Sheet

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Engineering
Corvallis, OR 97333
(509) 595-8990

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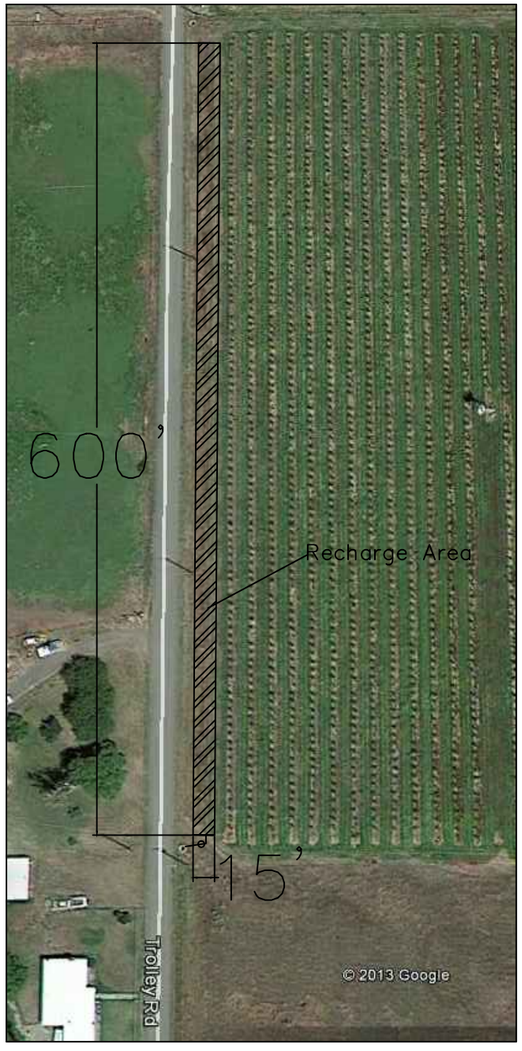
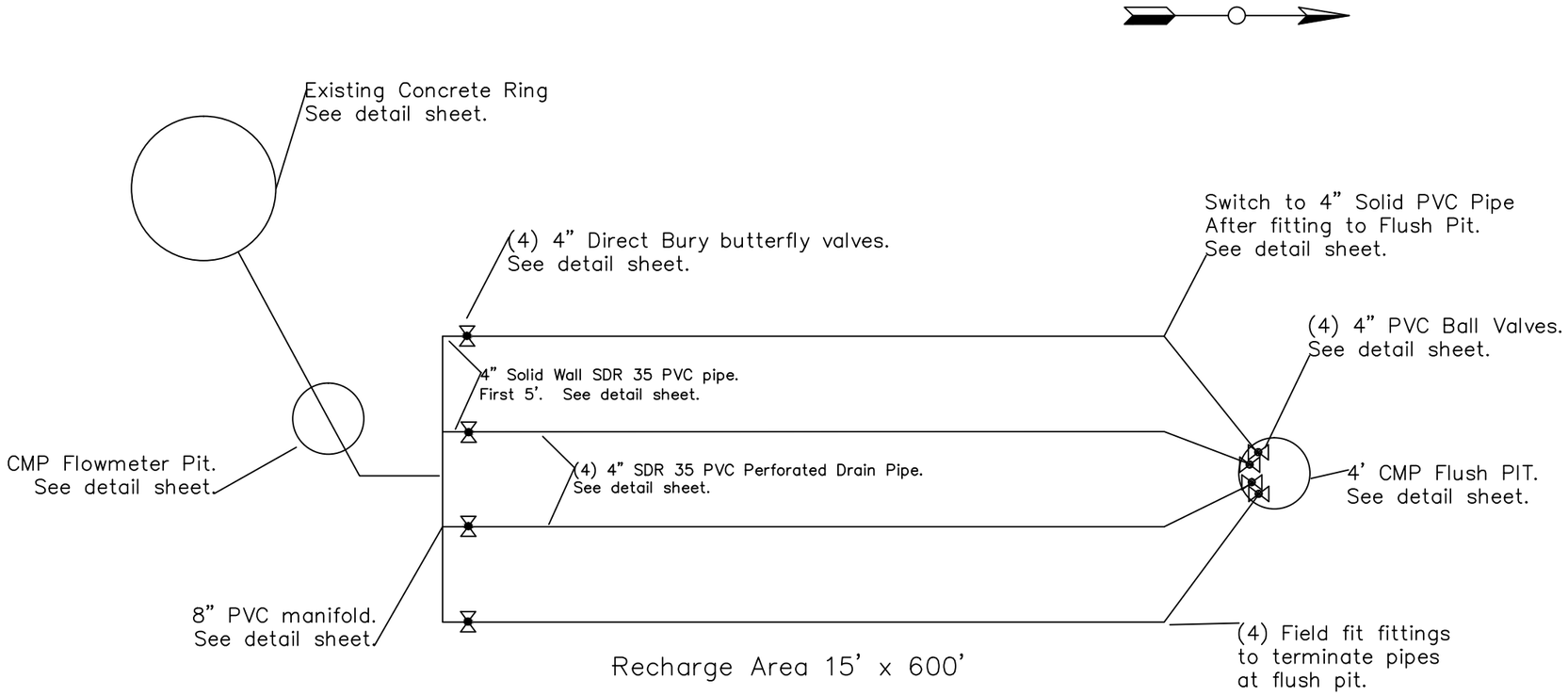
Trolley Lane Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 1

SHEET NO. 1 OF 4





Set invert at manifold to 5.0' below invert of pipe in concrete ring. Invert Elv= 712.0 Slope= 0.005 ft/ft. Approximate 7' burial at start tapering to 5' burial at end.

Plan View

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REVISED DATE: _____

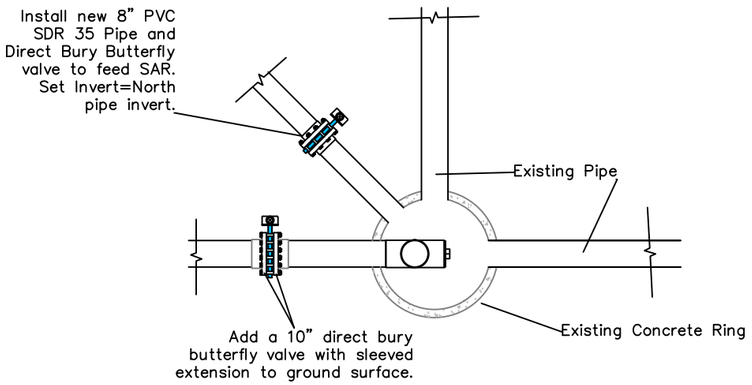
Trolley Lane Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

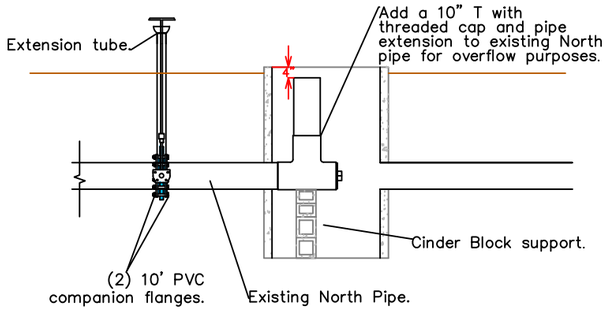
SHEET: 2

SHEET NO. 2 OF 4

Existing Concrete Ring

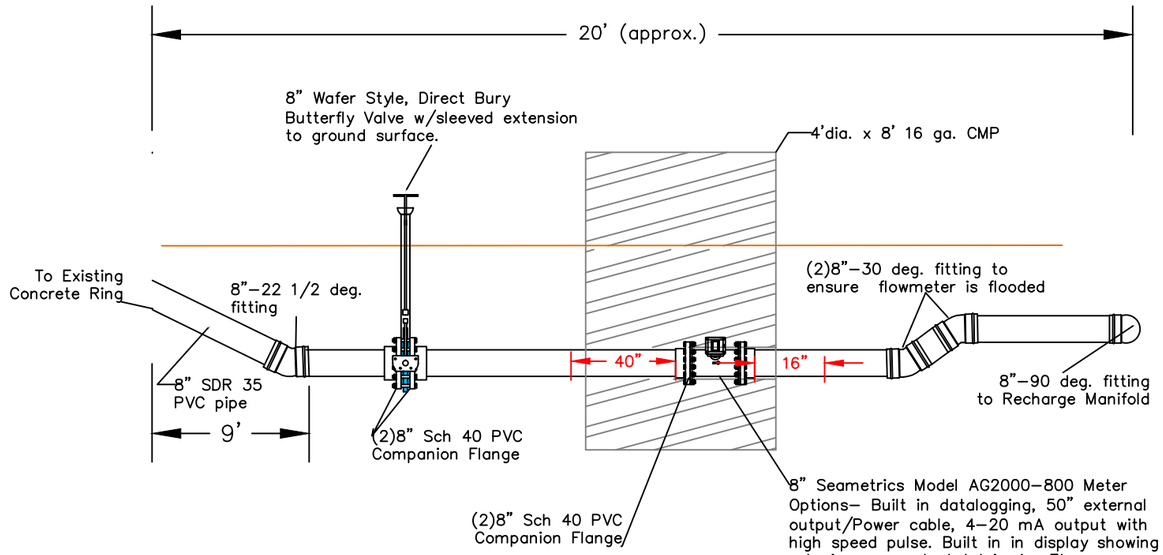


Plan View



Section View

CMP Flowmeter Pit



Details 1

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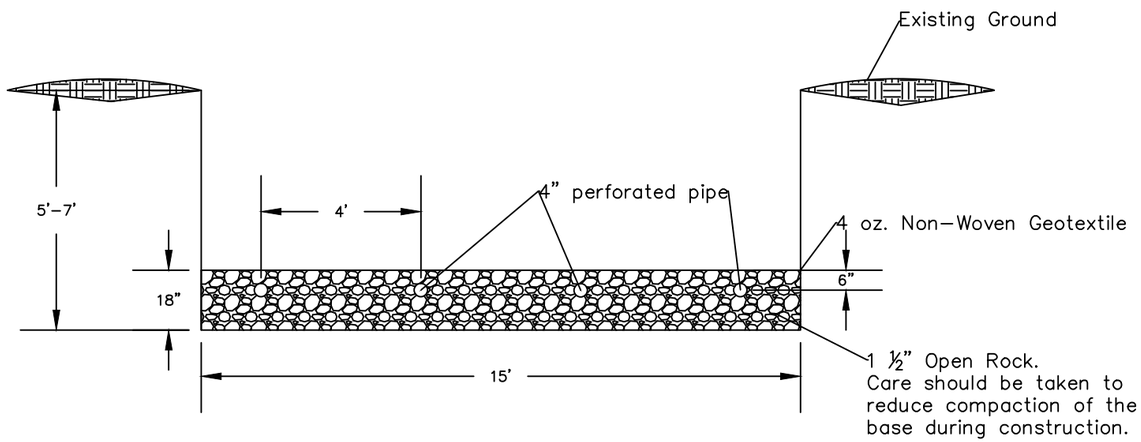
Trolley Lane Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

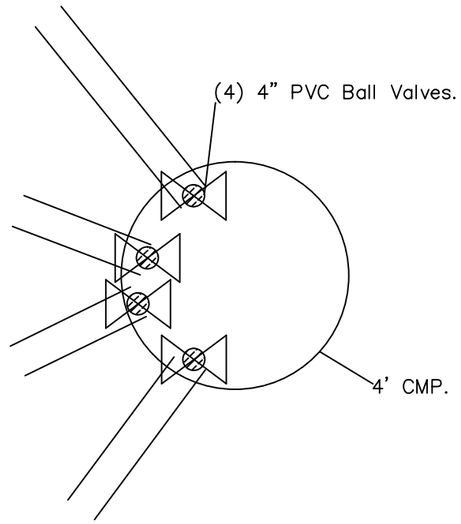
SHEET: 3

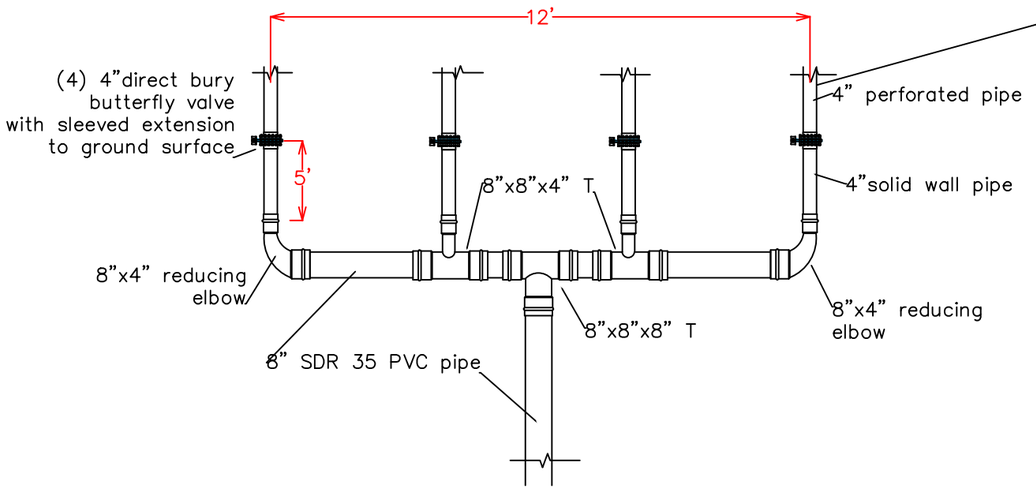
SHEET NO. 3 OF 4

Recharge Area– Trench

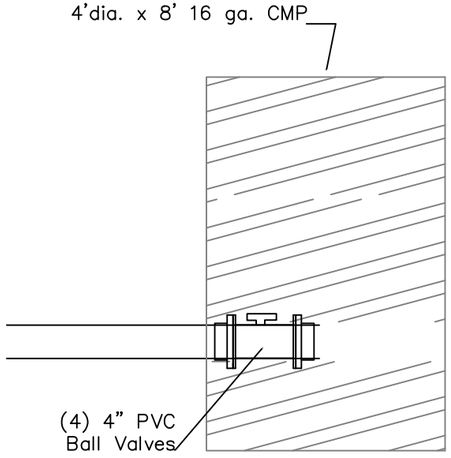


Flush Pit





4" SDR 35, perforated,
solvent weld pvc drain pipe.
Install with holes on the top.
4– 600' lines



Details 2

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Trolley Lane Recharge Project
Walla Walla Basin Watershed Council
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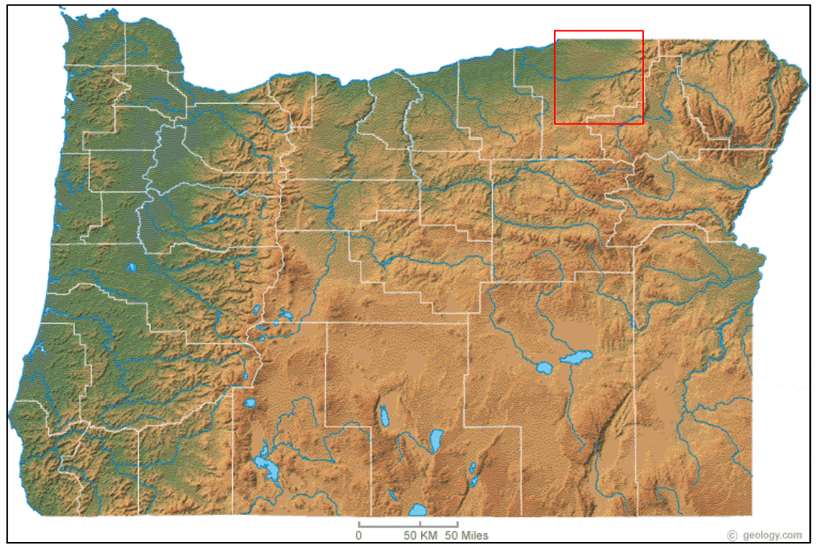
SIGNATURE: _____

SHEET: 4

SHEET NO. 4 OF 4



LOCATION MAP

Fruitvale
Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council

INDEX OF DRAWINGS

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Fruitvale Recharge Project
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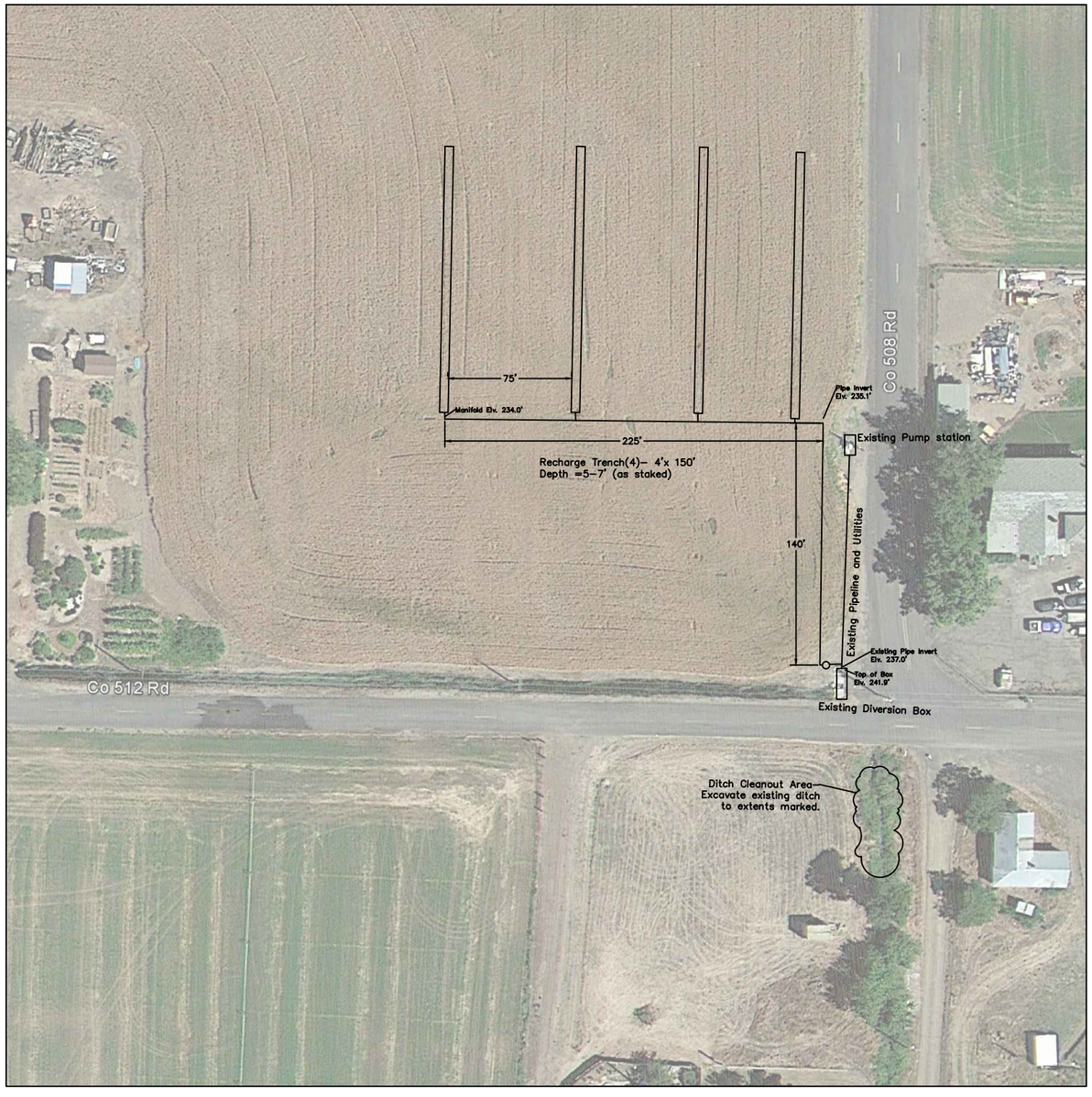
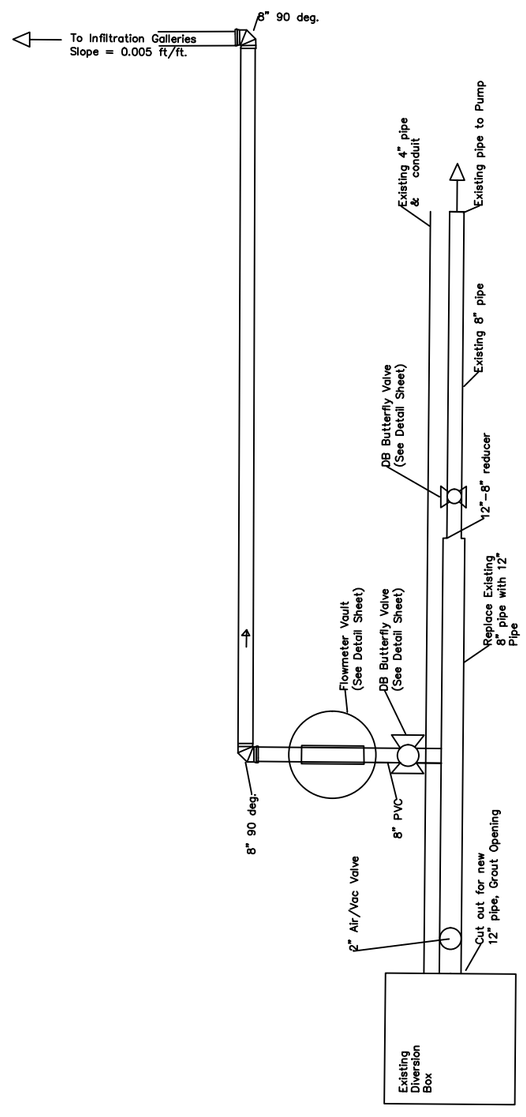
SHEET NO. 1 OF 4





Plan View

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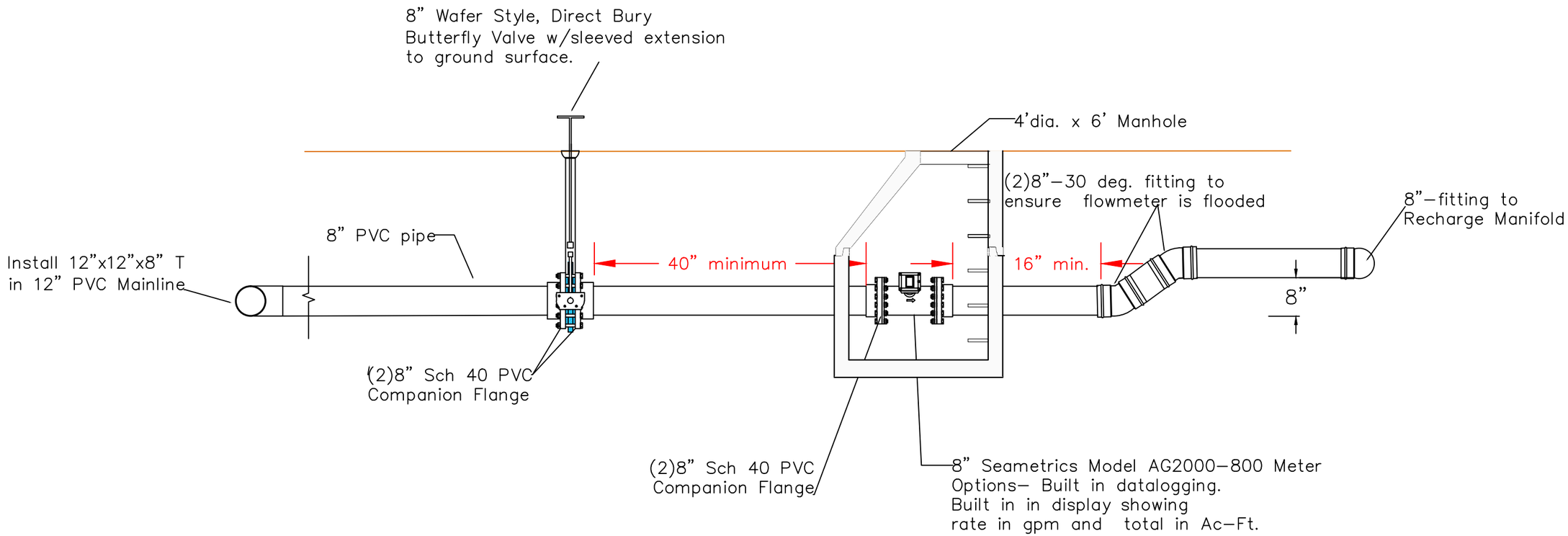

Flowmeter Vault

Details 1

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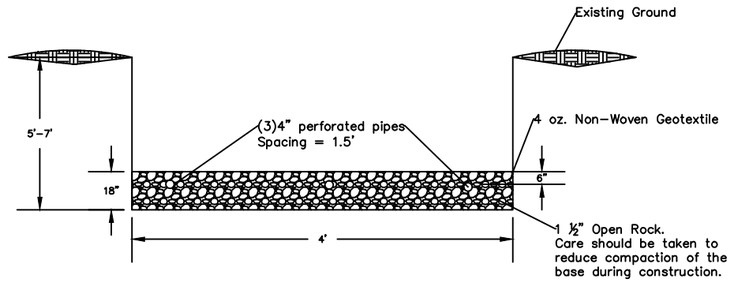
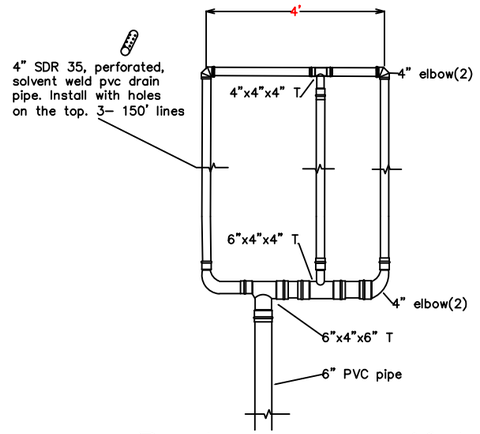


Recharge Area– Trench



Recharge Manifold

Construction Notes

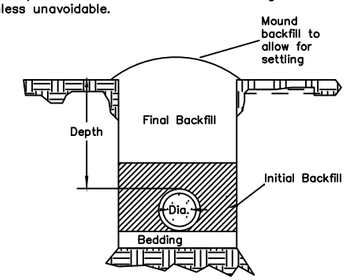
1) Bedding shall be used on foundations containing materials larger than ¾" inch.

2) The initial backfill material shall consist of soil or granular material that is free from rocks greater than ¾" in diamter.

3) The final backfill shall be free from material larger than 3 inches.

4) All exposed pipe and pipe within 12 inches of the ground surface shall be galvanized.

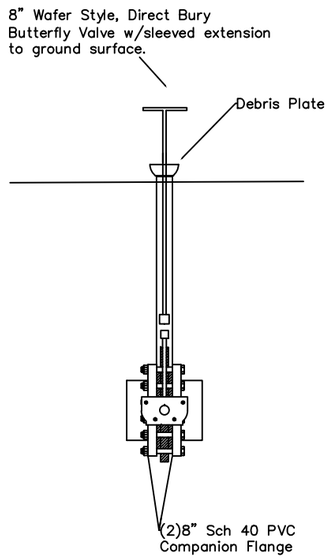
5) Pipe will be installed with no reverse grades unless unavoidable.



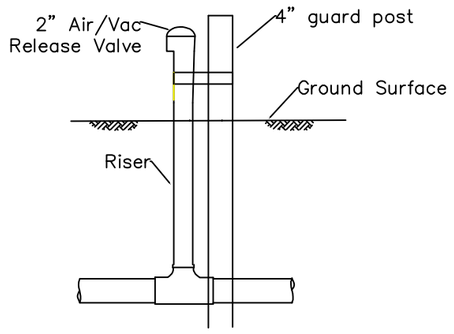
Pipe Specifications:
Diameter (Dia.) = 12"& 8" PVC
Min. Pressure Rating 80 psi

Drawing is not to Scale.

