Northern Water
Northern Integrated Supply Project

Larimer County Analysis – Glade Reservoir Recreation Voluntary Permit Conditions Supplement 1 to Technical Memorandum No. 4

Prepared for:
Larimer County

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Northern Integrated Supply Project
Water Activity Enterprise

May 2020

Northern Water
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MEMORANDUM

Glade Reservoir
Recreation Area Water and Wastewater Evaluation

B&V Project 403758
B&V File 188754\34.3100
May 7, 2020

To: Carl Brouwer, Christie Coleman

From: Arlene Little, Karen Burgi, and Lauren Gonzalez

Background

Northern Water is pursuing development of the Northern Integrated Supply Project (NISP), which includes the proposed Glade Reservoir and associated recreational opportunities. A 190-acre recreation area (Recreation Area; 170-acre new recreation area + 20-acre former KOA campground) is proposed and would consist of a network of trails, camping areas (for walk-in, car, and recreational vehicles), a visitor center, parking areas, and boat ramp.

State statutes require a 1041 Permit for any development that involves areas or activities of state interest. In accordance with Land Use Code Section 14, Northern Water submitted a 1041 Permit application to Larimer County (County) for development of the NISP. On March 18, 2020, the County issued a notification of completeness of the NISP 1041 Permit application. With the notification of completeness, the County requested further evaluation/additional information of water use for the proposed Recreation Area. While the County's request was limited to water use only, Northern Water requested Black & Veatch evaluate both water and wastewater use and facilities.

Purpose

The purpose of this memorandum is to advance understanding of potential water demands and associated wastewater generation, both in terms of capacity and relative locations within the Recreation Area. An approach was taken to broadly identify potential demands for this conceptual stage. As the recreation master planning continues, further refinements will occur. This memorandum provides recommendations and alternatives for water and wastewater facilities for consideration.

The memorandum is organized as follows:

- Summary of existing water and wastewater infrastructure associated with the former KOA property and water supply owned by Northern Water
- Evaluation of anticipated demands for water and wastewater
- Determination of potential configurations for water and wastewater systems

- Figures:
    - Figure 1 – Recreation Area Site Layout
    - Figure 2 – Potable Water Layout Options
    - Figure 3 – Fire Flow Layout Options
    - Figure 4 – Wastewater Layout
- Appendix A: Former KOA Campground Site Maps and Information
- Appendix B: Larimer County On-Site Wastewater Treatment System Permits and Records

Existing Facilities

Water Taps and Distribution

Potable water is available at the former KOA campground site. Two existing taps (one ¾-inch tap and one 1-inch tap) serve the site, with water supplied from the West Fort Collins Water District (LaPorte, CO). In addition to the existing water taps associated with the former KOA campground, an additional ¾-inch tap owned by Northern Water will serve the Recreation Area in the future.

In January 2020, the Glade design team contacted Anderson Consulting Engineers, who provide modeling services for the West Fort Collins Water District, to discuss available water supply and pressure near the former KOA campground site. Anderson Consulting Engineers indicated the available pressure is around 45 psi.

Several RV and car camping sites on the western portion of the former KOA campground have water and sewer hookups. It should be noted that one of the former KOA campground site maps shows that water pressure is highest toward the northwest portion of the site, indicating that an evaluation of supply-side water capacity and available pressure is needed. There is also water available in the central portion of the former KOA campground, where the pool, office, kitchen, and restrooms are located. According to maps of the KOA site (See Appendix A), there is also water supply to the south near "Tent Village," to the east near the RV dump station, and to the northeast near the six RV sites that do not have any hookups. The condition of the existing water distribution infrastructure is unknown.

Septic Systems and Collection System

According to historical permits and records for On-site Wastewater Treatment Systems (OWTS) from the Larimer County Health Department (See Appendix B), there are three existing septic systems located at the former KOA campground. Due to the age of the records and hand-drawn nature of schematics, it is unclear where the existing septic systems are located. The following provides a summary of pertinent information included in the historical permits and records.

- Septic System 1: 1971 (Original System) and 1981 (Expansion) Permit:

  - Two tanks:
    - One 1,500 gallon septic tank
    - One 1,000 gallon tank
  - Two leach fields:
    - 1,000 square foot (sq. ft.) leach field absorption area (originally inspected in 1971)
    - 1,200 sq. ft. leach field absorption area that was added in 1981.
  - Diversion structure was also added in 1981 to alternate between fields.
- Septic System 2: 1978 Permit:
  - One tank: 1,000 gallons
  - One leach field: 570 sq. ft. leach field absorption area.
- Septic System 3: 1988 Permit:
  - One tank: 1,000 gallons
  - One leach field: 760 sq. ft. leach field absorption area.

The Larimer County Department of Health and Environment On-Site Wastewater Treatment System Regulations (LC OWTS) [1] require septic tanks for multi-family and non-residential applications to be sized to detain incoming wastewater design flows for a minimum of 48 hours. Based on the information above, and assuming the septic systems are in good working condition, the capacity of the existing septic systems is estimated to be approximately 2,000 gallons per day (gpd).

Wastewater Flows and Water Demands

The following provides descriptions and estimates of anticipated water demands and wastewater flows at the Recreation Area. For many facilities, published values are available for wastewater flows, but not for water demands. Thus, as a general approach, wastewater flows were determined first, then used as a basis for calculating water demands.

Unit Demands

Estimates of water demands and wastewater flows associated with the Recreation Area are based on conceptual plans. Therefore, the demands included in the following sections are intended to be estimates for planning purposes only and may change significantly as design progresses.

Where available, wastewater unit demands were identified using the Larimer County Department of Health and Environment On-Site Wastewater Treatment System Regulations (LC OWTS) [2] regarding estimated daily design flow at maximum use. Most of the LC OWTS unit demands are provided in gpd. For those that are listed as "per fixture per hour when park is open," demands were converted to gpd per fixture by assuming the fixtures would run for half the day. Capacities for these fixtures are shown in parentheses in the table in gallons per minute (gpm). For facilities

[1] Larimer County OWTS Regulations (2018). https://www.larimer.org/sites/default/files/uploads/2017/lcdhe-owts-rules-2016.pdf
[2] Larimer County OWTS Regulations (2018). https://www.larimer.org/sites/default/files/uploads/2017/lcdhe-owts-rules-2016.pdf

and uses without an estimated design flow listed in the LC OWTS regulations, additional references were identified, including the U.S. Department of Agriculture (USDA) Forest Service publication entitled, *Water Use in Forest Service Recreation Areas: Guidelines for Water System Designers (Recreation Area Guidelines).* [3]

Similar, per unit, water demands were not available. Therefore, water demands were assumed to be 1.15 times the wastewater demands, unless more-specific information was available.

A summary of the unit demands is provided in Table 1. Additional explanation on assumptions used to develop the unit demands are included in the narrative sub-sections below.

Table 1 Maximum Wastewater and Water Unit Demands

Use Type	Maximum Unit Demands (gpd)	
	Wastewater	Water
RV and Car Camping, per Site • No Hookups	50 (A)	58 (E)
• Partial Hookups (Water and Electric)	50 (A)	58 (E)
• Full Hookups (Water, Sewer, Electric)	100 (A)	115 (E)
Cabins or Lodges, per Room	50 (A)	58 (E)
Primitive Camps, per Campsite	25 (A)	29 (E)
Conventional Toilet (0.6 gpm)	432 (A), (B)	497 (E)
Composting Toilet	N/A	7 (F)
Pit Toilet	N/A	N/A
Restroom, per Faucet (0.25 gpm)	180 (A), (B)	207 (E)
Drinking Fountain and Jug Filler	90 (C)	104 (C)
Shower, per Fixture (1.7 gpm)	1,200 (A), (B)	1,380 (E)
Laundry, per Machine	400 (A)	460 (E)
Swimming Pool	10 (A)	150 (G)
Kitchen, per Sink	6 (A)	7 (E)
RV Fill Station, per Trailer	N/A	50 (F)
RV Dump Station, per Trailer	40 (D)	N/A
Boat Wash-down	N/A (A)	540 (F)

Notes:
(A) LC OWTS Rules
(B) Assumed to be running half the day
(C) Assumed to be one-half the flow/demand of a restroom faucet
(D) *Recreation Areas Guidelines*
(E) Assumes water demands are 1.15 times greater than wastewater demands
(F) Various, see memo for description
(G) Based on 50,000 gallons of evaporation over the course of the summer

[3] USDA Forest Service (2007). https://www.fs.fed.us/t-d/pubs/pdfpubs/pdf07732326/pdf07732326dpi72.pdf

Existing and Planned Facilities

An illustrative site plan for the Recreation Area was developed and presented in the February 2020 Glade Reservoir Recreation Concept Master Plan, which was Attachment A to the Larimer County 1041 Permit application. This illustrative site plan was used as a basis for identifying existing and planned facilities. The illustrative site plan included general labels to identify each area. For purposes of this evaluation and to clearly identify water and wastewater demands associated with facilities, the Recreation Area has been further defined to delineate areas of interest, as shown on Figure 1. Table 2 provides a list of the areas, along with the planned amenities and facilities that can be found in each area. The table also includes average wastewater flows and water demands for each area, estimated in gpd.

