

**Drainage Report**  
**MG Properties, LLC Short Plat**  
PN: M2016-00xx

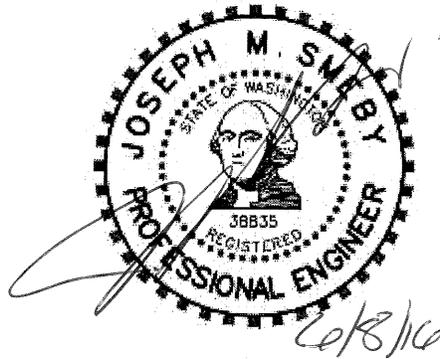
for

**MG Monroe Properties Inc.**

Attn: Clifford E. Moon  
19624 76<sup>th</sup> Ave W, Suite B  
Lynnwood, WA 98036

**SITE LOCATION:**

10X Dickinson Street  
Monroe, WA 98272



Prepared by:  
Joseph M. Smeby, P.E.

Job No: 06-053  
June 2016

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## 1. INTRODUCTION

This document is intended to provide engineering information necessary to support the short plat of a 0.41 acre lot and future building permit applications to the City of Monroe for the future lots proposed on this short plat. This parcel is currently vacant with some trees. Improvements to the west side of Dickinson Street along this projects frontage will be part of the application. No wetlands or other sensitive areas were found on this parcel.

This project proposes to create the three new lots, which will contain a building and driveway in the future. This will require the construction of a driveway approach off of the existing drive to the south of this property and the overlay of the existing drive. A private access easement will be provided over the existing drive for the access to the three new lots. Individual, stormwater facilities and utility connections will be provided for each new lot. The storm runoff from all new impervious surfaces on each lot will be collected and conveyed to an infiltration trench sized for that lot. Since the off-site improvement entail an overlay and shoulder improvements no runoff from the off-site work will be collected as a result of this project. Instead the existing road runoff will not be disturbed and will be allowed to follow the existing path.

## DRAINAGE INFORMATION SUMMARY FORM

Project: **Anderson 3 Lot Short Plat**  
 PFN: **M2015-00xx**  
 Engineer: **Omega Engineering, Inc.**  
 2707 Wetmore Ave  
 Everett, WA 98201  
 Attention: Joseph Smeby, P.E.

Total site area: **0.41 acres**  
 Offsite area: **0.00 acres**  
 Disturbed area: **0.41 acres**

Applicant: **MG Monroe Properties, LLC**  
 19624 76<sup>th</sup> Ave W., Suite B  
 Lynnwood, WA 98036

Number of lots/Units: **3**

<b>Drainage Basin Information</b>		
On-site Developed Area		0.41 acres
Off-site Improved Area		0.00 acres
Types of storage proposed		Infiltration Trench
Approximate total storage volume		441 cf per calc (each lot)
Soil Types		Type B/C Soils
<b>Basin Data</b>		
Pre-developed run-off rates:	2-year	0.004 cfs
	10-year	0.008 cfs
	100-year	0.016 cfs
Post-developed run-off rates:	2-year	0.036 cfs
(un-detained to Trench)	10-year	0.06 cfs
	100-year	0.10 cfs

### **3. EXISTING SITE CHARACTERISTICS and ASSUMPTIONS**

The site is located west of Dickinson Street at 10X Dickinson Street in the City of Monroe, and in the SW ¼ of Section 1, Township 27N, Range 6E, Willamette Meridian. See Figure 1 - Vicinity Map. The entire property consists of a single lot of 0.41 acres.

Land use around the site ranges from commercial to single-family. This site is currently vacant. The frontage improvements required for this project will be improving the shoulder along the west side of Dickinson to City Standards. The existing edge of asphalt will be saw cut and the shoulder widened or improved as needed. In addition, the drive to the south of this project which each lot will take access off of will be overlaid.

The existing site is irregular in shape approximately 215-feet long running east-west and 75-feet running north-south. The grades on the site are flat. The vegetation found on the existing property is grasses with some trees.

Grades on the site generally are flat and slope slightly to the south. Runoff if any, would generally sheet flow across the south property line and be collected by the storm system south of the existing drive. A site visit was conducted on May 26, 2006. The weather was overcast with temperatures in the 50's. No surface water was observed on this site.

The soil hydrologic types for this site have been identified as Type C or Till from the Snohomish County Soil Survey Map, see figure 4. The soil type mapped for this site is, Sultan silt loam. Soil tests on this site found a gravelly sands under lying this top layer of silt loam, therefore infiltration will be used for this project. Soil test pits were logged on this and the adjacent site to the north. The soil was classified using the USCS. The 2005 DOE manual provides long term infiltration rates to use for infiltration facility sizing based on the USCS method. For the gravelly sand soils the maximum rate is 10"/hr. However, since no testing was done to confirm this rate additional safety factors will be applied to the rate. For this project an additional safety factor of 2.85 will be used, which results in a design infiltration rate of 3.5"/hr. The gravelly sand soils were found in a range of 4-6.5' below existing grade. Refer to Appendix A for a copy of the soil logs on this and the adjacent site.

The storm drainage system has been sized to account for three future buildings and driveways to be constructed on the new lots. Each lot was assumed to have 3,600 sf of future impervious area. Approximately 60% of each lot was assumed to be impervious surface with the remaining 40% to be landscaped. The proposed infiltration systems will be sized to infiltrate up to the 100-year storm event. Due to the developed nature of the parcels around this project and the flat grades, very little off-site runoff was found entering this site.

#### 4. NARRATIVE OF DEVELOPED SITE CHARACTERISTICS

This development proposes to construct a three new driveways and buildings in the future. It was assumed that approximately 60% of each lot would be converted to impervious surfaces.