Trench Detail–Pipeline



Butterfly Valve



Air Vent

Details 2

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Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE:

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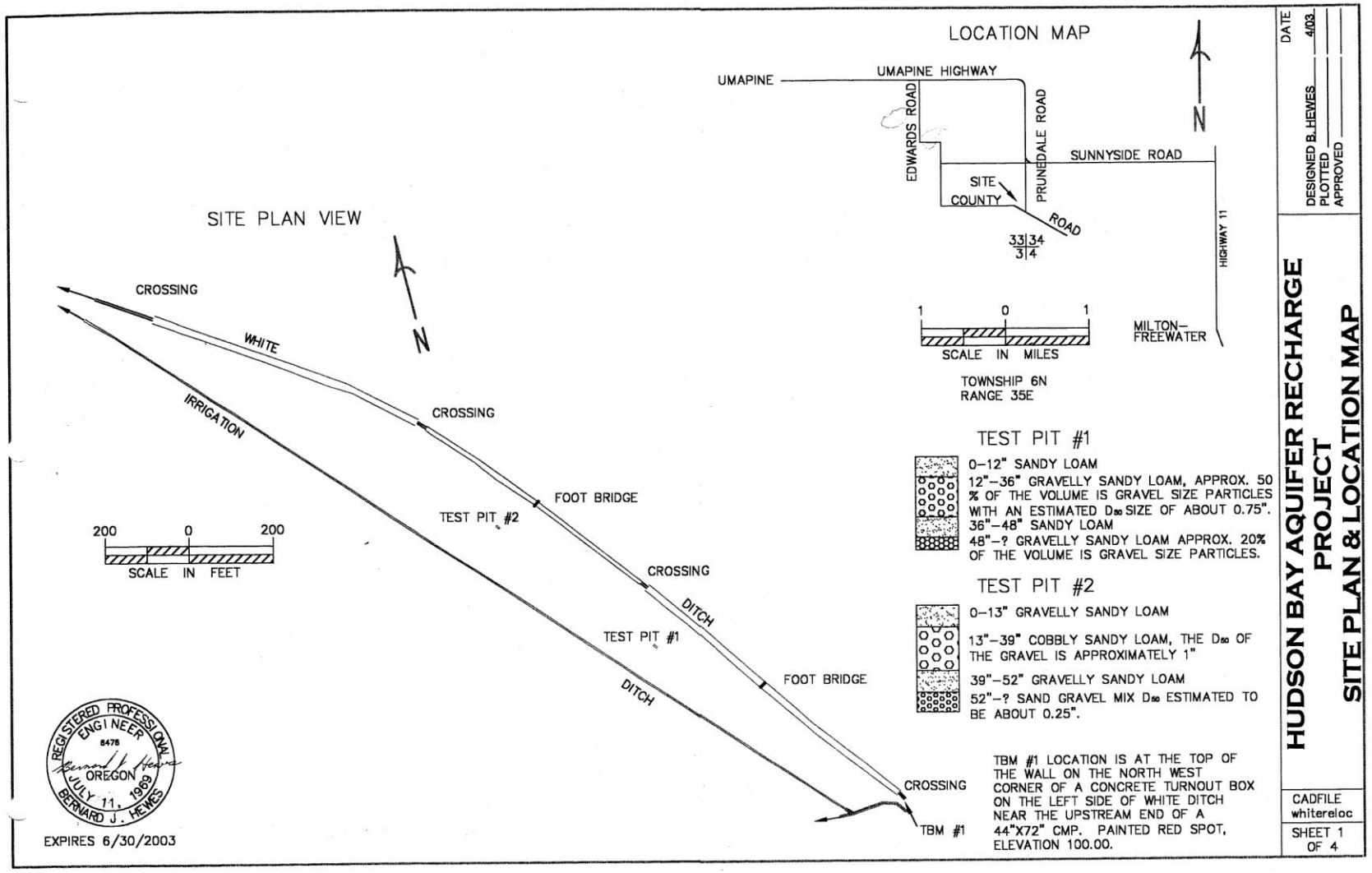
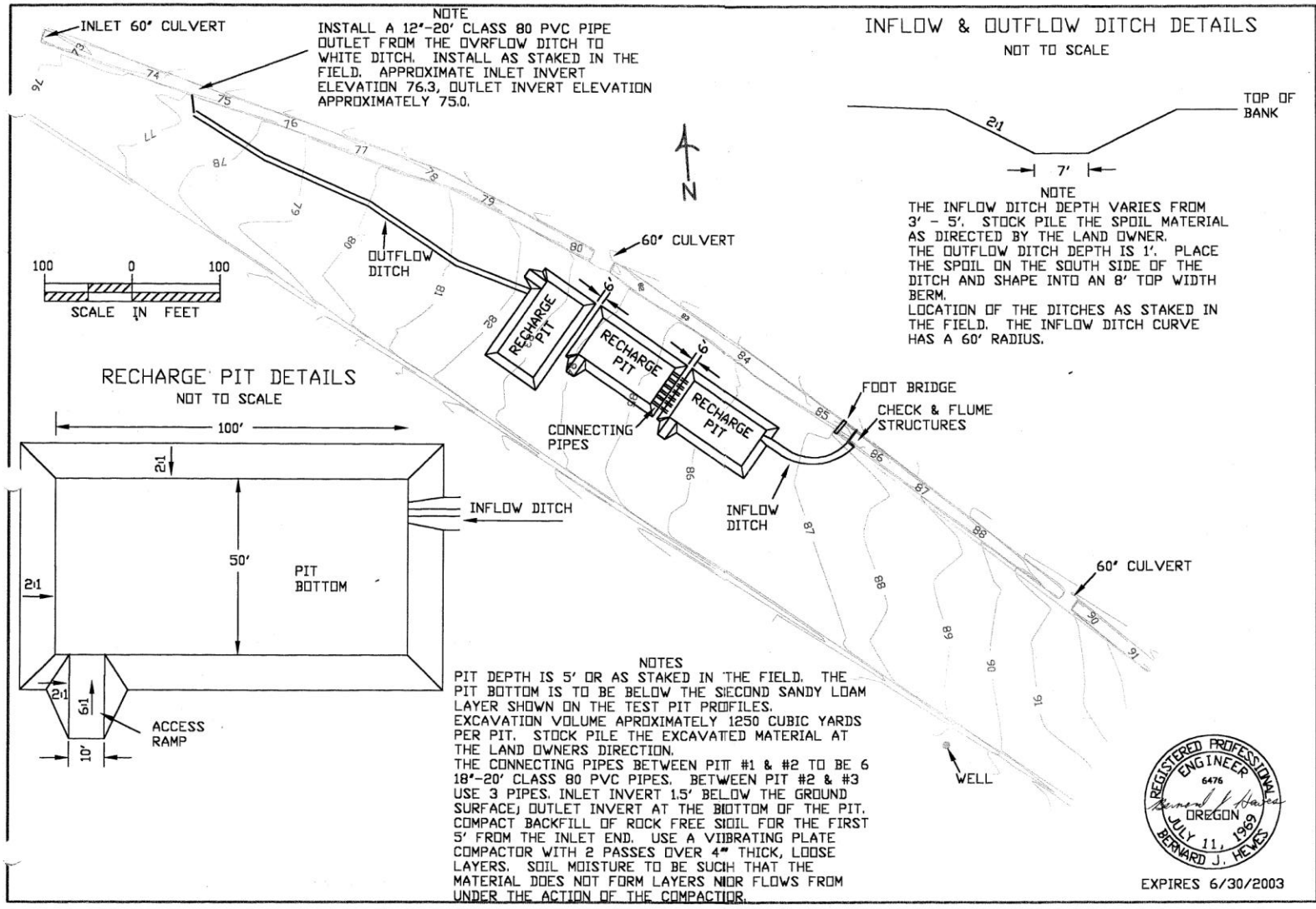
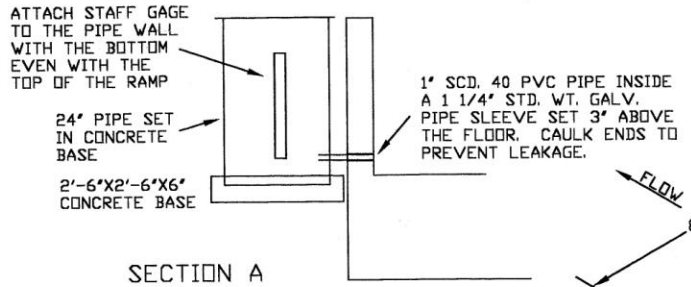
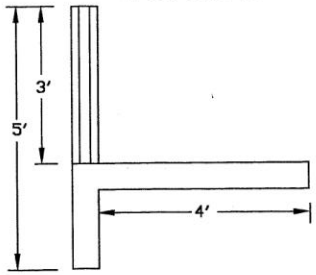

LOCATION MAP
UMAPINE
UMAPINE HIGHWAY
EDWARDS ROAD
PRUNEDALE ROAD
SUNNYSIDE ROAD
SITE
COUNTY
ROAD
33|34
3|4
HIGHWAY 11
MILTON–FREEWATER
1 0 1
SCALE IN MILES
TOWNSHIP 6N
RANGE 35E
SITE PLAN VIEW
CROSSING
WHITE
IRRIGATION
CROSSING
FOOT BRIDGE
TEST PIT #2
CROSSING
DITCH
TEST PIT #1
FOOT BRIDGE
DITCH
CROSSING
TBM #1
200 0 200
SCALE IN FEET
TEST PIT #1
0–12" SANDY LOAM
12"–36" GRAVELLY SANDY LOAM, APPROX. 50 % OF THE VOLUME IS GRAVEL SIZE PARTICLES WITH AN ESTIMATED D∞ SIZE OF ABOUT 0.75".
36"–48" SANDY LOAM
48"–? GRAVELLY SANDY LOAM APPROX. 20% OF THE VOLUME IS GRAVEL SIZE PARTICLES.
TEST PIT #2
0–13" GRAVELLY SANDY LOAM
13"–39" COBBLY SANDY LOAM, THE D∞ OF THE GRAVEL IS APPROXIMATELY 1"
39"–52" GRAVELLY SANDY LOAM
52"–? SAND GRAVEL MIX D∞ ESTIMATED TO BE ABOUT 0.25".
TBM #1 LOCATION IS AT THE TOP OF THE WALL ON THE NORTH WEST CORNER OF A CONCRETE TURNOUT BOX ON THE LEFT SIDE OF WHITE DITCH NEAR THE UPSTREAM END OF A 44"X72" CMP. PAINTED RED SPOT, ELEVATION 100.00.
REGISTERED PROFESSIONAL ENGINEER
8478
OREGON
JULY 11, 1969
BERNARD J. HEWES
EXPIRES 6/30/2003
DATE 4/03
DESIGNED B. HEWES
PLOTTED
APPROVED
HUDSON BAY AQUIFER RECHARGE PROJECT
SITE PLAN & LOCATION MAP
CADFILE whiteeloc
SHEET 1 OF 4

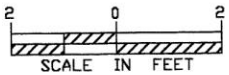

INLET 60" CULVERT
NOTE
INSTALL A 12'-20' CLASS 80 PVC PIPE OUTLET FROM THE OVRFLOW DITCH TO WHITE DITCH. INSTALL AS STAKED IN THE FIELD. APPROXIMATE INLET INVERT ELEVATION 76.3, OUTLET INVERT ELEVATION APPROXIMATELY 75.0.
INFLOW & OUTFLOW DITCH DETAILS
NOT TO SCALE
TOP OF BANK
2:1
7'
NOTE
THE INFLOW DITCH DEPTH VARIES FROM 3' - 5'. STOCK PILE THE SPOIL MATERIAL AS DIRECTED BY THE LAND OWNER.
THE OUTFLOW DITCH DEPTH IS 1'. PLACE THE SPOIL ON THE SOUTH SIDE OF THE DITCH AND SHAPE INTO AN 8' TOP WIDTH BERM.
LOCATION OF THE DITCHES AS STAKED IN THE FIELD. THE INFLOW DITCH CURVE HAS A 60' RADIUS.
N
OUTFLOW DITCH
60" CULVERT
100 0 100
SCALE IN FEET
RECHARGE PIT
RECHARGE PIT
RECHARGE PIT
6'
6'
CONNECTING PIPES
FOOT BRIDGE
CHECK & FLUME STRUCTURES
INFLOW DITCH
INFLOW DITCH
60" CULVERT
WELL
RECHARGE PIT DETAILS
NOT TO SCALE
100'
2:1
50'
PIT BOTTOM
2:1
2:1
6:1
ACCESS RAMP
10'
NOTES
PIT DEPTH IS 5' OR AS STAKED IN THE FIELD. THE PIT BOTTOM IS TO BE BELOW THE SECOND SANDY LOAM LAYER SHOWN ON THE TEST PIT PROFILES.
EXCAVATION VOLUME APROXIMATELY 1250 CUBIC YARDS PER PIT. STOCK PILE THE EXCAVATED MATERIAL AT THE LAND OWNERS DIRECTION.
THE CONNECTING PIPES BETWEEN PIT #1 & #2 TO BE 6 18'-20' CLASS 80 PVC PIPES. BETWEEN PIT #2 & #3 USE 3 PIPES. INLET INVERT 1.5' BELOW THE GROUND SURFACE; OUTLET INVERT AT THE BOTTOM OF THE PIT. COMPACT BACKFILL OF ROCK FREE SOIL FOR THE FIRST 5' FROM THE INLET END. USE A VIBRATING PLATE COMPACTOR WITH 2 PASSES OVER 4" THICK, LOOSE LAYERS. SOIL MOISTURE TO BE SUCH THAT THE MATERIAL DOES NOT FORM LAYERS NOR FLOWS FROM UNDER THE ACTION OF THE COMPACTOR.
REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES
EXPIRES 6/30/2003
DATE 4/03
DESIGNED B.HEWES
PLOTTED
APPROVED
HUDSON BAY AQUIFER RECHARGE PROJECT
SITE PLAN
CADFILE whiteplan
SHEET 2 OF 4

STILLING WELL DETAIL



SECTION A





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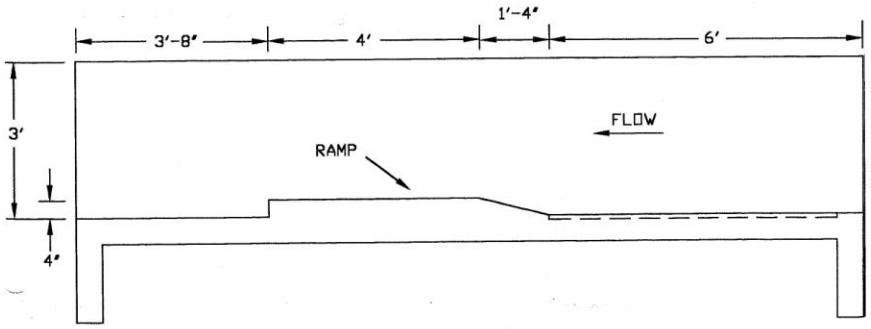
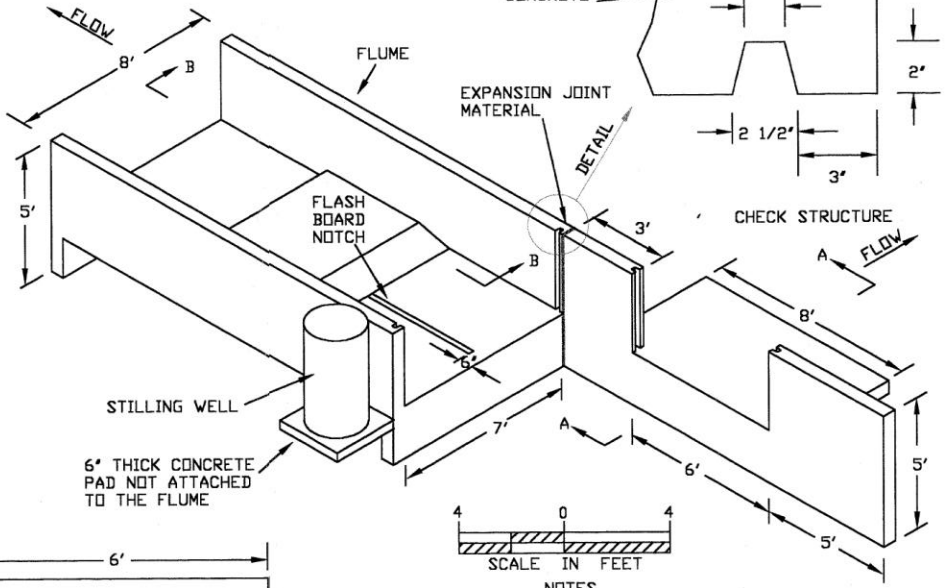
SECTION B



CHECK STRUCTURE & FLUME STRUCTURE PERSPECTIVE VIEW



FLASH BOARD NOTCH DETAIL

NOTES

INSTALL THE CONCRETE IN ACCORDANCE WITH CONSTRUCTION SPECIFICATION 42, ATTACHED.
ALL WALLS AND FLOORS TO BE 6" THICK.
USE 4000 PSI STRENGTH CONCRETE. 1.6 CUBIC YARDS NEEDED FOR THE CHECK STRUCTURE AND 4.9 CUBIC YARDS NEEDED FOR THE FLUME.
SEPARATE THE TWO STRUCTURES USING A 6"X 1/2"X 5' STRIP OF ASPHALT EXPANSION JOINT FILLER.
THE STILLING WELL PIPE MAY BE CORRUGATED METAL OR CLASS 80, MINIMUM, PVC PIPE.
THE FLASH BOARD NOTCH IN THE BOTTOM OF THE FLUME IS TO HOLD THE BOTTOM OF A SPLITTER WALL. USE 2 PIECES OF 3/4" MARINE PLYWOOD. HOLD THE TOP AT THE DOWNSTREAM END WITH A 2"X8"X8' WITH 2-2"X4"X8' CLEATS. AT THE UPSTREAM END USE 2-2"X12"X8' WITH 2-2"X4"X24' CLEATS.

DATE 4/03
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HUDSON BAY AQUIFER RECHARGE PROJECT
STRUCTURE DETAILS

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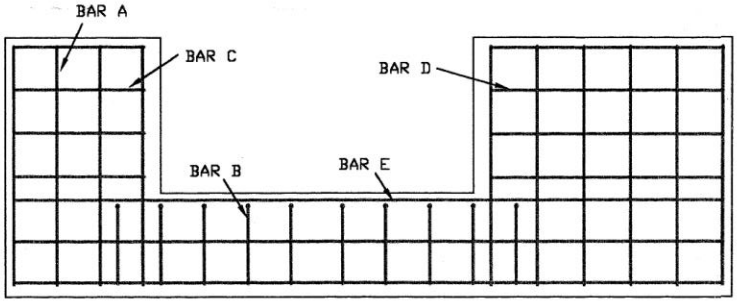
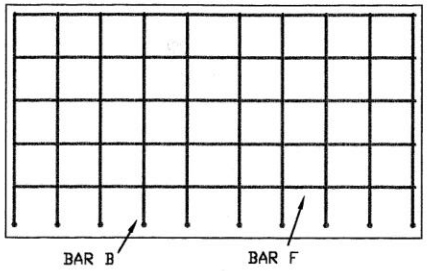
SHEET 3 OF 4

CHECK STRUCTURE ELEVATION VIEW



APRON PLAN VIEW



REINFORCING STEEL SCHEDULE

BAR	NO.	SHAPE	A	B	C
		CHECK			
A	10	STRAIGHT	4′-7″	–	–
B	10	AL B	1′-7″	4′-1″	–
C	4	STRAIGHT	2′-6″	–	–
D	4	STRAIGHT	4′-6″	–	–
E	3	STRAIGHT	13′-8″	–	–
F	5	STRAIGHT	7′-8″	–	–
		FLUME			
G	19	AL B C	3′-1″	7′-6″	3′-1″
H	20	AL B	1′-6″	8′-1″	–
I	4	STRAIGHT	7′-6″	–	–
J	8	STRAIGHT	14′-6″	–	–

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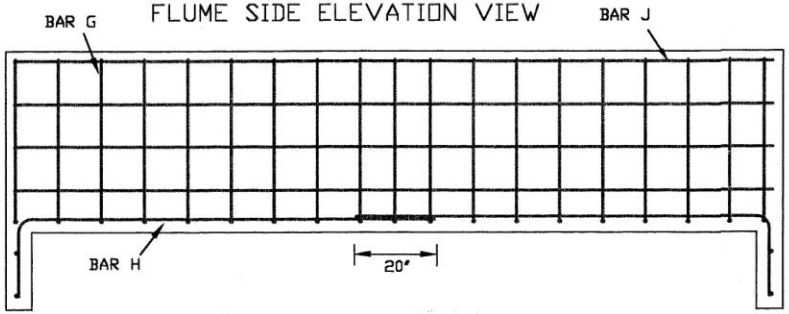
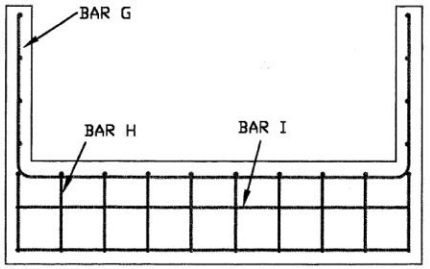
NOTES
ALL BARS TO BE NUMBER 4.
BARS TO BE PLACED IN THE CENTER OF THE WALLS AND FLOOR.
NEED 820 LINEAL FEET OF REINFORCING BARS WITHOUT ANY WASTE.

FLUME SIDE ELEVATION VIEW



FLUME END WALL ELEVATION VIEW



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STRUCTURE REINFORCING STEEL

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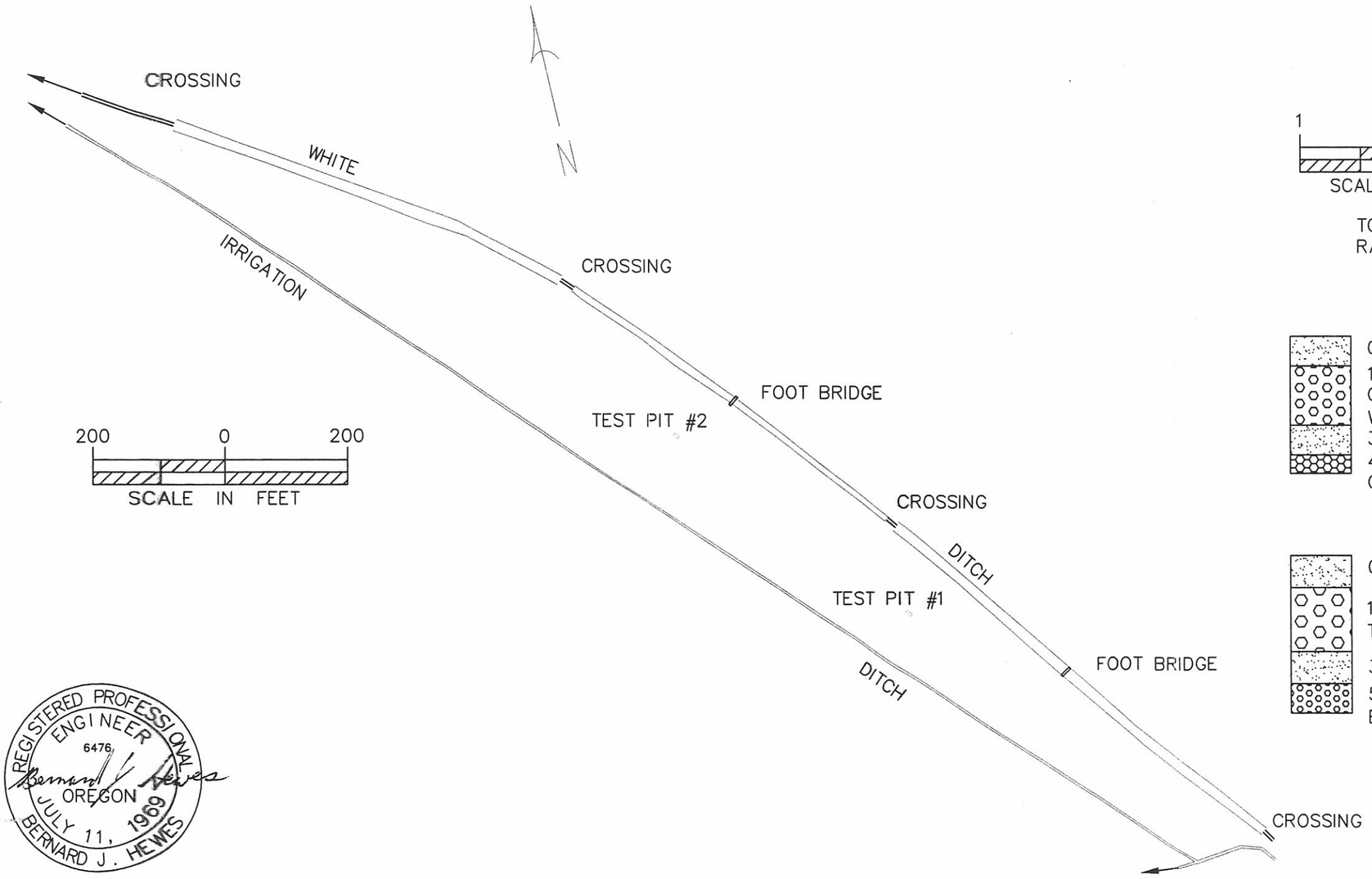
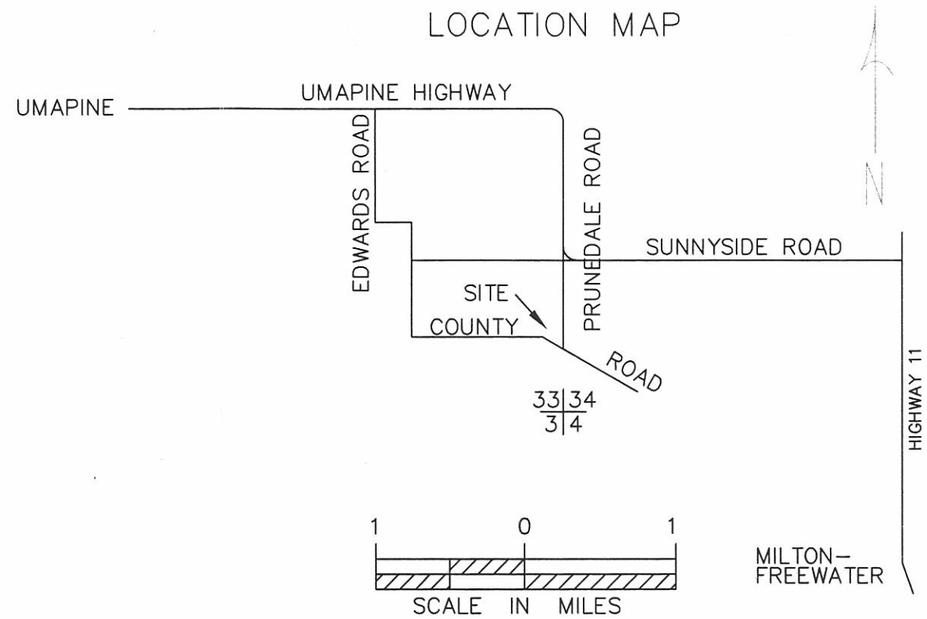
SITE PLAN VIEW



LOCATION MAP



TOWNSHIP 6N
RANGE 35E

TEST PIT #1

0–12" SANDY LOAM

12"–36" GRAVELY SANDY LOAM, APPROX. 50% OF THE VOLUME IS GRAVEL SIZE PARTICLES WITH AN ESTIMATED D_{50} SIZE OF ABOUT 0.75".

36"–48" SANDY LOAM

48"–? GRAVELY SANDY LOAM APPROX. 20% OF THE VOLUME IS GRAVEL SIZE PARTICLES.

TEST PIT #2

0–13" GRAVELY SANDY LOAM

13"–39" COBBLY SANDY LOAM, THE D_{50} OF THE GRAVEL IS APPROXIMATELY 1"

39"–52" GRAVELY SANDY LOAM

52"–? SAND GRAVEL MIX D_{50} ESTIMATED TO BE ABOUT 0.25".