Maximum (peak) wastewater flows and water demands can be calculated using the maximum unit demands (Table 1) and the number of fixtures or amenities (Table 2). To calculate the average wastewater flows and water demands shown in Table 2, the maximum values were divided by a peaking factor of 2.0. According to the USDA *Recreation Area Guidelines*, recreational areas in the general vicinity of the Recreation Area experience a peak month of water use and visitors in June, and have a peak to average use ratio of 2.0.[4]

As indicated in Table 2, additional information for the former KOA site is provided in a separate table (See Table 3). The facilities listed in Table 3 are estimates only. The number of showers, washing machines, and sinks were estimated based on available information, such as aerial and ground photography of the site. The overall wastewater and water demands in Table 2 are inclusive of the additional facilities indicated in Table 3.

Furthermore, irrigation water uses are not included in the water demand estimates in Table 2. A narrative description of the estimated irrigation demands is provided in the irrigation sub-section below.

[4] USDA *Recreation Area Guidelines* for Peak Water Use in Rocky Mountain-South

Table 2 Existing and Planned Facilities by Area

Area Name	No. of Sites					No. of Toilets			Rest-room Faucet	Drinking Fountain / Jug Filler	Boat Wash-down	Average Use[F] (gpd, nearest 100 gallons)	
	RV and Car Camping, Type of Hookup			Lodging and Tents		Toilets							
	None [A]	Partial [B]	Full [C]	Cabin/ Lodge	Camping, Primitive	Conven-tional	Compost-ing	Pit				Wastewater Flows	Water Demands[D]
Camping Area 1.1			20			2			2			1,000	1,200
Camping Area 1.2			25			2			2			1,300	1,400
Former KOA [E]	6		28	32		10			10			4,200	4,900
Poudre Canyon Parking						2			2	1	1	700	1,000
Visitor Center						6			6	2		1,900	2,200
Entry Station							1		1	1		100	200
Camping Area 2		20				2			2			500	600
Camping Area 3	14					2			2			400	400
Camping Area 4	9						2		2			200	300
Boat and Car Parking							2		2	1		200	300
Boat Ramps							4		4	1		400	500
Fishing Dock and Concessions							2		2	1		200	300
Camping Area 5					16			4				200	200
Total	**29**	**20**	**73**	**32**	**16**	**26**	**11**	**4**	**37**	**7**	**1**	**11,300**	**13,500**

Notes:

[A] None indicates no water or sewer connections; electric may or may not be included

[B] Partial Hookups include water and electric connections

[C] Full Hookups include water, sewer, and electric connections

[D] Water demands do not include irrigation or fire flow

[E] See Table 3 for additional facilities associated with the former KOA area

[F] Average use is assumed to be half of maximum use per *Recreation Areas Guidelines*. For camping areas with hookups, the water/ wastewater use per site is assumed to include all water usage (no additional usage for associated toilets or restroom faucets).

Table 3 Estimated Facilities for Former KOA Campground Area

Area Name	Swimming Pool, No. of Pools	Kitchen, No. of Faucets	Shower, No. of Fixtures	Laundry, No. of Machines	RV Fill Station, No. of Trailers per day	RV Dump Station, No. of Trailers per day
Former KOA	1	4	2	1	20	20

Wastewater

As shown in Table 2, the average wastewater flows for the Recreation Area are 11,300 gpd. This estimate is representative of average water use. To estimate maximum water demands in the anticipated peak month of June, the average water use estimates are multiplied by a peaking factor of 2.0.

The area with the greatest estimated wastewater demand is the former KOA campground, with 4,200 gpd. This estimate is inclusive of existing and planned facilities. The area with the second greatest wastewater flow is estimated to be the Visitor's Center with 1,900 gpd. High demands in the Visitor's Center are due to the planned use of restrooms with four conventional toilets inside the building, and two outside the building.

RV Dump Station

The former KOA campground area includes an existing wastewater dump station. RV dump station wastewater can be managed by either hauling the waste as a septic waste to a treatment facility or treating the waste on-site. For purposes of this evaluation, it was assumed that the RV dump station wastewater would be treated on-site. Treatment of the RV dump station wastewater would likely require a recirculating aerobic treatment unit or similar treatment prior to disposal in a pressurized leach field.

Water

The average water demand for the Recreation Area is 13,500 gpd, excluding irrigation and fire flow. Demands are representative of average water use. To estimate maximum water demands in the anticipated peak month of June, the average water use estimates are multiplied by a peaking factor of 2.0. The former KOA campground is expected to have the greatest water demands (4,900 gpd), which can be attributed to the number of showers, cabins, RV camp sites with full hookups and RV fill station.

Typical Use

Northern Water plans to install high-efficiency fixtures and appliances at the Recreation Area for water conservation. The following provides additional information on water demands for typical uses at the Recreation Area.

Boat Wash-down and Aquatic Nuisance Species Mitigation

Depending on Glade Reservoir's rules regarding invasive species mitigation, boat and other equipment may require wash-down before boat launch and possibly after boating. Several lakes in Colorado, including some in Larimer County, require mandatory vessel inspections prior to passing the entry gate in order to prevent the spread of invasive species, such as zebra mussels, quagga mussels, New Zealand mudsnail, Eurasian watermilfoil, rusty crayfish, and others. The inspection may include visual inspections, preventive wash-downs, and if necessary, decontamination with hot water.

For purposes of this evaluation, boat wash-down water demand estimates assume wash-down of all watercraft, tubes, fishing gear and other personal equipment before and after boating. It is estimated that boat wash-down will be 540 gpd. The assumptions for boat wash-down water demands are as follows:

- Preventive Wash-down (before launch): 360 gpd
    - 20 boats per day
    - 6-minute washdown per boat
    - 3 gpm hose
- Post-boating Wash-down: 180 gpd
    - 20 boats per day
    - 3-minute washdown per boat
    - 3 gpm hose

While the boat wash-down area is not currently shown on any of the figures, it may be beneficial to locate it at or near the Poudre Canyon Recreation parking area. This location would provide the ability to restrict entry to watercraft that are contaminated with invasive species and allow for quarantine of vessels.

Composting Toilet

Composting toilets do not have any wastewater flow; however, they are assumed to have some water demands. For purposes of this evaluation, the Clivus Multrum M54 Trailhead series composting toilet was used to estimate water demands. The M54 Trailhead composting toilet is designed for use in remote locations. Each composting toilet is capable of up to 60 uses (flushes) per day. The liquid and solids are separated and hauled away for disposal. Grid-power or solar would be necessary to power the odor-control fan.

Composting toilets are planned for the entry station, boat and car parking, boat ramps, and the fishing dock and concessions areas. Since these areas will likely have more visitors, including day

visitors, this evaluation assumes approximately 75 people would visit the areas where the composting toilets will be located. Water demands associated with composting toilets in these areas were estimated to be 7 gpd per composting toilet. This estimate is based on the following assumptions:

- Use of the Clivus Multrum M54 Trailhead Series composting toilet
  - 4 ounces (oz) of water per flush[5]
  - 75 visitors per day to the portions of the Recreation Area where the composting toilets will be located
  - 3 flushes per day per visitor

Composting toilets are also planned for camping area 4; however, the water and wastewater demands for composting toilets in this area are not included in the water demands because the camp sites already have water demands associated with the RV and car camping sites.

