STORMWATER CONVEYANCE
AND
DRAINAGE POND

OPERATION & MAINTENANCE MANUAL

Falcon Ridge

County File P-1807
CLC No. S99398

July 24, 2002

By
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Spokane, WA 99204
(509) 458-6840

1.00 PURPOSE

This document is intended to provide general operations and maintenance guidelines for the drainage ponds and other drainage facilities located within the Falcon Ridge single-family residential neighborhood, 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.

2.00 INTRODUCTION

Generally, the drainage system is intended to collect onsite stormwater runoff in the streets and convey it to two detention ponds and then to a filter unit prior to drywell discharge, via concrete gutters and storm pipes. The drainage facilities consist primarily of a series of onsite drainage structures, manholes, storm pipes, detention pond, filtration unit 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, pond, 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 Falcon Ridge is available, for review at Spokane County Public Works under County file P-1807.

3.00 GENERAL OPERATIONAL CHARACTERISTICS

The drainage facilities for Falcon Ridge are simple, functional, and have low maintenance requirements with the exception of the filtration unit. A periodic visual inspection of the facilities will identify any required maintenance. Most maintenance will consist of keeping the manholes, 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 drainage structures include concrete gutters, catch basins, discharge structures, manholes, piping and drywells. The concrete gutters, catch basins, discharge structures, manholes and piping convey stormwater runoff from the surface of the streets to the detention ponds where the storm water is stored and then discharged through a discharge structure for subsurface disposal to the drywells.

3.20 Filter Unit (Stormfilter)

A Stormwater Management, Inc. Stormfilter has been installed within the storm drainage system just prior to discharge to (4) City of Spokane Type "1" drywells. The monthly maintenance required on this unit will be preformed by the manufacturer and billed through the Falcon Ridge Home Owner Association. The

filter unit is located within a tract of the future McCarrolls East Addition in the City of Spokane. A site map showing the filter location and layout is attached to this document.

3.30 Detention Ponds

Two detention ponds are located within a Tract A along the North side of Maxine Avenue. The purpose of these detention ponds is to provide attenuation of the peak storm water runoff rate prior to discharge. A site map showing the location and layout of the ponds is attached to this document.

The pond has a flat bottom and is enclosed within earthen berms. The pond volume and outlet structure were designed to address the runoff flow rate and volume for the 100-year design storm event.

Pond characteristic information is provided in Table 3.30. Additional information is provided in the engineering drawings on file at Spokane County Public Works, under file P-1807.

Table 3.30 - Pond Characteristics

Pond Label	Pond Btm. Elev.	Pond Btm. Area (sf)	Outlet Structure	Outlet Elev.	Overflow Elev.
Pond 1	2348.00	21,250	Discharge Structure	Varies	2353.90
Pond 2	2440.00	6,473	Discharge Structure	Varies	2345.74

3.40 Infiltration Structures

The infiltration outlet structures consist of (4) City of Spokane Standard Type "1" drywells that are used to infiltrate stormwater runoff at a rate of less then 1 cfs. A copy of the City of Spokane Standard Plan B-102C *Precast Drywell Type 1* is attached for reference. This structure consists of a grated inlet, perforated concrete barrel sections, and buried washed drain rock, wrapped in porous filter fabric.

4.00 MAINTENANCE REQUIREMENTS AND SCHEDULES

As part of the development of Falcon Ridge, a homeowner's association (HOA) will be formed. Below is a maintenance description for each of the drainage system elements contained within the Falcon Ridge development, including the drainage structures, drywells, pipes 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 Falcon Ridge Plat.

The 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 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 concrete gutters, manholes and drainage structures (catch basins and drywells) to ensure they are clear of debris and obstructions.

2. Inspect all pond 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, pipes, manholes, and discharge structures 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 check 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.

4.20 Ponds

The detention ponds should be inspected every 3 months, or after every significant rainfall and/or snowmelt event, whichever is more frequent. The ponds consist of an earthen depression constructed from native soils, enclosed within soil berms and lined with a synthetic liner. The ponds 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 ponds 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 pond via the outlet structures, should be removed. Additionally, the pond 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.

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.