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WWBWC/HBDIC UPPER RECHARGE PROJECT
SITE PLAN & LOCATION MAP
UMATILLA COUNTY, OREGON

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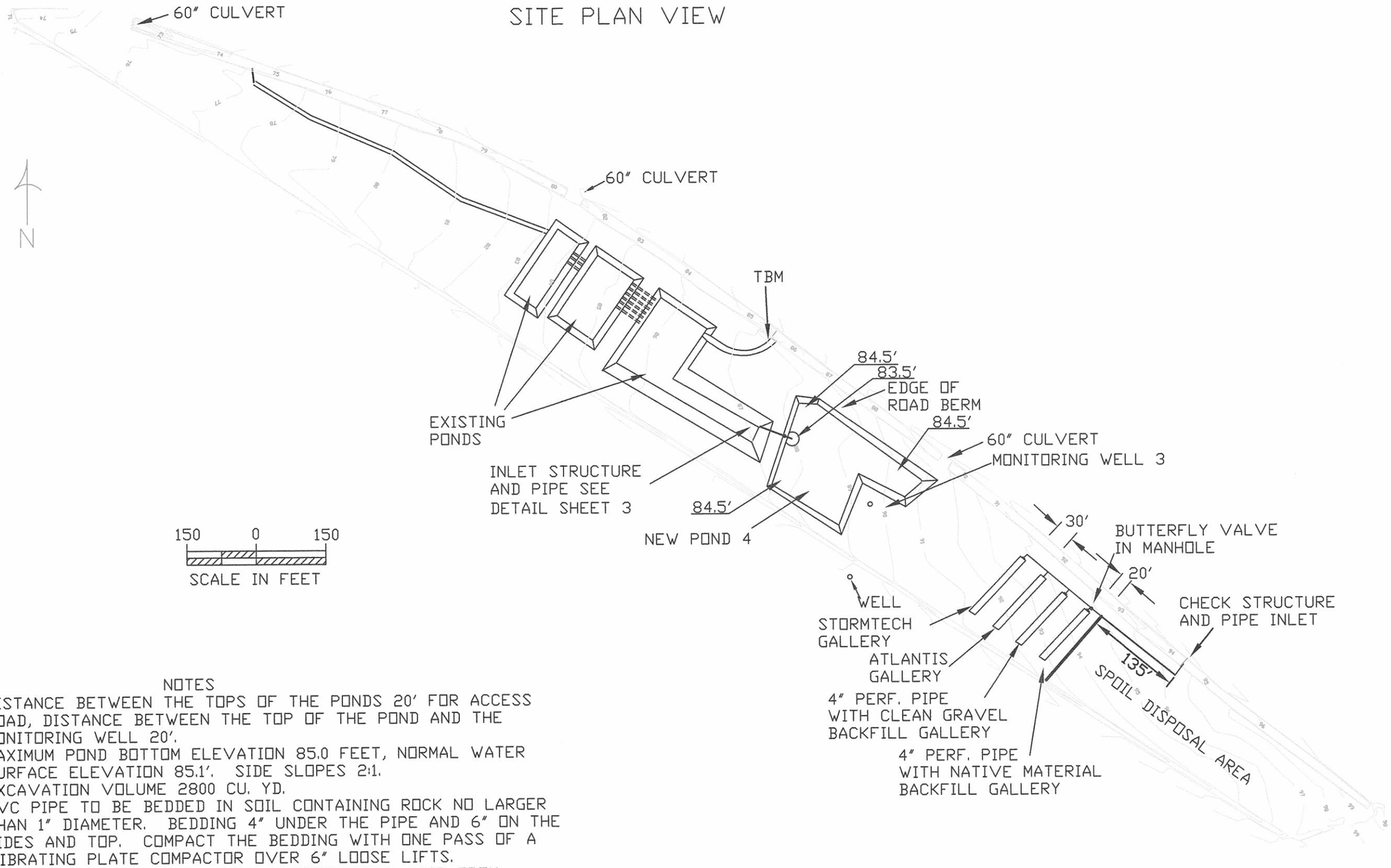
SHEET 1
OF 7

SITE PLAN VIEW



NOTES

DISTANCE BETWEEN THE TOPS OF THE PONDS 20' FOR ACCESS ROAD, DISTANCE BETWEEN THE TOP OF THE POND AND THE MONITORING WELL 20'.
MAXIMUM POND BOTTOM ELEVATION 85.0 FEET, NORMAL WATER SURFACE ELEVATION 85.1'. SIDE SLOPES 2:1.
EXCAVATION VOLUME 2800 CU. YD.
PVC PIPE TO BE BEDDED IN SOIL CONTAINING ROCK NO LARGER THAN 1" DIAMETER. BEDDING 4" UNDER THE PIPE AND 6" ON THE SIDES AND TOP. COMPACT THE BEDDING WITH ONE PASS OF A VIBRATING PLATE COMPACTOR OVER 6" LOOSE LIFTS.
CONSIDER FLOW METERS: AQUA MASTER MODEL 900R FROM JENNINGS INC.
McCROMETER MODEL E0300 PROPELLER STYLE METER.
CHECK FOR COMPATIBILITY WITH YOUR EXISTING RECORDING AND CONTROL EQUIPMENT.
SPACE THE DIFFERENT KIND OF GALLERIES 30'.
TBM IS AT THE TOP OF THE RIGHT SIDE WALL, DOWNSTREAM END OF THE FLUME. ELEVATION 88.7 FEET.

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SITE PLAN
UMATILLA COUNTY, OREGON

CADFILE
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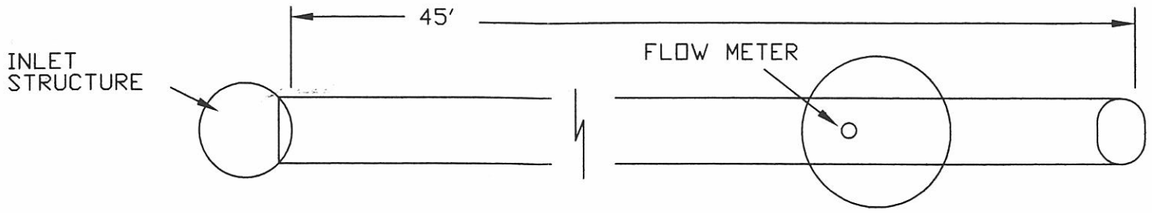
SHEET 2
OF 7

SUPPLY PIPE TO POND 4 PLAN VIEW



NOTES

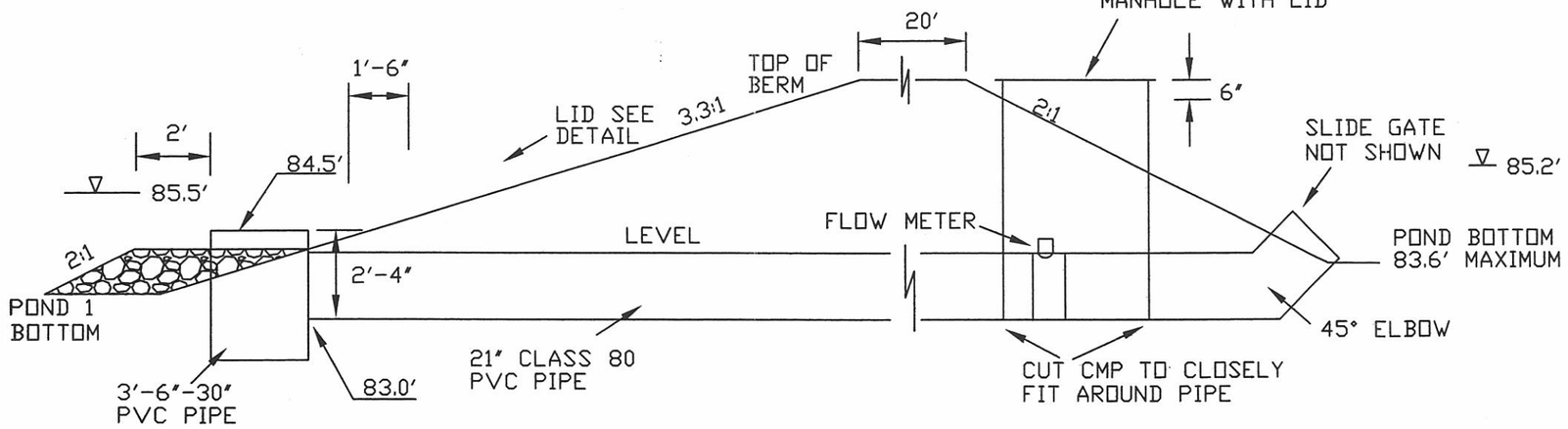
CUT THE HOLE IN THE INLET STRUCTURE TO CLOSELY FIT AROUND THE SUPPLY PIPE. FILL THE SPACE BETWEEN THE STRUCTURE AND PIPES WITH CAULKING ON BOTH SIDES.

THE BOTTOM LIP OF THE 45° ELBOW CAN BE NO LESS THAN 0.2' BELOW THE TOP OF THE 21" PIPE.

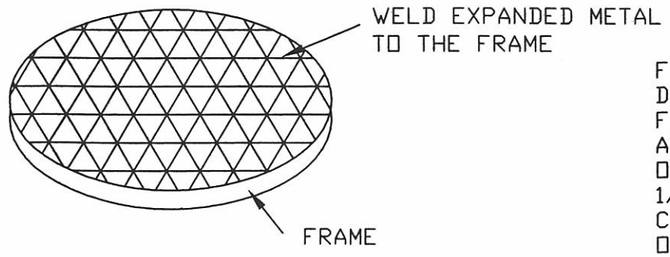
LID FOR THE CMP MANHOLE TO BE GALVANIZED $\frac{1}{8}$" THICK STEEL.

SLIDE GATE TO BE A WATERMAN C-8-4 OR EQUIVALENT. INSTALL A CATWALK FOR ACCESS TO THE SLIDE GATE.

SIDE ELEVATION VIEW TYPICAL

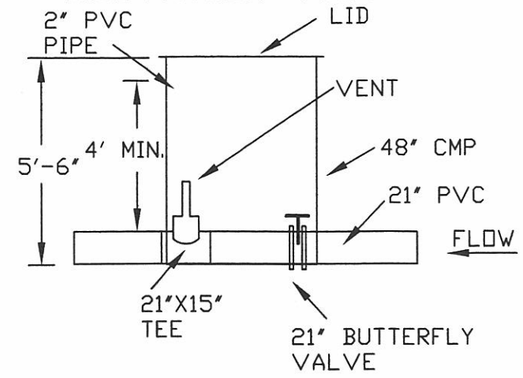


INLET STRUCTURE TRASH RACK DETAIL PERSPECTIVE VIEW

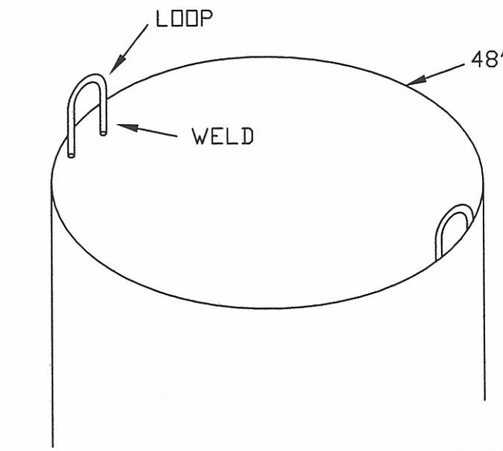


FRAME IS $\frac{1}{8}$" X 3" STEEL, INSIDE DIAMETER 32". COVER TO BE FLATTENED EXPANDED METAL APPROXIMATELY 0.120" THICK; OPENINGS APPROXIMATELY 1/2" X 1 5/8 ". CLEAN AND PAINT WITH 2 COATS OF HIGH ZINC COLD GALVANIZING PAINT.

GALLERY SUPPLY PIPE VALVE DETAILS ELEVATION VIEW



MANHOLE LID HOLD DOWN PERSPECTIVE VIEW



USE 1/2" DIAMETER ROD TO MAKE LOOPS. DIAMETER OF THE LOOP 2"

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MISCELLANEOUS DETAILS
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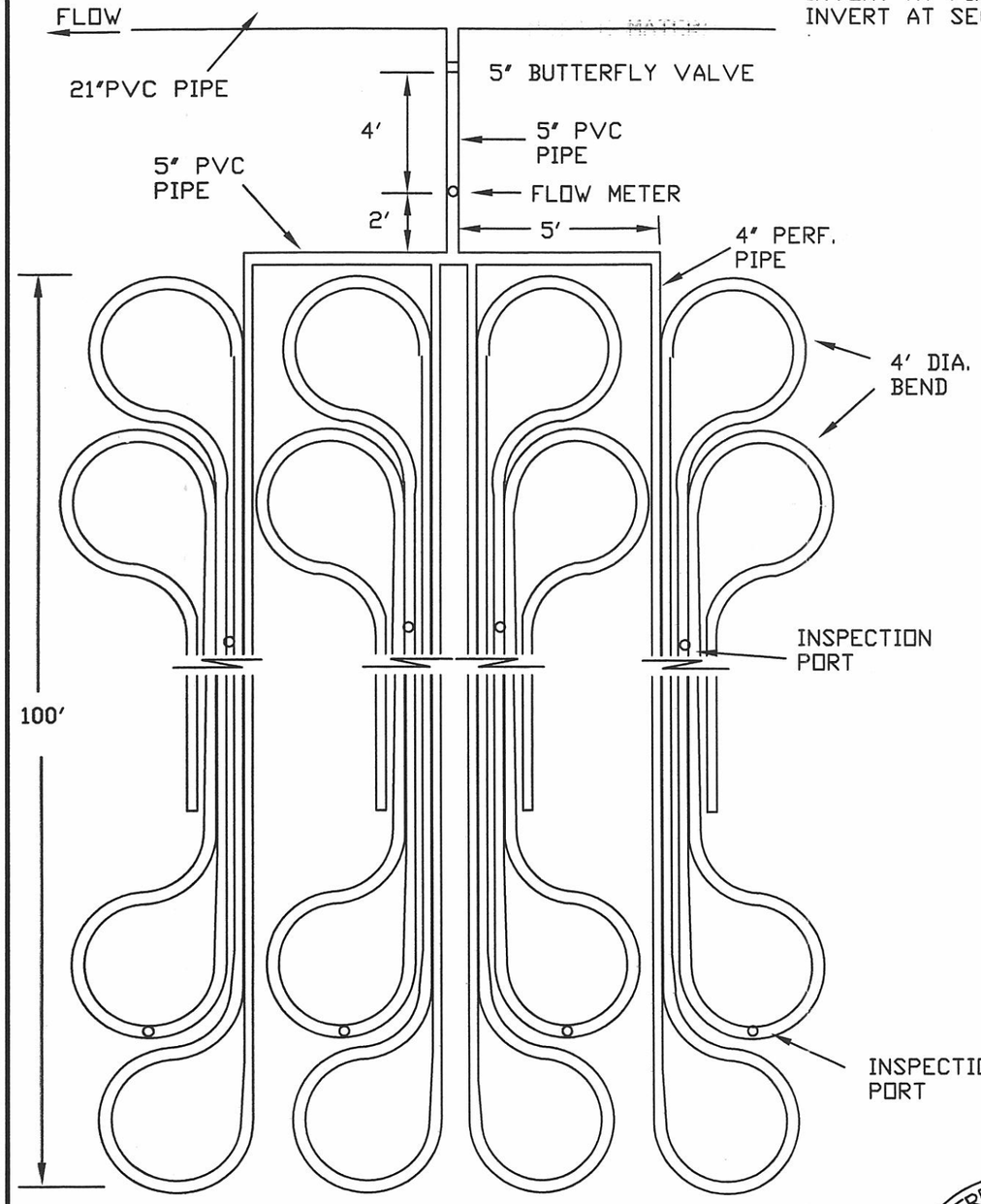
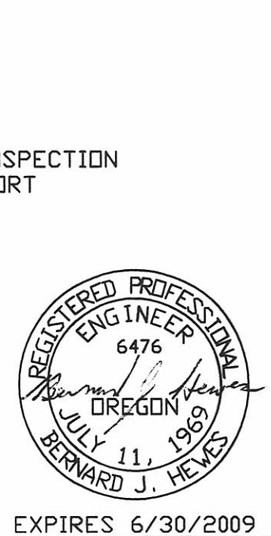
SHEET 3 OF 7

TYPICAL 4" PERFORATED PIPE GALLERY
PLAN VIEW



NOTE: ON THIS SIDE THE PERF. PIPE CHANGED TO SMOOTH DRAIN FIELD PIPE WITH A TEE FOR EACH PIPE ROW, 20 ROWS.



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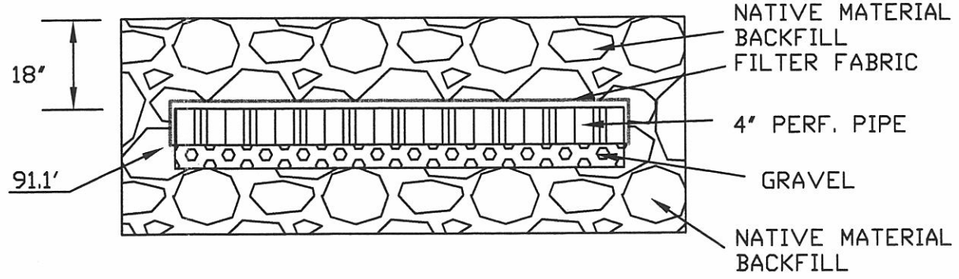
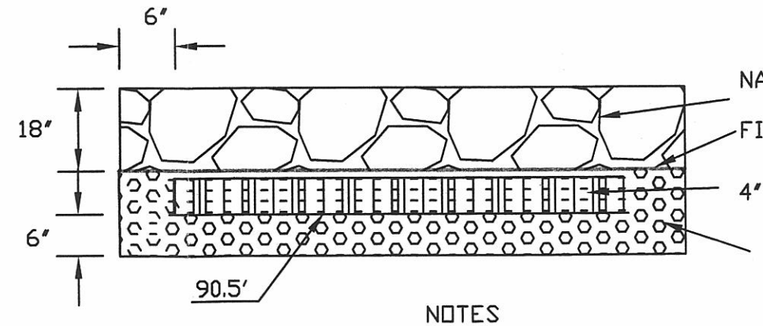
4" PERFORATED PIPE WITH NATIVE MATERIAL BACKFILL
ELEVATION VIEW



NOTES

NEED 2000' OF ADS 4" SINGLE WALL, PERFORATED, CORRUGATED POLYETHYLENE PIPE OR EQUIVALENT. CONNECT THE 4" TO THE 5" PIPE USING A MAR-MAC POLYSEAL PIPE COUPLER OR EQUIVALENT.
USE ONLY ENOUGH GRAVEL BEDDING TO PROVIDE A SMOOTH SURFACE TO LAY THE PIPE ON OR REMOVE ALL ROCK GREATER THAN 2" IN DIAMETER FROM CONTACTING THE PIPE.
THE INSPECTION PORT TO BE INSTALLED WHERE THE TWO PIPE ROLLS CONNECT AND NEAR THE END AS SHOWN. CONNECT THE ROLLS WITH A 4" TEE, USE 2' OF VERTICAL 4" PERF. PIPE WRAPPED WITH FILTER FABRIC FOR AN INSPECTION PORT. INSTALL A 4" CAP ON THE END OF THE PIPE AND INSPECTION PORT.
THE FILTER FABRIC TO BE ADS 4000 NONWOVEN OR EQUIVALENT. ABOUT 75 SQ. YD. NEEDED.

4" DRAIN FIELD PIPE WITH GRAVEL BEDDING
ELEVATION VIEW



NOTES

NEED 2000' OF 4" PVC DRAIN FIELD PIPE. CONNECT THE 4" TO THE 5" PIPE USING A MAR-MAC POLYSEAL PIPE COUPLER OR EQUIVALENT.
THE INSPECTION PORTS TO BE INSTALLED NEAR THE MIDDLE OF ONE OF THE ROWS AND NEAR THE END. USE 2' OF VERTICAL 4" PIPE WRAPPED WITH FILTER FABRIC FOR AN INSPECTION PORT. INSTALL A 4" CAP ON THE END OF THE PIPE AND INSPECTION PORT.
THE FILTER FABRIC TO BE ADS 4000 NONWOVEN OR EQUIVALENT. ABOUT 75 SQ. YD. NEEDED.
GRAVEL TO BE ANGULAR CRUSHED ROCK WITH THE MAJORITY BEING $\frac{3}{4}$"-2", ABOUT 60 CU. YD. NEEDED.

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4" PERF. & DRAIN FIELD PIPE DETAILS
UMATILLA COUNTY, OREGON
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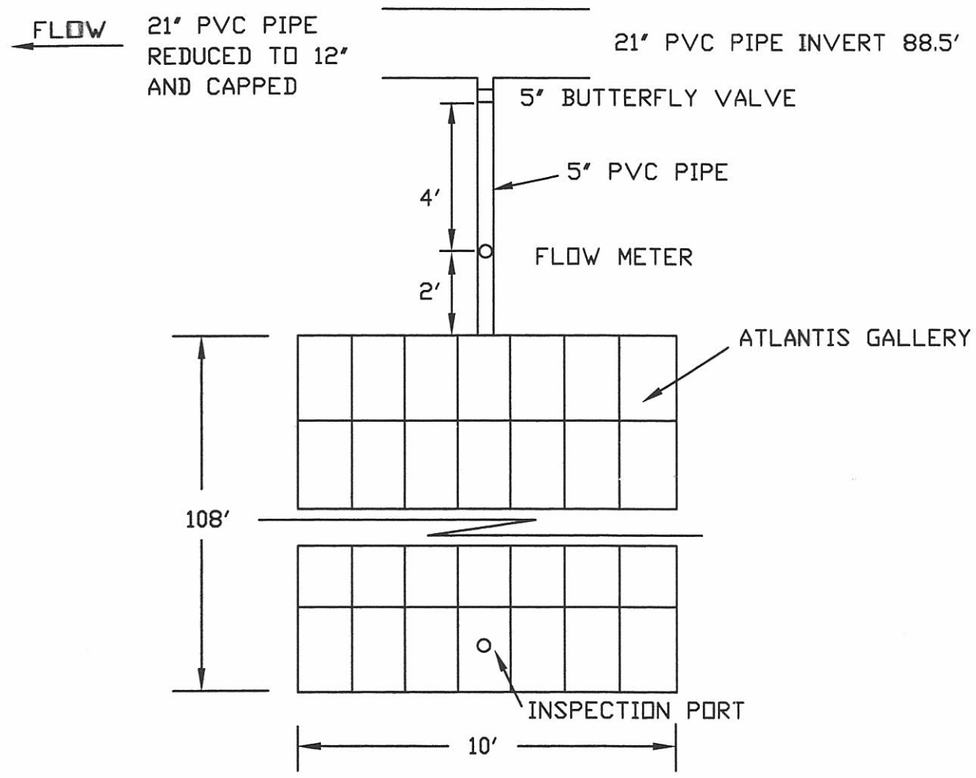
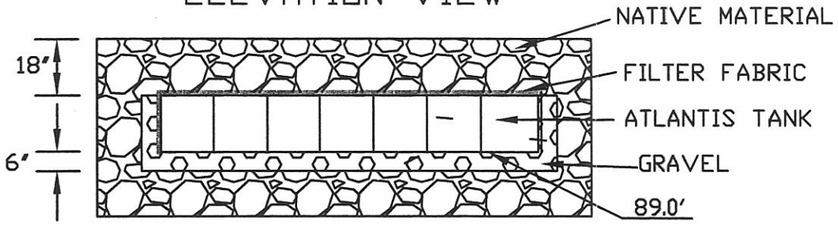
SHEET 4 OF 7

ATLANTIS RAIN TANK DETAIL
PLAN VIEW



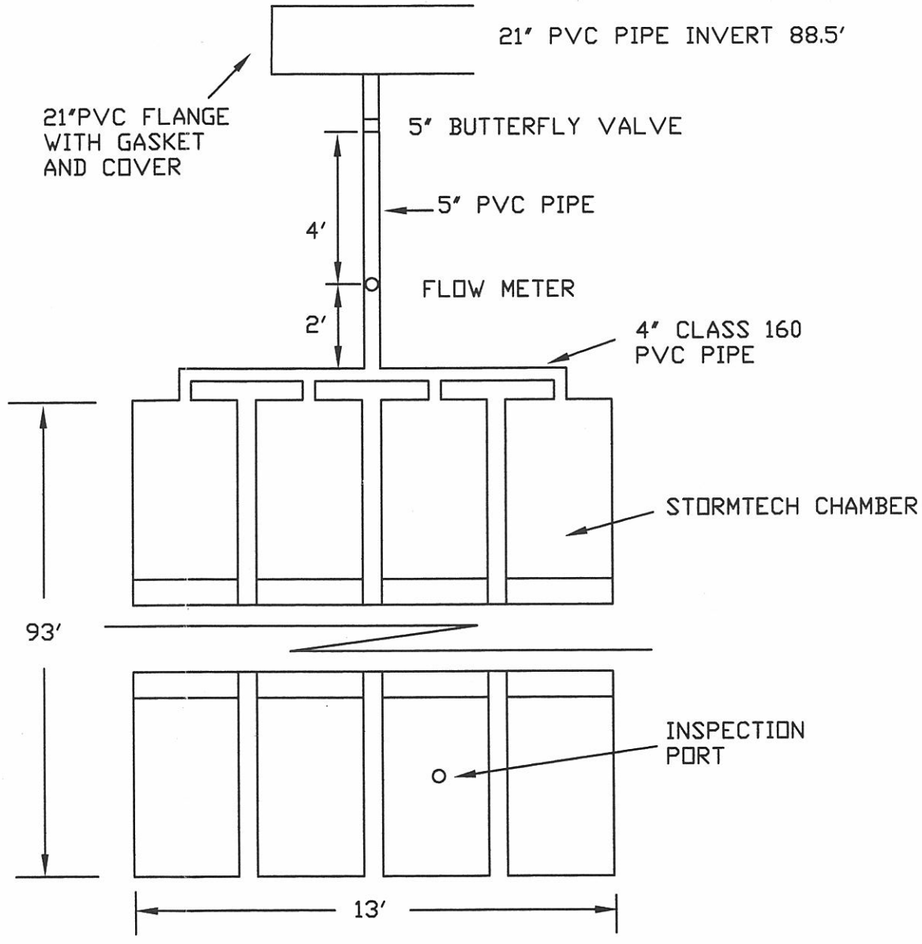
ELEVATION VIEW



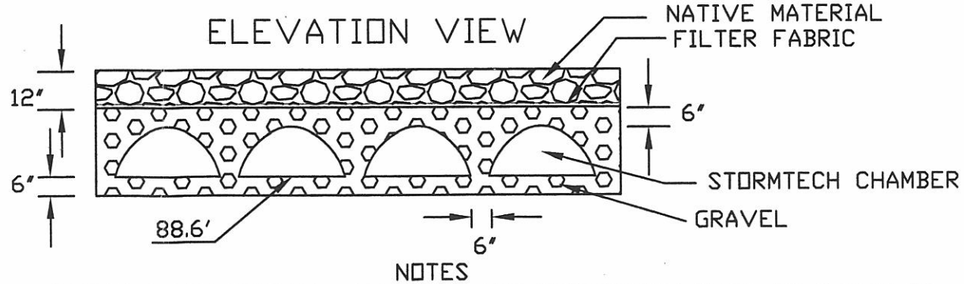
NOTES

ASSEMBLE AND INSTALL RAIN TANKS AND INSPECTION PORT AS DESCRIBED IN THE MANUFACTURERS LITERATURE. TANKS ARE 16" WIDE, 27" LONG AND 17¾" HIGH, NEED 336 TANKS FOR H-10 LOADING. USE 4" PVC PIPE FOR THE PORT, EXTEND 1' ABOVE GROUND AND PROTECT WITH A FENCE POST AND END CAP.
FILTER FABRIC TO BE ADS 4000 OR EQUIVALENT, NEED 160 SQ. YD.
FOLD AND TAPE THE CORNERS AS SHOWN IN THE LITERATURE.
GRAVEL TO BE ANGULAR CRUSHED ROCK WITH THE MAJORITY OF PARTICLES BETWEEN ¾"-2", NEED ABOUT 25 CU. YD.