Pit Toilet

Pit toilets are assumed to have zero water and wastewater demands. Pit toilets are planned for Camping Area 5 only, where primitive camping will occur.

Irrigation

Water for irrigation will be needed to establish grasses, plants, and trees (temporary irrigation) and to maintain the vegetation, once established (permanent irrigation). Northern Water plans to establish native grasses and water-wise landscaping to advance water conservation efforts. Additionally, drip irrigation could be utilized to further reduce water use. Vegetation may be planted in a phased approach, so as to reduce the water demands necessary for temporary irrigation in a single year.

Fire Flow

It is assumed that fire flow would be necessary at the Visitor's Center and at the main building of the former KOA campground. Water demand for the Visitor's Center (light hazard occupancy, anticipated to be 8,000 – 10,000 sf) would be approximately 175 gpm for a sprinkler system plus 100 gpm for inside and outside hose streams, such as hydrants. The total water demand would be 275 gpm for a minimum 30-minute duration.

Water demand for the Main Building for the former KOA campground (light hazard occupancy, approximately 2,600 sf) would be approximately 50 gpm for a sprinkler system plus 50 gpm for inside and outside hose streams, such as hydrants. The total water demand would be 100 gpm for a minimum 30-minute duration.

[5] Clivus Multrum website, M54 Trailhead Series (accessed April 2020). https://clivusmultrum.com/products-services.php#M54

In a February 14, 2020 Larimer County 1041 – Utility Descriptions memorandum prepared by the Black & Veatch/AECOM design team, the following information regarding fire flow was provided:

> The local fire protection district is the Poudre Fire Authority. The nearest station is Station 7 located at 2817 N. Overland Trail in Laporte, which is approximately 4 miles southeast of the Glade recreational facilities.
>
> The Livermore Fire Protection District (LFPD) also provides service to the northern portion of Glade Reservoir. The nearest station is Station 1 located at 311 W CR 74E in Livermore, which is approximately 4 miles north of the northern tip of Glade Reservoir. NISP staff have met with LFPD staff to discuss the project. As part of those conservations, NISP has committed to providing a water storage tank (up to 10,000 gallons in size) at a location determined by the LFPD for their use in staging water for fire-fighting purposes. This tank will be provided by the start of construction to increase LFPD's fire-fighting and emergency-response capabilities. LFPD staff also indicated that Glade Reservoir will provide a strategic water source for future aerial firefighting efforts.

Landscaping irrigation and potential Visitor's Center fire sprinkler flows may be provided by a non-potable system supplied from either Glade Reservoir or the forebay.

Evaluation and Recommendations

The average water demands for the Recreation Area are estimated to be 13,500 gpd (excluding irrigation and fire flows) with a peak day peaking factor up to 2. Additional water distribution facilities will be necessary in order to serve the planned facilities in the Recreation Area. NISP will dedicate two ¾-inch taps and one 1-inch tap to the Recreation Area. The ¾-inch taps will each have a capacity of 20 gpm and the 1-inch tap will have a capacity of 40 gpm.

Depending on the water option chosen and on the supply-side capacity, pump stations and a storage tank are most likely necessary to provide adequate supply and pressure to meet demands throughout the Recreation Area. An anticipated peak hour demand is around 50 gpm, based on a peak hour to peak day factor of 2.5. However, the relatively low available static pressure (45 psi), indicates it is unlikely the supply side could support this delivery rate at a pressure that would be adequate for service throughout the Recreation Area. Some form of pressure boosting will be necessary.

To reliably provide for peak demands, a storage tank with about one days' worth of storage accommodating peaks is recommended, approximately 20,000 – 25,000 gallons. Supply side water could be pumped into a tank placed at high enough elevation, and the Recreation Area water distribution system could float off the hydraulic grade line from the storage tank. This would enable utilizing smaller pumps operating part of the day rather than attempting to utilize a series of pumps to directly meet various demand levels.

The average wastewater flow for the Recreation Area is estimated to be 11,300 gpd with a peaking factor up to 2. In accordance with LC OWTS regulations, facilities with a design flow greater than 2,000 gpd must comply with the following:

- LC OWTS;
- Site location and design approval requirements in Section 25-8-702 of Colorado Revised Statutes (CRS); and
- Discharge permit requirements in Water Quality Control Act, CRS 25-8-501.

Once there is more definition regarding the number of septic systems desired, location, types and quantity of flows, the associated leach fields will need to be designed and sized in accordance with design criteria in the LC OWTS rules. [6]

Layouts

Conceptual layouts were developed for water, fire flow and wastewater uses. The following provides descriptions of the conceptual layouts.

Water Distribution and Treatment

Because of the significant grade differential of the site, rising from west to east, the water distribution will be more challenging for the eastern portion of the site (near the boat ramps and camping areas 4 and 5). Therefore, there are several water options provided in Figure 2, and described below.

The baseline scenario consists of potable water from West Fort Collins Water District being distributed to the western portion of the site. It is assumed that this baseline scenario would be implemented regardless of the following options chosen.

- Option 1 would include pumping potable water from the lower (western) portions of the site up to the boat ramp area (northeastern). This option would require a pump station and possibly a storage tank.

- Option 2 would include a water intake from Glade Reservoir and a small water treatment unit (filtration and disinfection, at a minimum) near the boat ramp to seasonally serve water needs in the area.

- Option 3 would include hauling water from the lower (western) portions of the site up to the boat ramp area (northeastern) and remote camping areas (north central). Appropriately sized on-site storage facilities would need to be provided at use areas.

The water layout options assume that camping area 4 will have the same access to water that the boat ramps area and fishing dock and concessions area will have. Camping area 5 is the most

[6] LC OWTS Rules, Sections 43.9, 43.10, and Appendix A, Tables 10-1 through 10-3

remote portion of the Recreation Area. Planned facilities include hiking trails and primitive campsites; therefore, the area does not have any water or sewer connections.

Fire Flow

Two areas are assumed to require fire flow at the Recreation Area: the Visitor's Center and the main building of the KOA area. Two options are provided for fire flow water. Conceptual layouts for the two fire flow options are provided in Figure 3 and described as follows.

- Option 1 consists of both non-potable and potable water used for fire flow. A non-potable water pump station would be located at the forebay of Glade Reservoir, across U.S. Highway 287 to the west of the Recreation Area. Non-potable water would be pumped to the Visitor's Center, where it would be used for fire flow. While not incorporated into the water demand evaluation presented earlier, this non-potable water could also be used for irrigation or toilet flush water. For the main building of the KOA site, water would be supplied from the West Fort Collins Water District, if sufficient supply is available.

- Option 2 would use potable water for all fire flow. Potable water supplied from the West Fort Collins Water District would be used for fire flow water at both the Visitor's Center and the main building of the former KOA site. This option would likely require storage near the Visitor's Center, which could be combined with Option 1 of the Water Scenarios.

Wastewater Collection and Treatment

A conceptual layout of the wastewater collection and treatment facilities at the Recreation Area is provided in Figure 4. The wastewater facilities will primarily consist of individual septic systems on the western portion of the site and composting or pit toilets on the eastern portion.

The former KOA campground is estimated to have the greatest average wastewater flow at 4,200 gpd. While there are existing septic systems at the former KOA site, the capacity of the existing septic systems is estimated to be approximately 2,000 gpd. Therefore, additional septic systems will be needed to serve the former KOA campground.

Depending on water availability in the eastern portion of the site, either composting toilets or pit toilets could be used at the boat and car parking area, boat ramps area, and the fishing dock and concessions area. For purposes of this evaluation, composting toilets are assumed to require a small amount of potable or non-potable water (7 gpd per toilet) for operation. However, there are some dry composting toilets that may be an option. Composting toilet rules are included in the LC OWTS regulations in Section 43.12.B.4.

Camping area 5 is the most remote portion of the Recreation Area. Planned facilities include hiking trails and primitive campsites; therefore, the area does not have any water or sewer connections. It is assumed that the toilets located in this area will be pit toilets (i.e., do not require water for operation).

