

**STORMWATER CONVEYANCE  
AND  
DRAINAGE SWALES**

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**OPERATION & MAINTENANCE  
MANUAL**

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**Fraser Estates Final Plat,  
Fraser Estates 1<sup>st</sup> Addition Final Plat**

County File P-1864  
CLC No. S990126

July, 2002

By  
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FINAL  
OFFICIAL PUBLIC DOCUMENT  
SPOKANE COUNTY ENGINEER'S OFFICE  
**ORIGINAL**  
PROJECT # 1846A  
SUBMITTAL # 2  
RETURN TO COUNTY ENGINEER

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# STORMWATER CONVEYANCE AND DRAINAGE SWALES OPERATION & MAINTENANCE MANUAL

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## **1.00 PURPOSE**

This Manual has been prepared to provide general operation and maintenance guidelines for the drainage facilities located within the Plats of Fraser Estates and Fraser Estates - First Addition, which are located outside of the County road rights-of-way. Implementation of these guidelines will insure that the drainage facilities installed will function as intended in the plat design. As additional phases are completed both within the Plat and within the Plat of Fraser Estates East, this Manual will be revised to reflect the additional storm drainage facilities requiring maintenance. As a result, when additional phases are completed, the annual recommend set aside fund amount will be modified.

## **2.00 INTRODUCTION**

Generally, the drainage system is intended to collect onsite stormwater runoff in the streets and convey it to the various drainage swales, via concrete gutters and storm pipes. The drainage facilities consist primarily of a series of onsite drainage structures, storm pipes, treatment/storage swales, and drywells. 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, swales, and drywells. If these facilities were to become completely clogged, the only remedy would be to completely reconstruct the drainage facilities. Therefore, periodic maintenance is a must. A full set of engineering drawings for Fraser Estates is available for review at Spokane County Public Works, under County file P-1864.

## **3.00 GENERAL OPERATIONAL CHARACTERISTICS**

The drainage facilities for Fraser 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 swales 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 drainage structures include concrete gutters, catch basins and drywells. These structures convey stormwater runoff from the surface streets to storage swales or the underground storm sewer system. The storm sewer system consists of piping, ditches and catch basins which direct the storm water runoff into swales containing drywells.

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## 3.20 Drainage Swales

Drainage swales are located at sites which have moderate to high infiltration rates. All "208" drainage swales are located within drainage tracts or within the landscaping area between the curb and sidewalk.

Each swale has a flat bottom and is enclosed within earthen berms. The soil located in the floor of the swale is required to be a medium to well draining material, with a minimum infiltration rate of 0.5 inches per hour. All swale volumes and outlet structures were designed to address the runoff flow rates and volumes for the 10-year design storm event.

Swale characteristic information is provided in Table 3.20A. Additional information is provided in the engineering drawings on file at Spokane County Public Works, under file P-1864.

Table 3.20A - Swale Characteristics

Swale/Tract Label	Swale Btm. Elev.	Swale Btm. Area	Swale Volume	Outlet Structure	Outlet Elev.	Overflow Elev.
Swale A	1985.03	735	409	1-Type A	1985.53	1985.78
Swale B	1989.90	934	537	1-Type A	1990.40	1990.65
Swale C	1990.10	267	200	None	1990.60	1990.85
Swale D	1990.10	267	200	1-Type A	1990.60	1990.70
Swale D1	1976.10	1725	968	1-Type A	1976.60	1978.10
Swale D2	1976.10	3150	1726	2-Type A	1976.60	1978.10
Swale D3	1974.00	576	288	1-Type A	1974.50	1976.00
Tract G	1986.17	466	310	1-Type A	1986.67	1986.67
Tract H	1986.30	390	307	1-Type A	1986.80	1987.05
Swale H	1970.17	3,280	1,732	2-Type B	1970.67	1971.72
Swale I	1977.16	1,100	638	1-Type A	1977.66	1978.00
Tract L	1982.40	1,620	908	Catch Basin	1982.90	1984.90
Tract M	1984.15	1,405	789	1-Type A	1984.65	1985.60
Swale R	1979.24	2,633	1,409	2-Type B	1979.74	1980.64
Swale T	1983.30	2,000	1,091	1-Type B	1983.80	1984.70
Tract I	1985.36	686	431	1-Type A	1985.86	1986.76
Tract J	1986.10	624	394	1-Type A	1986.60	1987.50
Swale W1	1987.20	288	185	1-Type A	1987.70	1988.60
Swale W2	1986.35	494	313	1-Type A	1986.85	1987.75
Swale X1	1987.20	288	185	1-Type A	1987.70	1988.60
Swale X2	1986.35	494	313	1-Type A	1986.85	1987.75
Swale Y	1982.35	224	136	1-Type A	1982.85	1983.75