STORMTECH CHAMBER
PLAN VIEW



ELEVATION VIEW



NOTES

ASSEMBLE AND INSTALL CHAMBERS AND INSPECTION PORT AS SHOWN IN THE MANUFACTURERS LITERATURE. TANKS ARE 34" WIDE, 7'-2" LONG AND 16" HIGH, NEED 50 CHAMBERS. IN LIEU OF THE SUBSURFACE PORT SHOWN IN THE LITERATURE EXTEND THE PORT 1' ABOVE GROUND AND PROTECT WITH A FENCE POST AND END CAP.
FILTER FABRIC TO BE ADS 4000 OR EQUIVALENT, NEED 190 SQ. YD.
GRAVEL TO BE ANGULAR CRUSHED ROCK WITH THE MAJORITY OF PARTICLES BETWEEN ¾"-2", NEED ABOUT 115 CU. YD.

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OREGON
JULY 11, 1969
BERNARD J. HEWES

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ATLANTIS & STORMTECH CHAMBERS DETAILS
UMATILLA COUNTY, OREGON

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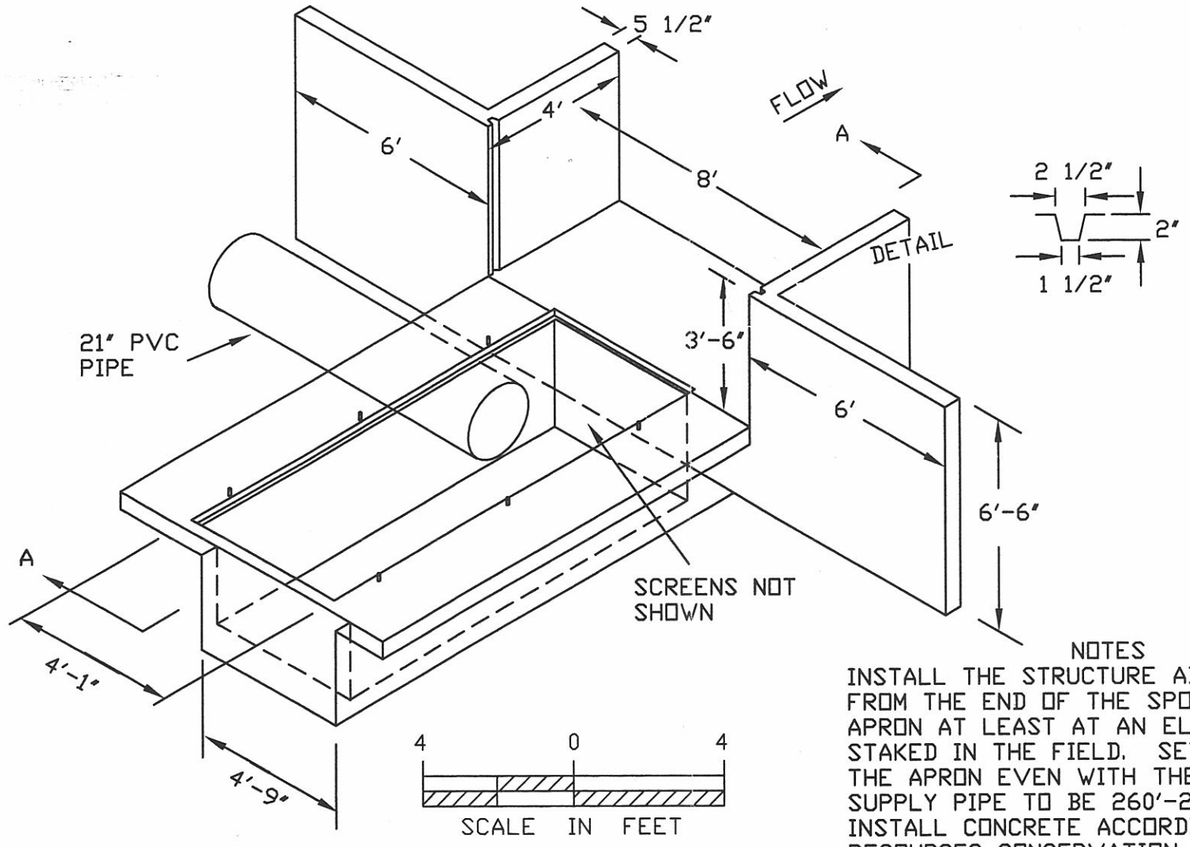
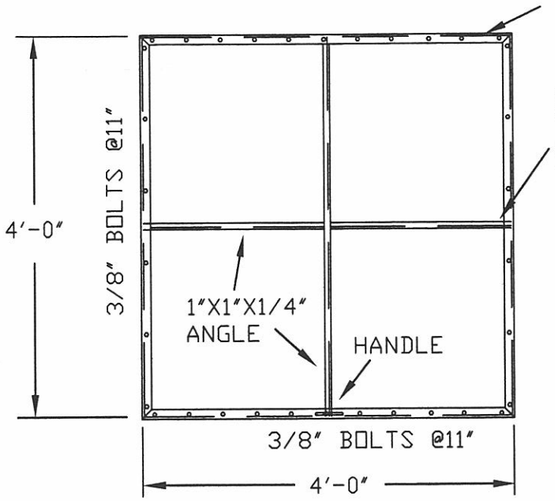
SHEET 5
OF 7

STRUCTURE PERSPECTIVE VIEW

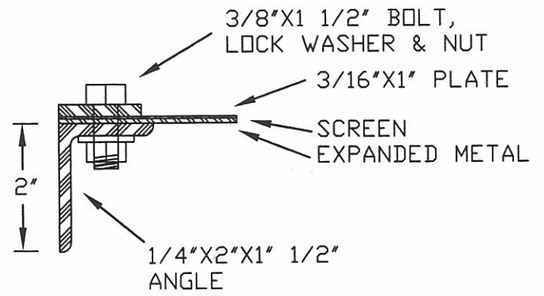


SCREEN FRAME DETAIL

3 NEEDED



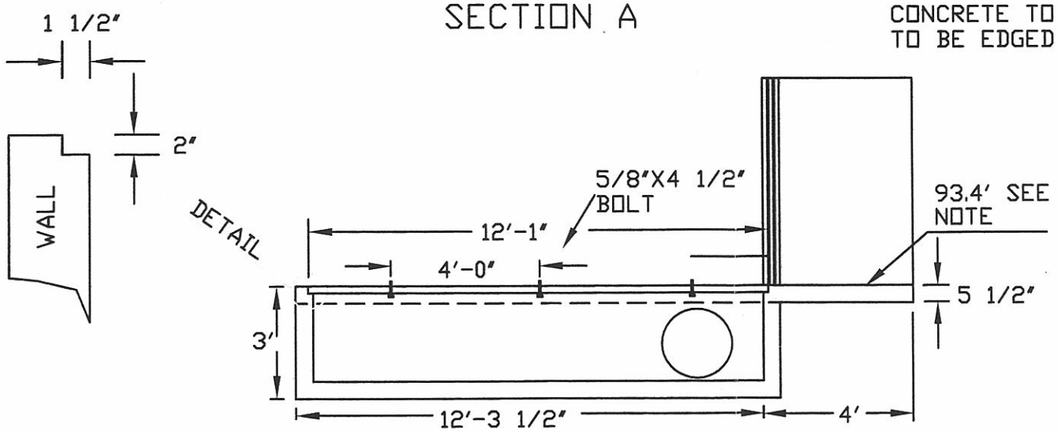
SCREEN FRAME DETAIL ELEVATION VIEW



NOTES

INSTALL THE STRUCTURE ABOUT 135' UPSTREAM FROM THE END OF THE SPOIL PILE WITH THE APRON AT LEAST AT AN ELEVATION OF 93.4' AS STAKED IN THE FIELD. SET THE ELEVATION OF THE APRON EVEN WITH THE CHANNEL BOTTOM.
SUPPLY PIPE TO BE 260'-21" CLASS 100 PVC.
INSTALL CONCRETE ACCORDING TO NATURAL RESOURCES CONSERVATION SERVICE SPECIFICATION 42, REINFORCED CONCRETE FOR MINOR STRUCTURES.
USE 4000 PSI STRENGTH CONCRETE, NEED 5.4 CU. YD.
CONCRETE TO BE VIBRATED, ALL EXPOSED EDGES TO BE EDGED WITH AN EDGING TOOL.

SECTION A



NOTE

NOTCH IS ON ALL 4 SIDES OF THE BOX.
BOLTS ARE TO HOLD DOWN THE SCREEN, USE A 1"X4"X¼"BAR WITH A 3/4" DIAMETER HOLE 1" FROM ONE END.

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JULY 11, 1969
BERNARD J. HEWES

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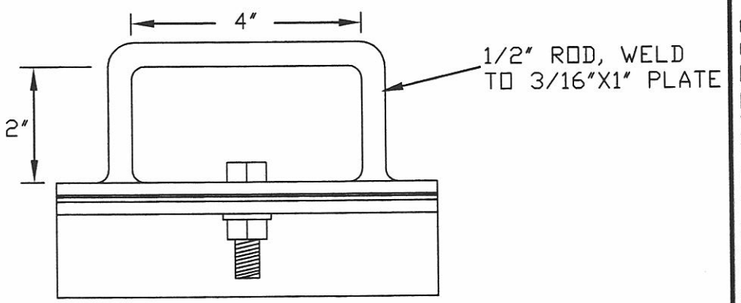
FRAME HANDLE DETAIL ELEVATION VIEW



NOTES

EXPANDED METAL TO BE CARBON STEEL, FLATTENED, 13 GAGE, 3/4" SHORT OPENING WIDTH.
SCREEN TO BE TYPE 304 STAINLESS STEEL, 20 GAGE MINIMUM WITH 3/32" HOLES SPACED 5/32" STAGGERED.

B. Hewes 8/21/2008 11:20 AM whitescreen.dwg

DESIGNED B. HEWES DATE 12/07
CHECKED
APPROVED

W/WBWC/HBDIC UPPER RECHARGE PROJECT
CHECK & SCREEN STRUCTURE
UMATILLA COUNTY, OREGON
R H ENGINEERING

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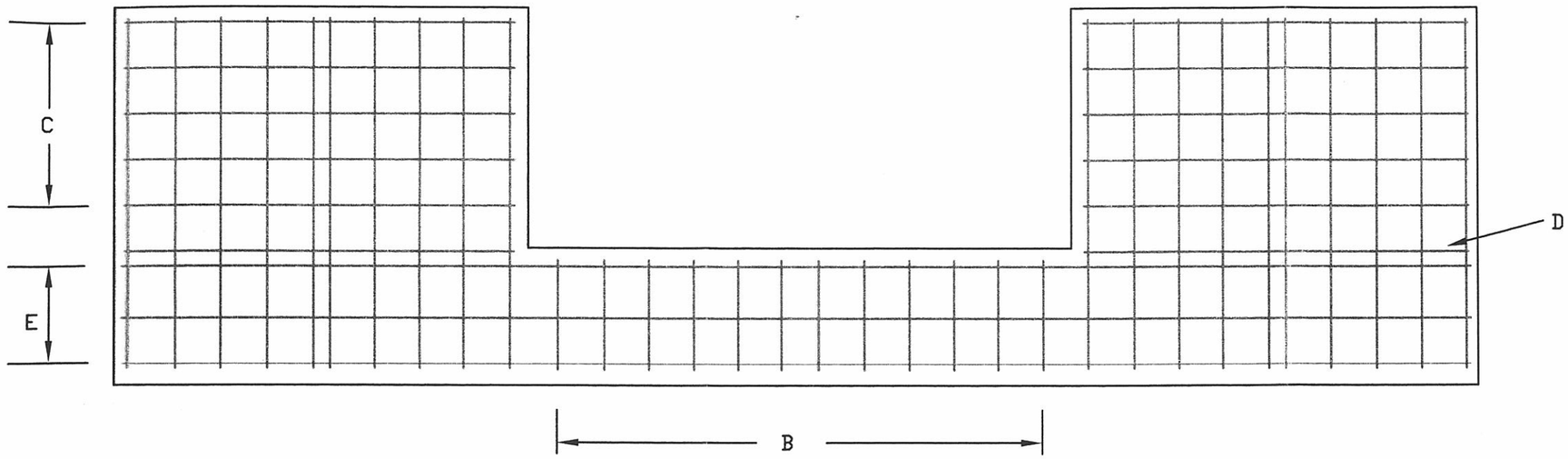
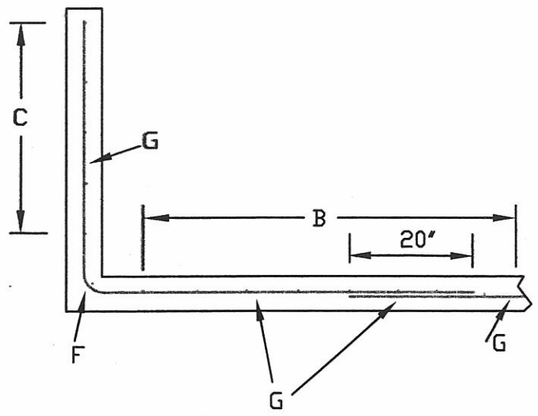
SHEET 6 OF 7

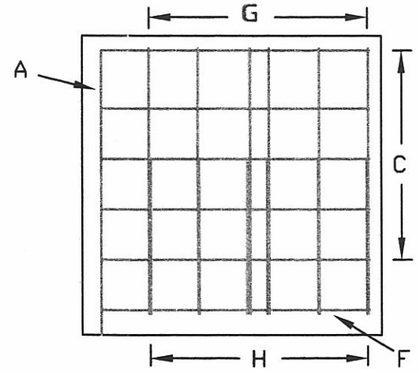
HEADWALL LOOKING DOWNSTREAM
ELEVATION VIEW



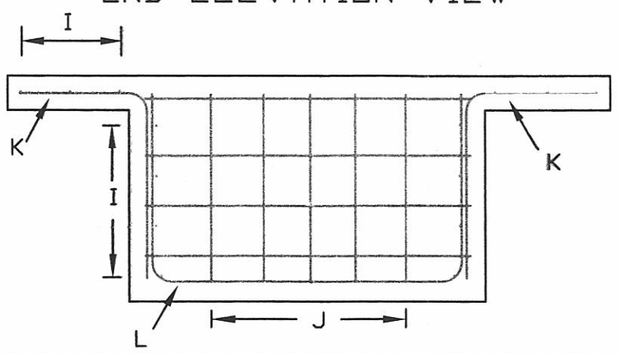
DOWNSTREAM SIDE WALL AND APRON
END ELEVATION VIEW



SIDE ELEVATION VIEW



SCREEN BOX
END ELEVATION VIEW



REINFORCING STEEL SCHEDULE

ALL NUMBER 4 BARS, 8" NOMINAL SPACING

BAR	NO.	SHAPE	A	B	C
A	20	STRAIGHT	6'-1"	--	--
B	12	A B	2'-7"	3'-7"	--
C	10	A B	5'-7"	3'-9"	--
D	2	STRAIGHT	5'-8"	--	--
E	3	STRAIGHT	19'-8"	--	--
F	2	STRAIGHT	3'-7"	--	--
G	12	A B	3'-7"	5'-1"	--
H	12	A B	2'-0"	2'-0"	--
I	14	STRAIGHT	12'-0"	--	--
J	5	A B	2'-6"	3'-8"	--
K	38	A B	1'-9"	2'-6"	--
L	19	A B C	2'-6"	4'-3"	2'-6"

1080 FEET NEEDED WITHOUT ANY WASTE

REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2009

B. Hewes 8/21/2008 11:11 AM whiterebar.dwg

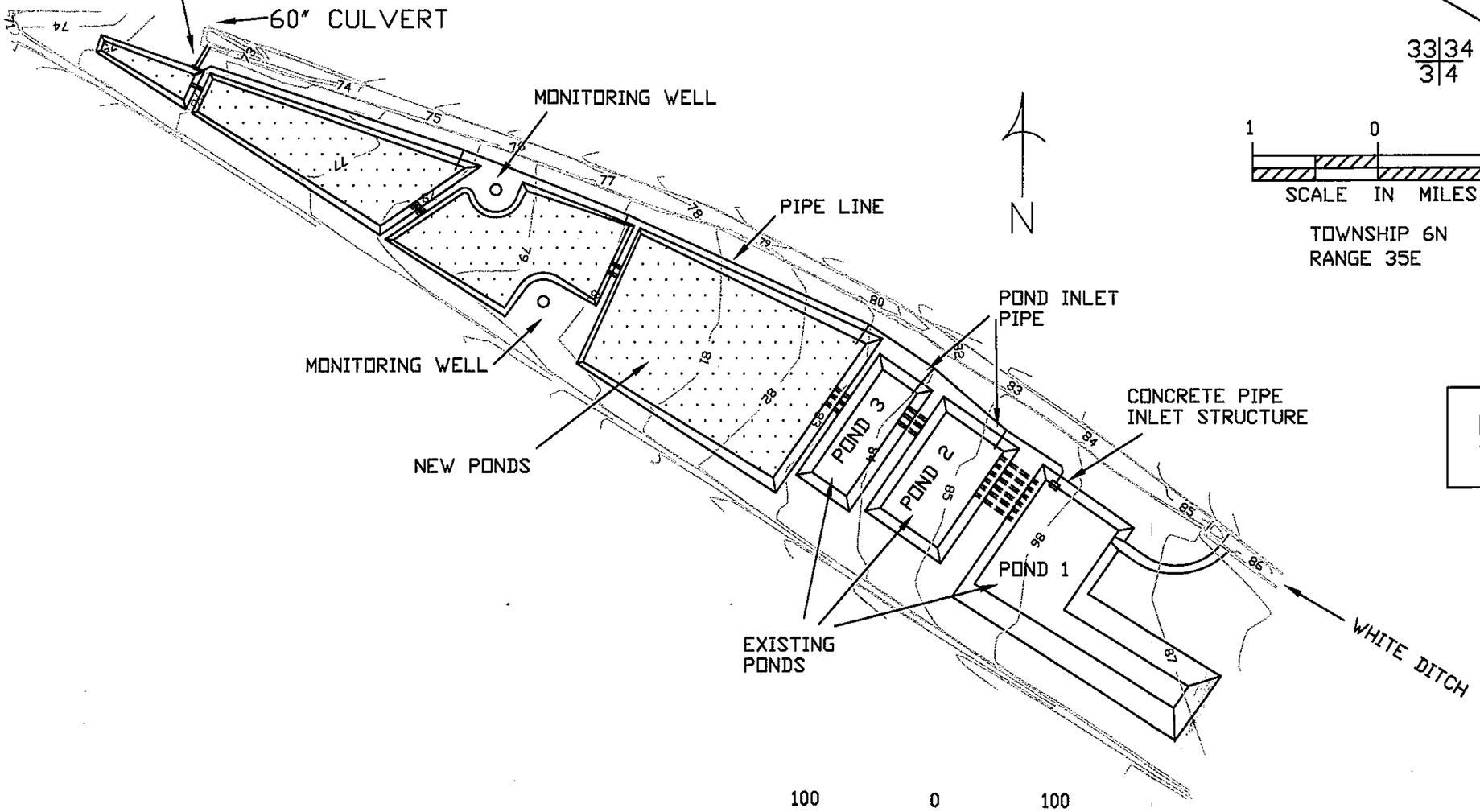
DESIGNED B. HEWES DATE 12/07
CHECKED
APPROVED

WWBWC/HBDIC UPPER RECHARGE PROJECT
REINFORCING STEEL DETAILS
UMATILLA COUNTY, OREGON
B H ENGINEERING

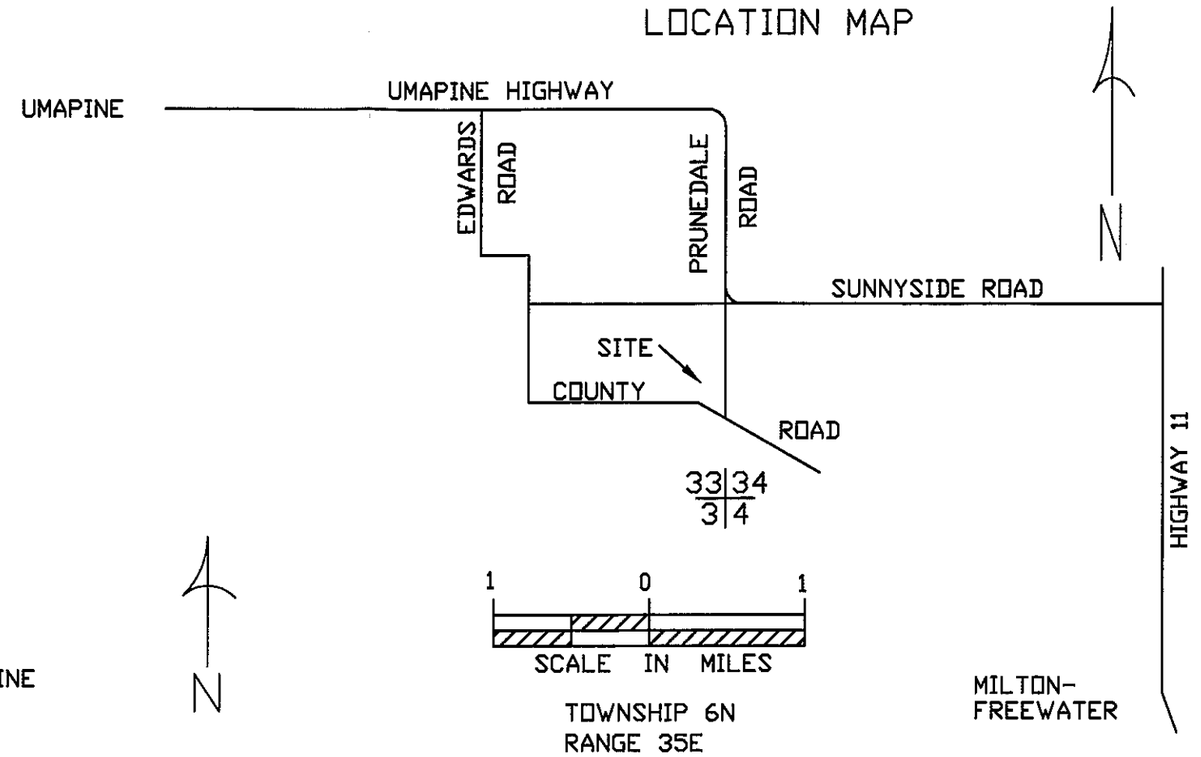
CAD FILE whiterebar

SHEET 7 OF 7

SITE PLAN VIEW



LOCATION MAP



PRELIMINARY SUBJECT TO REVISION

REGISTERED PROFESSIONAL ENGINEER 6476 OREGON JULY 11, 1969 BERNARD J. HEWES

EXPIRES 6/30/2011

DATE 9/09

DESIGNED B. HEWES

CHECKED

APPROVED

WWBWC/HBDIC LOWER RECHARGE PROJECT
LOCATION MAP & SITE MAP
UMATILLA COUNTY, OREGON

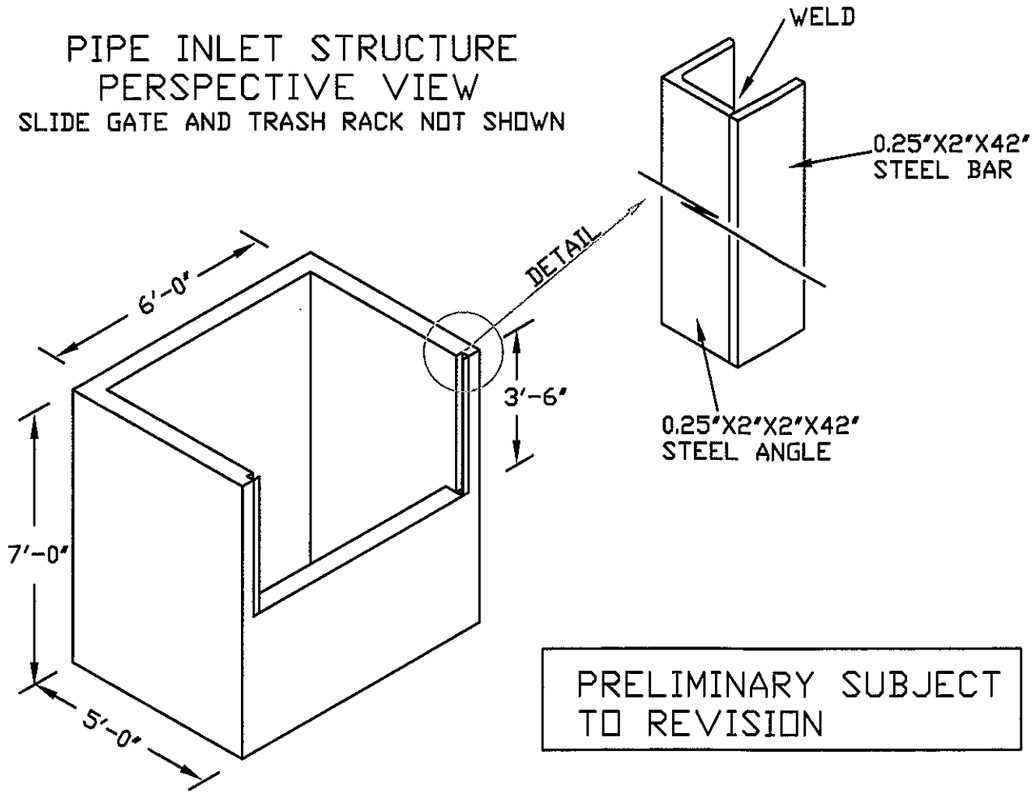
B H ENGINEERING

CAD FILE whitelowext

SHEET 1 OF 4

PIPE INLET STRUCTURE PERSPECTIVE VIEW

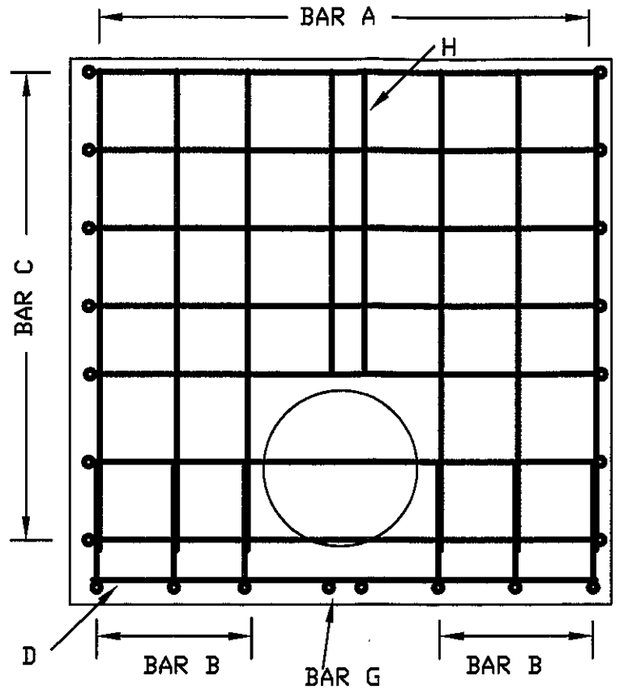
SLIDE GATE AND TRASH RACK NOT SHOWN



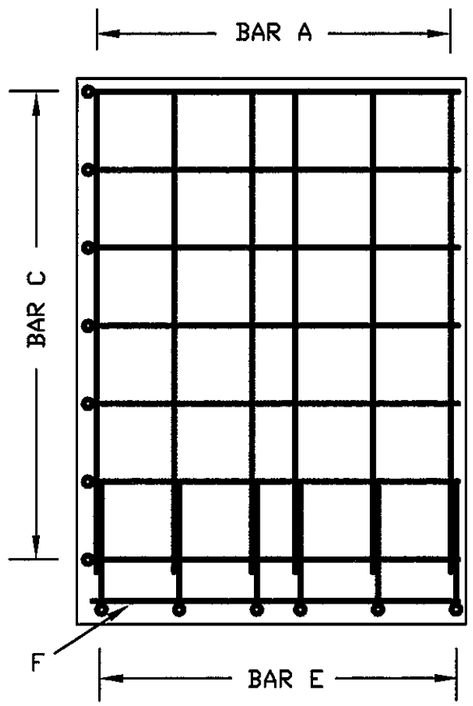
PRELIMINARY SUBJECT TO REVISION

REINFORCING STEEL DETAILS

BACK ELEVATION VIEW

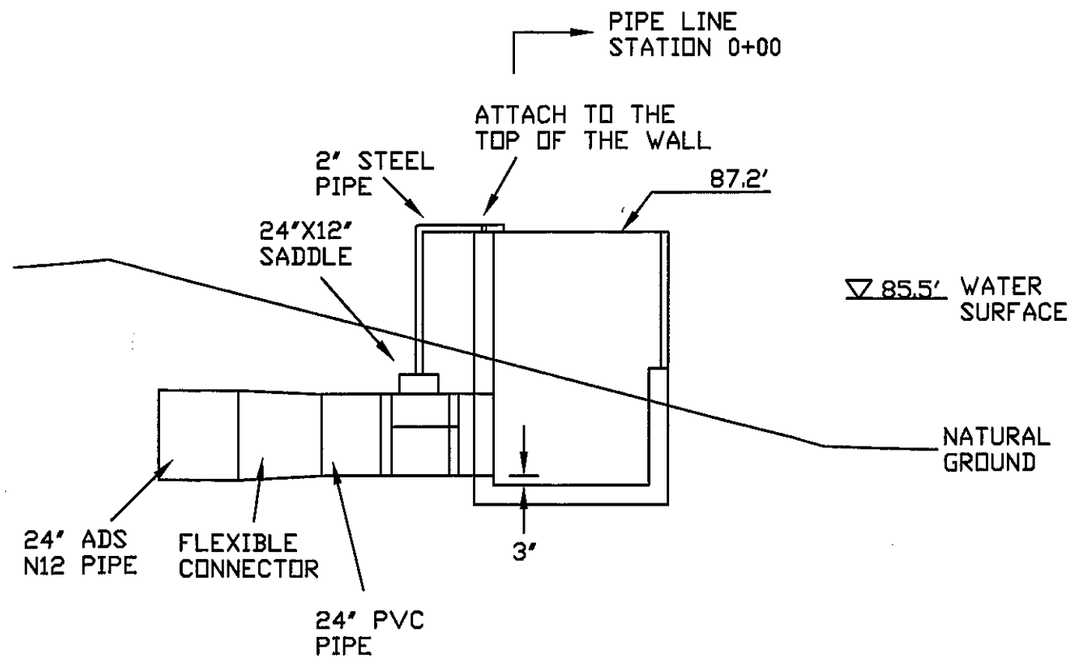


SIDE ELEVATION VIEW



CROSS SECTION VIEW

SLIDE GATE AND TRASH RACK NOT SHOWN



REINFORCING STEEL SCHEDULE

ALL NUMBER 4 BARS, 12" NOMINAL SPACING

BAR	NO.	SHAPE	A	B	C
A	18	straight	6'-2"	--	--
B	6	A B C	1'-7"	6'-6"	3'-1"
C	7	A B C	4'-7"	6'-6"	4'-7"
D	2	straight	6'-6"	--	--
E	6	A B C	1'-7"	6'-6"	1'-7"
F	2	straight	4'-6"	--	--
G	2	A B	6'-6"	3'-1"	--
H	2	straight	3'-11"	--	--

NOTES

INSTALL THE PIPE INLET STRUCTURE ACCORDING TO CONSTRUCTION SPECIFICATION 42, REINFORCED CONCRETE FOR MINOR STRUCTURES, USE 4000 PSI STRENGTH CONCRETE, APPROXIMATELY 3.0 CU. YD. NEEDED.
REINFORCING STEEL TO BE #4 BARS, NEED 400 FEET ASSUMING NO WASTE.

REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2011

DATE 10/09
DESIGNED B. HEWES
CHECKED
APPROVED

WWBWC/HBDIC LOWER RECHARGE PROJECT
PIPE INLET STRUCTURE
UMATILLA COUNTY, OREGON
B H ENGINEERING

CAD FILE
whitelowstruc

SHEET 2
OF 4

NOTES

PIPE NEEDS:
5'-24" CLASS 80 PVC PIPE
80'-24" ADS N12 CORRUGATED POLYETHYLENE PIPE
80'-18" " "
60'-15" " "
200'-12" " "
140-10" " "
220'-6" " "

N

0+00 PIPE INLET
0+05 FLEXIBLE COUPLER
0+10-24"-45° ELBOW
0+15-24"-45° ELBOW

20'-15" PIPE TO POND 2

0+70-24"X24"X15" TEE
0+80-24"X18" REDUCER

20'-12" PIPE TO POND 3

1+50-18"X18"X12" TEE
1+60-18"X15" REDUCER

20'-15" PIPE TO POND 6

2+05-15"X15"X15" TEE
2+20-15"X12" REDUCER

20'-10' PIPE TO POND 7

4+15-12"X12"X10" TEE
4+20-12"X10" REDUCER

20'-10" PIPE TO POND 8

5+55-10"X10"X10" TEE
5+60-10"X6" REDUCER

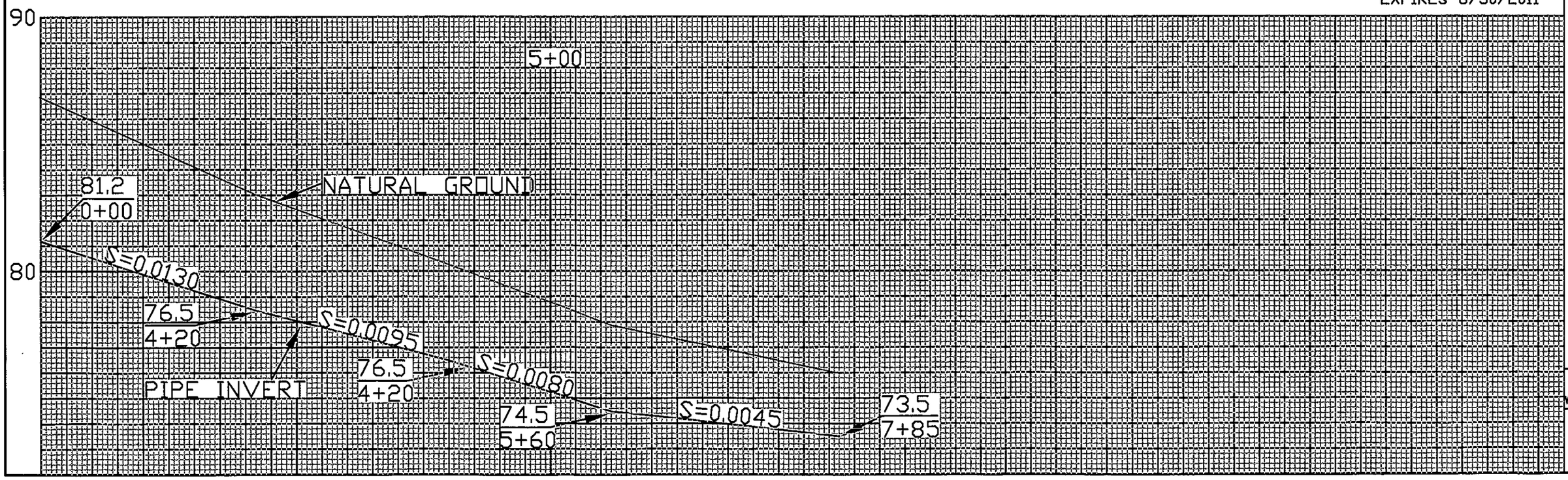
7+65-45° ELBOW
7+85 END OF PIPE
AT POND 9

PRELIMINARY SUBJECT TO REVISION

100 0 100
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2011



DATE
DESIGNED B. HEWES 10/09
PLOTTED
APPROVED

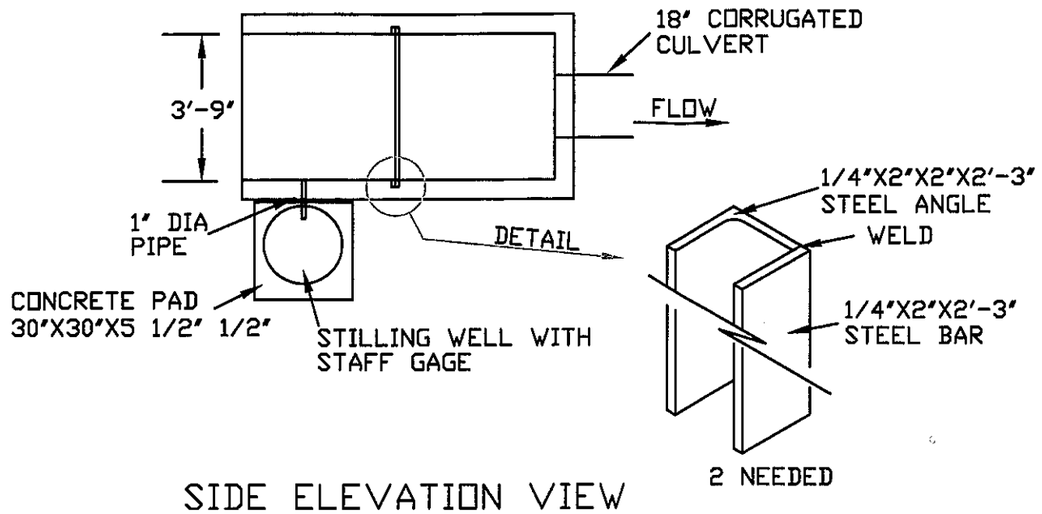
B. Hewes 11/14/2005 8:04 AM bhebanderkappdwg

WWBWC/HBDIC RECHARGE PROJECT
POND SUPPLY PIPE PLAN & PROFILE
UMATILLA COUNTY, OREGON

CAD FILE
whitelowpipe

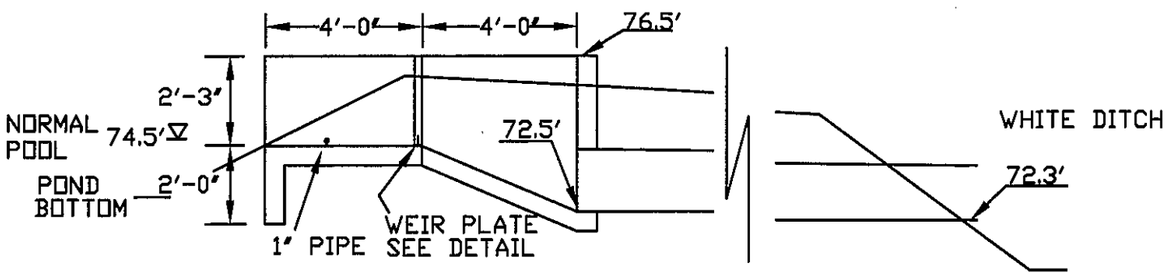
SHEET 3
OF 4

POND EMERGENCY OUTLET PLAN VIEW



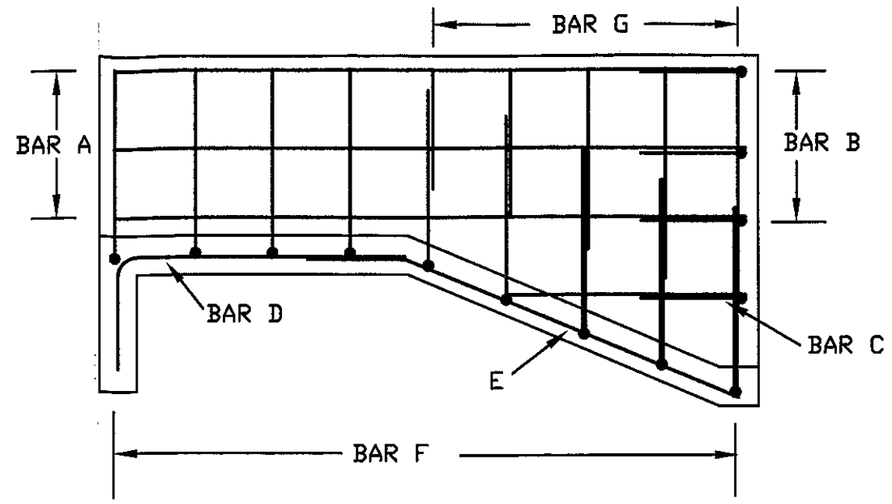
SIDE ELEVATION VIEW

STILLING WELL NOT SHOWN

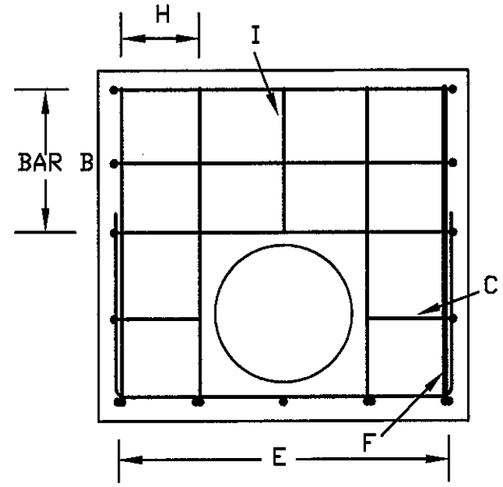


PRELIMINARY SUBJECT TO REVISION

REINFORCING STEEL DETAILS SIDE ELEVATION VIEW



PIPE INLET END ELEVATION VIEW



NOTES

INSTALL CONCRETE IN ACCORDANCE WITH CONSTRUCTION SPECIFICATION 42, "REINFORCED CONCRETE FOR MINOR STRUCTURES". USE 4000 PSI STRENGTH CONCRETE, NEED ABOUT 2.2 CU. YD.
REINFORCING STEEL ALL #4 BARS, NEED 260 FEET WITH NO WASTE.
CULVERT PIPE MAY BE STEEL OR HIGH DENSITY POLYETHYLENE.
SET THE WEIR PLATE IN A RABBET CUT INTO A 1 1/2"X1 3/4" BOARD AND SET INTO THE SOCKETS. THE WEIR PLATE TO BE STEEL 1/8"X3"X48".
SET THE STILLING WELL AT LEAST 2" INTO THE CONCRETE BASE. USE A MINIMUM PIPE DIAMETER OF 18" EITHER PVC OR STEEL.
SET THE STAFF GAGE ZERO POINT IN THE STILLING WELL LEVEL WITH THE CREST OF THE WEIR PLATE. INSTALL THE 1" PIPE TO THE STILLING WELL WITH 1" BETWEEN THE FLOOR AND PIPE.

REINFORCING STEEL SCHEDULE

ALL #4 BARS, 12" NOMINAL SPACING

BAR	NO.	SHAPE	A	B	C
A	6	straight	7'-8"	--	--
B	3	A B C	1'-3"	4'-3"	1'-3"
C	2	A B	1'-3"	1'-1"	--
D	5	A B	1'-6"	4'-0"	--
E	5	A B	1'-3"	4'-8"	--
F	9	A B C	2'-4"	4'-3"	2'-4"
G	10	straight	varies	--	--
H	4	A B	1'-3"	4'-1"	--
I	1	straight	1'-10"	--	--

REGISTERED PROFESSIONAL ENGINEER 6476 OREGON JULY 11, 1969 BERNARD J. HEWES

EXPIRES 6/30/2011

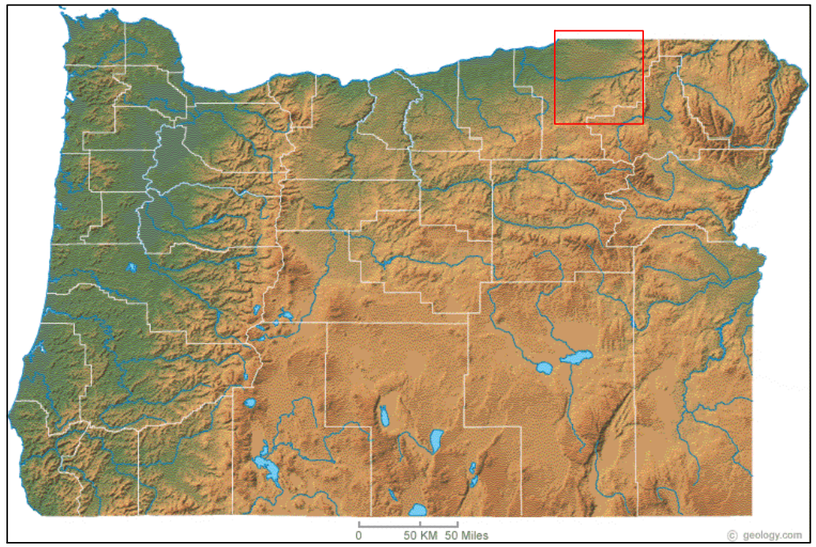
Bernard Hewes, r/a 10/15/2009 11:09 AM whitelowweir.dwg

DESIGNED B. HEWES DATE 10/09
CHECKED
APPROVED

WWBWC/HBDIC LOWER RECHARGE PROJECT
EMERGENCY SPILLWAY WEIR
UMATILLA COUNTY, OREGON
B H ENGINEERING

CAD FILE whitelowweir

SHEET 4 OF 4



LOCATION MAP

LeFore Road
Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council

INDEX OF DRAWINGS

SHEET NO.	TITLE
1	Cover Sheet & Location Map
2	Plan View
3	Details 1
4	Details 2

GENERAL NOTES

1. The attached Material and Installation Specifications are part of this plan and shall govern the installation of this project.
2. This installation shall be constructed to the lines and grades as shown on the drawings and detailed in the construction specificatoins.
3. Construction activities shall be performed in a manner that minimizes soil, water, and air pollution.
4. Construction activities will be conducted in a manner consistent with all safety regulations for work activities necessary for this installation.
5. No representation is made of any utilities, public or private. Absence of utilities on these drawings does not assure that no utilities are present. If buried utilities are shown, the location and depth are approximate. The exact location and depth of any utility must be determined by the utility company prior to any excavation.
6. Contractor is responsible for acquiring and complying with all permits.

UTILITIES

Oregon State Law requires Owners and Operators to notify utilities two business days before construction begins to have underground utilities located. To comply with the law call the Utilities Underground Location Center at: 1-800-332-2344

Review and Acceptance

I have reviewed the Drawings and Construction specifications provided and find them to be acceptable for installation. I also acknowledge that any modifications shall be approved by the Engineer prior to installation. I also acknowledge that I have received a copy of this plan.

Owner _____ Date _____

Cover Sheet

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

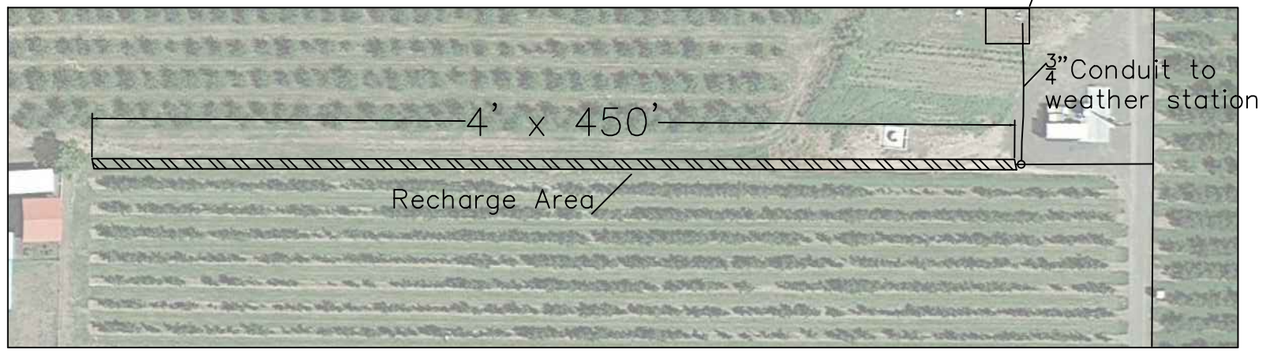
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

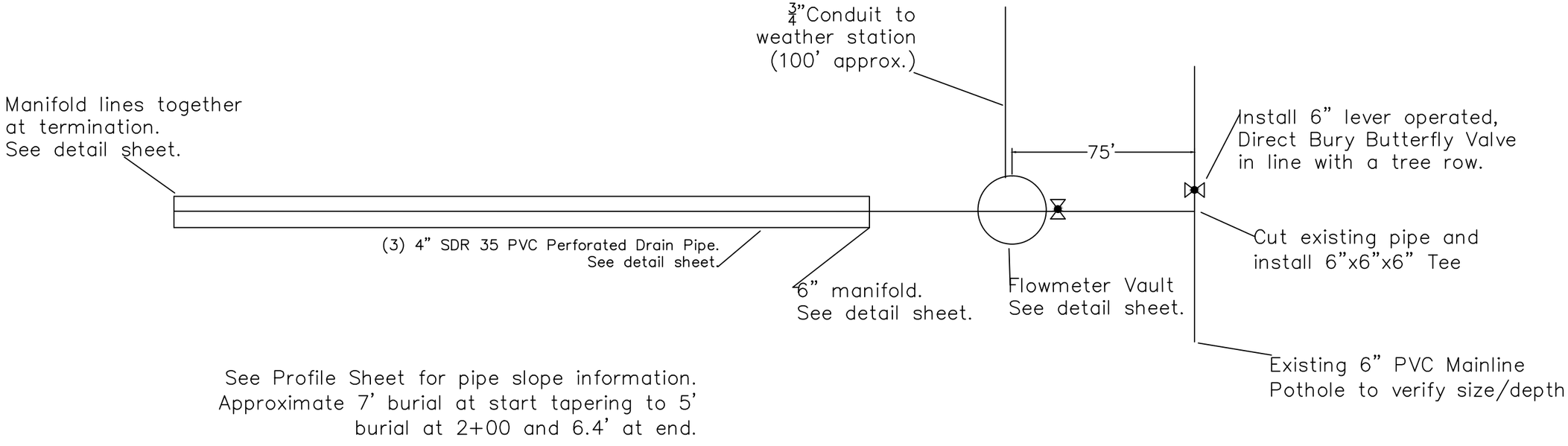
LeFore Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 1

SHEET NO. 1 OF 5





See Profile Sheet for pipe slope information.
Approximate 7' burial at start tapering to 5' burial at 2+00 and 6.4' at end.

Plan View

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

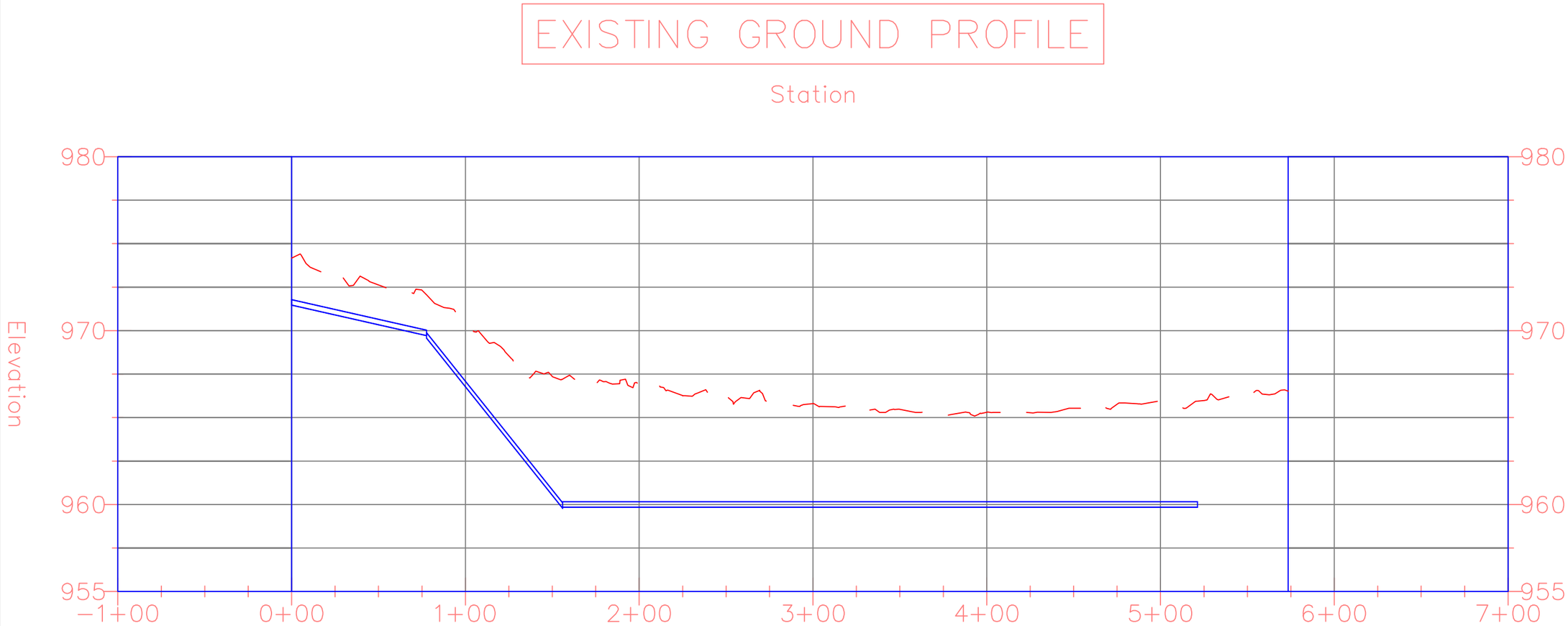
LeFore Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 2

SHEET NO. 2 OF 5

EXISTING GROUND PROFILE



Profile Sheet

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595−8990

DESIGNED BY:
DRAWN BY:
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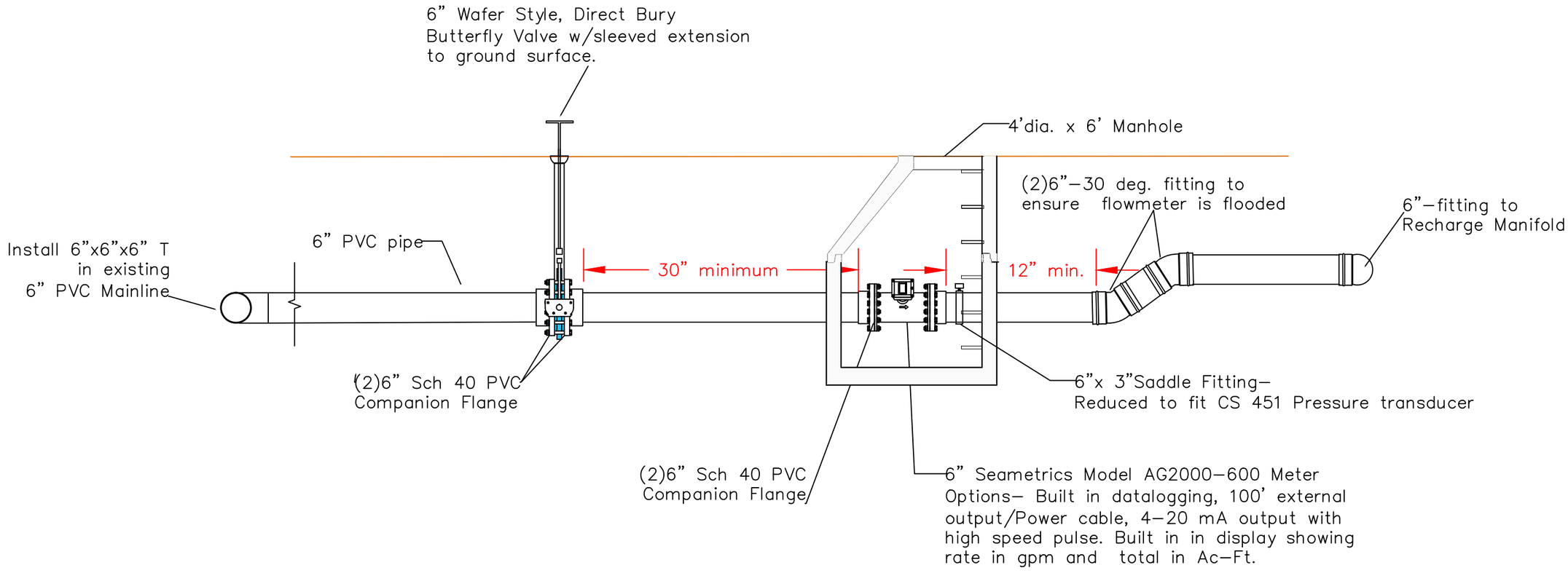
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

