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SPOKANE COUNTY ENGINEER

**STORMWATER CONVEYANCE
AND
DRAINAGE PONDS**

**OPERATION & MAINTENANCE
MANUAL**

SHAWNEE CANYON ESTATES

Spokane County Plat No. P-1825

CLC No. C-20-S990128

June, 2001

OFFICIAL PUBLIC DOCUMENT
SPOKANE COUNTY ENGINEER'S OFFICE

ORIGINAL

PROJECT # P1825

SUBMITTAL # 1

RETURN TO COUNTY ENGINEER

By
C.L.C. Associates, Inc.
707 W. 7th Avenue, Suite 200
Spokane, WA 99204
(509) 458-6840

STORMWATER CONVEYANCE AND DRAINAGE PONDS OPERATION & MAINTENANCE MANUAL

1.00 PURPOSE

This document is intended to provide general operations and maintenance guidelines for the drainage conveyance systems, ponds and other drainage facilities located within the Shawnee Canyon Estates residential neighborhood (Plat, P-1825). Implementation of these guidelines will insure that the drainage facilities installed will function as intended in the design.

2.00 INTRODUCTION

Generally, the drainage system is intended to collect uphill offsite and developed onsite stormwater runoff and convey it through the development or to the various storage ponds. The drainage facilities consist primarily of a series of onsite drainage structures, storm pipes, treatment/storage ponds, infiltration structures and by-pass culverts. It is of the utmost importance to provide adequate operations and maintenance activities to insure that the drainage facilities remain silt or dirt free, as this silt or dirt loading will affect the performance of the storm pipes, ponds and infiltration structures. If these facilities were to become completely clogged, the only remedy would be complete reconstruction the drainage facilities. Therefore, periodic maintenance is a must. A full set of engineering drawings is available for review at Spokane County Public Works, under County file P-1825. A site layout exhibit is provided in the Appendix of this document.

3.00 GENERAL OPERATIONAL CHARACTERISTICS

The drainage facilities for Shawnee Canyon Estates are generally very simple, functional, and have low maintenance requirements. A periodic visual inspection of the facilities will identify any required maintenance. Most maintenance will consist of keeping the pipes, structures and ponds free of debris and sediment. A specific inspection schedule should be followed. See Section 4.0 for recommended maintenance schedules.

3.10 Drainage Structures and Storm Pipes

The onsite drainage structures include concrete gutters, roadside ditches and catch basins. 10" to 12" High Density Polyethylene (HDPE) storm pipes convey the onsite runoff, collected in the streets, to the various treatment/storage ponds, located in the two drainage tracts.

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The drainage structures designed to address stormwater runoff from the "Offsite" area include rock-lined roadside drainage channels along the east sides of the uppermost streets and 18" to 30" HDPE storm pipes.

3.20 Drainage Ponds

Stormwater storage ponds were used in the design of the Shawnee Canyon Estates plat to provide treatment and storage for the runoff created by the development. The storage volume for each pond was designed to adequately contain the runoff created by the first ½" of rainfall on the street impervious areas and driveway areas draining directly to the streets, within the drainage basin it serves. The individual pond volumes provide water quality treatment to a depth of 0.50 to 0.67 feet, in accordance with the '208' treatment requirements specified in the Spokane County Guidelines for Stormwater Management.

Each pond is enclosed within earthen berms and/or retaining walls. The floor of a "208" pond includes the level portion of the floor of the swale and the sideslopes up to the outlet or overflow elevation. The soil located in the floor of the pond shall be a medium to well draining material, with a minimum infiltration rate of 0.5 inches per hour.

Pond specifications are provided in Table 3.20A. Additional information is provided in the engineering drawings on file at Spokane County Public Works, file P-1825.

Table 3.20A - Pond Specifications

Pond Label	Pond Btm. Elev.	Pond Btm. Area	Treatment Volume	Outlet Elev.	Berm Elev.
A	2176.00	1,773	972	2176.50	2177.00
B	2166.00	2,273	1,193	2166.50	2167.00
C	2129.00	2,493	1,792	2129.67	2130.00
D	2125.00	1,350	718	2125.50	2126.00

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3.30 Infiltration Structures

Infiltration structures include double-depth (Spokane County Standard Type B) drywells, and are used to infiltrate stormwater runoff beyond the required treatment volume. A copy of the Spokane County Standard Plan B-1a *Precast Drywells Placed in Swales* is provided in the Appendix for reference. These structures consist of a grated inlet, perforated concrete barrel sections, and buried washed drain rock, wrapped in porous filter fabric. The grate inlet elevation is set six to eight inches above the pond bottom to provide "208" treatment storage. The barrel sections and washed drain rock provide additional storage during infiltration.