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## 3.30 Infiltration Structures

Infiltration outlet structures include single and double-depth (Spokane County Standard Type A and B) drywells, which are used to infiltrate stormwater runoff beyond the available swale 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 inches above the swale bottom to provide stormwater storage and sediment removal prior to drywell infiltration.

## **4.00 MAINTENANCE REQUIREMENTS AND SCHEDULES**

Below is a maintenance description for each of the drainage system elements contained within the Fraser Estates development, including the drainage structures, pipes and swales. 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 Fraser Estates Plat.

The Fraser Estates Homeowner's Association shall provide to the Spokane County Parks Department and the Spokane County Engineer the name, address, and 24-hour phone number for those 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.

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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 concrete gutters and drainage structures (catch basins and drywells) to ensure they are clear of debris and obstructions.
2. Inspect all swale berms for breaches. Immediately repair any berm breaches with native sandy soil, compacted in place.

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

### 4.10 Drainage Structures and Storm Pipes

Catch basins and pipes should be inspected every 3 months, or after every significant storm event ( $\frac{1}{2}$ " ) 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 6 months.

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### 4.20 Drainage Swales

The drainage swales should be inspected every 3 months, or after every significant rainfall and/or snowmelt event, whichever is more frequent. The swales consist of earthen depressions constructed from native soils, enclosed within soil berms. Each swale 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 swales 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 swales via the outlet structures should be removed. Additionally, the swale berms should be inspected to insure that they are in good repair and structurally sound and that no outflow has occurred other than through the outlet structure.

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

### 4.30 Infiltration Structures

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

All drywells should be cleaned (vacuumed) every 6 months.

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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 ½ of the pipe and 11 drywells will need to be replaced within 20 years.

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

Table 5.00A - Maintenance and Future Replacement Costs

Drainage Facility	Annual Maintenance Costs	Annual Set-Aside Funds for Future Replacement or Major Renovation <sup>(1)</sup>
Swales, Drainage Structures & Pipes	\$ 6,500	\$ 622
Drywells	\$ 7,600	\$ 1,311
<b>Sub-total Annual Costs</b>	<b>\$ 14,100</b>	<b>\$ 1,933</b>

**Grand Total/year = \$ 16,033**  
**Cost per lot/year = \$ 302.51 (53 lots)**

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

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**TECHNICAL APPENDIX**

**SITE MAPS**

**PRECAST DRYWELL, DETAIL B-1A**

SW 1/4 SEC. 32, T.28 N., R.44 E., W.M.  
SPOKANE COUNTY, WASHINGTON

BASIN	FLOW	BASIN	FLOW
Q	235.70 AC. 10,287,092 SF	X1	0.18 AC. 8,964 SF
S	0.38 AC. 16,448 SF	X2	0.36 AC. 15,600 SF
T	1.32 AC. 57,356 SF	Y	0.09 AC. 3,870 SF
U	0.30 AC. 13,190 SF	H	4.33 AC. 188,527 SF
V	0.39 AC. 16,987 SF		
W1	0.13 AC. 5,592 SF		
W2	0.29 AC. 12,540 SF		
G1	0.86 AC. 37,308 SF		

UNION SOUND SERVICE ALERT  
ONE-CALL NUMBER  
456-8000  
CALL TWO BUSINESS DAYS  
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Fax: (509) 456-8044