##### Project Areas

	Total Area (ac)	Impervious (ac)	Landscaping (ac)	Wetlands (ac)	Undisturbed (ac)
On-Site	0.41	0.245	0.165	0.00	0.00
Off-Site	0.00	0.00	0.00	0.00	0.00

This is shown in the stormwater calculations in Appendix A.

All of the project was assumed to be disturbed and the infiltration trenches were sized for both the new impervious and pervious areas. The off-site impervious areas will be allowed to flow in the existing path since the should is already in place and just paved to meet the current City Standards.

The infiltration trench has been designed using the WWHM2 and meets the current State and City standards.

## 5. DESCRIPTION OF PROPOSED EROSION CONTROL BMP's

This section has been taken from the approved SWPPP report for the Clearing and Grading Permit previously approved for this site.

Clearing, grading, and temporary erosion and sediment control plans have been prepared as part of this phase. However, since a construction site is dynamic it will be necessary to re-assess the erosion control BMP's during construction and install additional measures when and if necessary.

Proposed temporary measures for this project will include the following BMP's:

- Installation of stabilized rock construction entrance(s).
- Straw mulch, hydroseed or other mulching and planting method to stabilize unworked areas.
- Silt Fencing
- Retention of existing vegetation.

Permanent measures to reduce or eliminate erosion or water quality degradation will include the following BMP's: (Under Future Phase/Permit)

- Paving all traffic areas
- Drainage collection system, including catch basins and floatable material separators
- Permanent landscaping in pervious areas.
- Limiting cut and fill slopes to 2:1 maximum, unless provided with Rockery Face
- Routine maintenance and inspection of the grounds and response to developing problems.

These proposed erosion control BMP's have been engineered for anticipated conditions in compliance with DOE guidelines. With proper installation, maintenance and inspection the proposed BMP's should result in minimal impact to the surrounding environment. The City retains the authority by code to require additional measures should the existing measures prove insufficient.

## **A. SITE GRADING/EROSION CONTROL RISK ASSESSMENT**

**SLOPE:** Existing grades onsite do not appear to slope in any one direction. Runoff from this site crosses the south, east and west property lines. Slope on this site are approximately 0.5-1.5%. The proposed driveway grades will be no greater than 1%.

**CRITICAL AREAS:** There were no critical areas observed on or around this site at the time of the site visit.

**SOILS:** In the development area of the site soils are Sultan Silt Loam, hydrologic group B/C.

**GROUND MOVEMENT POTENTIAL:** Based on the flat grades there is no potential for ground movement.

**SOURCES OF WATER FOR EROSION:** Rainfall will be the only significant source of onsite runoff.

**NEAREST DOWNSTREAM BODY OF WATER OTHER THAN ROAD DITCHES:** None this site proposes to infiltrate all runoff.

**MEASURES PROPOSED TO PREVENT/MINIMIZE EROSION:**

**TEMPORARY MEASURES:** Mulch cover, rock construction entrance(s) and silt fencing are all proposed to be used to prevent or minimize erosion and siltation during construction.

**PERMANENT MEASURES:** Future measures will include permanent vegetative cover in pervious areas, limiting permanent cut and fill slopes to 2:1 maximum unless protected with a rockery face, asphalt pavement to stabilize all vehicle traffic areas and a piped conveyance system to control the location of runoff release. Routine maintenance of the grounds and response to developing problems will be a function of the property owner.

**CONCLUSION:** Proposed erosion control BMP's in compliance with DOE guidelines have been engineered for anticipated conditions. Civil construction plans include a detailed ESC plan that provides details and notes for the proposed BMP's. With proper installation, maintenance and inspection, the proposed BMP's should result in minimal impact to the surrounding environment. Based on the above information the Erosion Risk for this site is Low to Moderate. Reports, studies and designs for this site include:

*Civil Engineering Construction Plans, by Omega Engineering, Inc.*

## **B. SWPPP Minimum Elements**

### **1: Mark Clearing Limits**

The first step in the "Construction Sequence" included on the clearing and grading plan sheets is for a surveyor to stake the limits of clearing and to have construction or silt fencing placed along the limits prior to any other construction activity.

### **2: Establish Construction Access**

The SWPPP calls for the proposed construction entrance to be conducted as the second step after the staking of clearing limits. A detail is provided on the plans.

### **3: Control Flow Rates**

This project will retain as much existing vegetation as possible. Due to the small size of the site and the flat on-site grades little or no runoff is expected to leave the site.

### **4: Install Sediment Controls**

This site and SWPPP proposes to construct a construction entrance and silt fencing to collect and contain the sediment on this site. These features are intended to minimize the opportunity for sediment to leave the site via stormwater or on vehicles. The construction of these features are one of the first items required in the "Construction Sequence". Mulch will also be used on the exposed soil as necessary to limit erosion.

### **5: Stabilize Soils**

The "Construction Sequence" calls for the stabilization of soils that remain unworked for certain lengths of time based on the time of year. Stabilization techniques may include but not limited to mulching, plastic sheeting or hydroseeding, notes have been added to the plan regarding protection for the stock pile area if necessary.

### **6: Protect Slopes**

No slopes exist or are proposed on the future Lot 2.

### **7: Protect Drain Inlets**

No existing inlets exist near this project. However, the proposed inlets will be protected as called out on the plans and shown on the detail.

### **8: Stabilize Channels and Outlets**

No channels or outlets are proposed for this project during construction. The future shallow swale will be seeded and stabilized before the inlet protection is removed from the storm grates.

### **9: Control Pollutants**

Since the construction of Lot 2 only proposes to construct a driveway and future building, no outside chemicals or pollutants are expected. All vehicles working on and around the site would need to meet the State requirements for emissions.

### **10: Control DeWatering**

DeWatering will not be necessary for the proposed construction on Lot 2..

#### 11: Maintain BMPs

The construction supervisor will be responsible for maintaining all BMPs during construction and working with the City to relocate or add BMPs as necessary as site conditions change.