LeFore Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 3

SHEET NO. 3 OF 5



Flowmeter Vault

Details 1

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

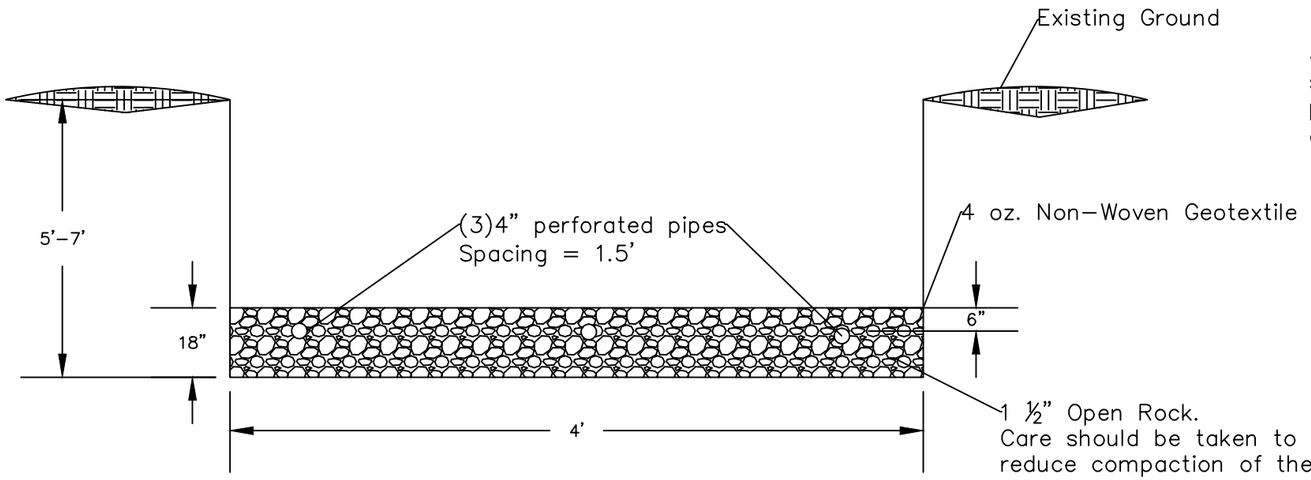
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

LeFore Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

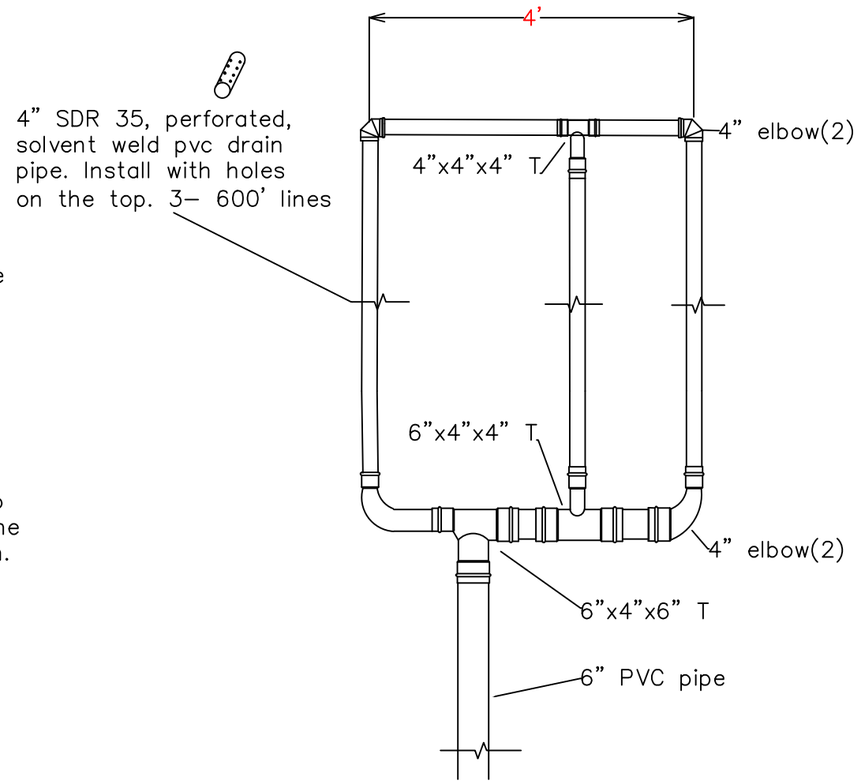
SIGNATURE: _____

SHEET: 4

SHEET NO. 4 OF 5



Recharge Area– Trench



Recharge Manifold

Details 2

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

DESIGNED BY:
DRAWN BY:
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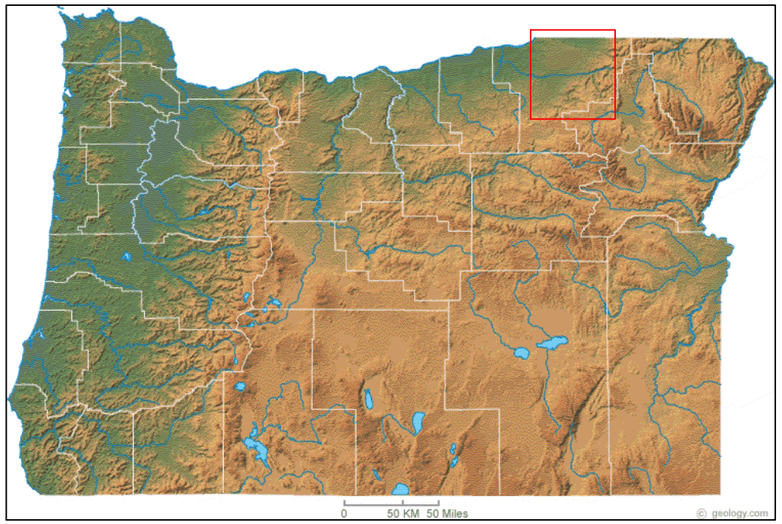
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

LeFore Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 5

SHEET NO. 5 OF 5



LOCATION MAP

Locust Road
Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council

INDEX OF DRAWINGS

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Review and Acceptance

I have reviewed the Drawings and Construction specifications provided and find them to be acceptable for installation. I also acknowledge that any modifications shall be approved by the Engineer prior to installation. I also acknowledge that I have received a copy of this plan.

Owner _____ Date _____

Cover Sheet

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

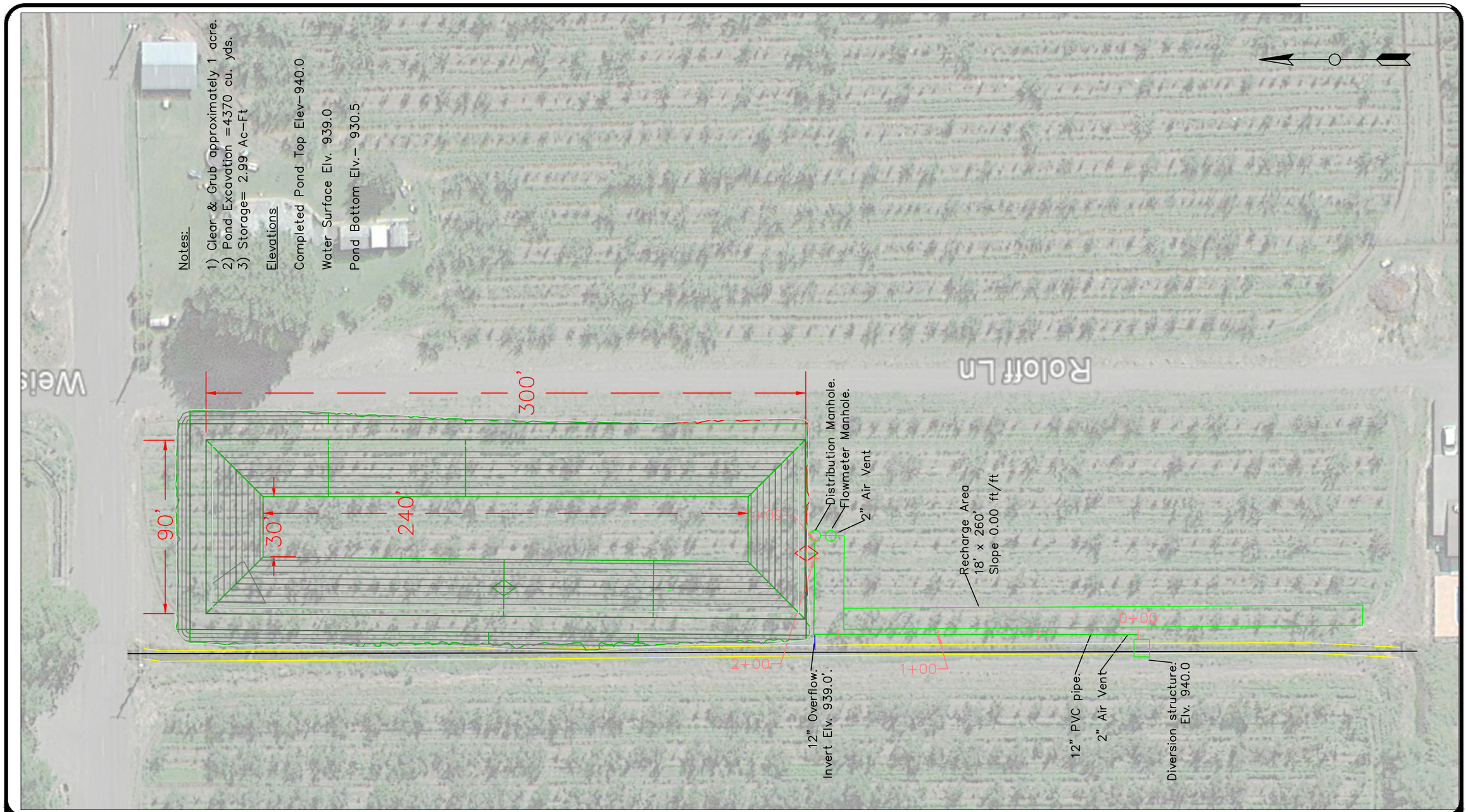
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Locust Road Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 1

SHEET NO. 1 OF 7



Plan View

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

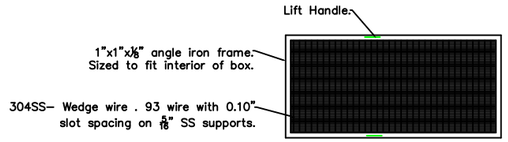
DESIGNED BY: _____
DRAWN BY: _____
CHECKED BY: _____
APPROVED BY: _____
REVISED BY: _____
SCALE: _____
DATE: _____
REVISED DATE: _____

Locust Road Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

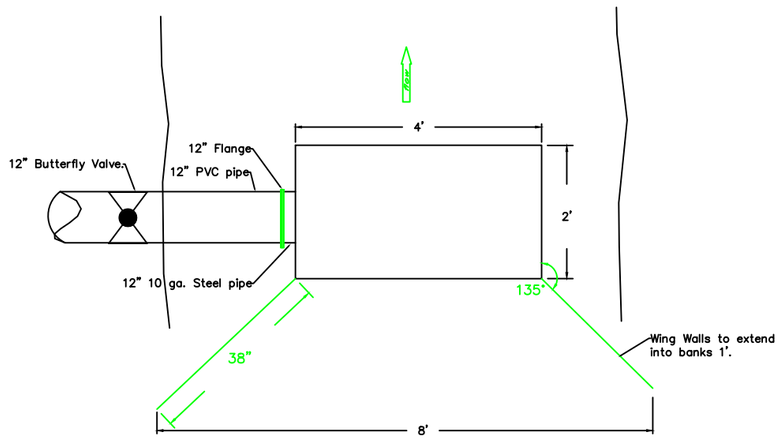
SIGNATURE: _____

SHEET: 2

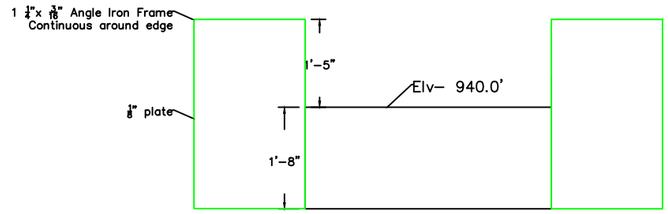
SHEET NO. 2 OF 7



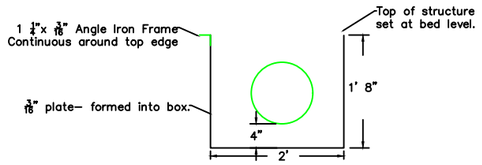
Screen



Intake Box– Plan



Intake Box– Section



Intake Box– Section

Notes

Intake Box shall be cleaned and painted with 2 coats of paint.

Control Structure

Details 1

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

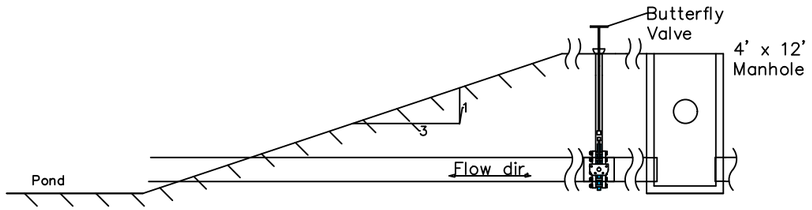
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Locust Road Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

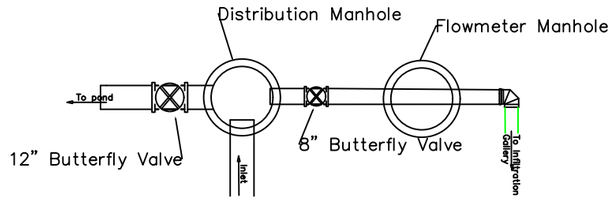
SIGNATURE:

SHEET: 3

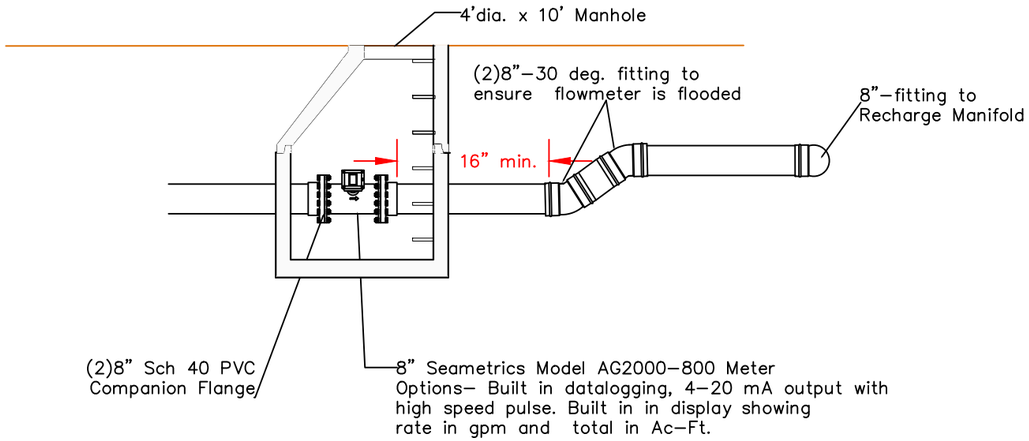
SHEET NO. 3 OF 7



Pond Embankment



Manhole Plan



Flowmeter Vault

Details 2

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

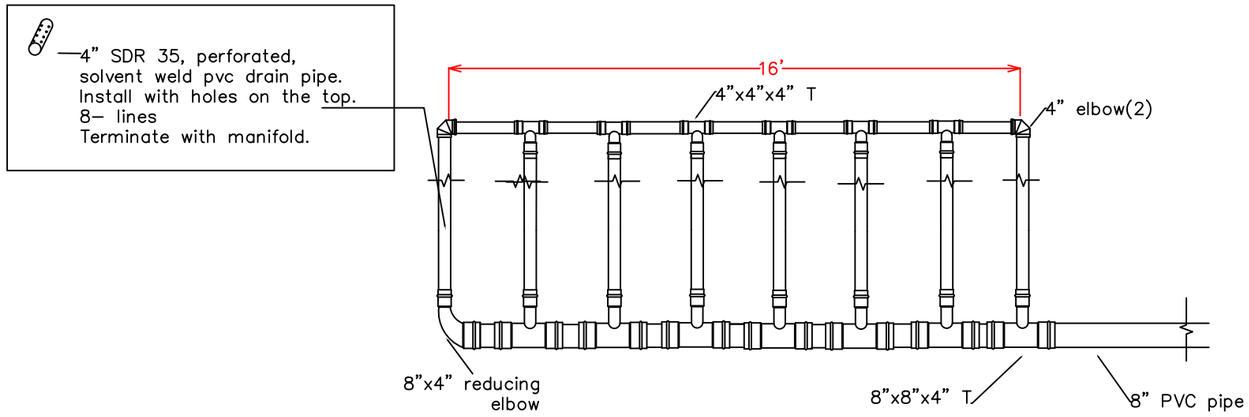
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Locust Road Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

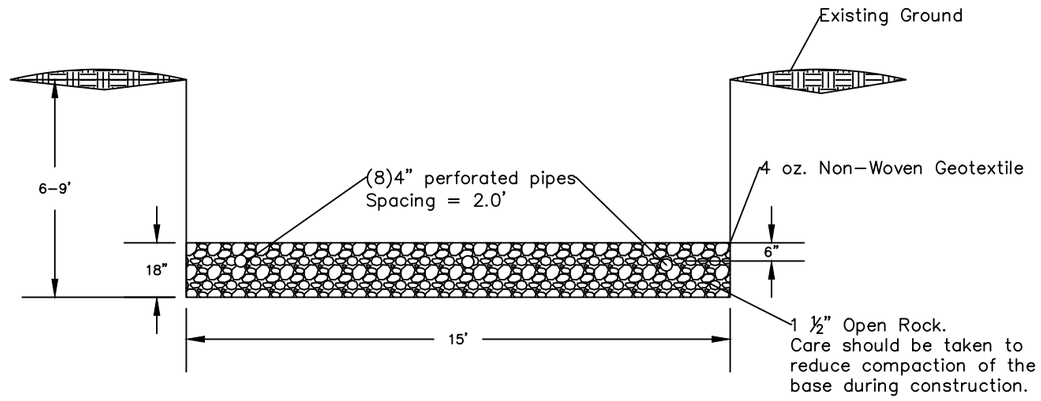
SIGNATURE:

SHEET: 4

SHEET NO. 4 OF 7



Recharge Manifold



Recharge Area– Trench

Details 3

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

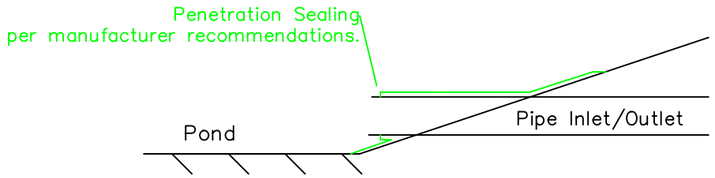
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Locust Road Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

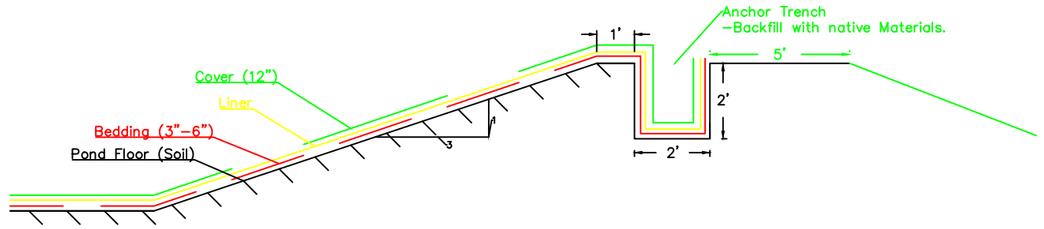
SIGNATURE: _____

SHEET: 5

SHEET NO. 5 OF 7



Typical Liner Penetration



Liner Details

Liner Details:

1. Remove organic materials.
2. Excavate to staked despth.
3. Grade side slopes to 3:1(or flatter).
4. If sharp materials are present in sub-grade materials bedding shall be installed. Project manager shall determine if bedding is required.
5. Liner shall be HDPE 40 mil (minimum). Liner size shall be determined after sub-grade is completed.
6. Install liner to manufacturer's recommendations.

Details 4

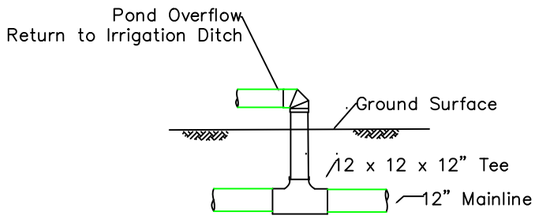
Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

DESIGNED BY: _____
DRAWN BY: _____
CHECKED BY: _____
APPROVED BY: _____
REVISED BY: _____
SCALE: _____
DATE: _____
REVISED DATE: _____

Locust Road Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 6
SHEET NO. 6 OF 7



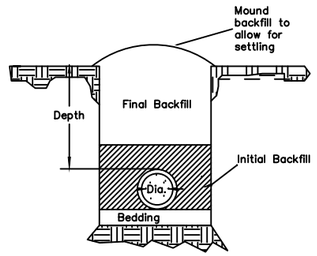
Pond Overflow

Construction Notes

1) Bedding shall be used on foundations containing materials larger than ¾" inch.

2) The initial backfill material shall consist of soil or granular material that is free from rocks greater than ¾" in diamter.

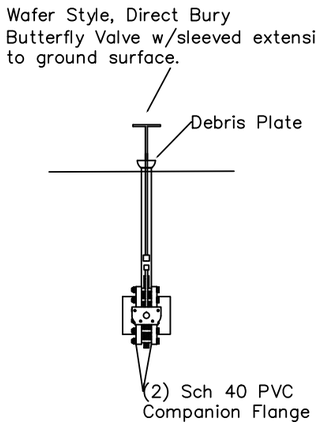
3) The final backfill shall be free from material larger than 3 inches.



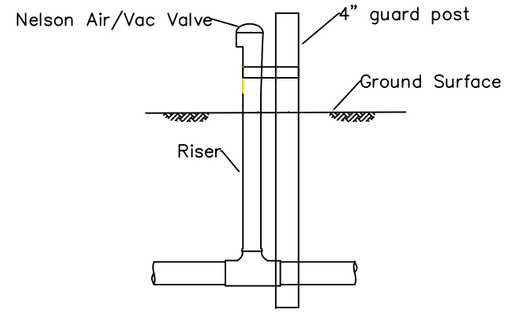
Pipe Specifications:
Diameter (Dia.) = 4", 8" & 12" PVC
Min. Pressure Rating 80 psi or SDR 35 as called out.
Minimum Burial= 3'

Drawing is not to Scale.

Trench Detail



Butterfly Valve



Air Vent

Details 5

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

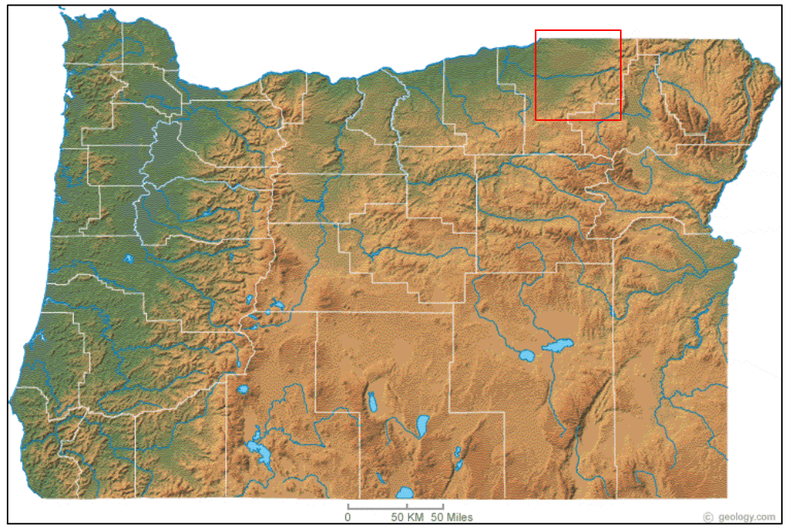
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Locust Road Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE:

SHEET: 7

SHEET NO. 7 OF 7



LOCATION MAP

Mud Creek
Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council

INDEX OF DRAWINGS

GENERAL NOTES

1. The attached Material and Installation Specifications are part of this plan and shall govern the installation of this project.
2. This installation shall be constructed to the lines and grades as shown on the drawings and detailed in the construction specificatoins.
3. Construction activities shall be performed in a manner that minimizes soil, water, and air pollution.
4. Construction activities will be conducted in a manner consistent with all safety regulations for work activities necessary for this installation.
5. No representation is made of any utilities, public or private. Absence of utilities on these drawings does not assure that no utilities are present. If buried utilities are shown, the location and depth are approximate. The exact location and depth of any utility must be determined by the utility company prior to any excavation.
6. Contractor is responsible for acquiring and complying with all permits.

UTILITIES

Oregon State Law requires Owners and Operators to notify utilities two business days before construction begins to have underground utilities located. To comply with the law call the Utilities Underground Location Center at: 1-800-332-2344

Review and Acceptance

I have reviewed the Drawings and Construction specifications provided and find them to be acceptable for installation. I also acknowledge that any modifications shall be approved by the Engineer prior to installation. I also acknowledge that I have received a copy of this plan.