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 ¼ of the pipe and 2 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 5.00. 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 5.00 - Maintenance and Future Replacement Costs

Drainage Facility	Annual Maintenance Costs	Annual Set-Aside Funds for Future Replacement or Major Renovation [1]
Catch Basins, Manholes & Pipes	$ 13,800	$ 2,418
Filtration Unit	$ 14,000	$ 6,079
Ponds	$ 4,000	
Drywells	$ 1,600	$ 298
Sub-Total Annual Costs	**$ 33,400**	**$ 8,795**

Grand Total/year = $ 42,195
Cost per lot/year = $ 727.50 (58 lots)

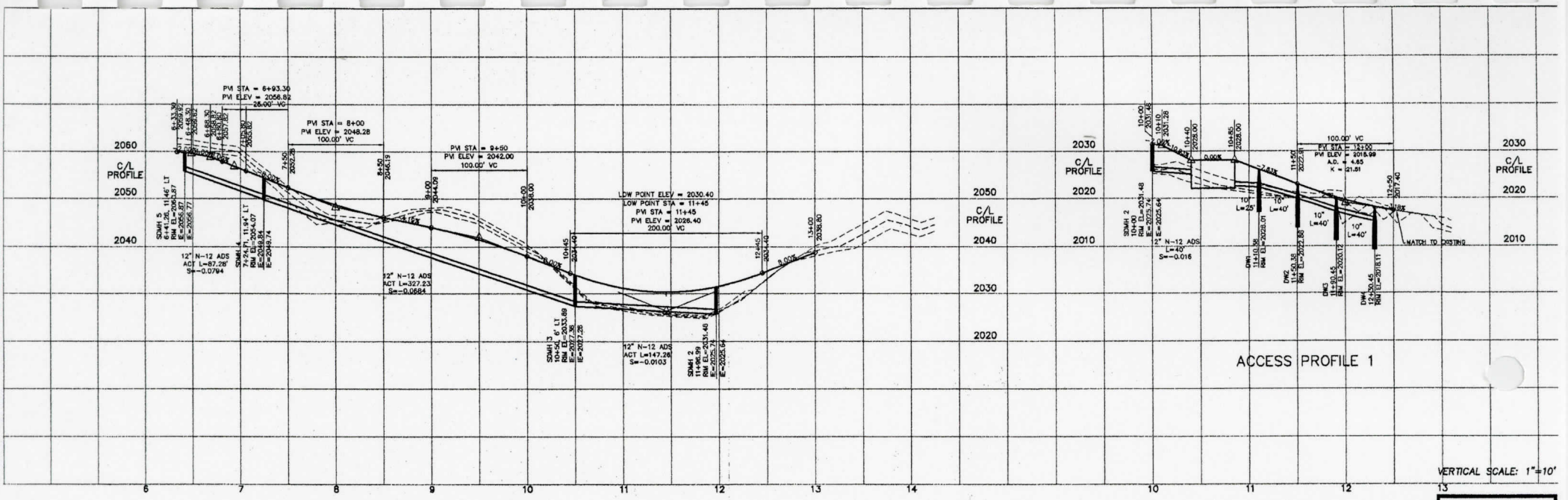
Note: (1) Assume replacement in 20 yrs, with 4% inflation and a 6% rate of return on investments for Future Replacement set-aside account.