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4.00 MAINTENANCE REQUIREMENTS AND SCHEDULES

Below is a maintenance description for each of the drainage system elements contained within the Shawnee Canyon Estates development, including the drainage structures, pipes, culverts, roadside ditches and ponds. All drainage facilities located outside of the County road right-of-way, are expected to be maintained by the homeowner's association; any drainage facilities located on individual residential lots are to be maintained by the respective homeowners. Should the homeowner's association be terminated for any reason, the maintenance responsibilities will become that of the individual homeowners, located within the Shawnee Canyon Estates plat.

The homeowner's association shall provide to the Spokane County Parks Department and the Spokane County Engineer the name, address, and 24-hour telephone number for the entity responsible for performing routine and emergency maintenance inspections and repairs. This information shall be confirmed on a yearly basis. The homeowner's association shall provide notice of any changes to the Spokane County Parks Department and the Spokane County Engineer within 15 days of said changes.

General

Proper maintenance procedures are necessary for the continued functioning of the drainage facilities. Improper maintenance, or lack of attentive maintenance measures, may result in negative drainage impacts. It is strongly recommended that the homeowner's association designate an individual who will be responsible for making sure the maintenance measures are implemented.

Generally, maintenance personnel are to conduct a visual inspection of the drainage facilities immediately following a substantial rainfall event or snowmelt event. Substantial events include:

- ▶ Noticeably hard rain for a short period (30 minutes or more),
- ▶ Steady rain for a long period (6 hours or more), or
- ▶ Significant rainfall and/or snowmelt when the ground is frozen.

For long duration storms, longer than 24 hours, maintenance personnel are to inspect the drainage facilities during the storm event to identify any developing problems and correct them before they become major problems.

1. Inspect all roadside ditches and drainage structures (culverts, catch basins and drawwells) to ensure they are clear of debris and obstructions.

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2. Inspect all pond berms and retaining walls for breaches. Immediately repair any berm breaches with native sandy soil, compacted in place, and wall breaks with new concrete blocks.

The above noted storm related visual inspections are in addition to the maintenance schedules noted below for each item.

4.10 Drainage Structures and Storm Pipes

Culverts, catch basins and pipes should be inspected every 3 months, or after every significant storm event (½") and/or snowmelt event, whichever is more frequent. Visually inspect the pipes, inlets and outlets, making sure they are clear of debris and checking that the pipe is in good condition, without breaks or cracks. If there is any obstruction present it should be removed immediately.

A flow test in the pipe can be used to readily detect major obstructions or breaks in the pipe. This test requires a water source (hydrant or water truck) and a person at the downstream end of the pipe observing the flow exiting out of the pipe section.

All catch basins should be cleaned (vacuumed) every 3 months.

4.20 Drainage Ponds

The drainage ponds should be inspected every 3 months, or after every significant rainfall and/or snowmelt event, whichever is more frequent. The ponds consist of earthen depressions constructed from native soils, enclosed within soil berms and/or block retaining walls. Each pond should be sodded and/or hydro-seeded with a dryland grass mixture, at a minimum. A lawn sod can be used if regular irrigating is implemented.

Routine maintenance and inspections of the pond will include removal of any accumulated debris, such as leaves, weeds and trash. Any obstructions which would not allow water to flow freely from the ponds via the outlet structures or overflow berms should be removed or repaired. Additionally, the berms and block walls of the ponds should be inspected to insure that they are in good repair and structurally competent and that no outflow has occurred other than through the outlet structure or overflow berm.

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The homeowner's association shall be responsible for replacement of any grass turf and underlying 1-foot depth of soil in ponds whenever the vegetation appears to indicate a problem due to contamination. The turf and underlying soil shall meet Spokane County requirements for permeability and cation exchange capacity/organic content in effect at the time of replacement.

The Spokane County Engineer requires soil tests where average pond depths are greater than six inches. One test each for cation exchange capacity and soil organic content per pond bottom area 1500 square feet or less. Tests shall be performed on a well-mixed composite sample consisting of the top six inches of soil from at least four cores uniformly distributed over the percolation area. If the average cation exchange capacity of the soil is 15 milliequivalents or more per 100 grams, or the soil is 2% or more organic carbon, the soil will be considered suitable for stormwater treatment. Pond C was designed to provide water quality treatment to a depth of 8 inches.

4.30 Infiltration Structures

The infiltration structures should be inspected every 3 months, or after every significant rainfall and/or snowmelt event, whichever is more frequent. These structures consist of a grated inlet, perforated concrete barrel sections, and buried washed drain rock, wrapped in porous filter fabric.

During routine inspection, if standing water is found 72 hours or more after the last significant rainfall event, the infiltration structure is most likely clogged due to silt and sediment. The structure shall be vacuumed of standing water and sediment.