#### 12: Manage the Project

It will be the responsibility of the Contractor and Developer to manage this project and coordinate with the City and Engineer.

#### Inspection and Monitoring:

Site inspections shall be done by a person who is knowledgeable in the principles and practices of erosion and sediment control. The person must have skills to first assess the site conditions and construction activities that could impact the quality of stormwater, and second assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

#### Maintaining an Updated Construction SWPPP:

The construction SWPPP shall be retained on-site or within reasonable access to the site.

The SWPPP shall be modified whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven days following inspection.

## **6. OFFSITE DRAINAGE ANALYSIS - UPSTREAM**

From field observation and review of the available topography, it appears that no off-site area is tributary to this site.

## **7. OFFSITE DRAINAGE ANALYSIS - DOWNSTREAM**

The project site is very flat and runoff may leave the site only in extreme storm events. This project proposes to infiltrate the runoff from the new lot improvements so no downstream analysis was conducted.

## 8. DETENTION STORAGE CALCULATIONS

Current City code requires this site be analyzed using the 2005 DOE manual and the WWHM2 stormwater software. Since this site proposes using infiltration the software will be used to size the infiltration trench necessary. All three of the lots were analyzed together in the WWHM2 software and then 1/3 of the design trench has been shown to be constructed on each lot.

The proposed infiltration trenches are located along the south property line of the new lots. These trenches will be beneath the new driveways and landscaping depending upon the future design. All runoff from impervious surfaces will be collected and conveyed to the infiltration trench. The driveway runoff will be collected by a shallow swale for treatment prior to entering the infiltration trench. The roof downspouts will be connected directly to the trench after passing through a tee with a screen to filter needles and leaves prior to entering the trench.

The trench dimensions required for this project are as follows:

### **Node ID: Inf-Vault (this is used to approximate the trench)**

#### **Total Site**

Start El:	100.0000 ft (assumed)	Max El:	101.7500 ft
	Length	Width	Void Ratio
	126.0000 ft	6.0000 ft	100.00

#### **Individual Lot**

Start El:	100.0000 ft (assumed)	Max El:	101.7500 ft
	Length	Width	Void Ratio
	42.0000 ft	6.0000 ft	100.00

Since the WWHM2 does not have a gravel trench facility option the depth of the vault was adjusted to provide the same volume of storage as a gravel trench with a void ratio of 35%. This was done by reducing the depth of the trench from 5 to 1.75-feet and using the 100% void ratio as provided with a vault design. The only affect this would have on the analysis would be if side-wall infiltration were used, and for this project only the bottom area was used for analysis.

These dimensions were used to calculate a storage volume of 1,323 cf for the total site and 441 cf for each lot.

Refer to appendix 'A' for the full output from the WWHM2 software.

## **9. WATER QUALITY DESIGN**

This project proposes to construct less than 5,000 sf of new pollutable impervious surfaces. Therefore, no formal water quality facility is proposed. A tee with a fine screen on bottom of the tee will be installed to filter the runoff for leaves and needles and oil/water separation prior to entering the infiltration trench.

## **10. CONVEYANCE CALCULATIONS**

Due to the size of this project the flattest pipe proposed for this project was analyzed for capacity using Mannings Equation. Since all other pipes would have a greater capacity it was determined that assuming all of the sites peak runoff from the 100-year storm event would pass through the most limiting pipe. The pipe analyzed has the following design information: 6" PVC, S = 1.0%. This pipe was found to have a peak capacity of 0.8 cfs. The peak 100-year un-detained runoff from this site is calculated to be 0.10 cfs. Therefore, the conveyance capacity of the proposed system has far greater capacity than necessary for this site.

Refer to the software printout in Appendix A for a detailed summary.

## **11. OPERATIONS AND MAINTENANCE MANUAL**

Each individual Property Owner will be responsible for maintaining the stormwater and landscaping on the individual lot that they own. Common maintenance will be shared over the private access easement between the three lots from this development and the property owner of the land the easement is on. Included in this manual are checklists for each feature specific to this project. Copies should be made of the checklists as necessary during routine inspections and required maintenance. Specific problems can be recorded along with the appropriate action taken.

These checklists are a guide for inspections and maintenance. The frequency of the inspections/maintenance is identified in the left hand column with the following abbreviations:

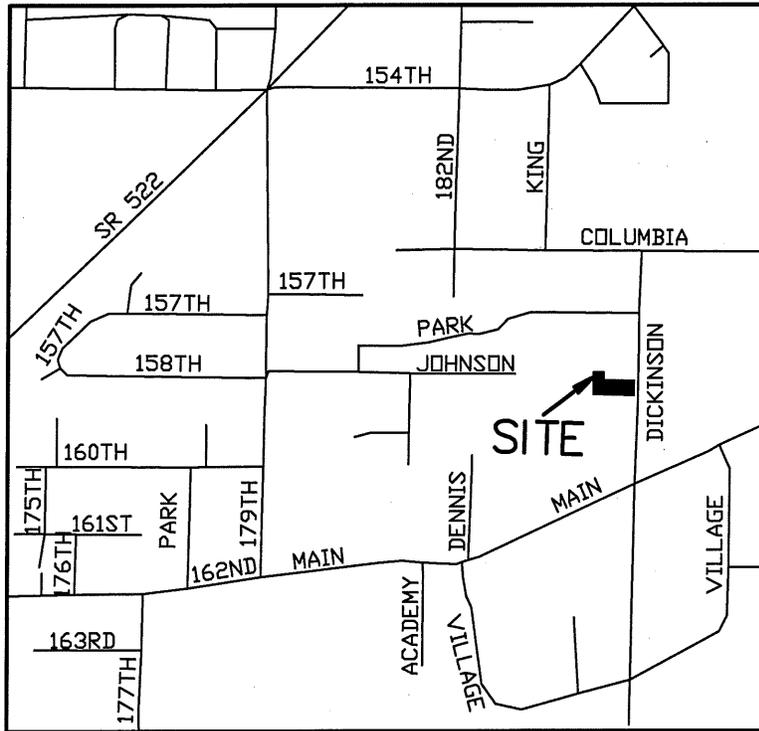
A = Annual (March or April preferred)

M = Monthly

S = After Major Storms (Use 1-inch in 24 hours as a guideline)

Routine inspections and maintenance will improve the long-term performance of the stormwater facilities. If at any time you are unsure if a problem exists or how to address a specific problem contact a Professional Engineer.