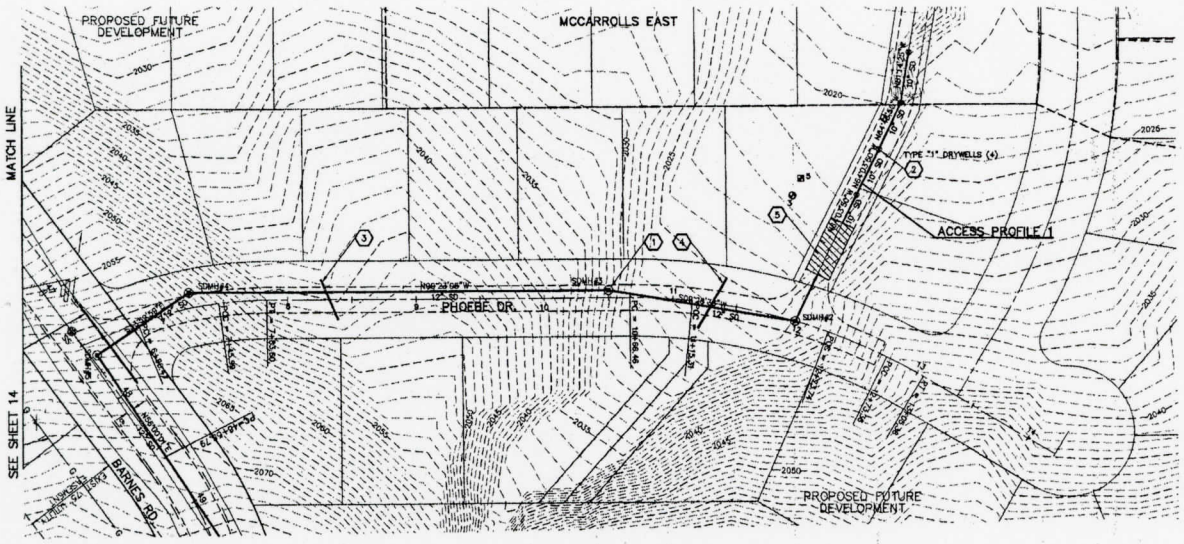
APPENDICES

STORMFILTER SITE MAP

DETENTION POND SITE MAP

PRECAST DRYWELL, DETAIL B-102C





DRAINAGE CONSTRUCTION NOTES:

1. TYPE "III-48" SEWER MANHOLE, PER CITY OF SPOKANE DETAIL Z105 (TYPICAL).
2. TYPE "1" DRYWELLS WITH SOLID LIDS PER CITY OF SPOKANE STANDARD PLAN B-102C.
3. 35 L.F. OF 12" N-12 ADS CULVERT PIPE IE(W)=2042.8, IE(E)=2045.5.
4. 45 L.F. OF 12" N-12 ADS CULVERT PIPE IE(W)=2023.8, IE(E)=2025.8.
5. 20' X 45' STORMFILTER™ UNIT BY STORMWATER MANAGEMENT, INC.

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

DRAINAGE NOTES:

1. THIS PLAN MAY NOT SHOW ALL EXISTING UTILITIES. EXISTING LOCATIONS ARE APPROXIMATE ONLY. IT IS THE CONTRACTOR RESPONSIBILITY TO VERIFY THE EXISTENCE AND ACTUAL LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION BY USING THE ONE CALL NUMBER NOTED ON THIS SHEET OR BY OTHER ACCEPTABLE MEANS.
2. LOCATING WIRE SHALL BE INSTALLED ALONG ALL PIPELINE INCLUDING CURVED PIPELINES, BEGINNING AND TERMINATING IN MANHOLES AS SHOWN IN THE STANDARD PLANS AND AS NOTED IN CITY OF SPOKANE SUPPLEMENTAL SPECIFICATIONS 7-17.3(2)J.

GRAPHIC SCALE
50 0 25 50 100
(IN FEET)
1 inch = 50 ft.

MANHOLE SCHEDULE

MANHOLE	TYPE	STATION	RIM EL.
MH 2	II-48	7+24.71	2054.07
MH 3	II-48	10+50	2033.89
MH 4	II-48	11+96.99	2031.48
NOTE: TEMPORARY RIM ELEVATIONS ON ALL ACCESS ROADS = RIM ELEV. - 0.5'			

DAVID N. RANDALL
STATE OF WASHINGTON
20984
REGISTERED PROFESSIONAL ENGINEER
7/3/02
EXPIRES 07/04/04

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707 West 7th · Suite 200
Spokane, WA 99204
(509) 456-6840
FAX: (509) 456-6844

13/20

REVISIONS	DATE	PROJ.	C.P.N.	FROM	TO	ACCEPT
AS BUILT						

GRADE ORDINANCE LIST					
FROM	TO	ORD. NO.	DATE	FILE NO.	