Conclusions

The average water demand for the Recreation Area is estimated to be 13,500 gpd with a peaking factor up to 2. This average water demand excludes irrigation and fire flow. Because of the significant grade increase moving from west to east across the site, water distribution will be more challenging for the northeastern portion of the site (near the boat ramps area and camping areas 4 and 5). Therefore, there are several water options considered in this memorandum.

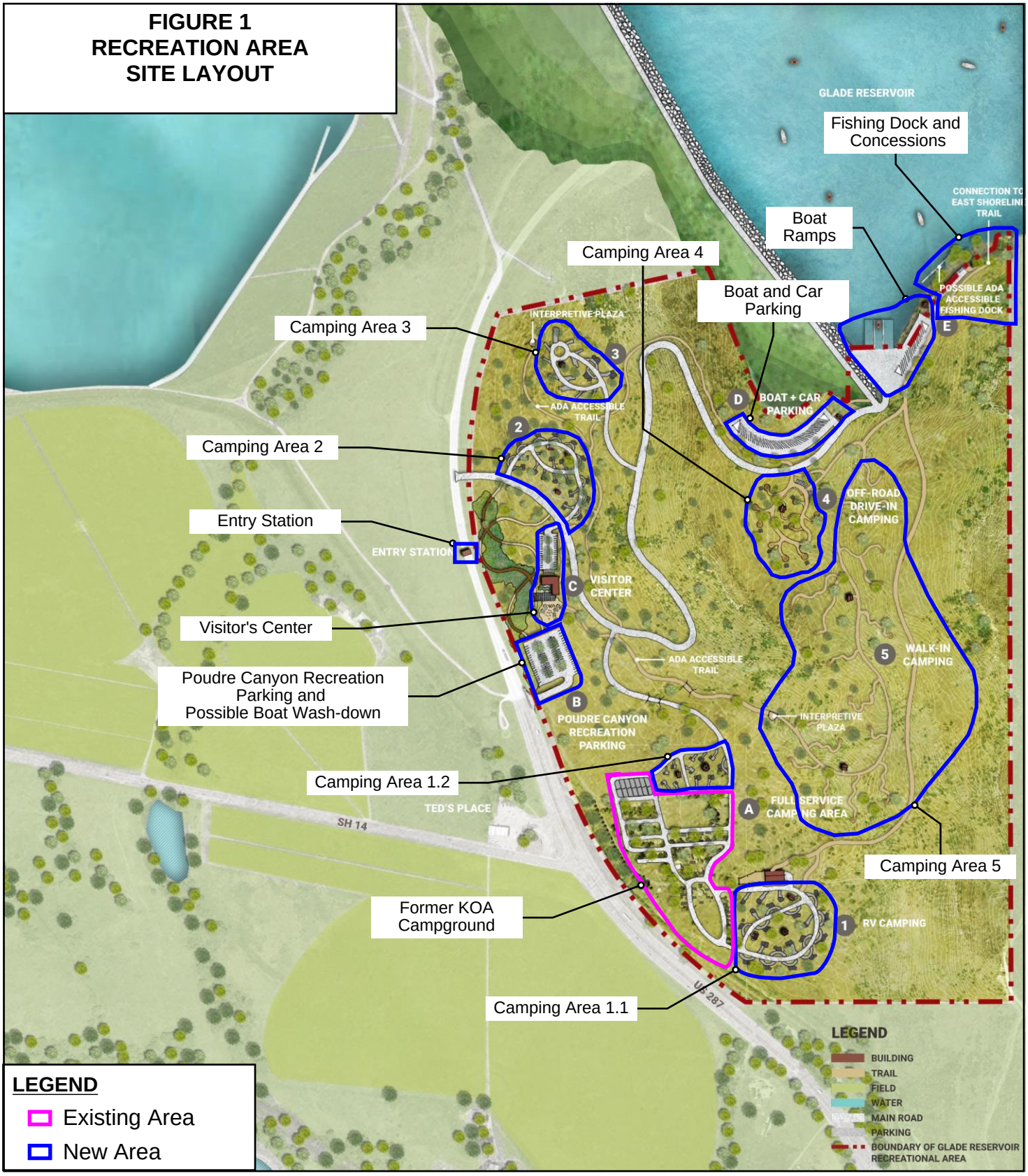
Potable water uses will be served by the West Fort Collins Water District. NISP will dedicate two ¾-inch taps and one 1-inch tap to the Recreation Area. The ¾-inch taps will each have a capacity of 20 gpm and the 1-inch tap will have a capacity of 40 gpm. However, the relatively low available static pressure (45 psi), indicates it is unlikely the supply side could support this delivery rate at a pressure that would be adequate for service throughout the Recreation Area. A storage tank and pumping system is recommended to reliably serve peak demands. Further investigation of supply-side capacity is warranted.

It is assumed that fire flow will be necessary at the Visitor's Center and at the main building of the former KOA campground. Water demand for the Visitor's Center (light hazard occupancy, approximately 8,000 – 10,000 sf) would be 175 gpm for a sprinkler system plus 100 gpm for inside and outside hose streams, such as hydrants. Water demand for the Main Building of the former KOA campground (light hazard occupancy, approximately 2,600 sf) would be 50 gpm for a sprinkler system plus 50 gpm for inside and outside hose streams, such as hydrants. Water used for irrigation and fire sprinkler flows could be provided by a potable water line served by the West Fort Collins Water District or by a non-potable system supplied from either Glade Reservoir or the forebay, as described earlier.

The average wastewater flow for the Recreation Area is estimated to be 11,300 gpd with a peaking factor up to 2. Additional wastewater treatment will be necessary, including additional wastewater collection facilities, septic tank and leach field systems, composting toilets, and pit toilets. It is anticipated that new, individual septic systems will be necessary for campgrounds and the Visitor's Center along the western edge of the Recreation Area. The former KOA campground has existing septic systems that do not have sufficient capacity (~2,000 gpd) to serve the estimated wastewater flow of 4,200 gpd. Therefore, additional septic systems will be needed to serve the former KOA campground. Furthermore, due to the age of the systems and uncertainty as to the construction and treatment quality, the existing septic systems will likely require significant improvements or replacement.