Refer to Appendix B for a list of each facility to be maintained and the appropriate maintenance checklist.



**VICINITY MAP**

SCALE 1" = 1,000'

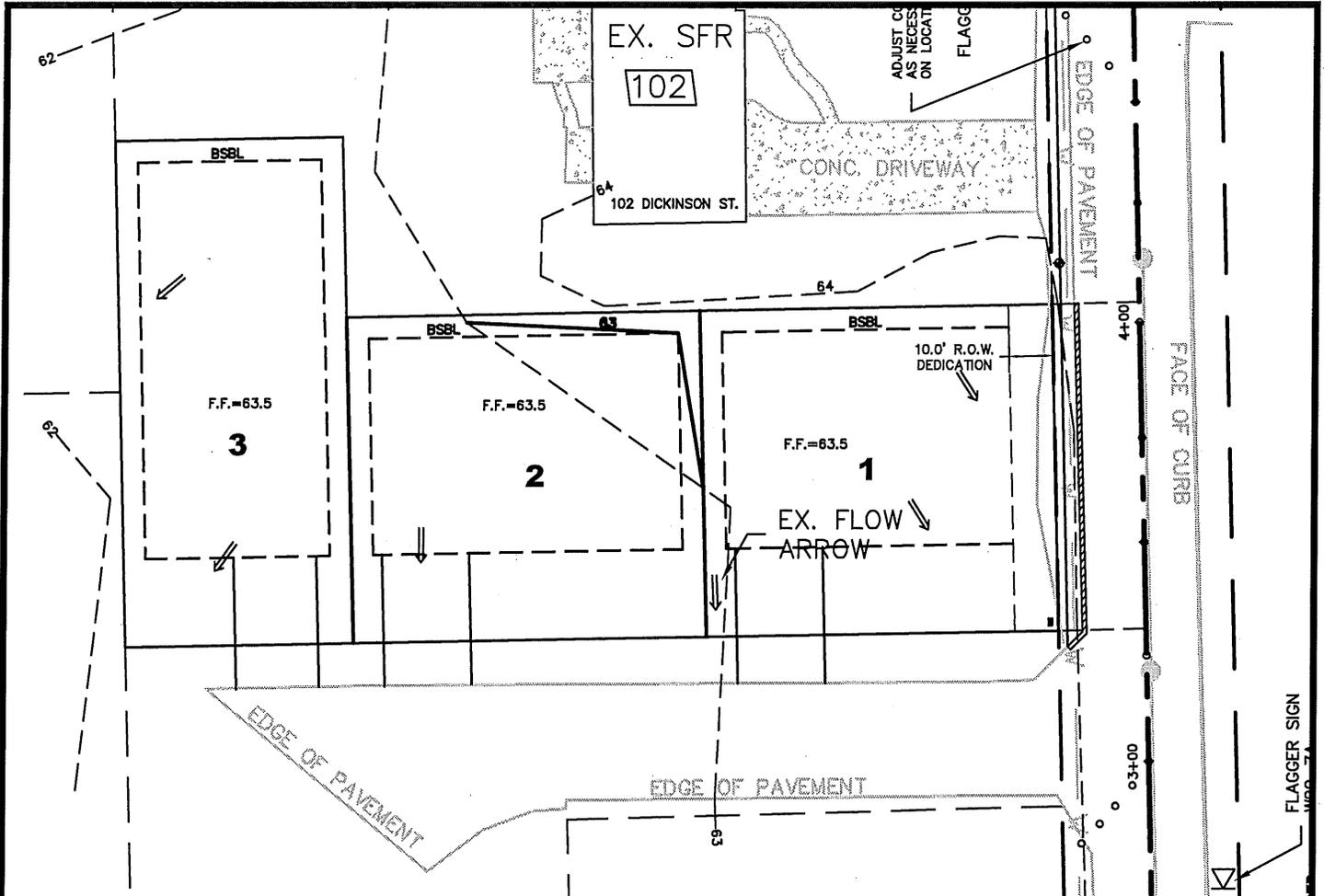


**OMEGA  
ENGINEERING, INC.**

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Everett, WA 98201  
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VICINITY MAP  
ANDERSON 3-LOT S.P.

DATE	JOB NO.	SCALE	SHEET
6/19/06	06-053		1 OF 1



**GROUND COVER/SOIL TYPE:**

1. THIS SITE IS COVERED IN GRASSES WITH OTHER LANDSCAPING.
2. PROPOSED SITE COVER WILL CONTAIN LANDSCAPING, DRIVEWAYS AND BUILDINGS.
3. SITE SOIL TYPES ARE SULTAN SILT LOAM (TYPE B/C, TILL), WITH GRAVELLY SANDS AT 4-6'.