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5.00 Recommended Set-Aside Funds for Maintenance & Future Replacement Costs

There will be annual maintenance costs, major renovation costs and future replacement costs of the drainage facilities. These costs are the responsibility of the homeowner's association or successors in interest. Major renovation and future replacement costs have been converted to annual costs, in the form of recommended set-aside funds. It is assumed that 1/2 of the pipe and 2 of the 3 drywells will need to be replaced within 20 years.

Table 5.00A - Pipe Replacement

H.D.P.E. Size	1/2 Total Length	Present Value		Future Value ⁽¹⁾
		Per L.f.	Total	
10"	265	\$ 12	\$ 3,180	\$ 6,968
12"	820	\$ 15	\$ 12,300	\$ 26,951
18"	300	\$ 22	\$ 6,600	\$ 14,461
30"	240	\$ 30	\$ 7,200	\$ 15,776
TOTAL				\$ 64,155

The estimated annual maintenance costs and recommended annual set-aside costs are listed below in Table 5.00B. It is recommended the homeowner's association set-aside these amount of funds annually, to ensure that adequate maintenance and replacement measures of the drainage facilities will be implemented.

Table 5.00B - Maintenance and Future Replacement Costs

Drainage Facility	Annual Maintenance Costs	Annual Set-Aside Funds for Future Replacement or Major Renovation ⁽¹⁾
Onsite Pipes & Drainage Structures	\$ 1,000	\$1,745
Drywells - Spokane County Type B	\$ 1,000	\$ 360
Sub-total Annual Costs	\$ 2,000	\$ 2,105

Note: (1) Assume replacement in 20 yrs, with 4% inflation and a 6% rate of return on investments for set-aside account.

Grand Total/year = \$ 4,105

Cost per lot/year = \$ 410.50 (10 lots)

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TECHNICAL APPENDIX

SITE MAP

ONSITE POND DETAILS

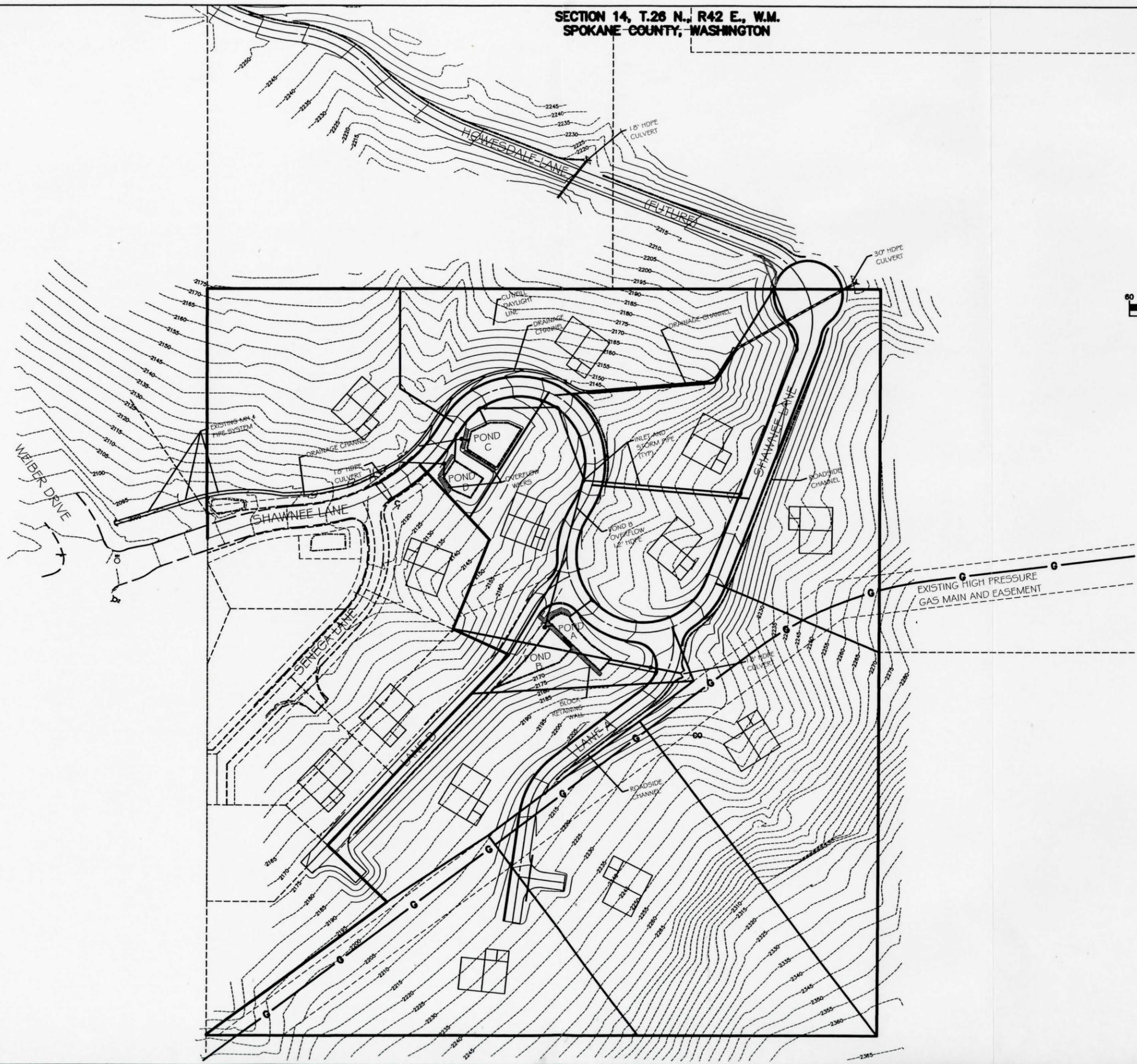
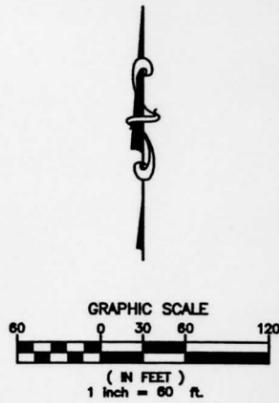
PRECAST DRYWELL