Owner _____ Date _____

Cover Sheet

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

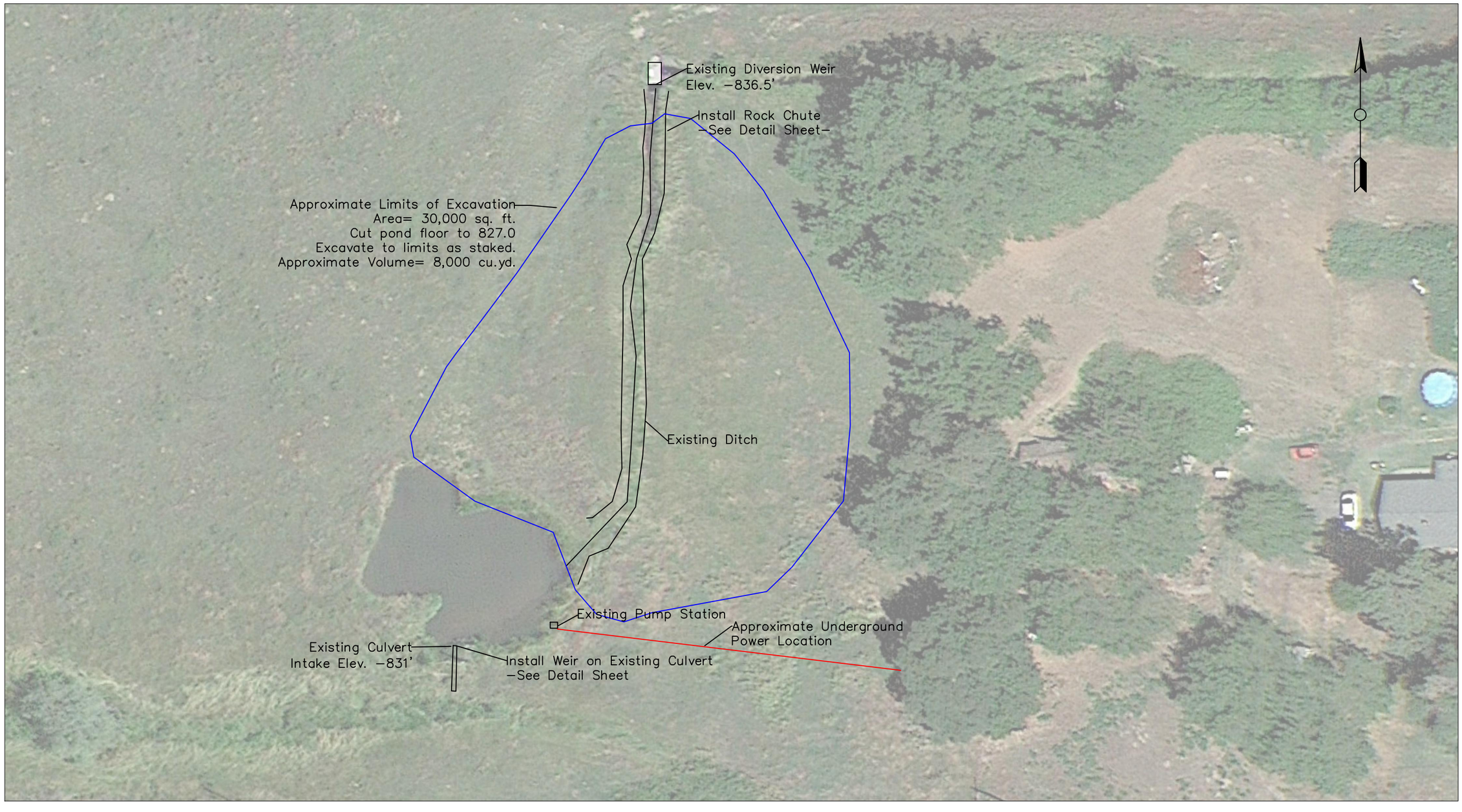
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Mud Creek Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 1

SHEET NO. 1 OF 3



Plan View

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595−8990

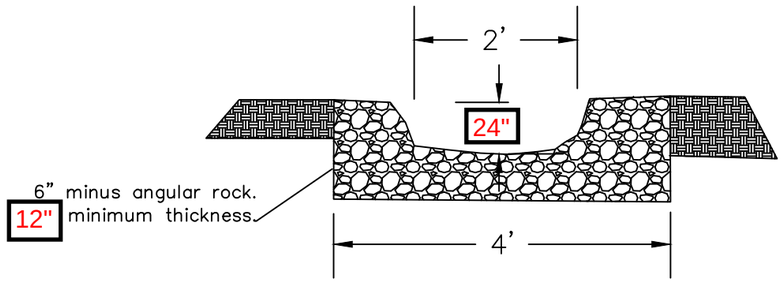
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Mud Creek Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

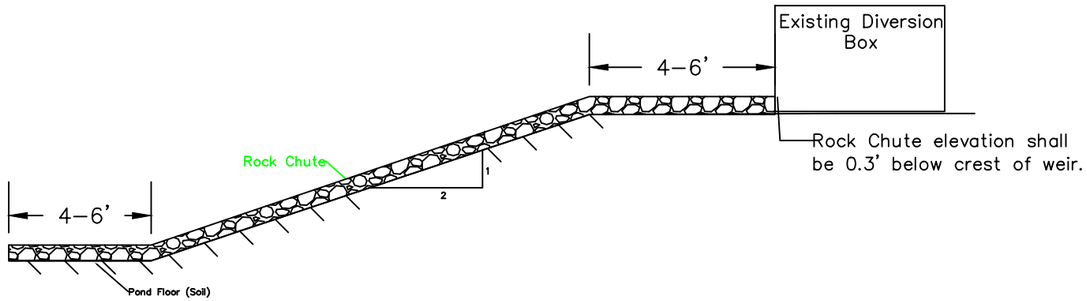
SIGNATURE: _____

SHEET: 2

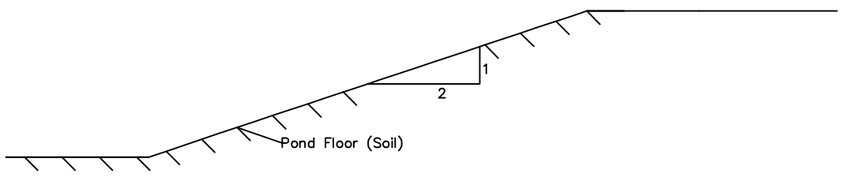
SHEET NO. 2 OF 3



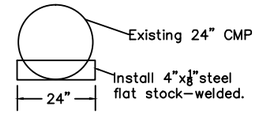
Rock Chute– Section View



Rock Chute Profile



Pond Side Slope Requirements



Weir– Existing culvert

Details 1

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

DESIGNED BY:
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CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Mud Creek Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

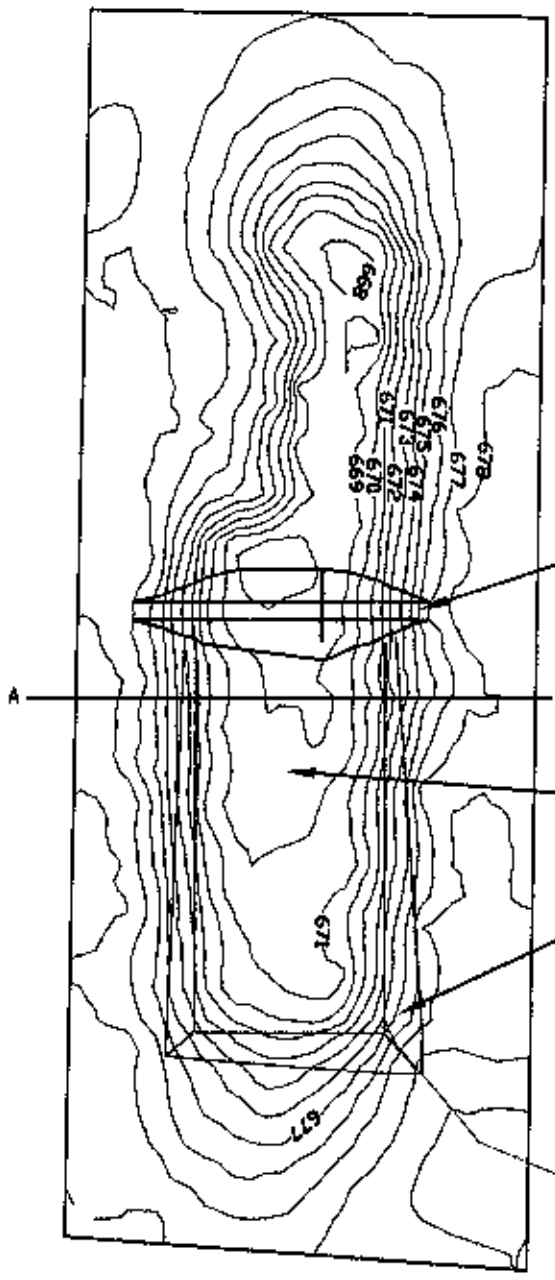
SIGNATURE: _____

SHEET: 3

SHEET NO. 3 OF 3

N

SITE PLAN VIEW



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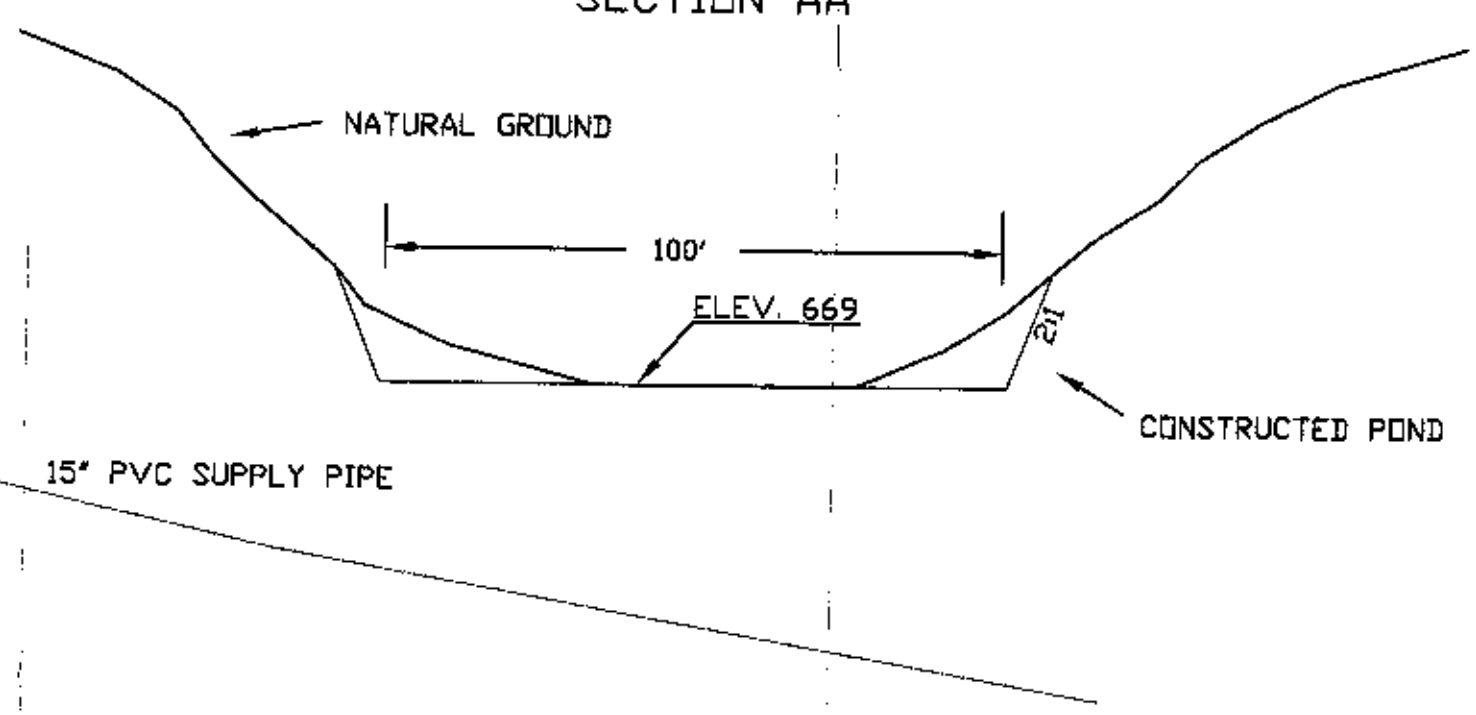
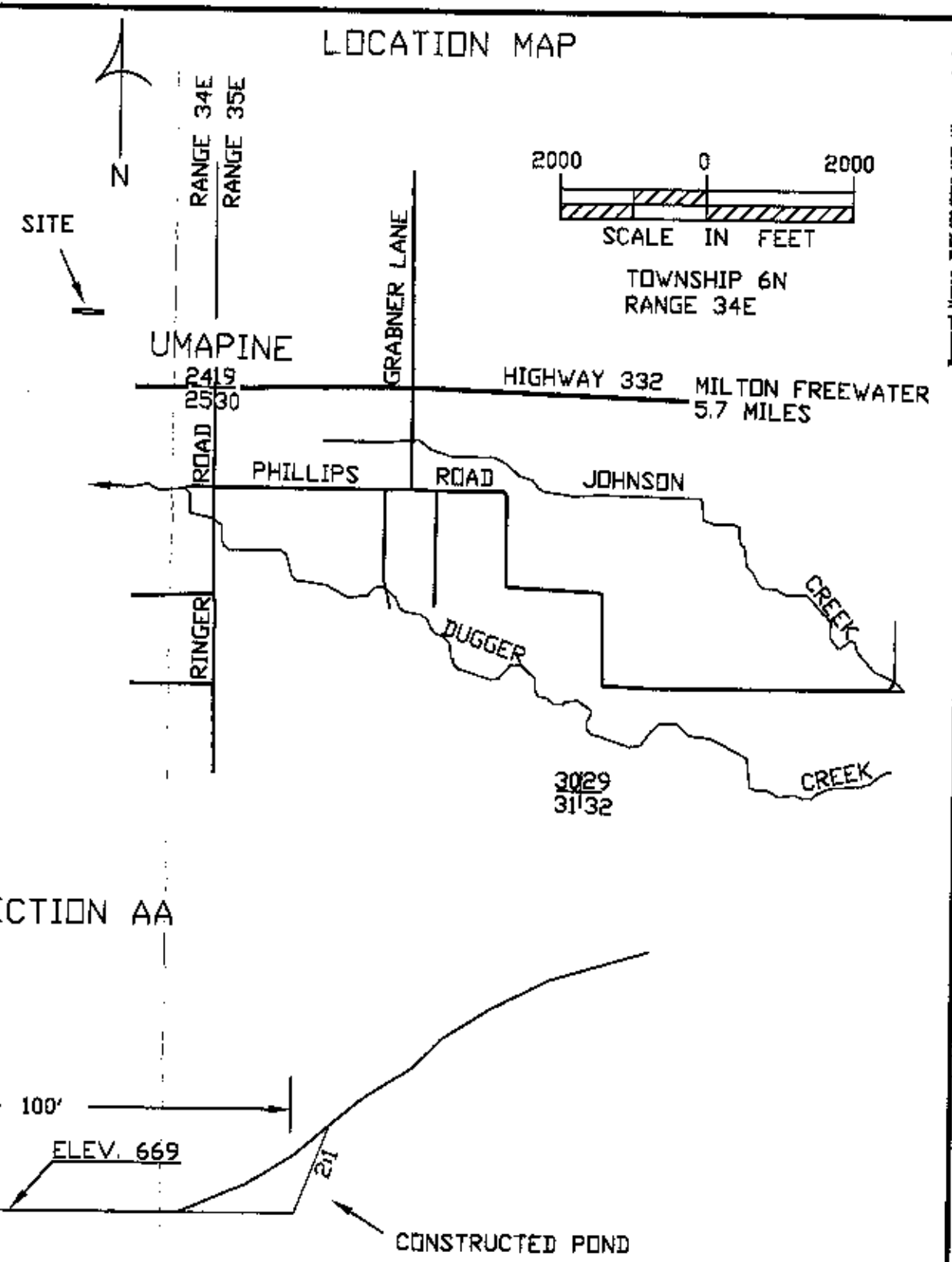
SCALE IN FEET

SECTION AA



LOCATION MAP



REGISTERED PROFESSIONAL ENGINEER
6476
Bernard Hewes
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2013

WWBWC/HBDIC UMAPINE RECHARGE PROJECT
PROJECT SITE PLAN AND LOCATION MAP
UMATILLA COUNTY, OREGON

B H ENGINEERING

DESIGNED B. HEWES DATE 5/12

CHECKED

APPROVED

CAD FILE umarcgpln

SHEET 1 OF 4

0+00 CONNECT TO THE EXISTING RICHARTZ PIPELINE.
0+00 = +/- 66+75 ON THE RICHARTZ PIPELINE.
0+04-15' GEAR OPERATED BUTTERFLY VALVE.
0+06-15' TEE WITH 3' CONTINUOUS ACTING AIR-VAC VALVE.
0+20 INSTALL 15' FLOW METER IN 48' MANHOLE

N

PC 5+00

PIPE CENTER LINE

9+35 OUTLET STRUCTURE
SEE DETAIL SHEET 3

CONSTRUCTED POND BOTTOM ELEVATION 669 FEET

NOTES
INSTALL PIPE ACCORDING TO NATURAL RESOURCES CONSERVATION SERVICE SPECIFICATION 430DD.
CURVE RADIUS IS 1000 FEET.
THE 48' MANHOLES NEAR THE PIPE ENTRANCE ARE TO EXTEND ABOVE THE GROUND SURFACE AT LEAST 18' TO ALLOW STHEM TO BE SEEN IN THE CROP.

100 0 100
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES
EXPIRES 6/30/2013

DATE
DESIGNED B. HEWES 5/12
PLOTTED
APPROVED

WWBWC/HBDIC UMAPINE RECHARGE PROJECT
SUPPLY PIPE PLAN & PROFILE
UMATILLA COUNTY, OREGON

CAD FILE umarcgpp

SHEET 2 OF 4

690
670

5+00 0+00

NATURAL GROUND

S=0.0020
684.00
0+00
PIPE INVERT

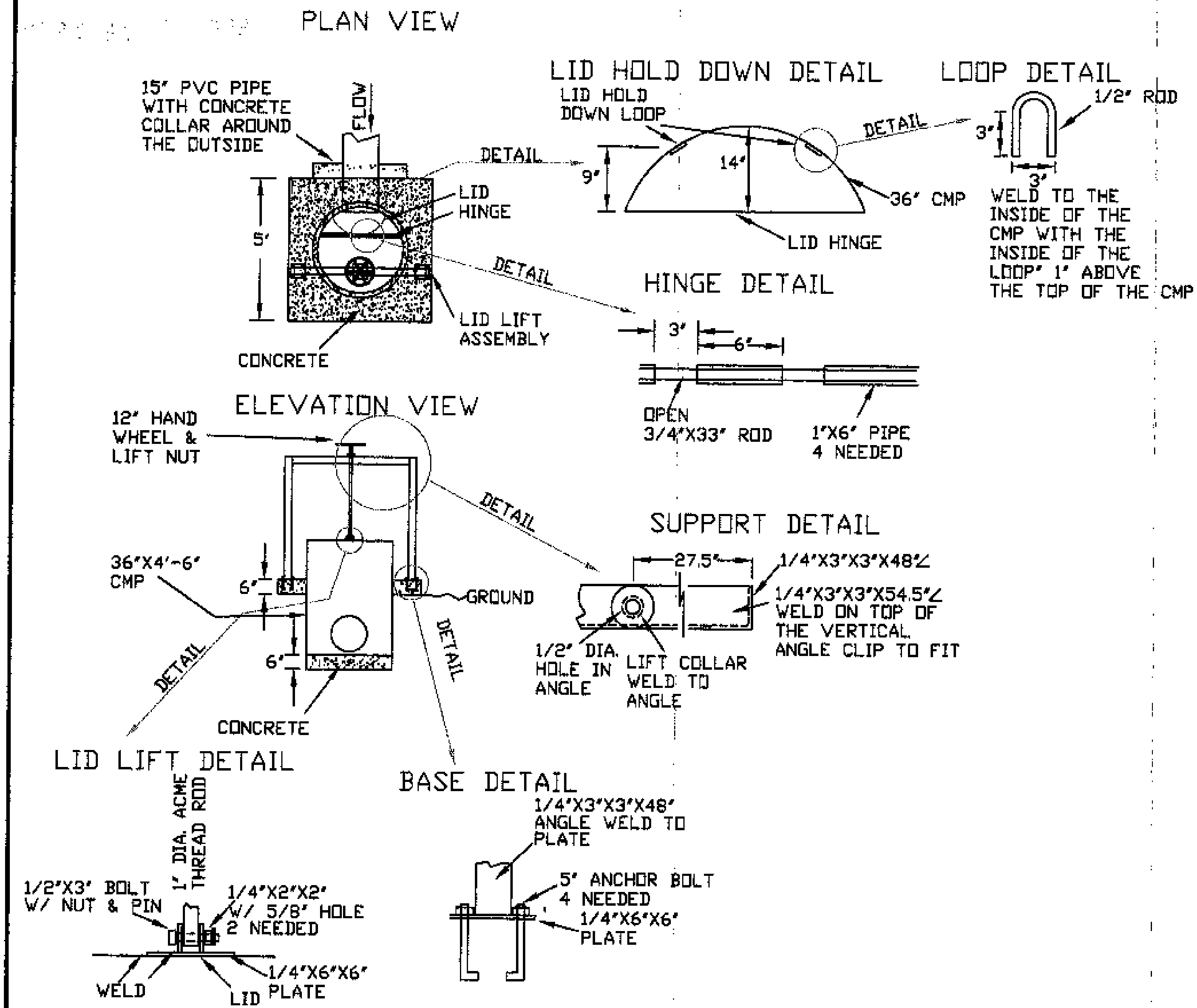
683.00
5+00
S=0.0500

678.00
6+00
S=0.0085

675.88
8+50
S=0.1030

667.12
9+35

15" CLASS 80 PVC PIP GASKETTED PIPE



NOTES

AT THE ESTIMATED DESIGN FLOW THE LID OPENING SHOULD BE ABOUT 6".
USE 4000 PSI STRENGTH CONCRETE, NEED 0.5 CU. YD. REINFORCE THE UPPER SLAB WITH A #4 BAR LOCATED 3" FROM THE OUTER EDGE, NEED 4-4'-6" BARS.
LID FOR THE OUTLET TO BE FABRICATED OUT OF 3/16" STEEL AND BE 40" IN DIAMETER.
USE 1" PIPE PIECES THROUGH THE LOOPS ON THE CMP TO TIGHTLY HOLD THE LID DOWN.

REGISTERED PROFESSIONAL ENGINEER 6476
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2013

WWBWC/HBDIC UMAPINE RECHARGE PROJECT
MISCELLANEOUS DETAILS
UMATILLA COUNTY, OREGON

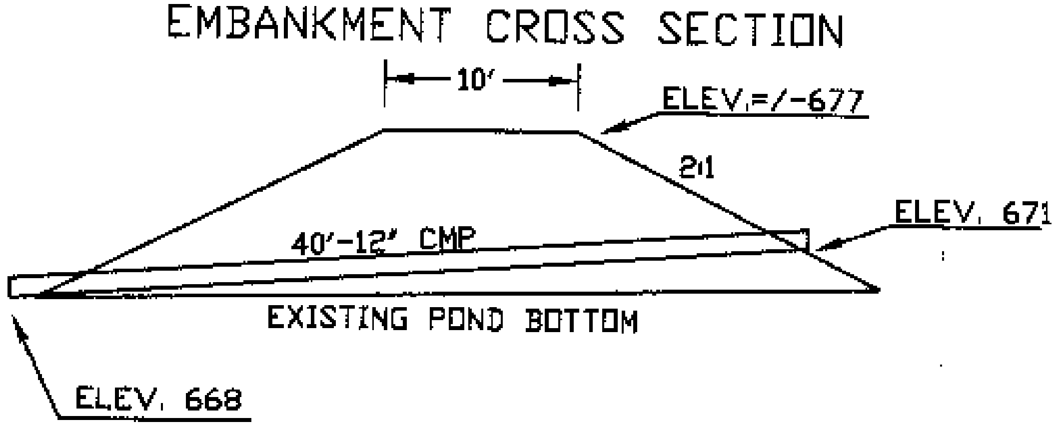
B H ENGINEERING

		DATE
DESIGNED	B. HEWES	5/12
CHECKED		
APPROVED		

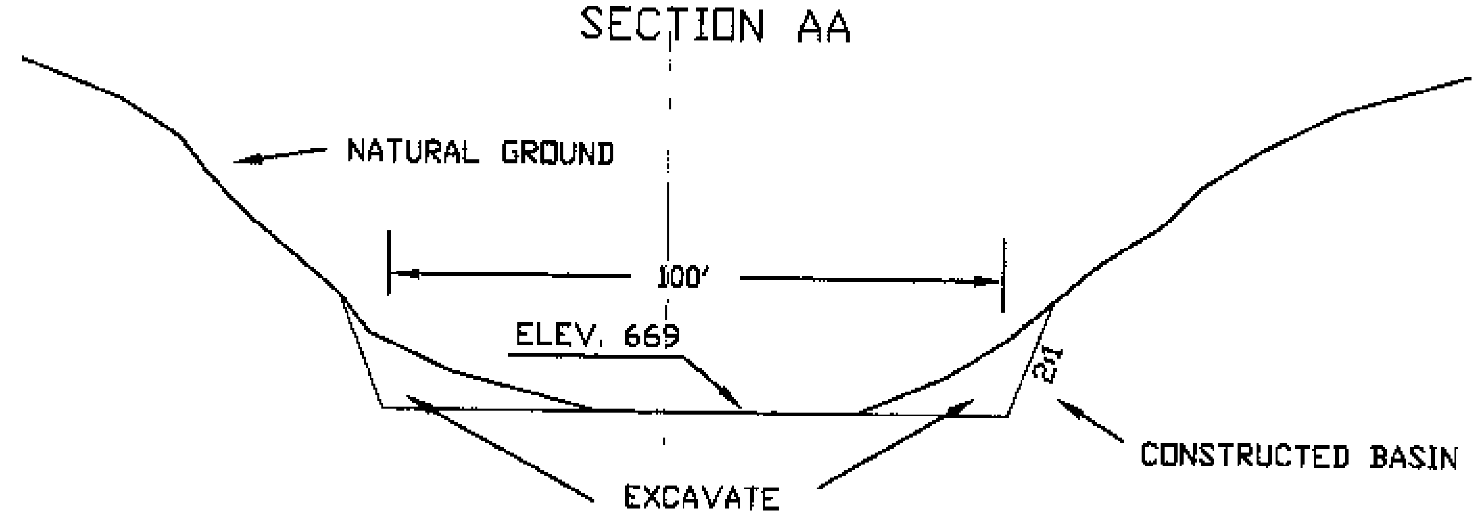
CAD FILE umarcgout

SHEET 3 OF 4

EMBANKMENT CROSS SECTION



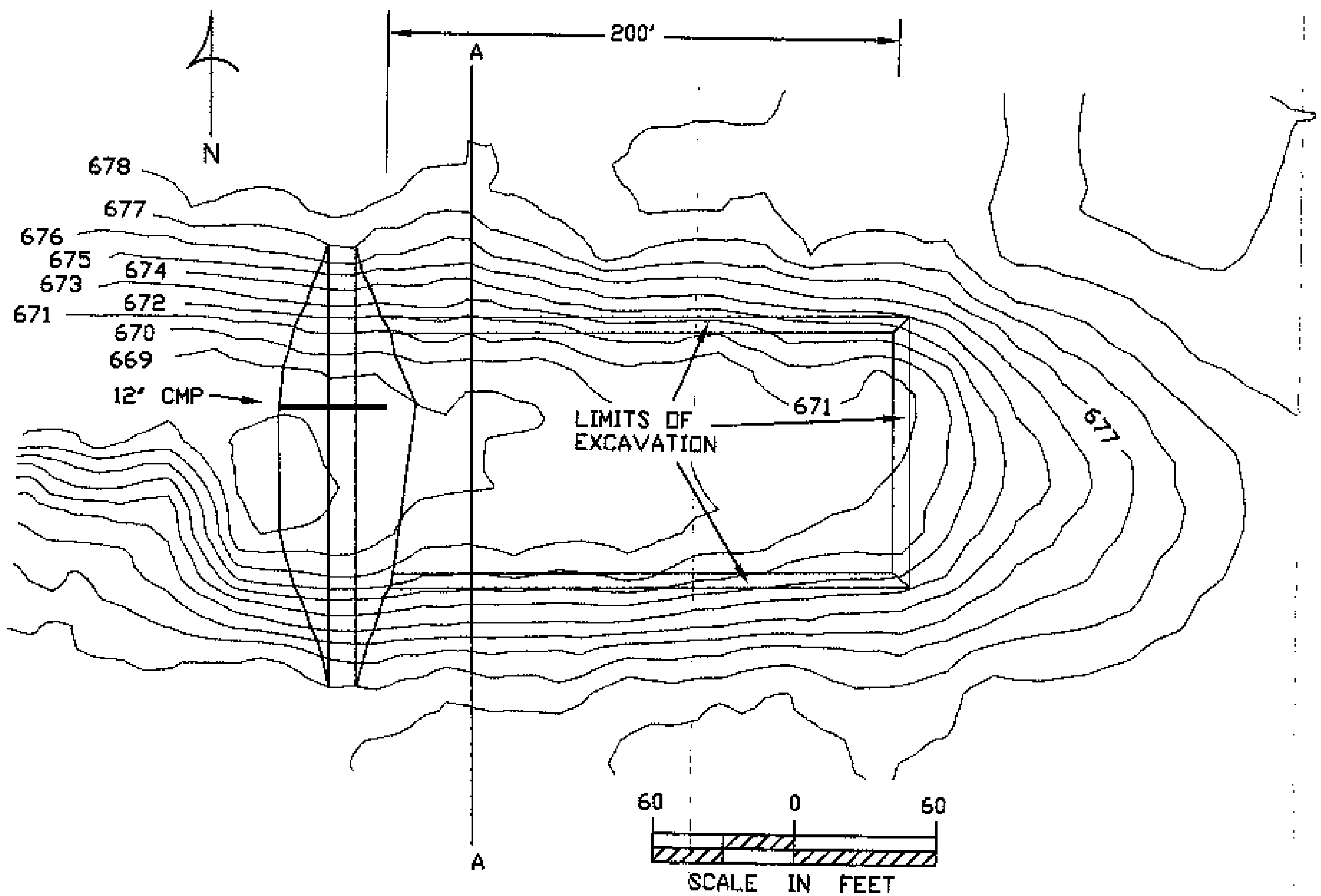
SECTION AA

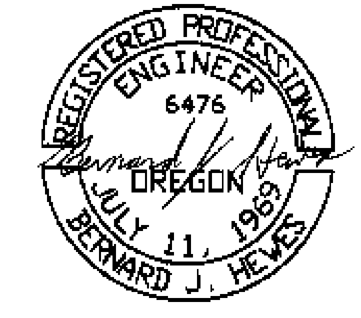


NOTES

ESTIMATED EXCAVATION VOLUME ABOUT 900 CU. YD.