FIGURES

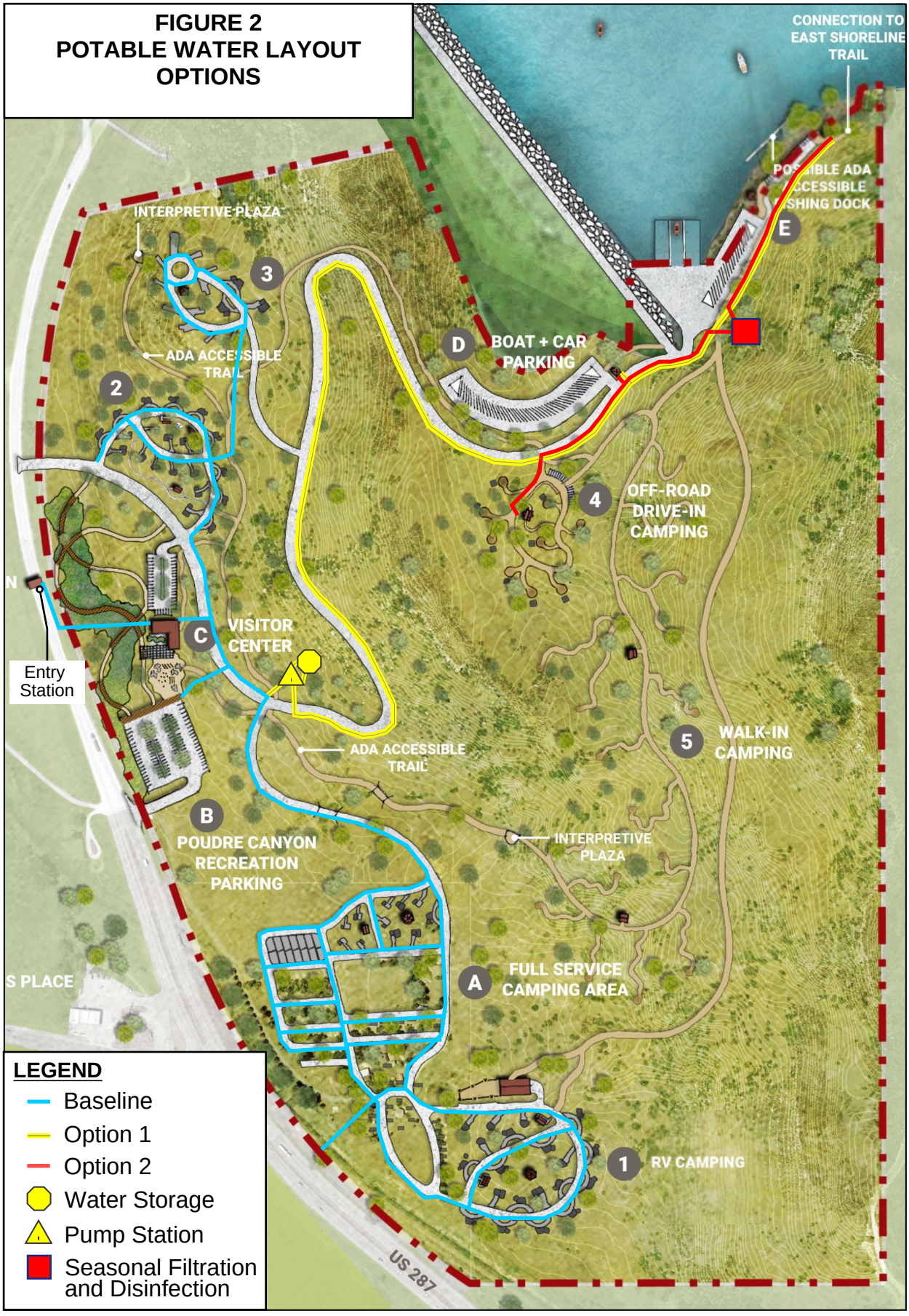
FIGURE 1
RECREATION AREA
SITE LAYOUT



LEGEND

- Existing Area
- New Area

FIGURE 2
POTABLE WATER LAYOUT OPTIONS



WATER OPTIONS

Baseline - Potable water from West Fort Collins Water District to lower portions of Recreation Area.

Option 1 - Pump from lower area up to boat ramp area. May need storage tank.

Option 2 - Provide small treatment unit near boat ramp to seasonally serve water needs in area

Option 3 - (Not shown) Haul water to boat ramp area

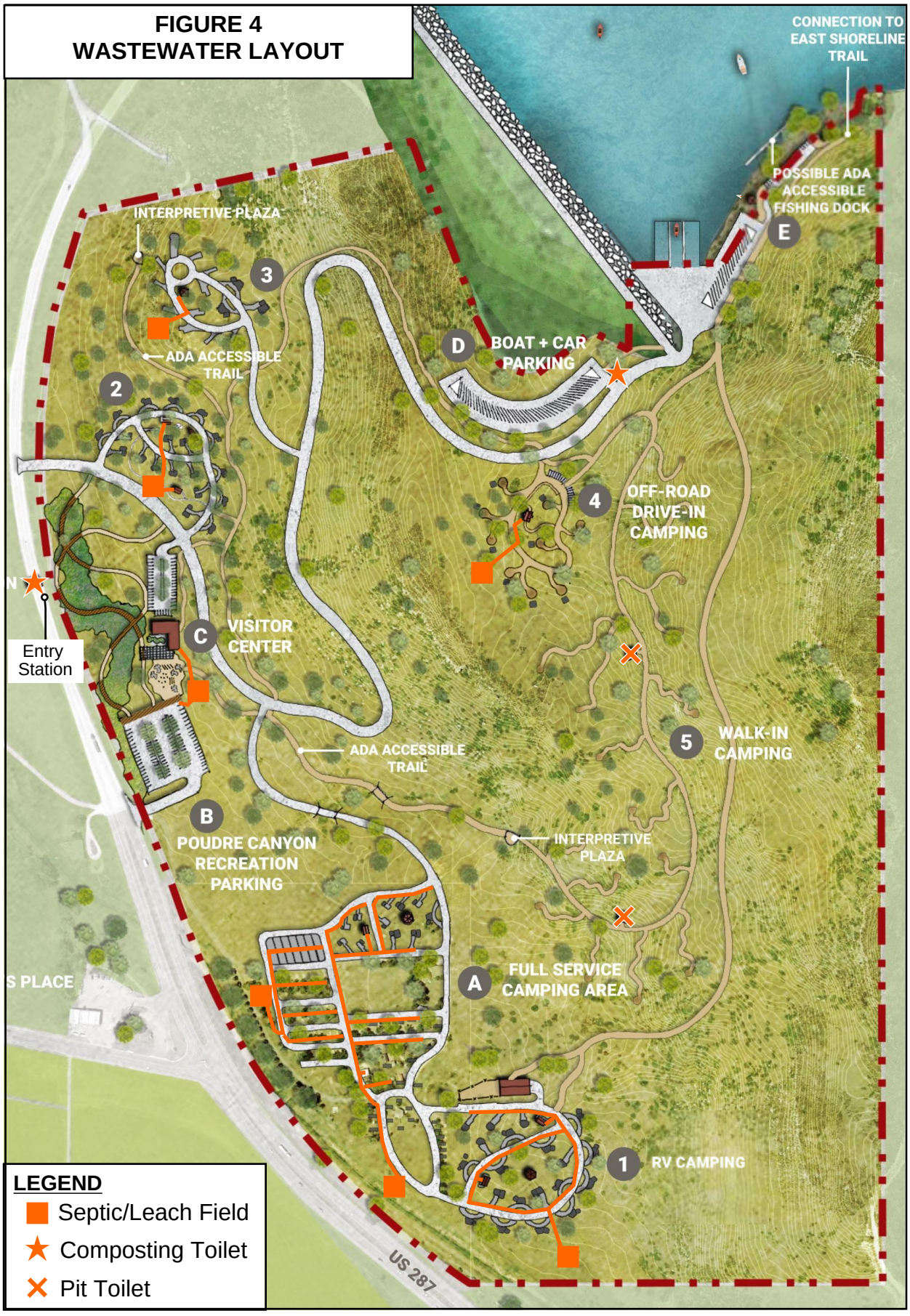
FIGURE 3
FIRE FLOW LAYOUT OPTIONS

FIRE FLOW OPTIONS

Option 1 - COMBINATION POTABLE / NON-POTABLE:
Non-potable water is pumped from forebay of Glade Reservoir to Visitor's Center for fire flow. Potable Water from West Fort Collins Water District is used by Main KOA Building for fire flow (if sufficient supply is available)

Option 2 - ALL POTABLE:
Potable fire flow water is provided from West Fort Collins Water District, likely requires storage to have required flow/volume. Storage could be combined with Potable Water Option 1 (See Fig. 2)