DAVID N. RANDALL  
TYPE OF REGISTERED  
PROFESSIONAL ENGINEER  
25884  
EXPIRES 07/04/02

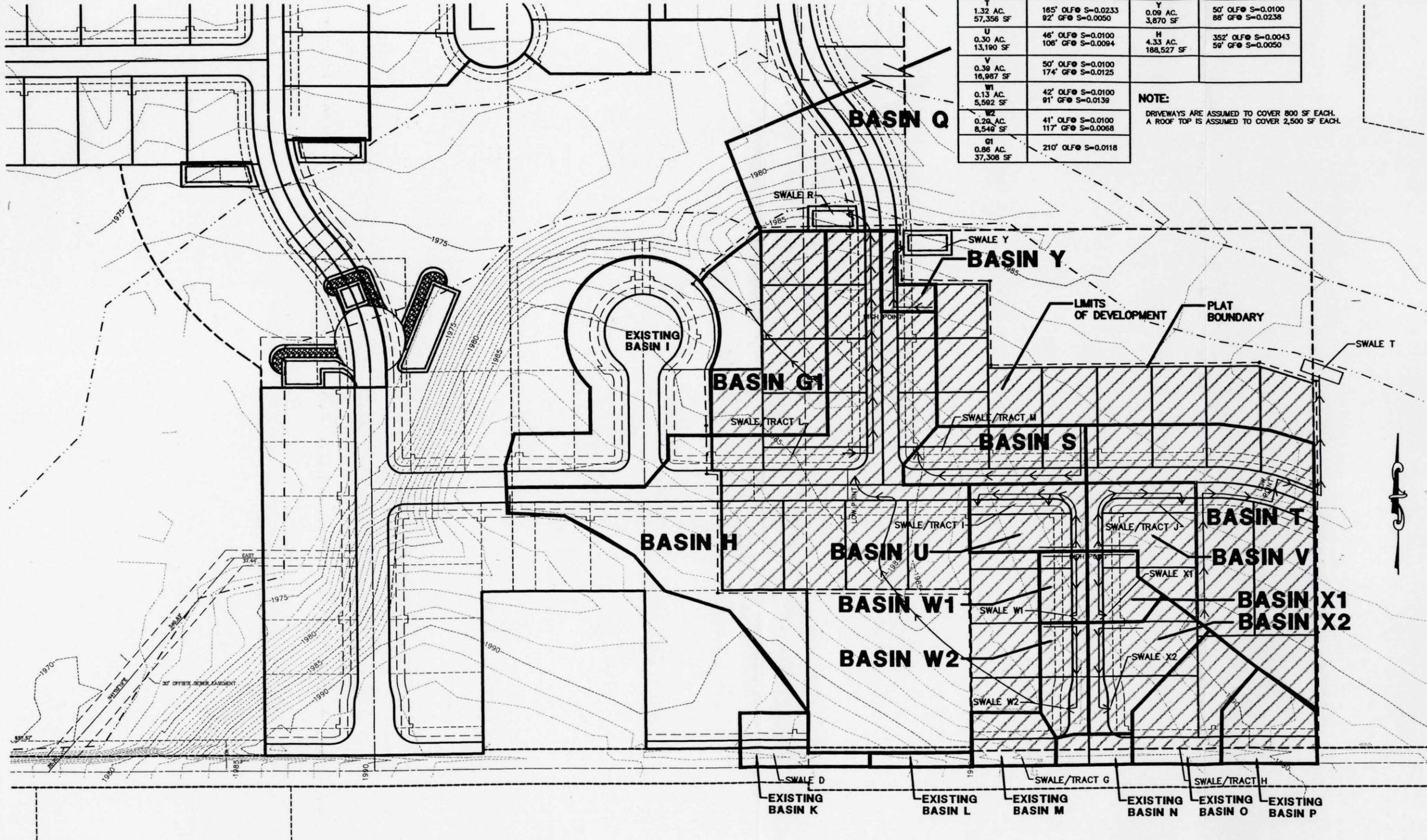
PREPARED UNDER THE DIRECT  
SUPERVISION OF  
DAVID N. RANDALL, P.E.  
WASHINGTON REGISTRATION  
NO. 25884  
FOR AND ON BEHALF OF  
CLC ASSOCIATES, INC.