RETAINING WALL SECTION

SECTION 14, T.28 N., R.42 E., W.M.
SPOKANE COUNTY, WASHINGTON

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
456-8000
CALL TWO BUSINESS DAYS
BEFORE YOU DIG

Associates, Inc.
Planning
Engineering
Architecture
Landscape Architecture
Land Surveying
707 W. 7th Avenue, Suite 200
Spokane, WA 99204
Phone: (509) 456-6840
Fax: (509) 456-6844

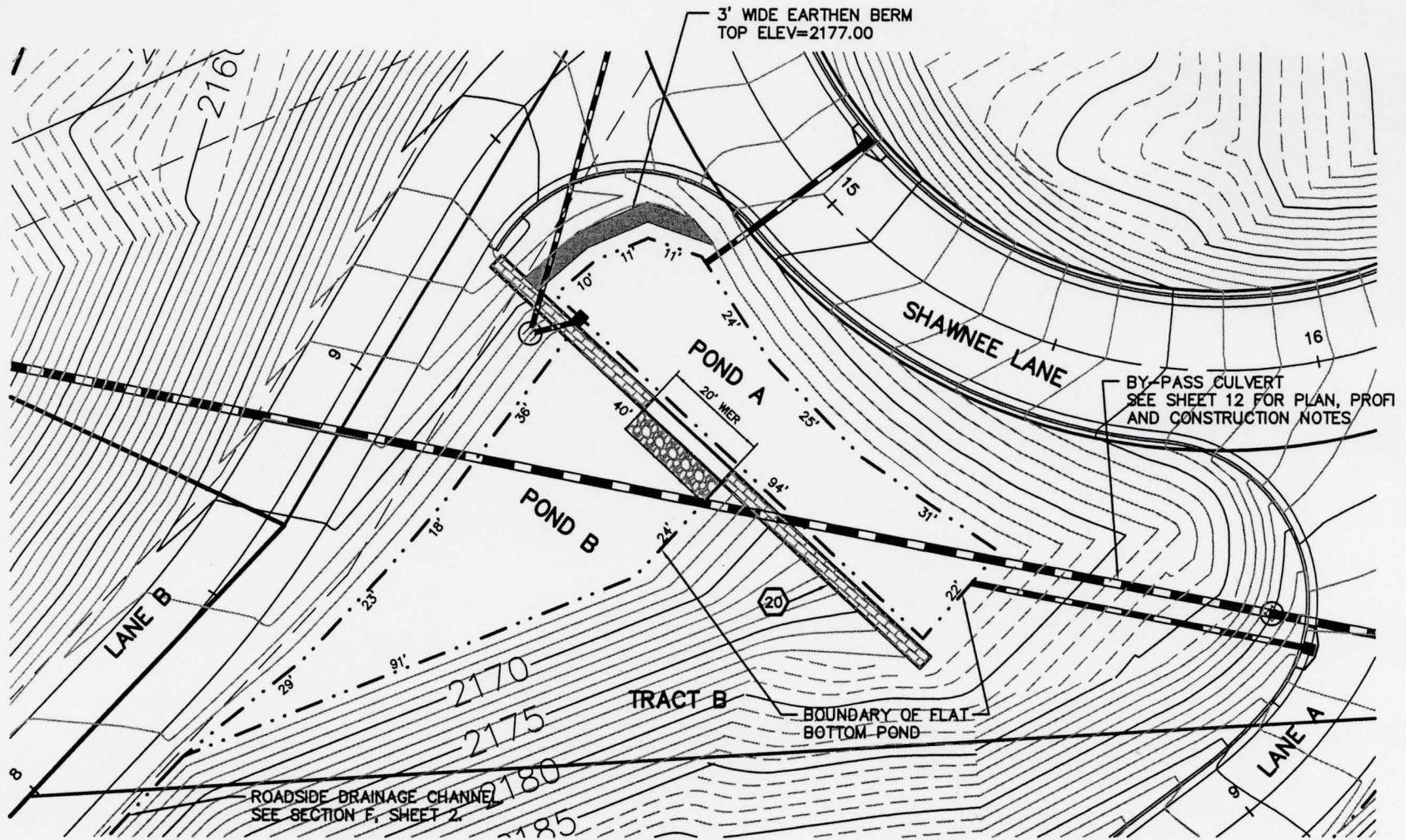


DATUM
BASED ON CITY DATUM, C.B.M. NO. 32,
N.E. CORNER - ARROWHEAD & SHAWNEE
19.7' NNC & 1.2' EEC
CITY ELEV. 1996.972 - 13.13' = NAVD88
ELEV = 1983.842.

Date: 04/20/01
Description: PRELIMINARY SUBMITTAL
County Plat No.: P-1825
CLC Job Number: S990128
Drawn By: NWO
Designed By: NWO
Checked By: NWO
THESE PLANS ARE INSTRUMENTS OF PROFESSIONAL SERVICE AND ARE PROTECTED BY FEDERAL, STATE AND OTHER RESERVED RIGHTS INCLUDING COPYRIGHT. THEY MAY NOT BE REPRODUCED OR USED FOR ANY PURPOSE WITHOUT THE WRITTEN CONSENT OF CLC ASSOCIATES, INC. (AN AFFILIATE OF COLORADO LAND CONSULTANTS, INC.)

8 STREET CONSTRUCTION PLANS
SHAWNEE CANYON ESTATES
DEVELOPED SITE PLAN
SPOKANE COUNTY, WASHINGTON

Sheet Title
Post-Developed
Site Plan
A1
Sheet Number



PONDS A & B DETAIL

SCALE: 1" = 20'