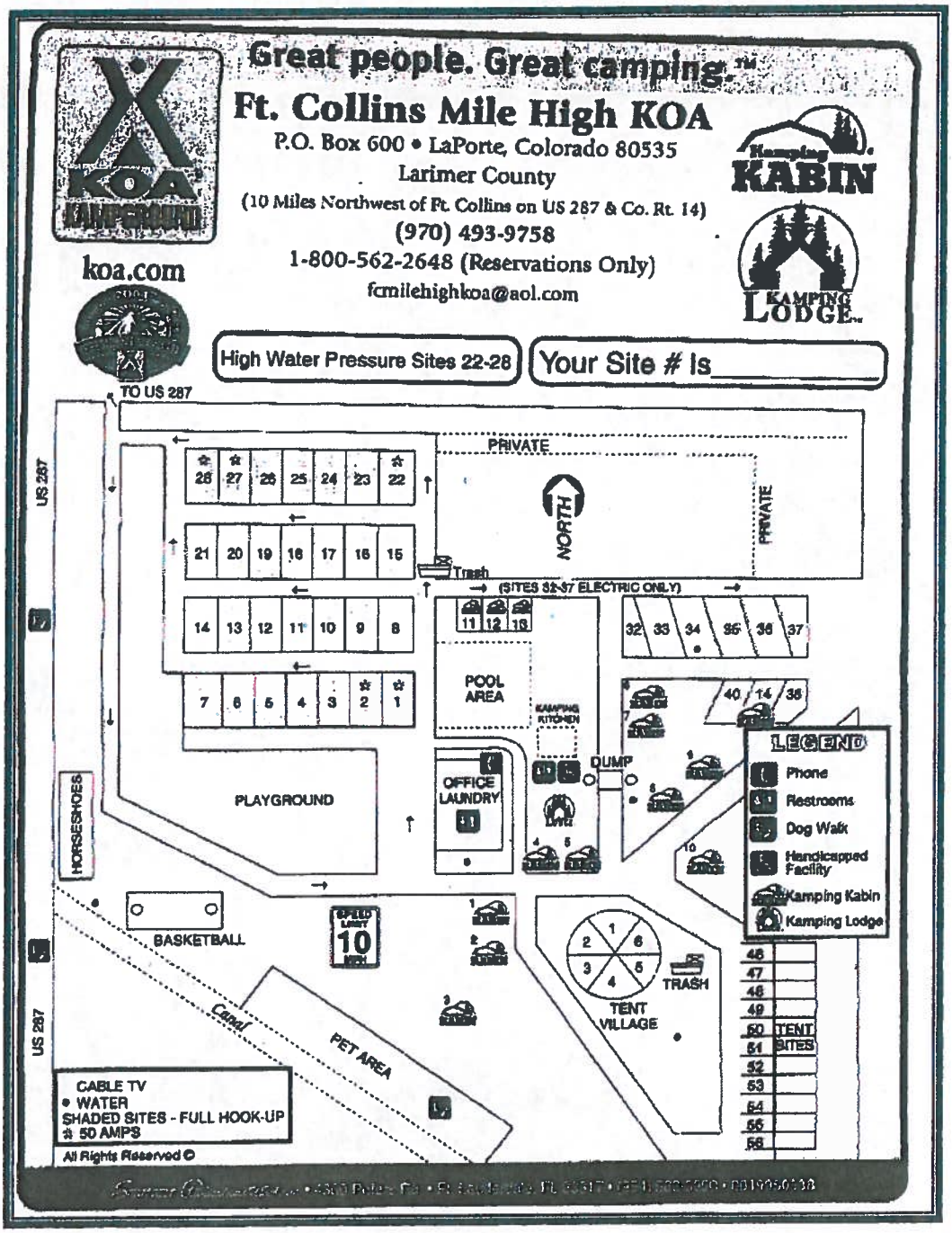
FIGURE 4
WASTEWATER LAYOUT



APPENDIX A

FORMER KOA CAMPGROUND
SITE MAPS AND INFORMATION

Site Layout:


Great people. Great camping.™
Ft. Collins Mile High KOA
P.O. Box 600 • LaPorte, Colorado 80535
Larimer County
(10 Miles Northwest of Ft. Collins on US 287 & Co. Rt. 14)
(970) 493-9758
1-800-562-2648 (Reservations Only)
fcmilehighkoa@aol.com
koa.com
Kamping KABIN
KAMPING LODGE
High Water Pressure Sites 22-28
Your Site # is_____
TO US 287
US 287
PRIVATE
NORTH
Trash
(SITES 32-37 ELECTRIC ONLY)
POOL AREA
KAMPING KITCHEN
DUMP
OFFICE LAUNDRY
PLAYGROUND
HORSESHOES
BASKETBALL
SPEED LIMIT 10 MPH
Canal
PET AREA
TENT VILLAGE
TRASH
TENT SITES
LEGEND
Phone
Restrooms
Dog Walk
Handicapped Facility
Kamping Kabin
Kamping Lodge
CABLE TV
• WATER
SHADED SITES - FULL HOOK-UP
☆ 50 AMPS
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APPENDIX B

LARIMER COUNTY ON-SITE WASTEWATER TREATMENT SYSTEM PERMITS AND RECORDS

*HHA 0813000014

MICROFILMED ENTERED

Larimer County Health Department

PERMIT

FOR WASTE DISPOSAL SYSTEM

1020 Hospital Lane
Fort Collins, Colo.
Phone 482-3105

Dist. _____
Legal R 70 T 8 S 13
Sub _____ Lot. No.

Name of Owner K.O.A. Campground ; Dean Knight — Zoned _____

Mailing Address R.R., LaPorte, Colo — Phone _____ — Size of Lot _____

Agent or Contractor Rotar Rooter Syd Shipman — Depth of Water over 7'

Mailing Address Ft. Collins — Phone _____ — Depth of Rock over 7'

Location 5104 N Hwy 287 Entrance to Poudre Canyon on E side of Rd. — Soil _____

Type of Building Trailer park — Perc. Test _____
Residence, cabin, trailer court, business, school, camp or other

Type of System 1500 gal + 1000 gal septic tank, 1000 ft leach field — Installers I.D. _____

Special Instructions above design is based on a letter from Lon Schuyler of State Health Dept. dated 13 may 71. code C (1)

Applicant Syd Shipman DBA Rotar Rooter — Colo. Water Pollution Control Commission ☐ Approved ☐ Disapproved

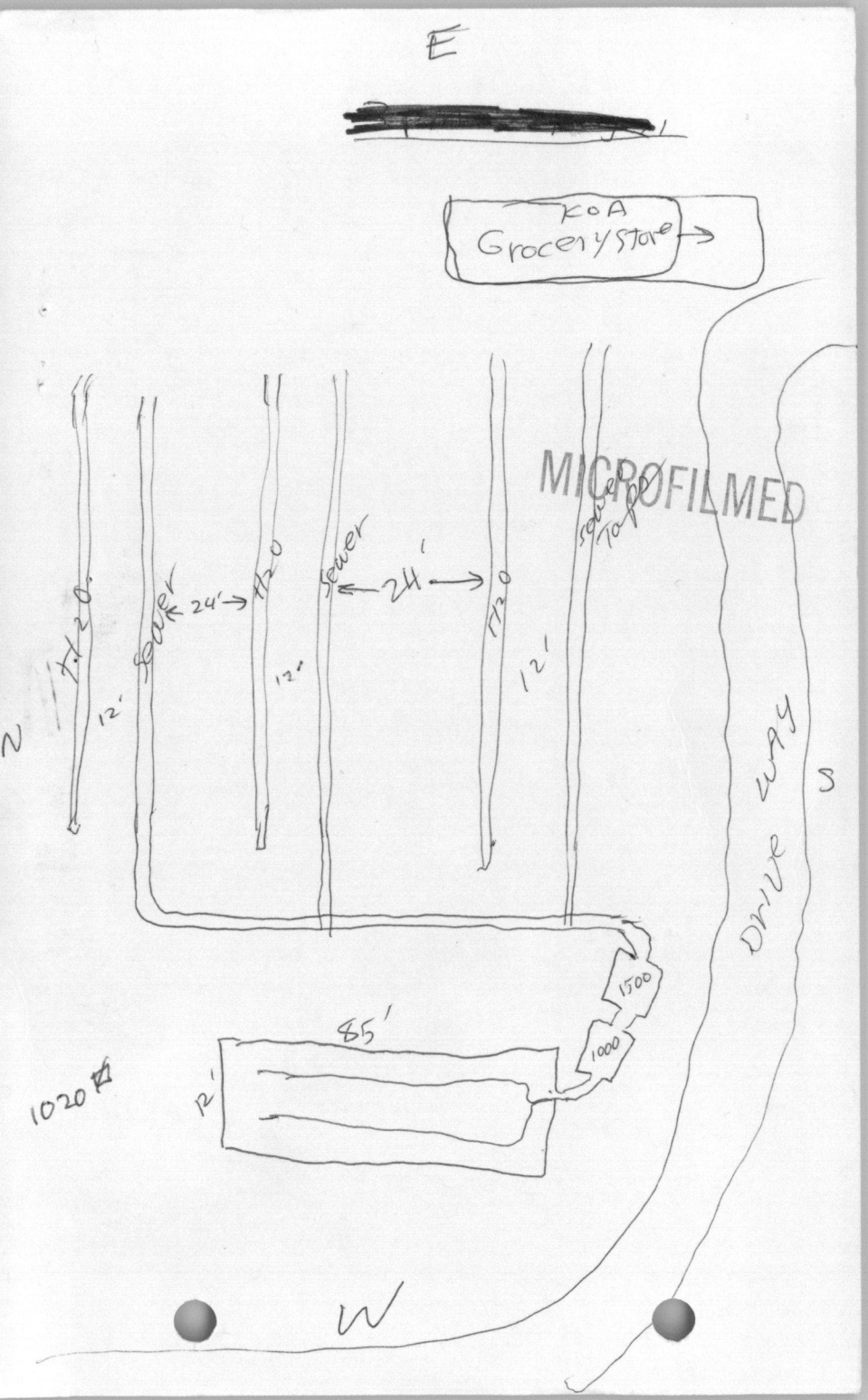
Lon Dunlop — Date 22 May 71

Preliminary Approval

Tom Dunlop — Date 24 May 71

Final Approval

LCHD EH-216 1/69


E
[redacted]
KOA
Grocery/Store
MICROFILMED
sewer
24'
H2O
sewer
24'
H2O
sewer
24'
H2O
12'
12'
12'
12'
N
Drive way
S
1500
1000
85'
2'
1020
W