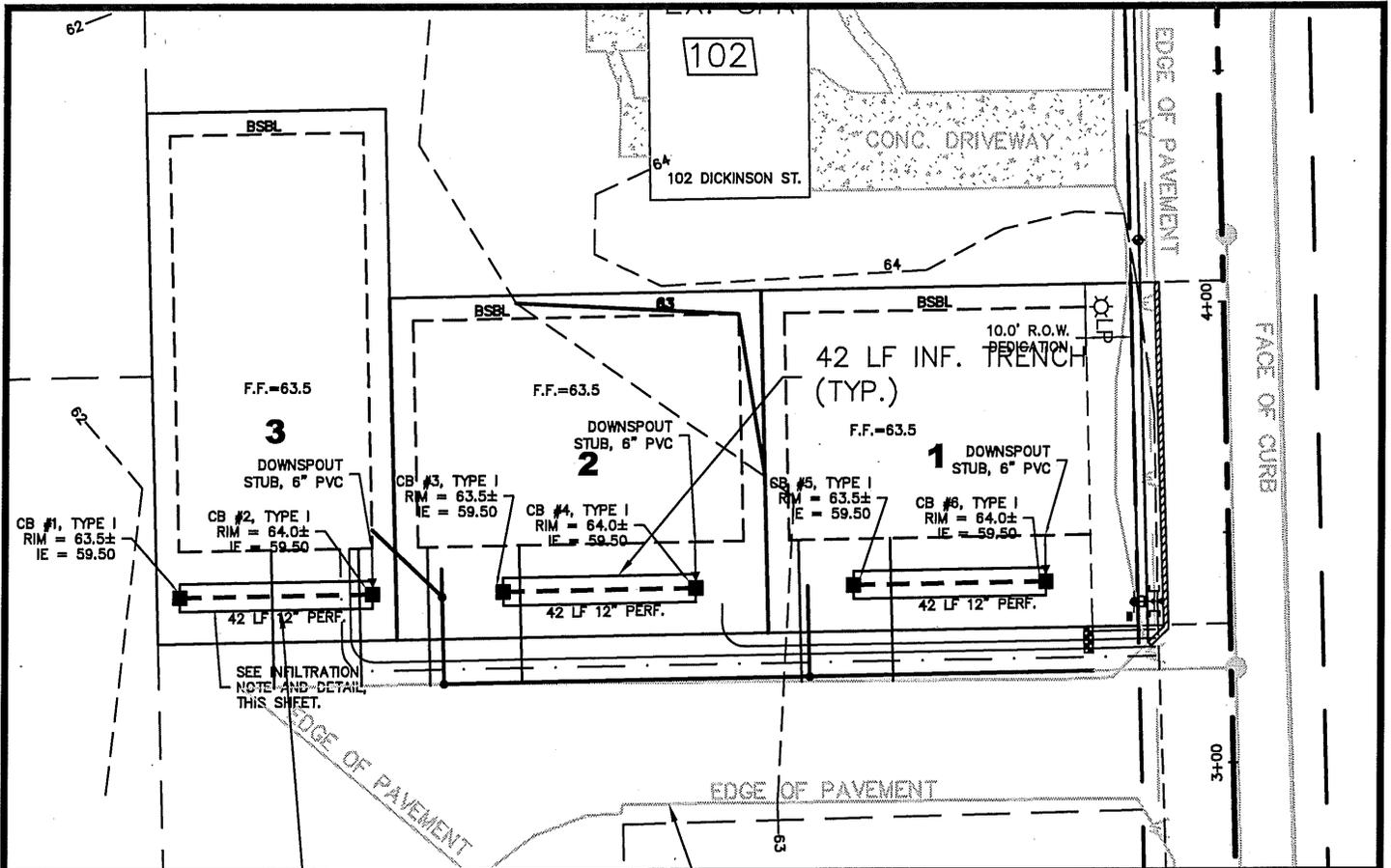


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EXISTING BASIN MAP  
ANDERSON 3-LOT S.P.

DATE	JOB NO.	SCALE	SHEET
6/19/06	06-053	1" = 40'	1 OF 1



DRIVE TO BE OVERLAPPED WITH 2" ASPHALT.

INDIVIDUAL INFILTRATION TRENCH SIZED FOR EACH LOT.