CONSOLIDATE THE EMBANKMENT FILL USING A VIBRATING ROLLER COMPACTOR. USE AT LEAST TWO PASSES OVER 1' THICK, LOOSE LAYERS.





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WWBWC/HBDIC UMAPINE RECHARGE PROJECT
BASIN DETAILS
UMATILLA COUNTY, OREGON

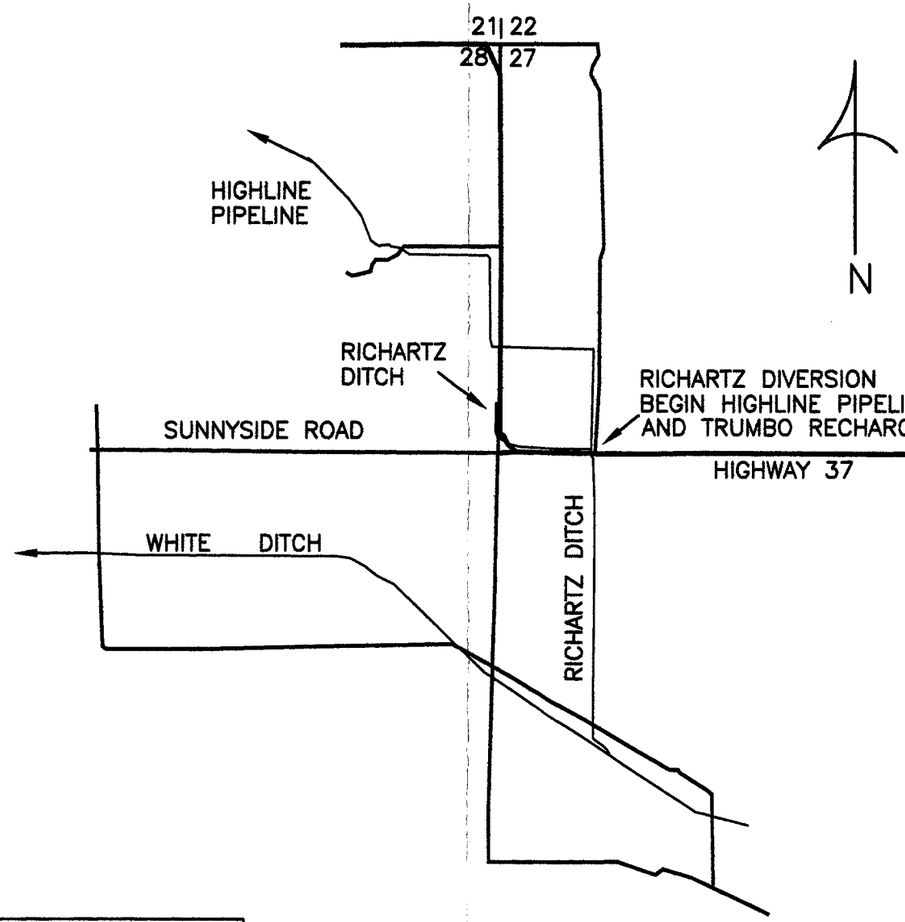
B H ENGINEERING

DESIGNED	B. HEWES	DATE 5/12
CHECKED		
APPROVED		

CAD FILE umarcgpond

SHEET 4 OF 4

PRELIMINARY SUBJECT
TO REVISION



SECTION 27
TOWNSHIP 6N
RANGE 35E

REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2013

Bernard Hewes, BHES/4/2012 3:18 P:\trumboloc.dwg

DESIGNED B. HEWES DATE 9/12
CHECKED
APPROVED

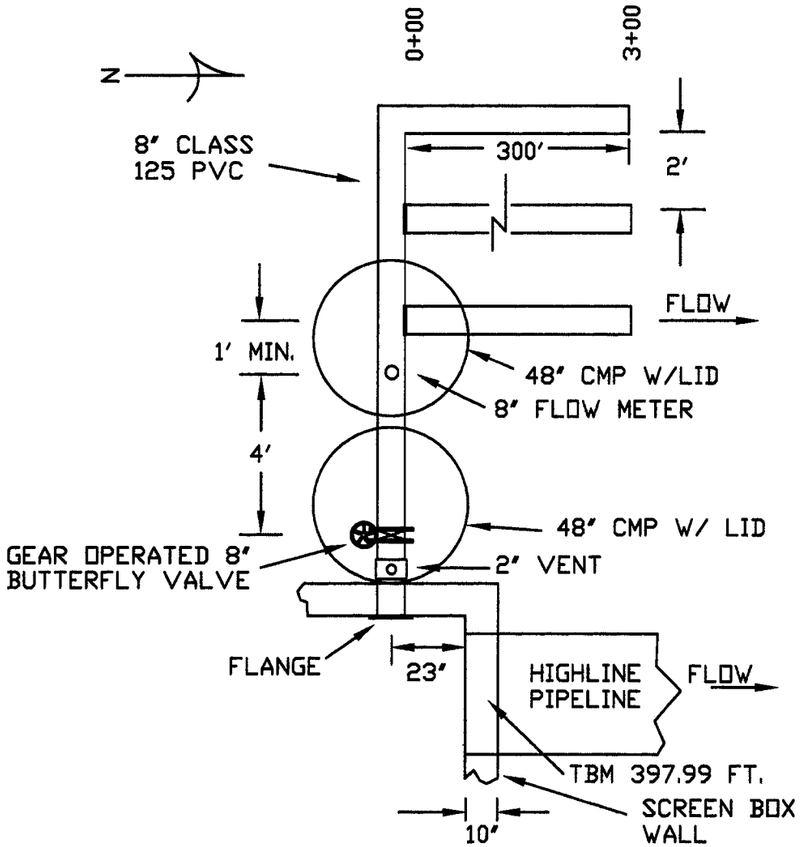
WWBWC/HBDIC TRUMBO LANE RECHARGE
LOCATION MAP
UMATILLA COUNTY, OREGON

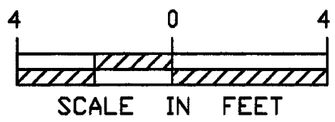
B H ENGINEERING

CADFILE
trumboloc

SHEET 1
OF 2

RECHARGE SYSTEM PLAN VIEW

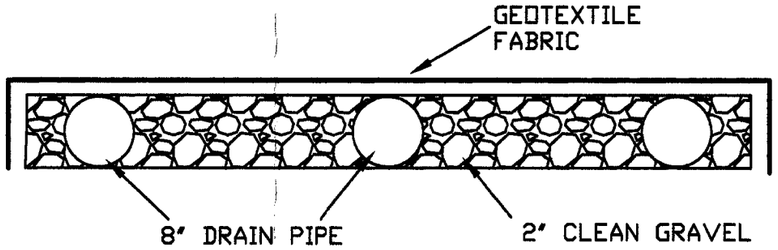




NOTES

BOTTOM OF THE HOLE FOR THE 8" OUTLET PIPE IS 20" ABOVE THE FLOOR AND 23" FROM THE INSIDE OF THE NORTH WALL. MINIMUM DIAMETER OF THE HOLE IS 10".
PLACE CAULK BETWEEN THE FLANGE AND THE WALL WHEN SETTING THE 8" PIPE. FORCE NON-SHRINK GROUT BETWEEN THE PIPE AND HOLE WALL. AFTER THE GROUT IS SET CLEAN UP ANY VOIDS WITH CAULKING COMPOUND.
THE 8" RECHARGE PIPE CAN BE EITHER CORRUGATED ABS PERFORATED DRAIN PIPE OR SMOOTH WALL LEACH FIELD PIPE. INSTALL A WYE NEAR 0+00 AND 2+00 ON EACH LINE FOR A CLEAN OUT. PLACE A REMOVABLE CAP ON THE END OF EACH DRAIN LINE FOR CLEANING OUT.

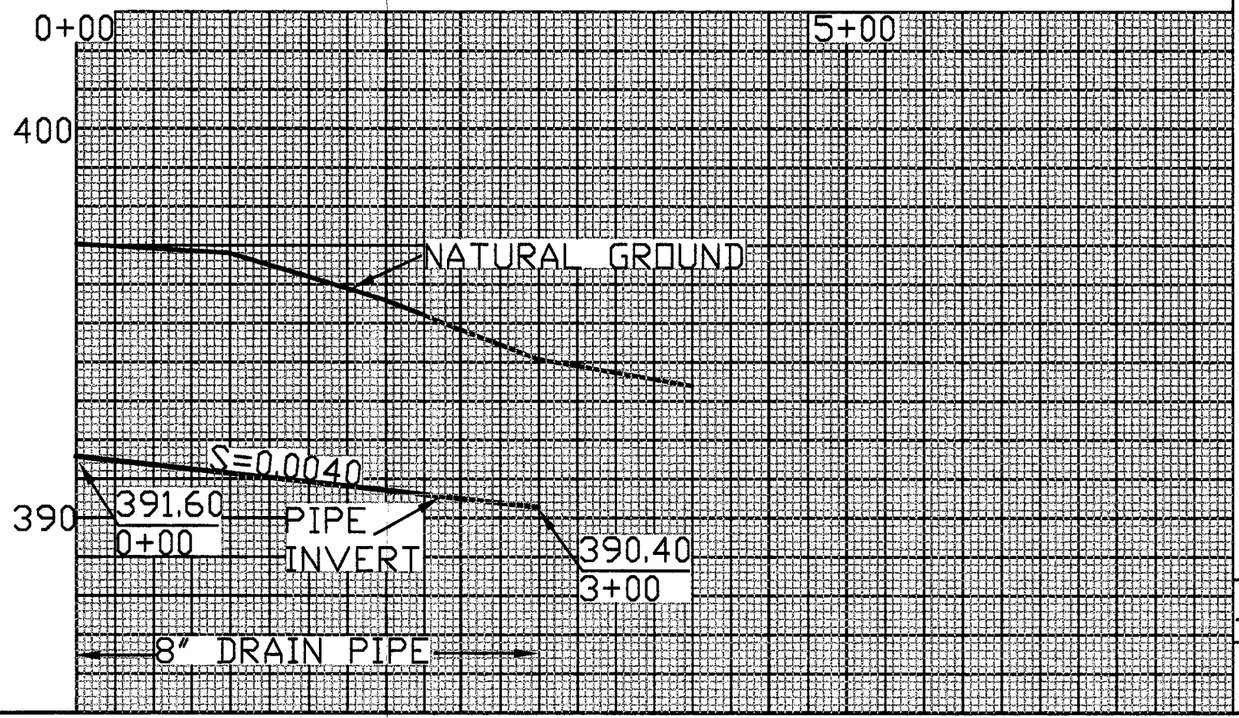
DRAIN PIPE CROSS SECTION ELEVATION VIEW



PRELIMINARY SUBJECT TO REVISION

REGISTERED PROFESSIONAL ENGINEER
6476
OREGON
JULY 11, 1969
BERNARD J. HEWES

EXPIRES 6/30/2013



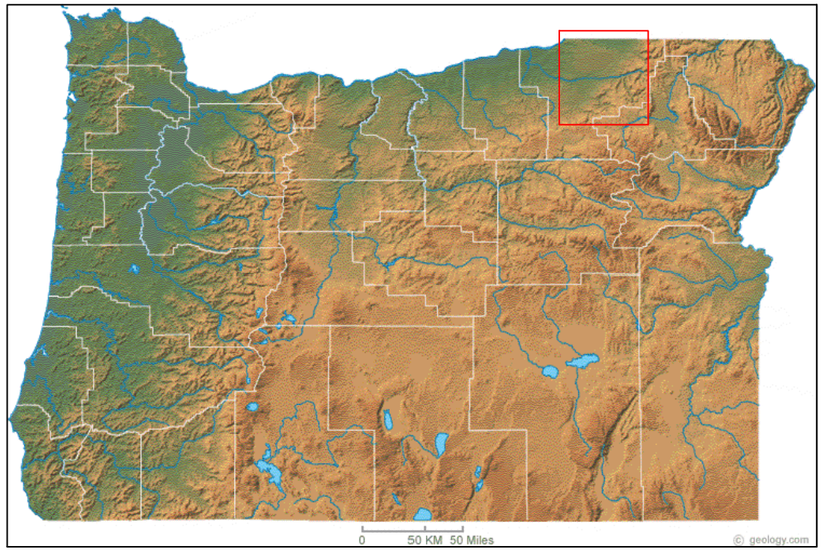
DESIGNED B. HEWES 9/12
PLOTTED
APPROVED
DATE

WWBWC/HBDIC TRUMBO LANE RECHARGE
PLAN & PROFILE
UMATILLA COUNTY, OREGON

CAD FILE trumboplan

SHEET 2 OF 2

Ringer Road
Shallow Aquifer Recharge Project
Walla Walla Basin Watershed Council



LOCATION MAP

INDEX OF DRAWINGS

SHEET NO.	TITLE
1	Cover Sheet & Location Map
2	Plan View
3	Details 1
4	Details 2

General Notes

1. The attached Material and Installation Specifications are part of this plan and shall govern the installation of this project.
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Review and Acceptance

I have reviewed the Drawings and Construction specifications provided and find them to be acceptable for installation. I also acknowledge that any modifications shall be approved by the Engineer prior to installation. I also acknowledge that I have received a copy of this plan.

Owner _____ Date _____

Cover Sheet

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

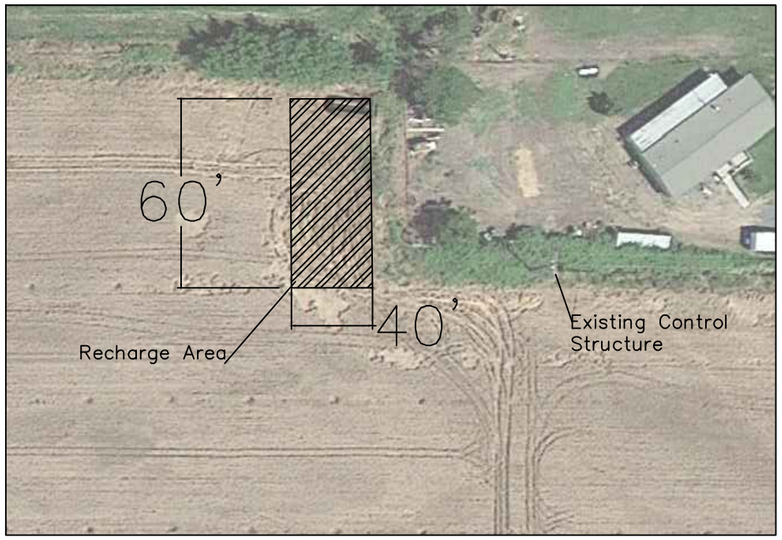
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

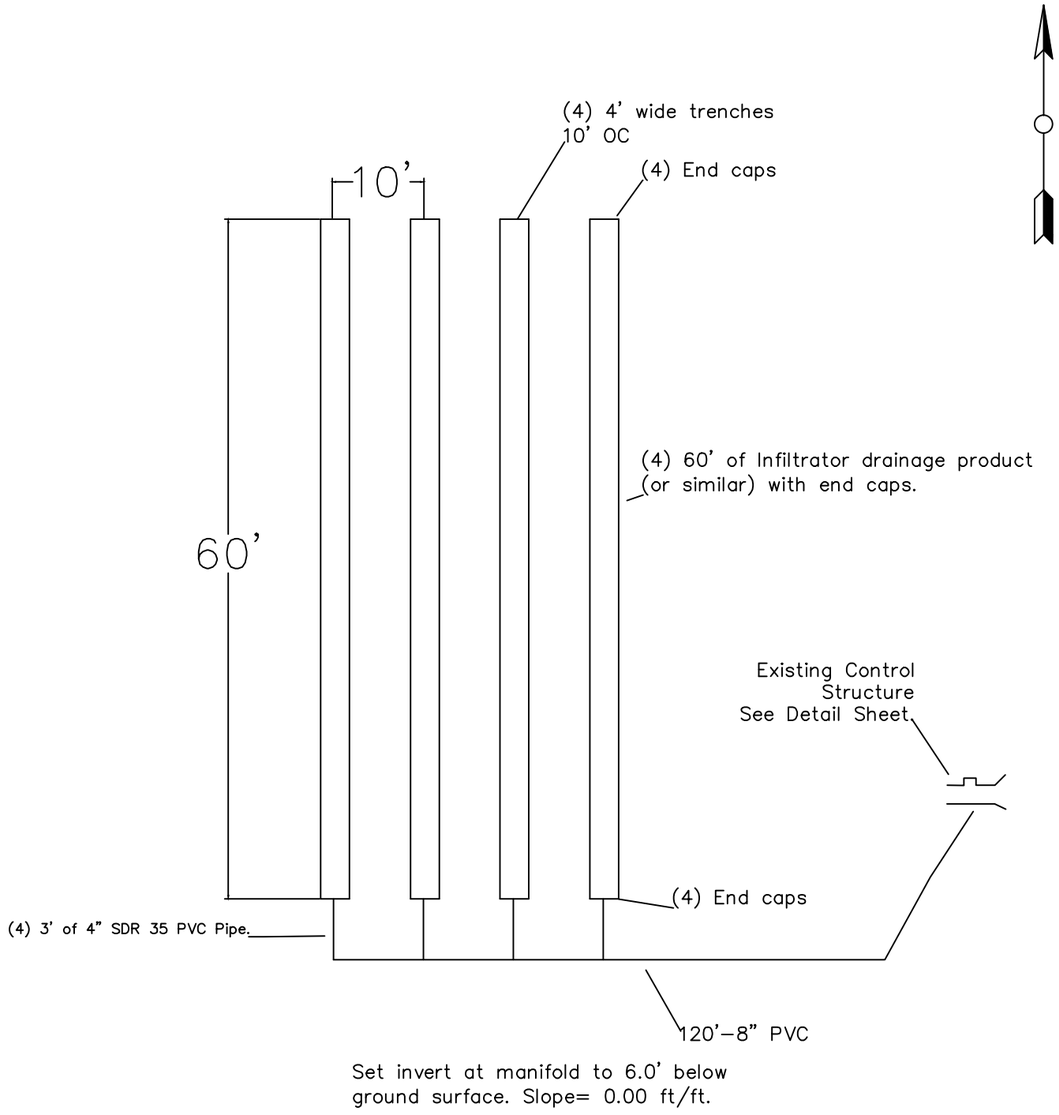
Ringer Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 1

SHEET NO. 1 OF 4





Set invert at manifold to 6.0’ below ground surface. Slope= 0.00 ft/ft.

Plan View

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595–8990

DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

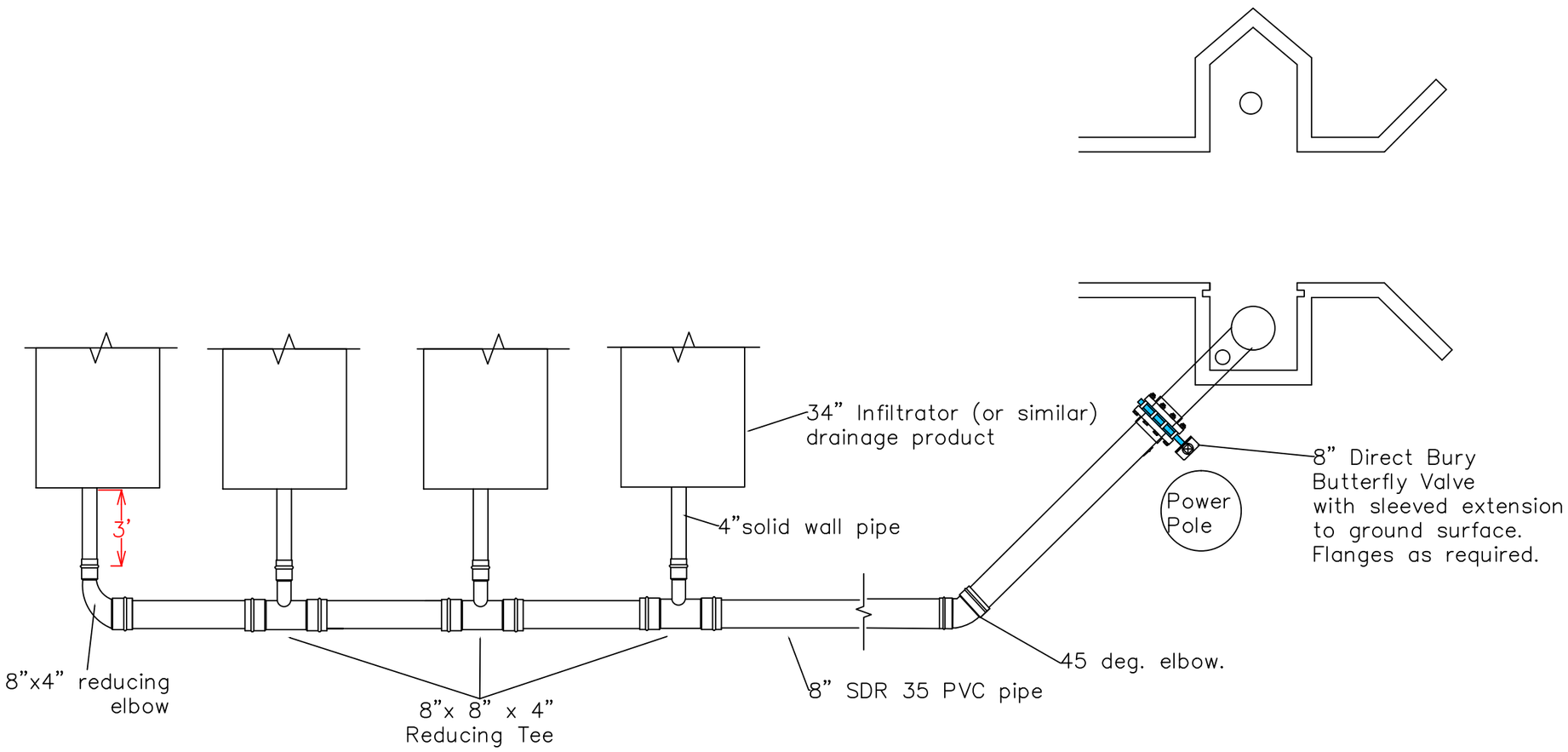
Ringer Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE:

SHEET: 2

SHEET NO. 2 OF 4

Plan Details



Details 1

Lance Horning
Engineering
Corvallis, OR 97333
(509) 595-8990

DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

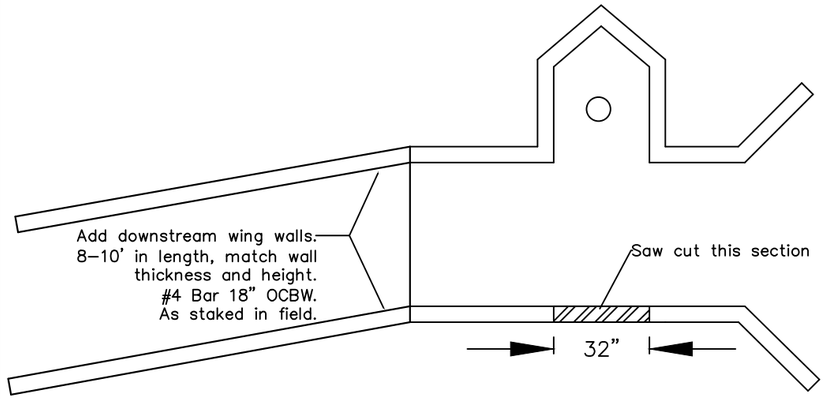
Ringer Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

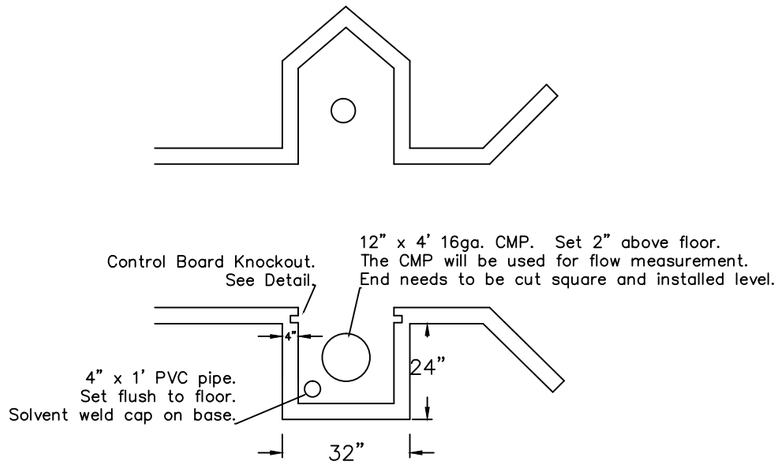
SHEET: 3

SHEET NO. 3 OF 4

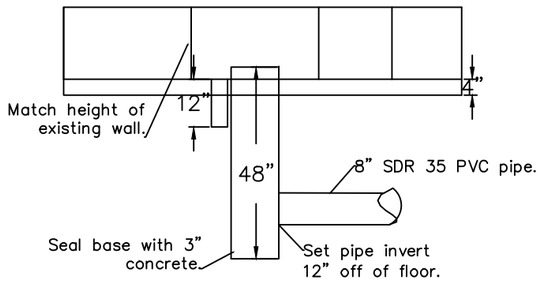
Control Structure



Cut Area

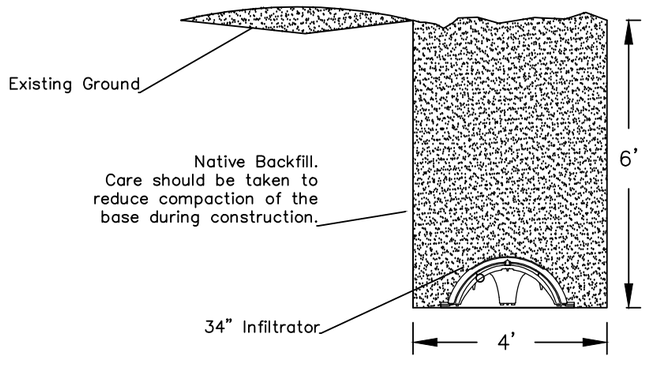


Top View



Section View

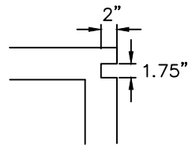
Trench Detail



Trash Screen

Provide and install and framed trash screen to fit the new diversion box. The screen mesh shall be ¼" opening. Screen should be installed at a slight incline and provide at least 1" clearance to the CMP intake.

Control Board Notch



Details 2

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Corvallis, OR 97333
(509) 595–8990

DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
REVISED BY:
SCALE:
DATE:
REVISED DATE:

Ringer Road Recharge Project
Walla Walla Basin Watershed Council
Milton Freewater, OR

SIGNATURE: _____

SHEET: 4

SHEET NO. 4 OF 4