LOCATION	BRASS CAP LOCATED AT INTERSECTION OF JOHANNSEN ROAD AND FIVE MILE ROAD		
ELEVATION	2368.56	HORIZONTAL	1" = 50'
DBN NO.	88	VERTICAL	1" = 10'
NAV 88 DATUM		SCALE	

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DRAFTING STANDARD			
DCS - ADOPTED 2/95			
DATE		DRAWN	AJC,SMH
07/08/02		CHECKED	DNR
10/01/01		APPROVED	DNR

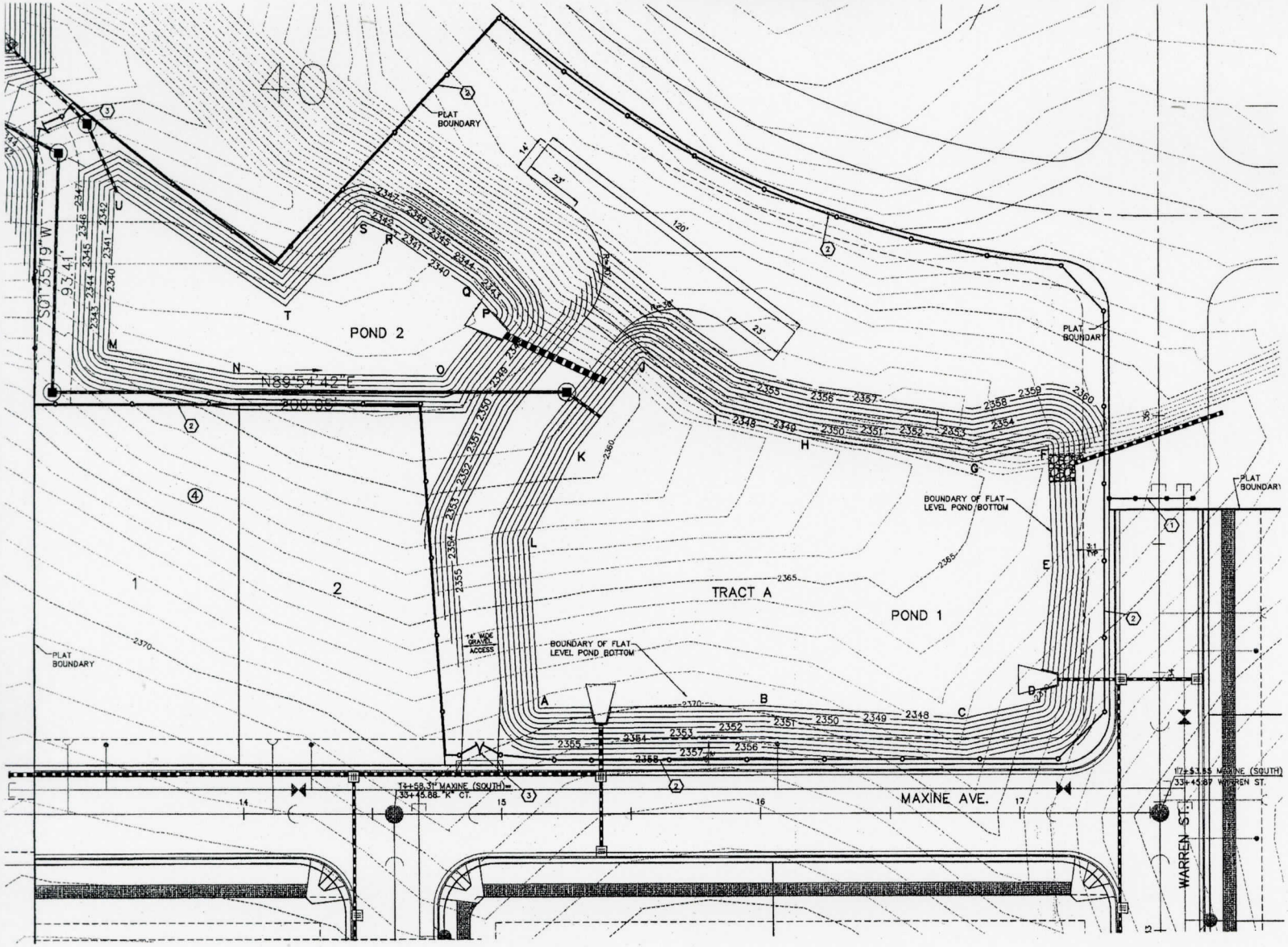
CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

SHEET LIMITS:
PROJECT LIMITS:

PHOEBE DRIVE
STA 6+33.30 TO 14+24.56

TYPE OF IMPROVEMENT: DRAINAGE	
CITY PROJECT NUMBER	CITY PLAN NUMBER
—	PHOEB D(05)1
	22-28-42

SECTION 23, T.26 N., R42 E., W.M.
SPOKANE COUNTY, WASHINGTON



PONDS 1 & 2 DETAILS
SCALE: 1" = 20'

1/—

POND 1

POND BOTTOM ELEV = 2348.00
POND BOTTOM AREA = 21250 S.F.
MINIMUM BERM ELEV = 2367.00

POND BOTTOM LOCATION TABLE
MAXINE AVE. STATION & OFFSET

POINT	STATION	OFFSET
A	15+14.60	41.11' LT
B	16+01.23	41.71' LT
C	16+77.81	36.54' LT
D	17+07.92	53.07' LT
E	17+13.07	96.34' LT
F	17+11.47	142.67' LT
G	16+92.95	158.77' LT
H	16+17.89	146.28' LT
I	15+84.98	134.93' LT
J	15+38.70	172.52' LT
K	15+28.63	141.36' LT
L	15+10.79	108.30' LT

POND 2

POND BOTTOM ELEV = 2340.00
POND BOTTOM AREA = 6473 S.F.
MINIMUM BERM ELEV = 2369.20

POND BOTTOM LOCATION TABLE
MAXINE AVE. STATION & OFFSET

POINT	STATION	OFFSET
M	13+47.75	180.81' LT
N	13+97.05	171.31' LT
O	14+17.05	170.04' LT
P	14+97.12	195.04' LT
Q	14+97.68	205.49' LT
R	14+57.68	226.01' LT
S	14+17.01	209.67' LT
T	14+17.04	197.89' LT
U	13+50.58	242.76' LT

88 DATUM
CBM # 95 BEING A
> IN MONUMENT CASE
:T THE INTERSECTION OF
ROAD AND FIVE MILE ROAD.
1.56

CONSTRUCTION NOTES:

1. WSDOT TYPE 3 BARACADES
2. INSTALL 6' HIGH CHAIN LINK FENCE. SEE DETAIL 5, SHEET 19 OF 20.
3. INSTALL 14' WIDE ACCESS GATE.

DEVELOPER'S APPROVAL

7/31/02
DATE

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

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

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DAVID N. RANDALL
STATE OF WASHINGTON
26984
REGISTERED
PROFESSIONAL ENGINEER
7/31/02
EXPIRES 07/04/04

PREPARED UNDER THE DIRECT SUPERVISION OF DAVID N. RANDALL, P.E. WASHINGTON REGISTRATION NO. 26984 FOR AND ON BEHALF OF CLC ASSOCIATES, INC.

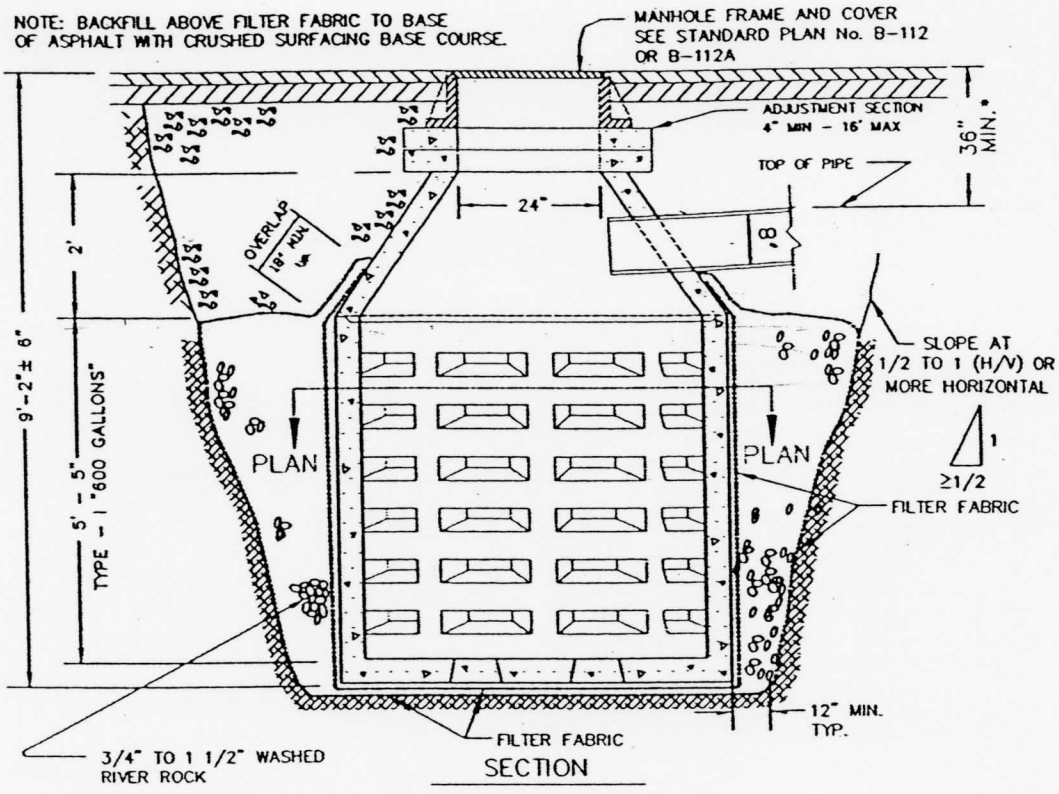
Date	Description
07/30/02	ORIGINAL PREPARATION

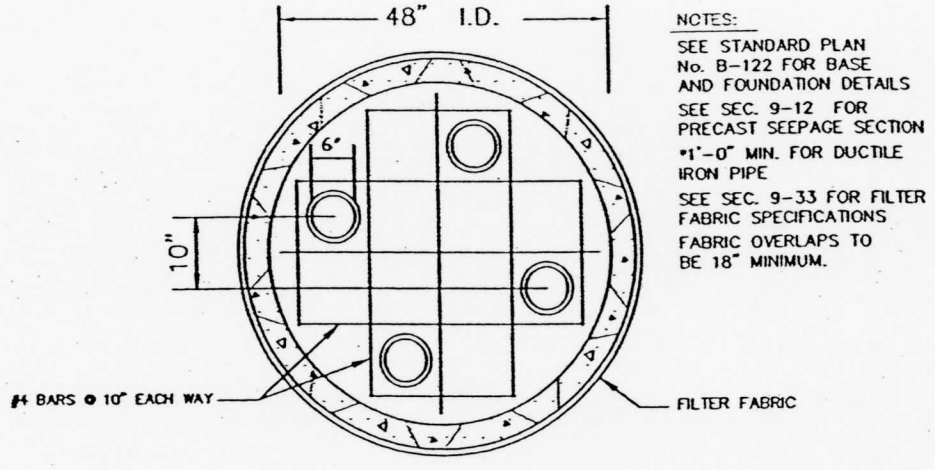
County Plat No.: P-1807
CLC Job Number: 99388
Drawn By: JME, MEK
Designed By: NWO
Checked By: NWO

STREET CONSTRUCTION PLANS
FALCON RIDGE
STREET AND STORM DRAINAGE
DETAILS
SPOKANE COUNTY, WASHINGTON

Sheet Title
DETAILS

12 OF 20
Sheet Number





NOTES:

SEE STANDARD PLAN No. B-122 FOR BASE AND FOUNDATION DETAILS

SEE SEC. 9-12 FOR PRECAST SEEPAGE SECTION

*1'-0" MIN. FOR DUCTILE IRON PIPE

SEE SEC. 9-33 FOR FILTER FABRIC SPECIFICATIONS

FABRIC OVERLAPS TO BE 18" MINIMUM.

APPROVED BY

Katy Allen

DIRECTOR, ENGINEERING SERVICES — KATY D. ALLEN, P.E.

PRINCIPAL ENGINEER, DESIGN — JIM R. SMITH, P.E.

ADOPTED: 2/90
REVISED: 12/98
SUPERSEDES: 6/97
SCALE: N.T.S.
DWG./REV. BY: REP

PRECAST DRYWELL TYPE 1
FOR STORM DRAINAGE

ENGINEERING SERVICES
CITY OF SPOKANE, WASHINGTON

STANDARD PLAN No. B-102C