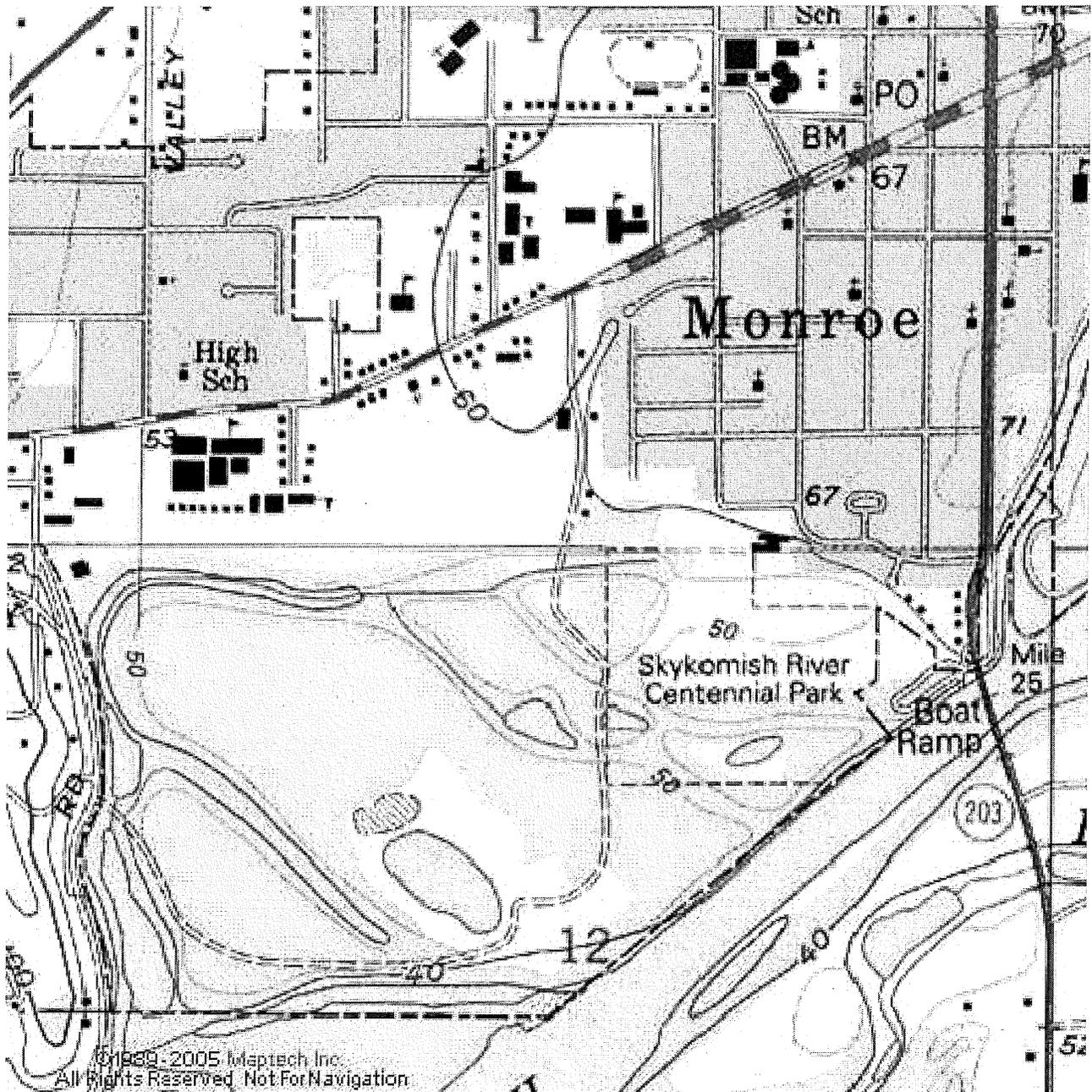


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DEVELOPED BASIN MAP  
 ANDERSON 3-LOT S.P.

DATE	JOB NO.	SCALE	SHEET
6/19/06	06-053	1" = 40'	1 OF 1



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TRIBUTARY AREA  
ANDERSON 3-LOT S.P.

DATE	JOB NO.	SCALE	SHEET
6/19/06	06-053	1" = 40'	1 OF 1

**APPENDIX A**  
**STORMWATER CALCULATIONS**

LOG OF TEST PITS				
Test Pit No.	Depth Interval (ft)	USCS Class.	Soil Description	Lab Testing
TP-1	0.0-1.5	OL	Dark Brown, Organic (topsoil)	No
	1.5-4.5	ML	Tan/Brown Silt, (loam)	No
	4.5-6.5	SM	Tan Loamy Sand w/ gravels	No
	6.5-12	SW	Med. Sand w/ gravels, some cobbles	No

Notes:

- Test pit terminated on 5/26/06 at 12.0 feet, due to max. reach of equip.
- No groundwater encountered
- Test pit backfilled upon completion

LOG OF TEST PITS				
Test Pit No.	Depth Interval (ft)	USCS Class.	Soil Description	Lab Testing
TP-2	0.0-1.0	OL	Dark Brown, Organic (topsoil)	No
	1.0-2.0	ML	Tan/Brown Silt, (loam) w/ roots	No
	2.0-4.0	ML	Tan Silt, (loam)	No
	4.0-9.0	SW	Med. Sand w/ gravels, some cobbles	No

Notes:

- Test pit terminated on 5/26/06 at 12.0 feet, due to surrounding vegetation.
- No groundwater encountered
- Cemented layer @ 4'
- Test pit backfilled upon completion

LOG OF TEST PITS				
Test Pit No.	Depth Interval (ft)	USCS Class.	Soil Description	Lab Testing
TP-3	0.0-1.0	OL	Dark Brown, Organic (topsoil)	No
	1.0-5.0	ML	Tan/Brown Silt, (loam)	No
	5.0-12	SW	Med. Sand w/ gravels, some cobbles	No

Notes:

- Test pit terminated on 5/26/06 at 12.0 feet, due to max. reach of equip.
- No groundwater encountered
- Cemented layer @ 5'
- Test pit backfilled upon completion

LOG OF TEST PITS				
Test Pit No.	Depth Interval (ft)	USCS Class.	Soil Description	Lab Testing
TP-4	0.0-1.5	OL	Dark Brown, Organic (topsoil)	No
	1.5-5.0	ML	Tan/Brown Silt, (loam)	No
	5.0-6.0	ML	Tan Silt, (loam) w/ sand and gravels	No
	6.0-12	SW	Med. Sand w/ gravels, some cobbles	No

Notes:

- Test pit terminated on 5/26/06 at 12.0 feet, due to max. reach of equip.
- No groundwater encountered
- Test pit backfilled upon completion

WESTERN WASHINGTON HYDROLOGY MODEL V2  
PROJECT REPORT

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Project Name: default  
Site Address: 10X Dickinson Street  
City : Monroe  
Report Date : 6/17/2006  
Gage : Everett  
Data Start : 1948  
Data End : 1997  
Precip Scale: 1.20

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PREDEVELOPED LAND USE

Basin : 3 Lots  
Flows To : Point of Compliance  
GroundWater: No

<u>Land Use</u>	<u>Acres</u>
TILL FOREST:	0.41

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DEVELOPED LAND USE

Basin : 3 Lots  
Flows To : Trench  
GroundWater: No

<u>Land Use</u>	<u>Acres</u>
TILL GRASS:	0.165
IMPERVIOUS:	0.245

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RCHRES (POND) INFORMATION

Pond Name: Trench  
Pond Type: Vault  
Pond Flows to : Point of Compliance  
Pond Rain / Evap is not activated.  
Dimensions  
Depth: 2.75ft.  
Width : 126 ft.  
Length : 6 ft.  
Volume at Riser Head: 0.030 acre-ft.  
Discharge Structure  
Riser Height: 1.75 ft.  
Riser Diameter: 12 in.