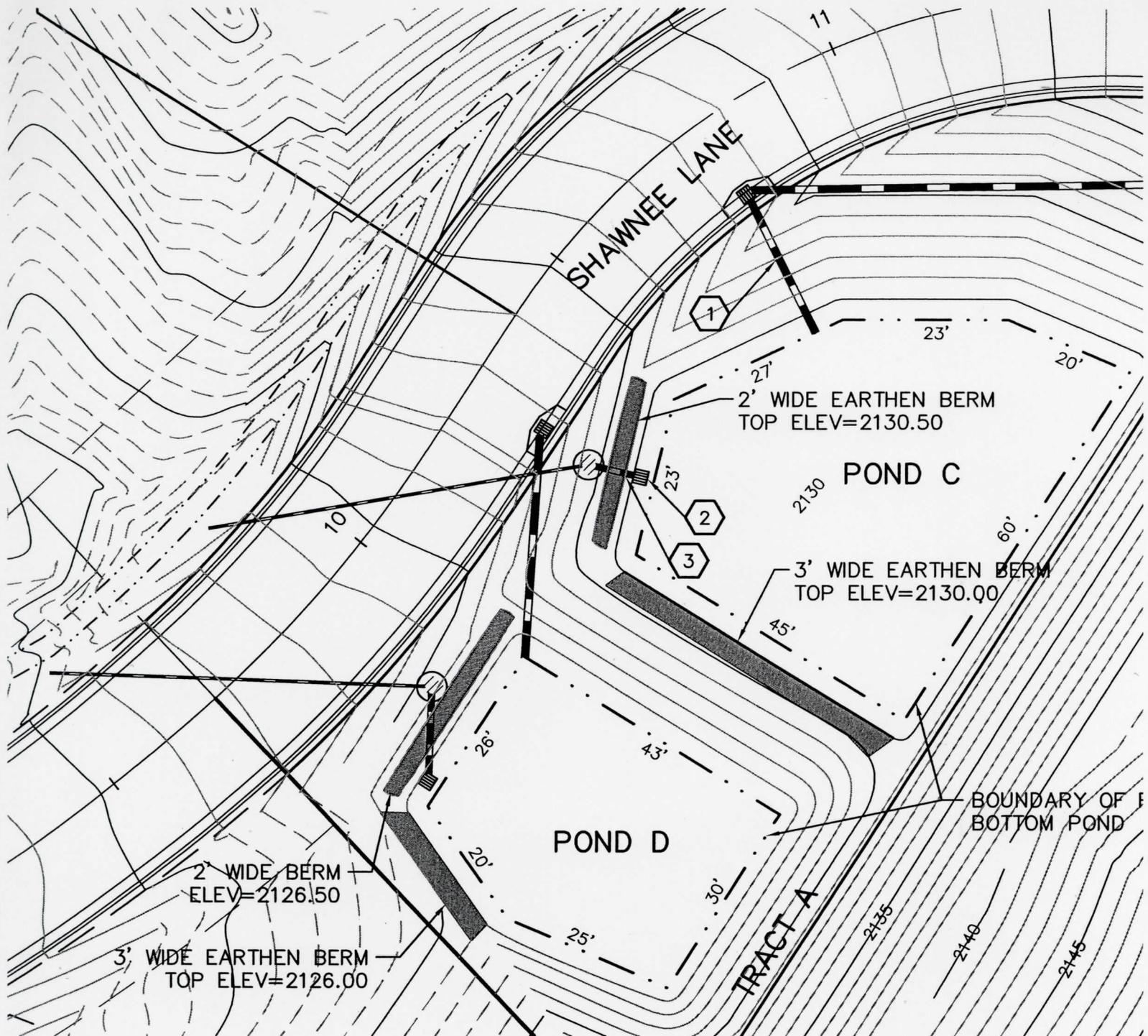
POND B

POND BOTTOM ELEV = 2166.00
 POND BOTTOM AREA = 2273 S.F.
 REQUIRED "208" VOLUME = 558 C.F.
 PROVIDED "208" VOLUME = 1193 C.F.
 OUTLET ELEVATION = 2166.50
 MINIMUM BERM ELEV = 2167.20

POND A

POND BOTTOM ELEV = 2176.00
 POND BOTTOM AREA = 1773 S.F.
 REQUIRED "208" VOLUME = 951 C.F.
 PROVIDED "208" VOLUME = 972 C.F.
 OUTLET ELEVATION = 2176.50
 TOP OF WALL ELEV = 2177.33
 MINIMUM BERM ELEV = 2177.00





PONDS C & D DETAIL

SCALE: 1" = 20'

POND D

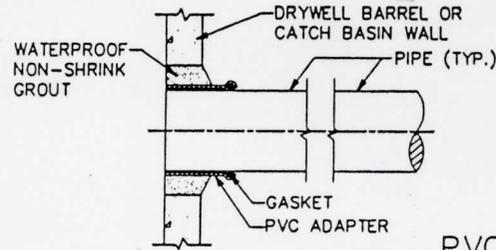
POND BOTTOM ELEV = 2125.00
 POND BOTTOM AREA = 1350 S.F.
 REQUIRED "208" VOLUME = 82 C.F.
 PROVIDED "208" VOLUME = 718 C.F.
 OUTLET ELEVATION = 2125.50
 MINIMUM BERM ELEV = 2126.00

POND C

POND BOTTOM ELEV = 2129.00
 POND BOTTOM AREA = 2493 S.F.
 REQUIRED "208" VOLUME = 1790 C.F.
 PROVIDED "208" VOLUME = 1792 C.F.
 OUTLET ELEVATION = 2129.67
 MINIMUM BERM ELEV = 2130.00