APPLICATION AND PERMIT FOR INDIVIDUAL SEWAGE DISPOSAL SYSTEM

LARIMER COUNTY HEALTH DEPARTMENT
363 Jefferson St., Fort Collins, CO 80524
221-2100 EXT. 596

ENTERED

MICROFILMED

Parcel # 0813000014

1. ____¼, ____¼, ____¼, S 13 T 8 R 70
2. Subdivision ____
3. Lot ____ Block ____ Filing ____ Zoned ____
4. New ____ Repair X
5. Address/Location KOA Campground - N. 287 LaPorte AKA 5104 N. Highway 287 LaPorte, CO 80535
6. Owner of Record POTTER, Bob Address Same Ph. ____
7. Agent ____ Address ____ Ph. ____
8. System Contractor Woelfle Address ____ Ph. ____
9. Building Type ____ Basement Bathroom ____ Design Capacity ____
10. Lot Size 3-4 A Slope ____ Perc. Rate/H.C. ____ Depth to Bedrock > 8'
11. Depth to water Table > 8' Potable Water Supply Public Aquifer ____
12. Water District W. FC
13. Sanitation District NA
14. Nearest Location of Public Sewer To Building NA
15. Exhibits check: Plot Plan ____ Eng. Geol. Report ____ Engineers Design ____
16. Owner/Agent Signature X Gordon Woelfle Date 8-12-81
17. Engineer Signature ____ P.E. Reg. # ____ Date ____
18. Fee of $ NA payable at time Permit is issued.
19. Plot plan on reverse of this form.

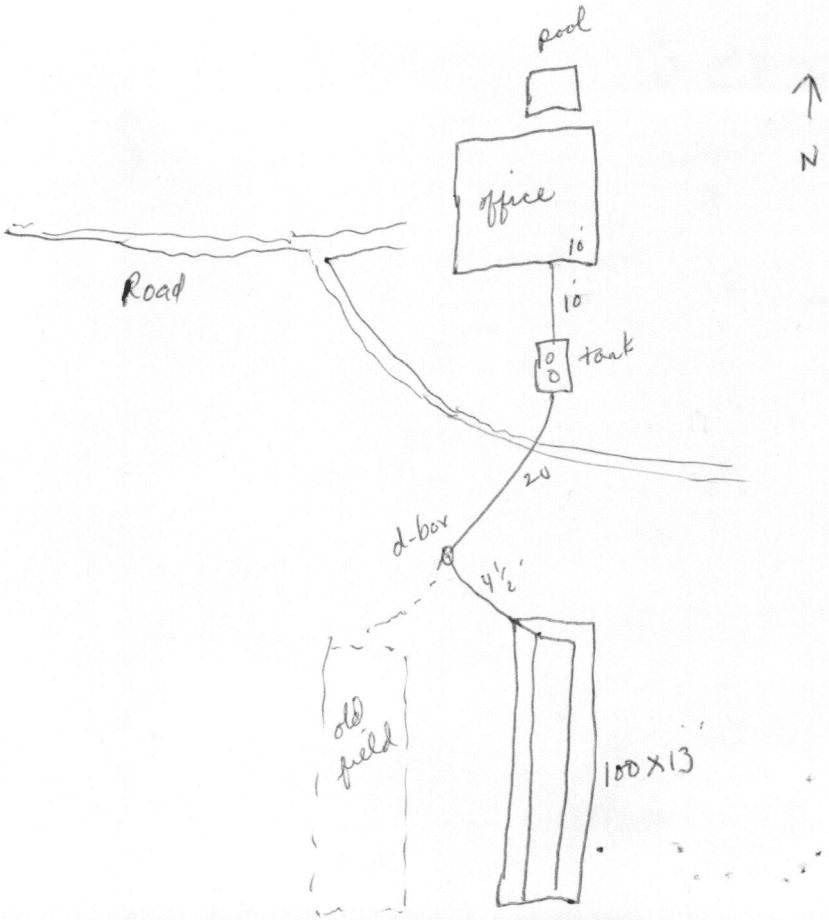
Permission is hereby granted to the owner or his agent to perform the work indicated below in accordance with the Larimer County Individual Sewage Disposal Regulations and is conditional upon the final installation approval of the Larimer County Health Department. This permit is to remain in full force for the duration of the Larimer County Building Permit, or 120 days after its issuance, where applicable, providing it is not revoked for non-compliance. The issuance of this permit does not constitute assumption by the Department or its employees of liability for the failure or inadequacy of the sewage disposal system.

20. Type and design of System Add 1200 ft² leaching area to existing system - diversion structure to be added to alternate between existing beds (Design Code R2 (1))
21. Maintenance Schedule Pump tank every 3 yrs
22. Please notify the department 24 hours in advance of backfilling to obtain final inspection for issuance of "Occupancy Certificate".

	Approval Signature	Date	Approval Signature	Date
23. Site Inspection:	Dow	8-10-81	Sanitation District:	
24. Preliminary:	McClosky R.P.S.	8-10-81	Occupancy Permit Signed:	
25. Final Inspection:	McClosky R.P.S.	8/21/81	And Transmitted By:	

Route: white - owner; pink - system contractor; Tag Copy - File.

L.C.H.D. E.H. 233 6/80


pool
office
10'
10'
tank
Road
20'
d-bar
4½'
old field
100 x 13'
N

APPLICATION AND PERMIT FOR INDIVIDUAL SEWAGE DISPOSAL SYSTEM

MICROFILMED

08130000 14

LARIMER COUNTY HEALTH DEPARTMENT
363 Jefferson St., Fort Collins, CO 80524
221-7496

ENTERED

BP #88-F2803

5182

1. ____¼, ____¼, ____¼, S 13 T 8 R 70
2. Subdivision ____
3. Lot ____ Block ____ Filing ____ Zoned ____
4. New System ✓ Repair ____ New Vault ____
5. Address/Location 6670 SH 287 No Hwy 287 - La Porte KOA Campground
6. Owner of Record KIPSCHULL, Theresa Address Same Ph. ____
7. Agent Myles Custom Bldg. Address ____ Ph. 221 2034
8. System Contractor Bath Exc Address ____ Ph. ____
9. Building Type SWMH Basement Bathroom No Design Capacity 2
10. Lot Size ____ Slope — Perc. Rate/H.C. 28 MPI Depth to Bedrock >8'
11. Depth to water Table >8' Potable Water Supply W. F.C. Aquifer ____
12. Water District W. FC
13. Sanitation District NA
14. Nearest Location of Public Sewer To Building NA
15. Exhibits check: Plot Plan ✓ Eng. Geol. Report ✓ Engineers Design ____
16. Owner/Agent Signature X Date ____
17. Engineer Signature EMPIRE P.E. Reg. # ____ Date ____
18. Fee of $ 150 payable at time Permit is issued.
19. ~~Plot plan on reverse of this form.~~

Receipt # 6344

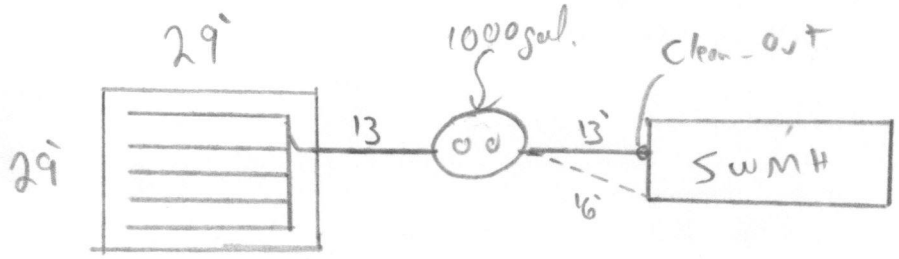
Permission is hereby granted to the owner or his agent to perform the work indicated below in accordance with the Larimer County Individual Sewage Disposal Regulations and is conditional upon the final installation approval of the Larimer County Health Department. This permit is to remain in full force for the duration of the Larimer County Building Permit, or 120 days after its issuance, where applicable, providing it is not revoked for non-compliance. The issuance of this permit does not constitute assumption by the Department or its employees of liability for the failure or inadequacy of the sewage disposal system.