Pond Hydraulic Table

<u>Stage(ft)</u>	<u>Area(acr)</u>	<u>Volume(acr-ft)</u>	<u>Dschrg(cfs)</u>	<u>Infilt(cfs)</u>
100.0	0.017	0.000	0.000	0.000
100.3	0.017	0.004	0.000	0.061
100.5	0.017	0.009	0.000	0.061
100.8	0.017	0.013	0.000	0.061
101.0	0.017	0.017	0.000	0.061
101.3	0.017	0.022	0.000	0.061
101.5	0.017	0.026	0.000	0.061
101.8	0.017	0.030	0.000	0.061
102.0	0.017	0.035	1.217	0.061
102.3	0.017	0.039	3.443	0.061
102.5	0.017	0.043	6.326	0.061
102.8	0.017	0.048	9.739	0.061

**ANALYSIS RESULTS**

**Flow Frequency Return Periods for Predeveloped**

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.013458
5 year	0.020195
10 year	0.025529
25 year	0.033353
50 year	0.040028
100 year	0.047478

**Flow Frequency Return Periods for Developed Unmitigated**

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.107399
5 year	0.149963
10 year	0.180535
25 year	0.221918
50 year	0.254771
100 year	0.289384

**Flow Frequency Return Periods for Developed Mitigated**

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

**Yearly Peaks for Predeveloped and Developed-Mitigated**

<u>Year</u>	<u>Predeveloped</u>	<u>Developed</u>
1949	0.009	0.000
1950	0.025	0.000
1951	0.009	0.000
1952	0.011	0.000
1953	0.014	0.000
1954	0.023	0.000
1955	0.022	0.000
1956	0.015	0.000

1957	0.024	0.000
1958	0.023	0.000
1959	0.013	0.000
1960	0.012	0.000
1961	0.016	0.010
1962	0.021	0.000
1963	0.033	0.000
1964	0.012	0.000
1965	0.011	0.000
1966	0.007	0.000
1967	0.015	0.000
1968	0.017	0.000
1969	0.025	0.000
1970	0.009	0.000
1971	0.014	0.000
1972	0.011	0.000
1973	0.009	0.000
1974	0.012	0.000
1975	0.010	0.000
1976	0.009	0.000
1977	0.008	0.000
1978	0.010	0.000
1979	0.035	0.000
1980	0.010	0.000
1981	0.012	0.000
1982	0.011	0.000
1983	0.013	0.000
1984	0.012	0.000
1985	0.017	0.000
1986	0.036	0.000
1987	0.017	0.000
1988	0.009	0.000
1989	0.017	0.000
1990	0.012	0.000
1991	0.012	0.000
1992	0.011	0.000
1993	0.007	0.000
1994	0.008	0.000
1995	0.012	0.000
1996	0.021	0.000
1997	0.048	0.000

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**Ranked Yearly Peaks for Predeveloped and Developed-Mitigated**

<b>Rank</b>	<b>Predeveloped</b>	<b>Developed</b>
1	0.0359	0.0000
2	0.0348	0.0000
3	0.0326	0.0000
4	0.0253	0.0000
5	0.0252	0.0000
6	0.0237	0.0000
7	0.0235	0.0000
8	0.0228	0.0000
9	0.0219	0.0000
10	0.0209	0.0000
11	0.0206	0.0000
12	0.0173	0.0000

13	0.0171	0.0000
14	0.0168	0.0000
15	0.0167	0.0000
16	0.0161	0.0000
17	0.0148	0.0000
18	0.0148	0.0000
19	0.0144	0.0000
20	0.0142	0.0000
21	0.0129	0.0000
22	0.0128	0.0000
23	0.0124	0.0000
24	0.0122	0.0000
25	0.0121	0.0000
26	0.0121	0.0000
27	0.0118	0.0000
28	0.0116	0.0000
29	0.0116	0.0000
30	0.0115	0.0000
31	0.0114	0.0000
32	0.0113	0.0000
33	0.0109	0.0000
34	0.0107	0.0000
35	0.0107	0.0000
36	0.0100	0.0000
37	0.0099	0.0000
38	0.0098	0.0000
39	0.0093	0.0000
40	0.0090	0.0000
41	0.0090	0.0000
42	0.0089	0.0000
43	0.0087	0.0000
44	0.0086	0.0000
45	0.0079	0.0000
46	0.0077	0.0000
47	0.0069	0.0000
48	0.0069	0.0000

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1/2 2 year to 50 year

Flow(CFS)	Predev	Final	Percentage	Pass/Fail
0.0067	0	0	.0	Pass
0.0071	0	0	.0	Pass
0.0074	0	0	.0	Pass
0.0077	0	0	.0	Pass
0.0081	0	0	.0	Pass
0.0084	0	0	.0	Pass
0.0087	0	0	.0	Pass
0.0091	0	0	.0	Pass
0.0094	0	0	.0	Pass
0.0098	0	0	.0	Pass
0.0101	0	0	.0	Pass
0.0104	0	0	.0	Pass
0.0108	0	0	.0	Pass
0.0111	0	0	.0	Pass
0.0114	0	0	.0	Pass
0.0118	0	0	.0	Pass
0.0121	0	0	.0	Pass