Description  
Date  
07/25/01  
PRELIMINARY SUBMITTAL

Spokane County No. P-1884  
CLC Job Number: S8901288  
Drawn By: RLM  
Designed By: DNR  
Checked By: DNR  
THESE PLANS ARE INSTRUMENTS OF PROFESSIONAL SERVICE AND ARE PROVIDED BY OWNER. THE STATEMENT AND OTHER RESERVED RIGHTS INCLUDING COPYRIGHT, ARE NOT TO BE REPRODUCED OR USED FOR ANY PURPOSE WITHOUT THE WRITTEN CONSENT OF CLC ASSOCIATES, INC. (AN AFFILIATE OF COLLEGIUM LAND CONSULTANTS, INC.)

BASIN MAP  
FRASER ESTATES FIRST ADDITION  
POST-DEVELOPED CONDITION  
SPOKANE COUNTY, WASHINGTON

DRAINAGE  
BASINS  
PLAN  
B1.01

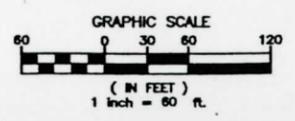


NOTE:  
DRIVEWAYS ARE ASSUMED TO COVER 800 SF EACH.  
A ROOF TOP IS ASSUMED TO COVER 2,500 SF EACH.

COUNTY DATUM  
BASED ON INVERT ELEVATION OF SEWER  
MANHOLE NO. 31 AS SHOWN ON  
"MILLWOOD-NORTHWOOD SEWER  
EXTENSION PLAN" SHEET 8 OF 21,  
ELEVATION=1856.64

THE DESIGN IMPROVEMENTS SHOWN IN THIS SET OF PLANS AND CALCULATIONS  
CONFORM TO APPLICABLE EDITIONS OF THE SPOKANE COUNTY STANDARDS FOR  
ROAD AND SEWER CONSTRUCTION AND THE SPOKANE COUNTY GUIDELINES FOR  
STORMWATER MANAGEMENT. ALL DESIGN DEVIATIONS HAVE BEEN APPROVED BY  
THE SPOKANE COUNTY ENGINEER. I APPROVE THESE PLANS FOR CONSTRUCTION.

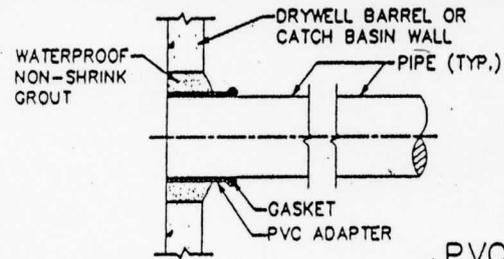
LEGEND  
OLF OVERLAND FLOW  
GF GUTTER FLOW  
→ FLOW PATH FOR TO CALCULATION



J:\L\proj\912\vg\B\...dwg, 2012 5:04 PM, DR

## GENERAL NOTES

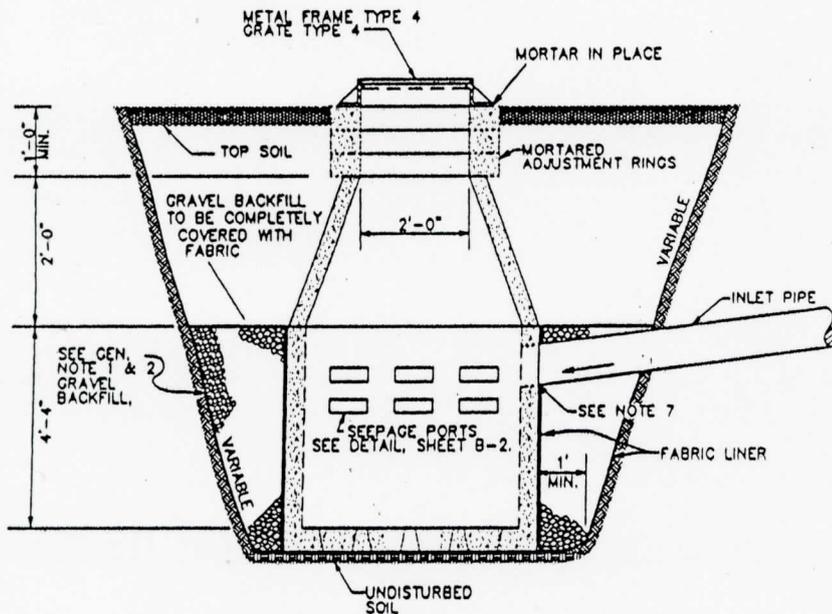
- GRAVEL BACKFILL QUANTITY FOR DRYWELLS :  
TYPE "A" - 30 CUBIC YARDS MINIMUM / 42 TONS.  
TYPE "B" - 40 CUBIC YARDS MINIMUM / 56 TONS.  
OR AS SPECIFIED ON ROAD PLANS.
- SPECIAL BACKFILL MATERIAL FOR DRYWELLS SHALL CONSIST OF WASHED GRAVEL GRADED FROM 1" TO 3" WITH A MAXIMUM OF 5% PASSING THE U.S. No. 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.