20. Type and design of System Standard design: 1000 gallon tank
& 760 sq. ft. absorption area in area of
test bores 1 and 3
(Design Code 1)
21. Maintenance Schedule Pump tank every 3-4 yrs
22. Please notify the department 24 hours in advance of backfilling to obtain final inspection for issuance of "Occupancy Certificate".

	Approval Signature		Date		Approval Signature		Date
23.	Site Inspection:	Dm	7-20-88	Sanitation District:			
24.	Preliminary:	McCloskey R.P.S.	7-20-88	Occupancy Permit Signed:			
25.	Final Inspection:	BC R.P.S.	7-25-88	And Transmitted By:			

Route: white - owner; pink - system contractor; Tag Copy - File.

L.C.H.D. E.H. 233 6/80



$\sim 841\ Ft^2$

APPLICATION AND PERMIT FOR INDIVIDUAL SEWAGE DISPOSAL SYSTEM

LARIMER COUNTY HEALTH DEPARTMENT
363 Jefferson St.; Fort Collins, CO 80251
221-2100 EXT. 500

ENTERED

LARIMER COUNTY COLORADO

Parcel #0813000014 #4767 MICROFILMED

1. ____¼, ____¼, ____¼, S 13 T 8 R 70
2. Subdivision MASON EXEMPTION
3. Lot B Block ____ Filing ____ Zoned ____
4. New X Repair ____
5. Address/Location 5104 N HWY 287
6. Owner of Record POTTER, BOB Address 5104 N Hwy 287 Ph. 493-5538
7. Agent ____ Address ____ Ph. ____
8. System Contractor ____ Address ____ Ph. ____
9. Building Type ____ Basement Bathroom ____ Design Capacity ____
10. Lot Size 10 A Slope ____ Perc. Rate/H.C. 8 Depth to Bedrock >8
11. Depth to water Table >8 Potable Water Supply PUBLIC Aquifer ____
12. Water District WEST F.C.
13. Sanitation District ____
14. Nearest Location of Public Sewer To Building ____
15. Exhibits check: Plot Plan ✓ Eng. Geol. Report ✓ Engineers Design ✓
16. Owner/Agent Signature [signature] Date 6-7-78
17. Engineer Signature CORNELL P.E. Reg. # 3249 Date 6-6-78
18. Fee of $ 75.00 payable at time of Building Permit is issued. # 208
19. Plot plan on reverse of this form.

Permission is hereby granted to the owner or his agent to perform the work indicated below in accordance with the Larimer County Individual Sewage Disposal Regulations and is conditional upon the final installation approval of the Larimer County Health Department. This permit is to remain in full force for the duration of the Larimer County Building Permit, or 120 days after its issuance, where applicable, providing it is not revoked for non-compliance. The issuance of this permit does not constitute assumption by the Department or its employees of liability for the failure or inadequacy of the sewage disposal system.

20. Type and design of System 1000 Gallon Tank with 570 ft² of leach field

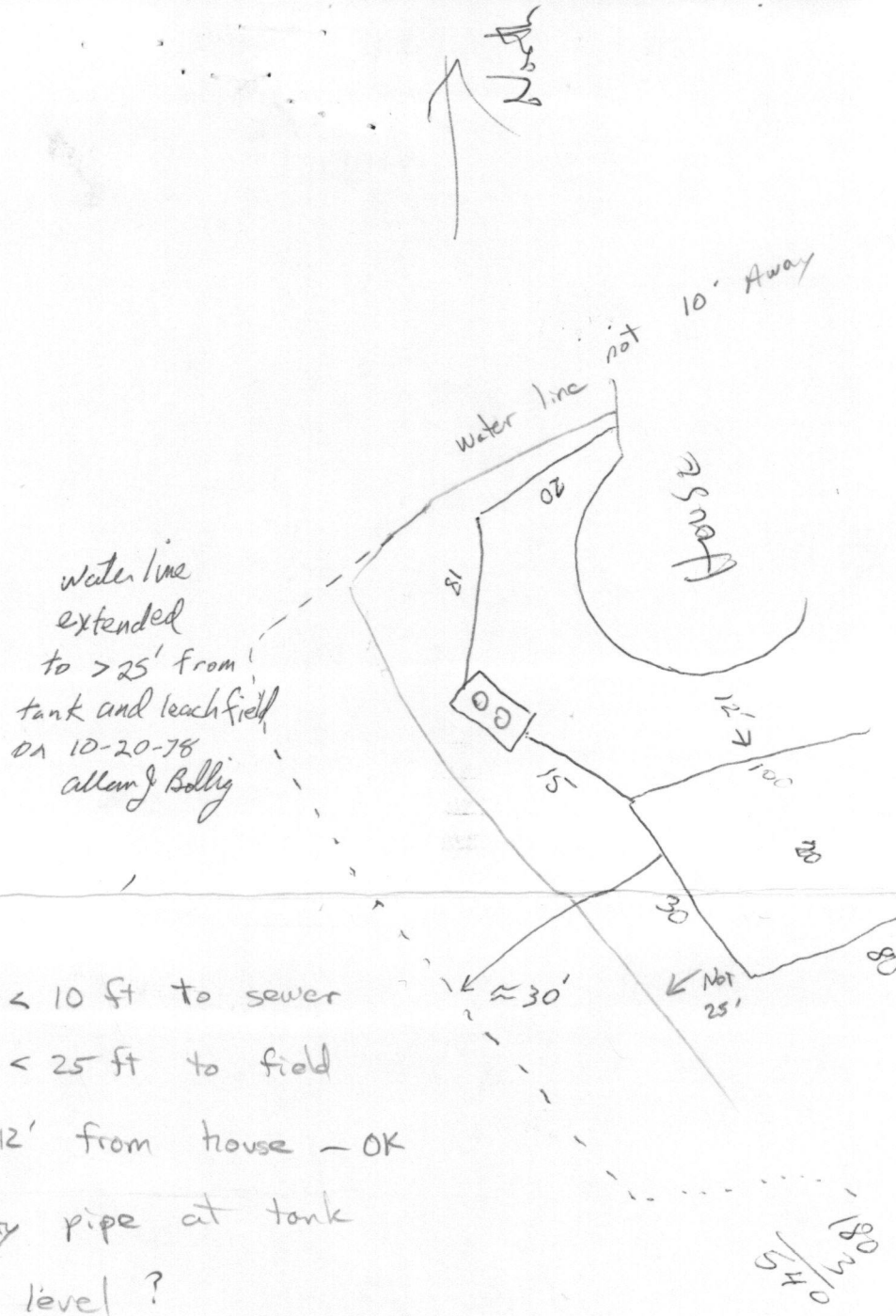
(Design Code 1)

21. Maintenance Schedule Pump every 3-4 years
22. Please notify the department 24 hours in advance of backfilling to obtain final inspection for issuance of "Occupancy Certificate".

	Approval Signature	Date	Approval Signature	Date
23. Site Inspection:			Sanitation District:	
24. Preliminary:	Mark Williams R.P.S.	6-7-78	Occupancy Permit Signed:	
25. Final Inspection:	McCloskey Bollig Williams R.P.S.	10-20-78	And Transmitted By:	

Route: white - owner; pink - system contractor; Tag Copy - File.

L.C.H.D. E.H. 233 12/76



water line extended to > 25' from tank and leach field on 10-20-78 allen J Bolly

Water line < 10 ft to sewer

" " < 25 ft to field

Field only 12' from house — OK

No heavy duty pipe at tank

Field not level ?

10-13-78

MW

PW