GENERAL NOTES

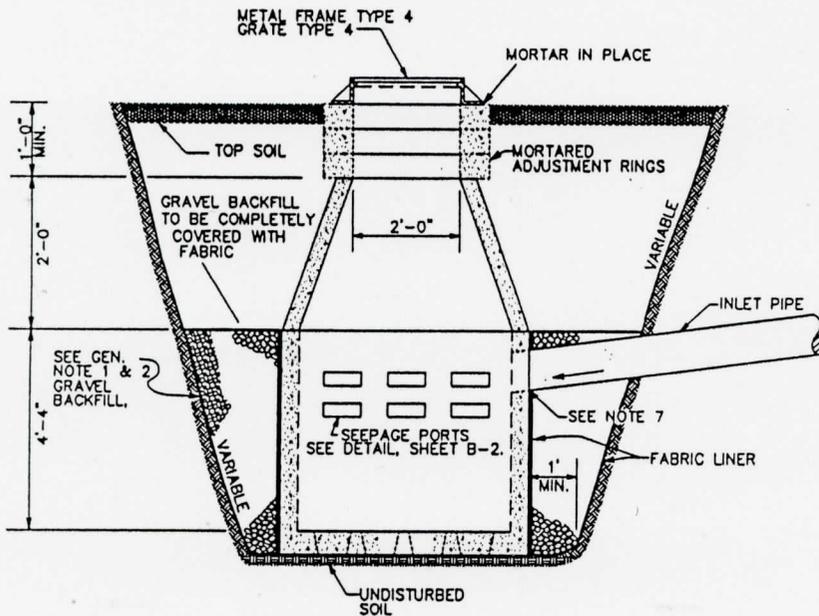
- GRAVEL BACKFILL QUANTITY FOR DRYWELLS :
TYPE "A" - 30 CUBIC YARDS MINIMUM / 42 TONS.
TYPE "B" - 40 CUBIC YARDS MINIMUM / 56 TONS.
OR AS SPECIFIED ON ROAD PLANS.
- SPECIAL BACKFILL MATERIAL FOR DRYWELLS SHALL CONSIST OF WASHED GRAVEL GRADED FROM 1" TO 3" WITH A MAXIMUM OF 5% PASSING THE U.S. No. 200 SCREEN, AS MEASURED BY WEIGHT. A MAXIMUM OF 10% OF THE AGGREGATE, AS MEASURED BY WEIGHT, MAY BE CRUSHED OR FRACTURED ROCK. THE REMAINING 90% SHALL BE NATURALLY OCCURRING UNFRACTURED MATERIAL.
- FABRIC SHALL BE MODERATE SURVIVABILITY AS OUTLINED IN STANDARD SPECIFICATIONS 9-33
- SEE STANDARD PLANS SHEETS B-2 AND B-3 FOR PRECAST CONCRETE DETAILS.
- ADJUSTMENT BLOCKS SHALL BE CEMENT CONCRETE.
- PRECAST RISER MAY BE USED IN COMBINATION WITH OR IN LIEU OF ADJUSTING BLOCKS.
- WHEN PVC PIPE IS USED A PVC ADAPTER SHALL BE INSTALLED.
- PIPES SHALL BE GROUTED INTO DRYWELLS.



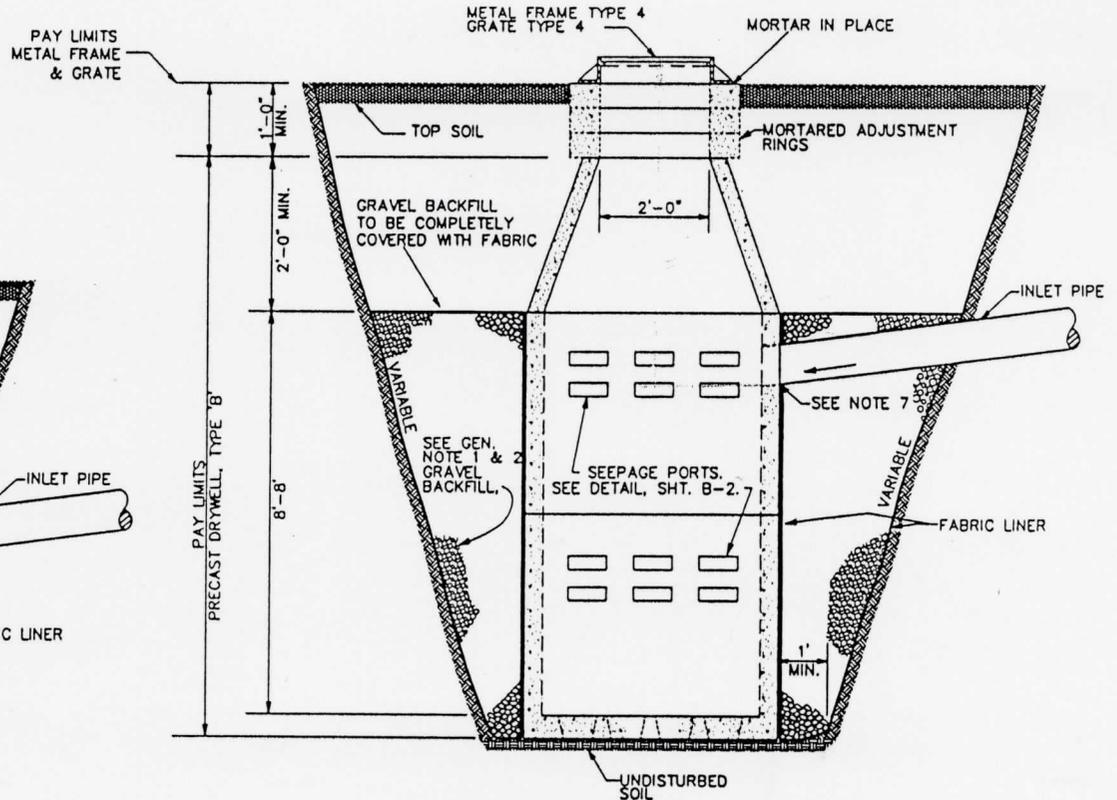
NOTE:

PVC PIPE ADAPTERS AND GASKET MAY VARY IN SHAPE AND SIZE AS ILLUSTRATED IN DETAIL BY ACCEPTABLE ALTERNATE IN ACCORDANCE WITH A.S.T.M.-C-428.

PVC ADAPTER (SAND COLLAR)



DRYWELL - TYPE 'A' SWALE



DRYWELL - TYPE 'B' SWALE

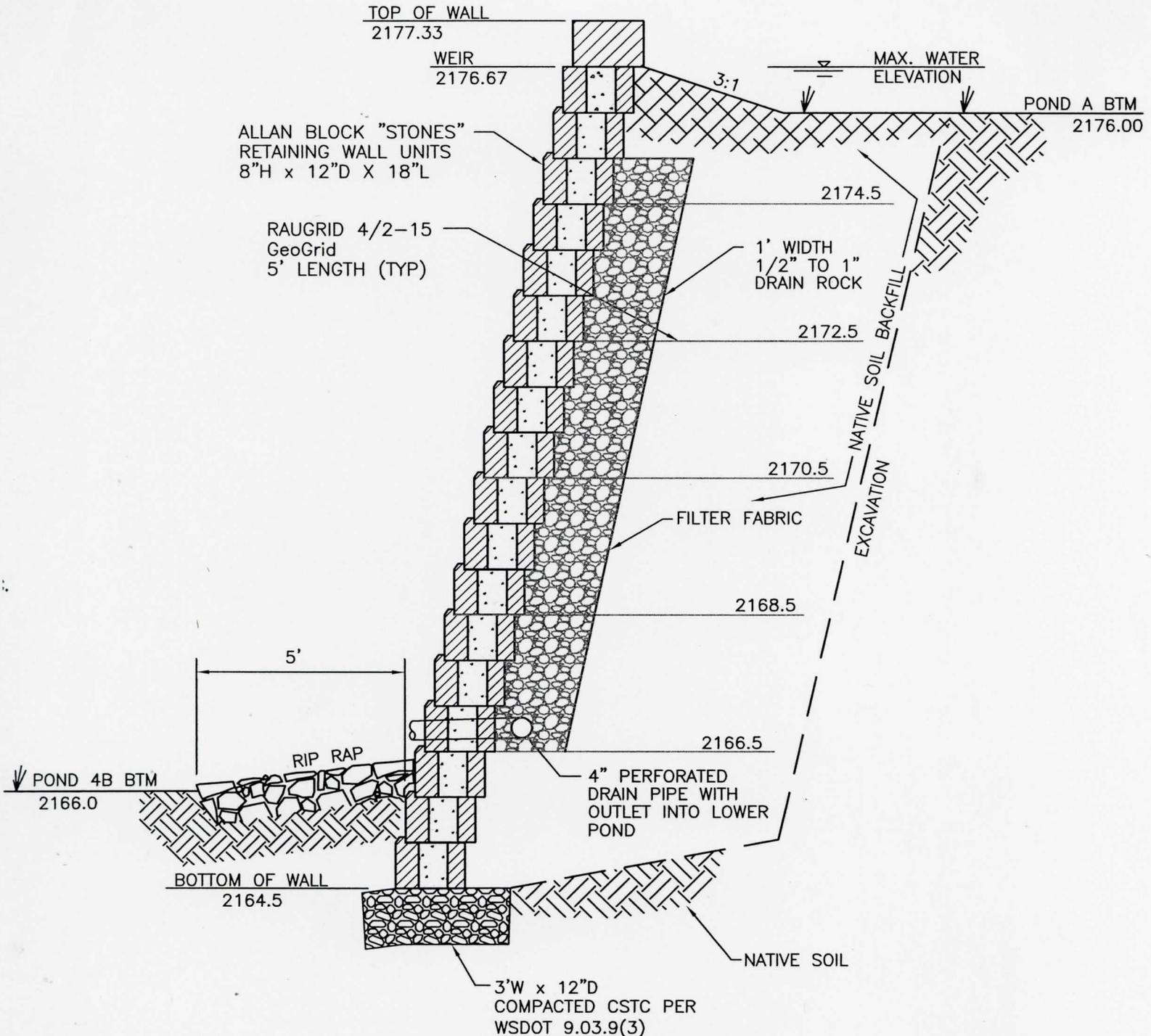
SPOKANE COUNTY
DEPARTMENT OF PUBLIC WORKS
SPOKANE, WA. 99206 456-3600

APPROVED:
COUNTY ENGINEER
DATE: 11/22/98

STANDARD
PRECAST DRYWELLS PLACED IN SWALES

STD-B1-A-DWG
SHEET
B-1a

NO.	DATE	BY	CHKD.	APPR.	REVISION



RETAINING WALL SECTION

NOT TO SCALE