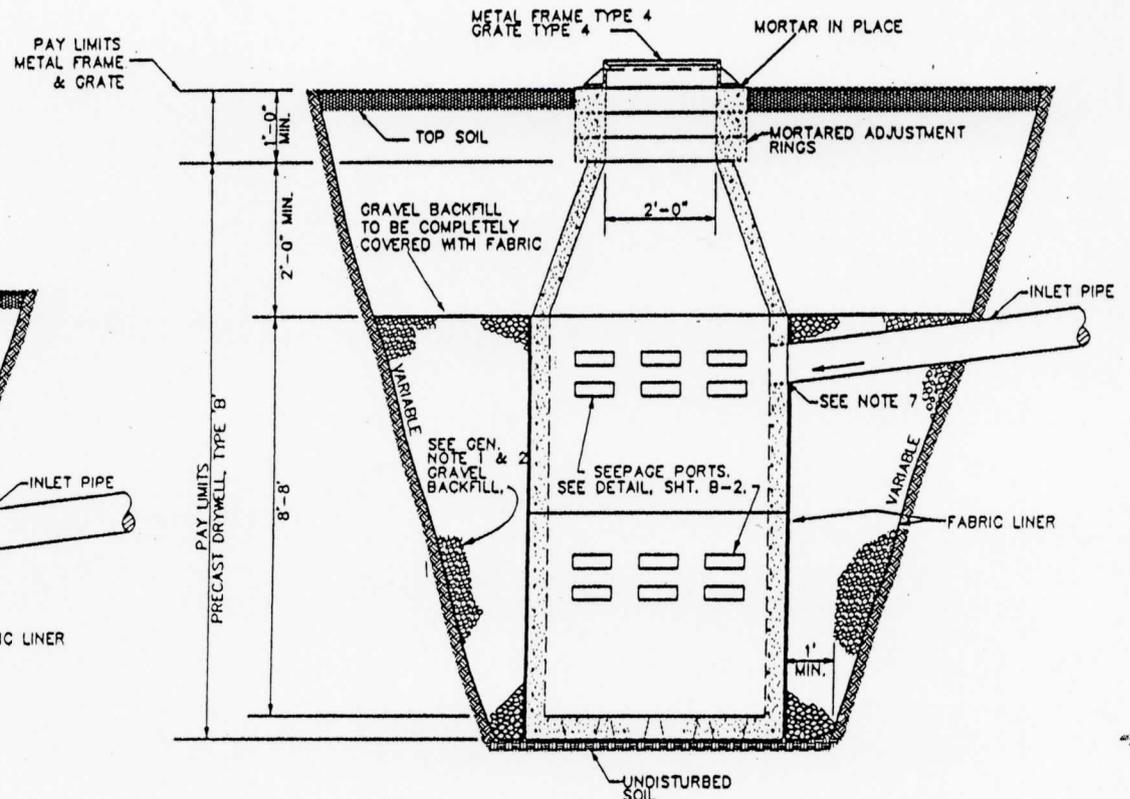
### NOTE:

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

NO.	DATE	BY	CHKD.	APPR.	REVISION

SPOKANE COUNTY  
DEPARTMENT OF PUBLIC WORKS  
SPOKANE, WA. 99208 456-3600

APPROVED:  
COUNTY ENGINEER  
DATE: 11/27/78



STANDARD  
PRECAST DRYWELLS PLACED IN SWALES

FTS-B-A-270  
SHEET  
B-1a