0.0124	0	0	.0	Pass
0.0128	0	0	.0	Pass
0.0131	0	0	.0	Pass
0.0135	0	0	.0	Pass
0.0138	0	0	.0	Pass
0.0141	0	0	.0	Pass
0.0145	0	0	.0	Pass
0.0148	0	0	.0	Pass
0.0151	0	0	.0	Pass
0.0155	0	0	.0	Pass
0.0158	0	0	.0	Pass
0.0161	0	0	.0	Pass
0.0165	0	0	.0	Pass
0.0168	0	0	.0	Pass
0.0172	0	0	.0	Pass
0.0175	0	0	.0	Pass
0.0178	0	0	.0	Pass
0.0182	0	0	.0	Pass
0.0185	0	0	.0	Pass
0.0188	0	0	.0	Pass
0.0192	0	0	.0	Pass
0.0195	0	0	.0	Pass
0.0198	0	0	.0	Pass
0.0202	0	0	.0	Pass
0.0205	0	0	.0	Pass
0.0209	0	0	.0	Pass
0.0212	0	0	.0	Pass
0.0215	0	0	.0	Pass
0.0219	0	0	.0	Pass
0.0222	0	0	.0	Pass
0.0225	0	0	.0	Pass
0.0229	0	0	.0	Pass
0.0232	0	0	.0	Pass
0.0235	0	0	.0	Pass
0.0239	0	0	.0	Pass
0.0242	0	0	.0	Pass
0.0246	0	0	.0	Pass
0.0249	0	0	.0	Pass
0.0252	0	0	.0	Pass
0.0256	0	0	.0	Pass
0.0259	0	0	.0	Pass
0.0262	0	0	.0	Pass
0.0266	0	0	.0	Pass
0.0269	0	0	.0	Pass
0.0272	0	0	.0	Pass
0.0276	0	0	.0	Pass
0.0279	0	0	.0	Pass
0.0283	0	0	.0	Pass
0.0286	0	0	.0	Pass
0.0289	0	0	.0	Pass
0.0293	0	0	.0	Pass
0.0296	0	0	.0	Pass
0.0299	0	0	.0	Pass
0.0303	0	0	.0	Pass
0.0306	0	0	.0	Pass
0.0309	0	0	.0	Pass
0.0313	0	0	.0	Pass

0.0316	0	0	.0	Pass
0.0320	0	0	.0	Pass
0.0323	0	0	.0	Pass
0.0326	0	0	.0	Pass
0.0330	0	0	.0	Pass
0.0333	0	0	.0	Pass
0.0336	0	0	.0	Pass
0.0340	0	0	.0	Pass
0.0343	0	0	.0	Pass
0.0346	0	0	.0	Pass
0.0350	0	0	.0	Pass
0.0353	0	0	.0	Pass
0.0357	0	0	.0	Pass
0.0360	0	0	.0	Pass
0.0363	0	0	.0	Pass
0.0367	0	0	.0	Pass
0.0370	0	0	.0	Pass
0.0373	0	0	.0	Pass
0.0377	0	0	.0	Pass
0.0380	0	0	.0	Pass
0.0383	0	0	.0	Pass
0.0387	0	0	.0	Pass
0.0390	0	0	.0	Pass
0.0394	0	0	.0	Pass
0.0397	0	0	.0	Pass
0.0400	0	0	.0	Pass

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**Water Quality BMP Flow and Volume.**

On-line facility volume: 0.0364 acre-feet

On-line facility target flow: 0.044 cfs.

Adjusted for 15 min: 0.0474 cfs.

Off-line facility target flow: 0.0247 cfs.

Adjusted for 15 min: 0.0266 cfs.

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**APPENDIX B**  
**MAINTENANCE & OPERATIONS MANUAL**

## No. 2 – Infiltration Facilities

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Function of facility is impaired by or likely to be impaired by trash and debris.	Trash and debris is removed.
	Vegetation	Function of facility is impaired by vegetation.	Vegetation is removed or managed to restore proper function of facility.  Use of herbicides shall be in accordance with applicable regulations.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants  Note: Coordinate removal/cleanup with local and/or state water quality response agency.	Contaminants or pollutants are removed
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes are stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration.  (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. If two inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Berms	Settling	Any part of a berm which has settled at least 4 inches lower than the design elevation.  If settlement is apparent, measure berm to determine amount of settlement.  Settling can be an indication of more severe problems with the berm or outlet works. Note: A licensed civil engineer may be needed to determine the cause of the settlement.	Berm is repaired and restored to the design elevation.
	Erosion	Any erosion observed on a compacted structural berm embankment.  Note: A licensed civil engineer may be needed to inspect, evaluate and recommend a repair plan.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.

## No. 2 – Infiltration Facilities

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Piping	Discernable water flow through a compacted structural berm. Ongoing erosion with potential for erosion to continue.  Tree growth on a compacted structural berm over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.  Evidence of rodent holes in berm, and/or water piping through berm via rodent holes  Note: A geotechnical engineer may be needed to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored.  Note: A licensed civil engineer may be needed to determine proper berm/spillway restoration.
	Rock Armoring	Rock layer on subgrade is less than 1.0 feet deep and/or subgrade is exposed	Rocks and pad depth are restored to a minimum depth of 1.0 feet.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes are stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	The settling area or sump contains sediment/debris up to a depth of either 6 inches or the sedimentation design depth.	Sediment/debris is removed.

## No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Sediment & Debris	Sediment, trash, and/or other debris material is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No sediment or debris is located immediately in front of catch basin or on grate opening.
		Sediment, trash, and/or other debris material (located in the catch basin) exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No sediment or debris is in the catch basin.
		Sediment, trash, and/or other debris material located in any inlet or outlet pipe is blocking more than 1/3 of its height.	Inlet and outlet pipes are free of sediment and debris.
		Dead animals or vegetation that impair catch basin function or that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation are present within the catch basin.
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch  (Intent is to make sure no material is seeping into the catch basin).	Top slab is free of holes and cracks.  No water and/or soil is seeping into the catch basin
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks, or qualified maintenance or inspection personnel determine that the vault is not structurally sound.	Catch basin is replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	Settlement of misalignment of the catch basin causes a safety, function, or design problem.	Catch basin is replaced or repaired to design standards.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants  Note: Coordinate removal/cleanup with local and/or state water quality response agency.	Contaminants or pollutants are removed.
Access Hole Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is fully in place
	Locking Mechanism Not Working	Locking mechanism cannot be opened or lock bolts cannot be removed by one maintenance person with proper hand tools.	Mechanism or lock bolts open with proper hand tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure with proper hand tools. Intent is keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person with proper hand tools.

### No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, cracked/broken rungs, rungs not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

### No. 6 – Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe