Washington State Department of Transportation

January 2006

WSDOT Course Code: CVS

Washington State Department of Transportation
Highway Runoff Manual (HRM)
Training

Module 1 & 2

Participant Workbook

Table of Contents

I. Introduction I-1

II. Executive Summary II-1

III. Course Goal and Outcomes III-1

IV. Course Agenda IV-1

V. Course Slides V-1

VI. Lesson 6 TDA Delineation Exercise VI-1

Lesson 6 – TDA Delineation Exercise – 75 minutes VI-1

VII. Example Problems VII-1

W1-A: Project Thresholds *(Emphasizes gravel and replaced surfaces)* VII-1

W1-B: Project Threshold *(Emphasizes land-disturbance and over 50% new impervious surface compared to existing)* VII-4

RT-1: Runoff Treatment *(Emphasizes PGIS vs NPGIS)* VII-7

RT-2: Runoff Treatment *(Emphasizes TDA differences, and treatment type)*.. VII-12

RT-3: Runoff Treatment *(Emphasizes Replaced PGIS and effective PGIS)* .VII-17

FC-1: Flow Control VII-22

FC-2: Flow Control *(Reverted and net-new impervious)* VII-27

FC-3: Flow Control *(Emphasizes non-effective impervious)* VII-32

FC-4: Flow Control *(Emphasizes effective impervious for TDA's)* VII-37

VIII. Terminology and Abbreviations VIII-1

IX. Web Links IX-1

I. Introduction

The Washington State Department of Transportation (WSDOT) Highway Runoff Manual (HRM) Module 1 & 2 course is a full day program developed to introduce participants to the first several chapters of the recently revised WSDOT HRM. The module guides participants through the regulatory structure of the HRM as well as the minimum requirements that apply to the planning and design of stormwater management facilities and best management practices for state highways and facilities.

Although the contents of the participant workbook are comprehensive, it cannot substitute for the HRM itself. This course is the first in a series designed to give participants a comprehensive, interactive, and hands-on introduction to the revised WSDOT HRM. The HRM should be consulted for complete information and revisions.

II. Executive Summary

The HRM was developed to guide WSDOT staff in planning and designing stormwater management facilities for Washington state highways and facilities. HRM standards are designed to protect water quality, beneficial uses of the state's waters, and environmental health. The recent HRM revision illustrates a significant change in thinking regarding WSDOT stormwater management.

The HRM Modules 1 through 7 courses are designed to familiarize WSDOT staff, consultants, designers, engineers, biologists, and local agencies with the revised HRM. The seven module courses, listed below, should be taken in sequential order:

- Module 1: Project site assessment
- Module 2: Overview of HRM contents, Minimum Requirements, TDA delineation
- Module 3: Hydrologic analysis and hydraulic modeling
- Module 4: Permanent best management practices (BMP) selection and design
- Module 5: Construction site erosion and sediment control BMP selection and design
- Module 6: Permanent stormwater BMP operation and maintenance
- Module 7: Preparation of biological assessments.

The Module 1 & 2 course serves as a general introduction to the structure of WSDOT's HRM as well as the Minimum Requirements for stormwater planning and design. Key points included in this course are as follows:

- Definitions and key terms
    - The revised HRM introduces some concepts and terms that are different from those used in the Department of Ecology stormwater management manuals and the 1995 HRM. These terms are essential to understanding the revised HRM.
- Overview of WSDOT stormwater management methods and philosophy
- Presentation of HRM's Minimum Requirements
    - For each Minimum Requirement, the objectives, applicability, and, if applicable, exemptions will be discussed. The Minimum Requirements will also be the focus of several interactive learning examples and exercises.

This course is not intended to make participants experts, but rather to provide them with the tools required to effectively use the HRM. These tools include direction on where to go for more information.

III. Course Goal and Outcomes

Course Goals
The purpose of this course is to introduce the participants to the recently revised WSDOT HRM and to present the Minimum Requirements. While some of this material may not be new to participants, the focus of this course is on synthesis and application of the requirements of the revised HRM. The goals of the course are to:

- Explain the purpose, organization, and use of the WSDOT HRM
- Discuss basic stormwater issues and WSDOT's stormwater approach
- Use the HRM thresholds and Minimum Requirements in a site predesign analysis.

Learning Outcomes
At the end of this course, participants will be able to:

1. Define key terms used in the HRM
2. Analyze a proposed project in eastern or western Washington and determine the applicable thresholds and exceptions
3. Analyze a proposed project in eastern or western Washington and describe its Minimum Requirements and/or exemptions.

IV. Course Agenda

Time	Lesson	Length (min)
8:30-9:15	Module 1-Introduction and Lesson 1 & Lesson 2	45
9:15-9:30	Break	15
9:30-10:15	Module 2- Lesson 1 & Lesson 2	45
10:15-10:30	Break	15
10:30-11:45	Module 2- Lesson 3	75
11:45-12:45	Lunch break	60
12:45-2:00	Module 2 – Lesson 4 & Lesson 5	75
2:00-2:15	Break	15
2:15-3:15	Module 2- Lesson 6	60
3:15-3:45	Lesson 7	30
3:45-4:00	Wrap-up, summary, questions	15

Washington State Department of Transportation

Highway Runoff Manual Training
October 2005

WELCOME

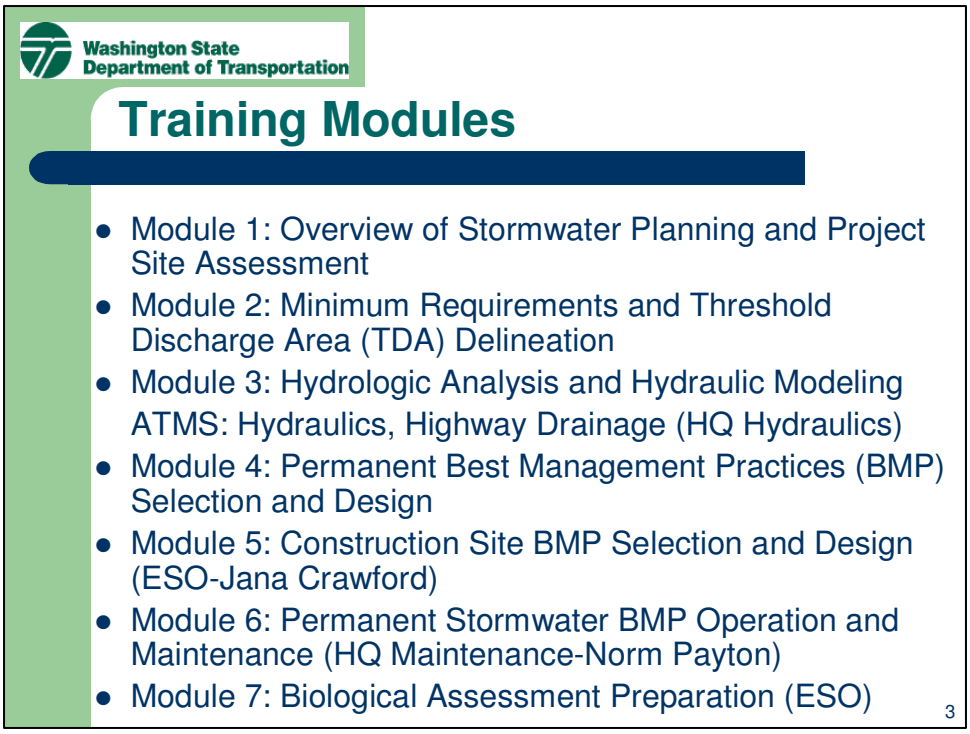
V. Course Slides

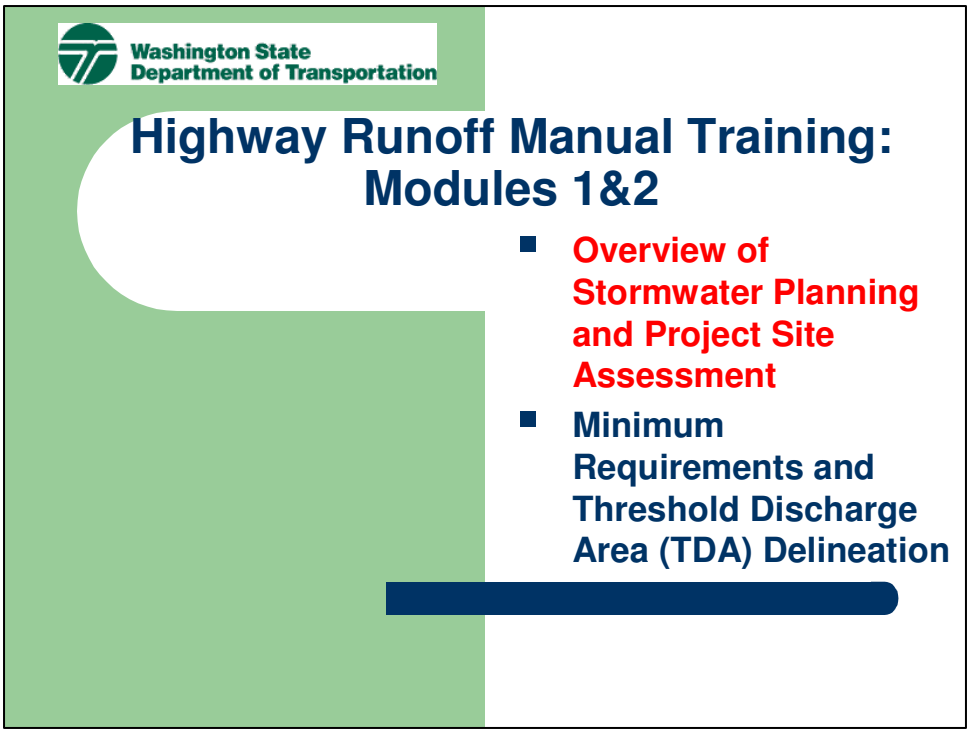
Washington State Department of Transportation

Course Agenda

- Schedule
  - See Participant Notebook
- Have you worked with the 2005 HRM?
- What questions would you like answered by this class?

2


Washington State Department of Transportation
Training Modules
Module 1: Overview of Stormwater Planning and Project Site Assessment
Module 2: Minimum Requirements and Threshold Discharge Area (TDA) Delineation
Module 3: Hydrologic Analysis and Hydraulic Modeling
ATMS: Hydraulics, Highway Drainage (HQ Hydraulics)
Module 4: Permanent Best Management Practices (BMP) Selection and Design
Module 5: Construction Site BMP Selection and Design (ESO-Jana Crawford)
Module 6: Permanent Stormwater BMP Operation and Maintenance (HQ Maintenance-Norm Payton)
Module 7: Biological Assessment Preparation (ESO)
3


Washington State Department of Transportation
Highway Runoff Manual Training: Modules 1&2
Overview of Stormwater Planning and Project Site Assessment
Minimum Requirements and Threshold Discharge Area (TDA) Delineation

Washington State Department of Transportation

Learning Objectives: Module 1

- Lesson 1: General Stormwater Planning
- Lesson 2: Project Site Assessment
- The HRM Glossary
  - Contact region hydraulic contact for questions about definitions

5

Washington State Department of Transportation

Lesson 1: General Stormwater Planning

Washington State Department of Transportation

Stormwater Planning: General Overview

- Evolving focus
- Various applicable regulations
- Stormwater Management Approach
- Broader roles and responsibilities for designers
- Multi-team approach
- Every project is unique

7

Washington State Department of Transportation

Stormwater Planning: Evolution of Highway SW Management

- Conveyance and safety
- Ecological impacts
- Water quality
- Physical impacts to streams and rivers
- See also HRM 3-2.1

8

Washington State Department of Transportation

Stormwater Planning: Applicable Regulations

- Substantial regulatory drivers exist for stormwater:
  - Clean Water Act (e.g., NPDES and TMDLs)
  - ESA
  - Local regulations/basin plans

9

Washington State Department of Transportation

Stormwater Planning: Stormwater Management Approach

1. Avoid and minimize impacts on hydrology and water quality
2. Compensate for impacts by mimicking natural processes
3. Compensate for impacts by using end-of-pipe solutions

- See also HRM 3-2.2.2

10

Washington State Department of Transportation

Stormwater Planning: Designer's Role

- Designer must be aware and knowledgeable on how the design relates to other project and environmental issues
- Not just a conveyance design role
- Stormwater design requires a multi-team approach
  - Requires input from geotechnical, hydraulic, environmental, permitting, and design engineering experts
  - Communication and coordination is critical
  - Saves project time, effort, and money

11

Washington State Department of Transportation

Stormwater Planning: Project Variability

- Cannot use a "boilerplate" approach working from outdated designs
- Each project requires a detailed Project Site Assessment and unique design approach
- Team approach: Solicit and incorporate input from multiple disciplines.

12

Washington State Department of Transportation

Lesson 2: Project Site Assessment

Washington State Department of Transportation

Project Site Assessment

- Extensive project site factors and variables that must be considered (HRM 3-5.3)
  - General site data
  - Water resources data
  - Water quality data
  - Soil/groundwater data

14

Washington State Department of Transportation

Project Site Assessment: General Site Data

- Project vicinity map and site map
- Land cover types and areas
- Aerial photographs
- Topography – USGS, survey
- Land surveys
- Utilities
- Vegetation surveys

15

Washington State Department of Transportation

Project Site Assessment: Water Resource Data

- Watershed or drainage basin boundaries
- Drainage patterns and drainage areas
- Receiving water conditions
- Basin plan data (basin-specific needs)
- Wetlands
- Stream flow data
- Ditches drainage and enclosed drainage
- Existing stormwater outfalls (outfall inventory and site reconnaissance)
- Floodplains
- Other

16

Washington State Department of Transportation

Project Site Assessment: Water Quality Data

- Land use types and associated pollutants
- Total maximum daily loads (TMDLs), water cleanup plans, and Clean Water Act Section 303(d) list of impaired waters
- Hazardous materials or wastes
- Other

17

Washington State Department of Transportation

Project Site Assessment: Soil / Groundwater Data

- Soil types, depth, and slope - Natural Resources Conservation Service (NRCS) soil surveys
- Ground water data including depth to seasonal high water table
- Soil infiltration rates
- Geotechnical evaluation (see also HRM 3-5.4).
- Other

18

Washington State Department of Transportation

Highway Runoff Manual Training: Modules 1&2

- Overview of Stormwater Planning and Project Site Assessment
- Minimum Requirements and Threshold Discharge Area (TDA) Delineation

Washington State Department of Transportation

Learning Objectives: Module 2

- Lesson 1: HRM Organization and Updates
- Lesson 2: Minimum Requirements 1 – 4
  - Example L2-1 and L2-2
- Lesson 3: Minimum Requirement 5 (Runoff Treatment)
  - Example L3-1 and L3-2
- Lesson 4: Minimum Requirement 6 (Flow Control)
  - Example L4-1 and L4-2
- Lesson 5: Minimum Requirements 7 – 9

20

Washington State Department of Transportation

Learning Objectives: Module 2

- Lesson 6: TDA Delineation
  - Example TDA1
  - Example TDA2

21

Washington State Department of Transportation

Lesson 1
HRM Organization and Updates

- **Chapter 1**
  - Background
- **Chapter 2**
  - Minimum requirements & Applicability
- **Chapter 3**
  - Planning and design integration into the project development process.
- **Chapter 4**
  - Hydrologic analysis methods
- **Chapter 5**
  - Permanent BMP selection
  - BMP design criteria
- **Chapter 6**
  - Construction BMP selection
  - ESC, SPCC BMPs
  - BMP design criteria
  - Monitoring guidance

22

Washington State Department of Transportation

Lesson 1
HRM Organization and Updates

- Appendices
- Glossary and abbreviations
- Latest electronic copy can be found at:

Internet:
http://www.wsdot.wa.gov/environment/wqec/hrm_resource.htm

23

Washington State Department of Transportation

Lesson 2:
Minimum Requirements 1 - 4

Washington State Department of Transportation

Lesson 2
HRM Minimum Requirements 1 - 4

1 - Stormwater Planning
2 - Construction Stormwater Pollution Prevention
3 - Source Control
4 - Preservation of Natural Drainage
5 - Runoff Treatment
6 - Flow Control
7 - Wetland Protection
8 - Basin/Watershed Planning
9 - Operations and Maintenance

25

Washington State Department of Transportation

Lesson 2
HRM Minimum Requirements 1 - 4

- **Examples of activities exempt from all Minimum Requirements**
  - **Typically Maintenance & Preservation Activities:**
    - Patching
    - Resurfacing without expanding coverage area
    - Shoulder grading
    - Crack sealing
    - Re-shaping/re-grading drainage systems
    - Vegetation maintenance

26

Washington State Department of Transportation

Lesson 2
MR 1 – Stormwater Planning

- Objective
  - To demonstrate how water quality will be maintained both during project construction and in the final developed conditions.
- Applicability
  - All projects need construction and permanent pollution prevention controls
    - Construction
      - SPCC plans
      - TESC
    - Permanent
      - Hydraulics report

27

Washington State Department of Transportation

Lesson 2
MR 2 – Construction Stormwater Pollution Prevention

- **Objective (ESO Jana Crawford)**
  - To ensure that construction projects do not impair water quality by allowing sediment to discharge from the site or allowing spills of pollutants.
- **Applicability**
  - SPCC
  - TESC

28

Washington State Department of Transportation

Lesson 2

MR 2 - Construction Stormwater Pollution Prevention

- **Activities subject only to MR 2 (Construction Stormwater Pollution Prevention)**
  - Repairing roadway base or subgrade
  - Some underground utility projects
  - Some roadways replacements/removals
  - See Module 5 Training (Richard Tveten)

29

Washington State Department of Transportation

Lesson 2

MR 3 – Source Control

- **Objective**
  - Prevent pollutants from contacting and mixing with stormwater.
  - Source control is more cost-effective than treatment.
- **Applicability**
  - All projects during construction
  - For post-construction, source control addressed via maintenance program
  - Structural BMPs
  - Operational BMPs

30

Washington State Department of Transportation

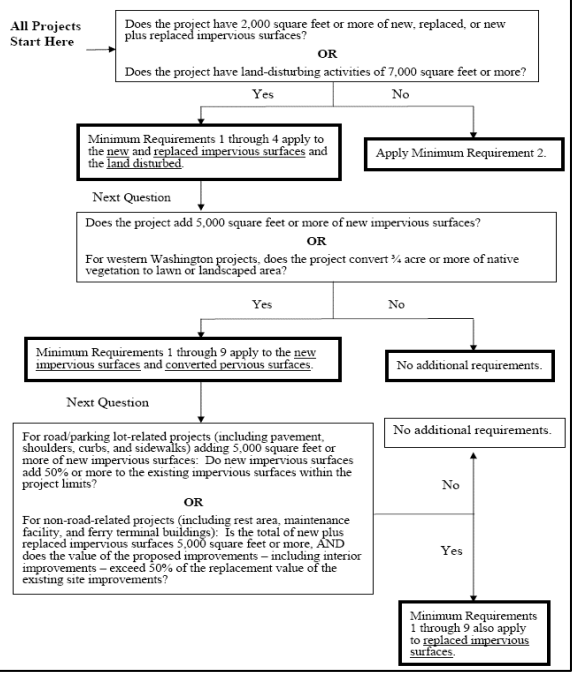
Lesson 2
MR 4 – Preservation of Natural Drainage

- **Objectives (Region Hydraulic Contacts)**
  - Preserve natural drainage systems to the fullest extent
  - To prevent erosion
- **Applicability**
  - Applies to all projects meeting thresholds to the maximum extent practicable

31

Washington State Department of Transportation

Figure 2.1



Washington State Department of Transportation

Lesson 2
MR 1 - 4 – Example L2-1

Example L2-1 (How to use Fig. 2.1 – Tier 1)

Tier 1 (Applies for entire Project)

- 1,000 sq. ft of new impervious surface
- 9,000 sq. ft of replaced impervious surface

Main Point of Example L2-1:

Figure 2.1 directs designer to sections in the HRM based on applicable MRs. Literally, designer needs to go to that section in HRM for more information on what is required

33

Washington State Department of Transportation

Figure 2.1

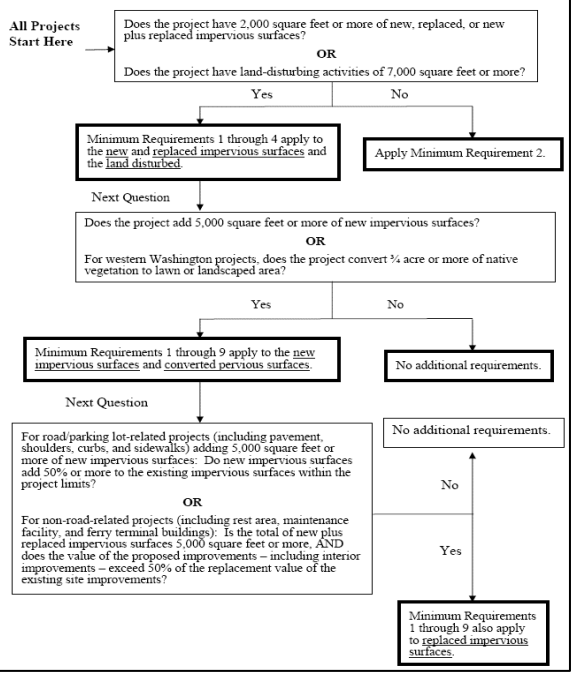
Example L2-1
Tier 1 – Figure 2.1

1,000 sq. ft of new impervious surface

9,000 sq. ft of replaced impervious surface

Min. Req. 1-4 apply to new and replaced surfaces.

Min Req 5-9 do not apply to this project.



Washington State Department of Transportation

Lesson 2
MR 1 - 4 – Example L2-2

- Existing Condition:
  - Two lane concrete highway (12 ft lanes)
  - Two 6 ft paved asphalt outside shoulders
  - There are 3 ft wide compacted gravel areas adjacent to the paved shoulders on both sides of the highway for the length of the project
  - The area adjacent to the gravel areas is comprised of grass
  - Assume the project is within one TDA
- Proposed Condition: Asymmetrical widening
  - Add one 12 ft lane (PCCP)
  - Widen to 8 ft paved asphalt outside shoulders
  - The project length is 600 feet

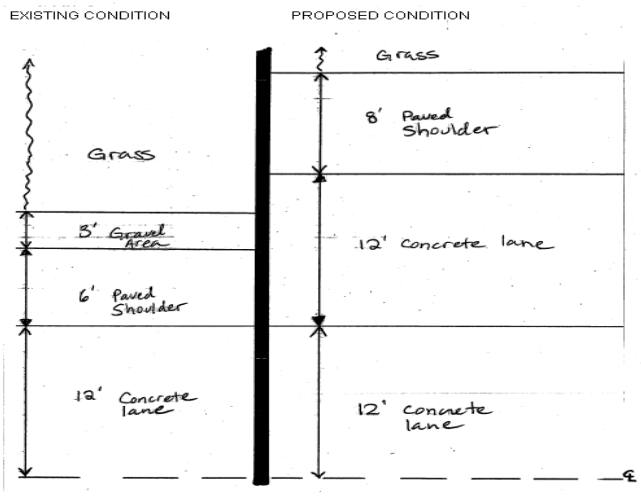
Looking only at Tier 1, what Minimum Requirements Apply to this project?

Please note: Numbers do not include lane tapers to simplify example
Typically designer would include tapers in the design calculations

35

Washington State Department of Transportation

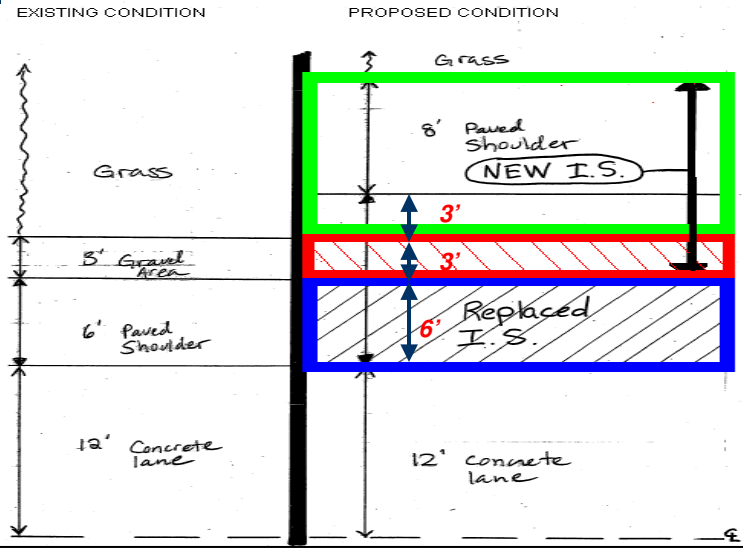
Lesson 2
MR 1 - 4 – Example L2-2



36

Washington State Department of Transportation

Lesson 2
MR 1 - 4 – Example L2-2



37

Washington State Department of Transportation

Lesson 2
MR 1 - 4 – Example L2-2

- Determine Existing Impervious Area
- Determine New Impervious Area
- Determine Replaced Impervious Area
- Determine what Minimum Requirements apply to this project?

38

Washington State Department of Transportation

Lesson 2
MR 1 - 4 – Example L2-2

- Existing Impervious = 25,200 sf
  - Highway = 2 x (12 ft x 600 ft) = 14,400 sf
  - Paved shoulders = 2 x (6 ft x 600 ft) = 7,200 sf
  - Gravel areas = 2 x (3 ft x 600 ft) = 3,600 sf
- New Impervious = 8,400 sf
  - New highway lane = 6 ft x 600 ft = 3,600 sf
  - New shoulder = 8 ft x 600 ft = 4,800 sf
- Replaced Impervious = 3,600 sf
  - Replace existing paved shoulder = 6 ft x 600 ft = 3,600 sf

39

Washington State Department of Transportation

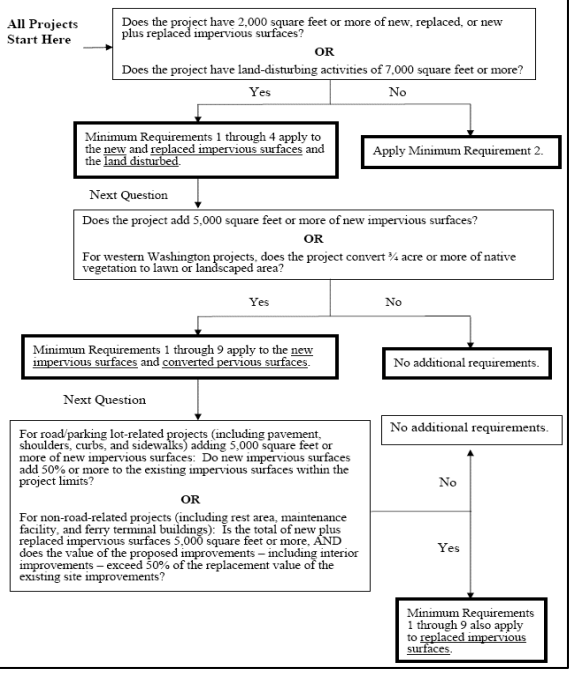
Figure 2.1

Example L2-2
Tier 1 – Figure 2.1

8,400 sq. ft of new impervious surface

3,600 sq. ft of replaced impervious surface
8,400 < ½ (25,200) sf

Min Req 1-4 apply to new & replaced impervious surfaces.
Min Req 5-9 apply to new imp surfaces.



Washington State Department of Transportation

Lesson 3:
Minimum Requirement 5 Runoff Treatment

Washington State Department of Transportation

Lesson 3
MR 5 – Runoff Treatment

- **Objective**
  - To reduce pollutant loads and concentrations in stormwater.
- **Exemptions (See Section 2-3.5.2)**
  - Where no new **PGIS** (Pollution Generating Impervious Surface) is added
  - UIC (Underground Injection Control) facilities under specific conditions
- See Region Hydraulic Contact for questions

42

Washington State Department of Transportation

Lesson 3
MR 5 – Runoff Treatment

- **Applicability (See Section 2-3.5.3)**
  - Tier 2 - Step 1, Project Level
    - Project adds > 5000 sq. ft of new PGIS

      -or-
    - Convert > ¾ acres of native vegetation to PGPS (additional requirement for western WA Only)

If project adds > 5,000 sq. ft of new PGIS,

a) For road related projects, is the new project PGIS > 1/2 (existing project PGIS)?

If yes, apply MR 5 to the replaced project PGIS as well

b) For non-road-related projects, is the value of proposed improvements > ½ (replacement value of existing site improvements)?

If yes, apply MR 5 to the replaced project PGIS as well

43

Washington State Department of Transportation

Lesson 3
MR 5 – Runoff Treatment

- **Applicability (See Section 2-3.5.3)**
  - Tier 2 - Step 2 , TDA Level
    - TDA effective PGIS > 5,000 sf

      -or-
    - Total TDA PGPS is ¾ of an acre or more and there is a surface discharge in a natural or man-made or conveyance system from the site (additional requirement for western WA only)

44

Washington State Department of Transportation

Lesson 3
MR 5 – Runoff Treatment

How to determine effective PGIS (at TDA level only)

Effective PGIS = (new PGIS) + (applicable replaced PGIS) – (non-effective PGIS)

- For effective PGIS, applicable replaced PGIS is determined at MR 5 Tier 2 – Step 1.
- Non-effective PGIS areas are those areas that are managed by a dispersion area meeting the BMP requirements in the HRM. See region hydraulic contact for questions.

45

Washington State Department of Transportation

Lesson 3
MR 5 – Runoff Treatment

- Treatment Standards
  - Types of treatment:
    - Basic
    - Enhanced
    - Oil control
    - Phosphorus control
  - Applications given in Table 2-1.
  - Basic treatment receiving waters listed in Table 2-2
  - Talk to Region Hydraulic Contact if applying oil control or phosphorus control to your project.

46

Washington State Department of Transportation

Table 2-1. Runoff treatment targets and applications for roadway projects

Treatment Target	Application	Performance Goal
Basic Treatment	All project threshold discharge areas (TDAs) where runoff treatment threshold is met.	80% removal of total suspended solids (TSS)
Enhanced Treatment (greater removal of dissolved metals than for basic treatment)	Same as for Basic Treatment. AND Roadway ADT[1] is ≥ 30,000 or is required by an adopted basin plan or water clean-up plan/TMDL. (See Table 2-2 for receiving water exemptions)	50% removal of dissolved copper (Cu) and zinc (Zn) for influent concentrations ranging from 0.003 to 0.02 mg/L for dissolved Cu and 0.02-0.3 mg/L for dissolved Zn
Oil Control	Same as for Basic Treatment. AND There is an intersection where either ≥15,000 vehicles (ADT) must stop to cross a roadway with ≥25,000 vehicles (ADT) or vice versa.[2] OR Rest areas with an expected ADT count equal to or greater than 100 vehicles per 1,000 square feet of gross building area. OR Maintenance facilities that park, store, or maintain 25 or more vehicles (trucks or heavy equipment) that exceed 10 tons gross weight each.	No ongoing or recurring visible sheen and 24-hr average total petroleum hydrocarbon concentration of not greater than 10 mg/L with a maximum of 15 mg/L for a discrete (grab) sample
Phosphorus Control	Same as for Basic Treatment. AND The project is located in a designated area requiring phosphorus control as prescribed through an adopted basin plan or water clean-up plan/TMDL.[3]	50% removal of total phosphorus for influent concentrations ranging from 0.1 to 0.5 mg/L TP

47

Washington State Department of Transportation

Table 2-2. Basic Treatment receiving waters.

1. All saltwater bodies	
2. Rivers (only Basic Treatment applies below the location)	
Baker (Anderson Creek)	Quillayute (Bogachiel River)
Bogachiel (Bear Creek)	Quinault (Lake Quinault)
Cascade (Marblemount)	Sauk (Clear Creek)
Chehalis (Bunker Creek)	Satsop (Middle and East Fork confluence)
Clearwater (Town of Clearwater)	Similkameen
Columbia (Canadian Border)	Skagit (Cascade River)
Cowlitz (Skate Creek)	Skokomish (Vance Creek)
Elwha (Lake Mills)	Skykomish (Beckler River)
Green (Howard Hanson Dam)	Snake
Grand Ronde	Snohomish (Snoqualmie River)
Hoh (South Fork Hoh River)	Snoqualmie (Middle and North Fork confluence)
Humptulips (West and East Fork confluence)	Sol Duc (Beaver Creek)
Kalama (Italian Creek)	Spokane
Kettle	Stillaguamish (North and South Fork confluence)
Klickitat	North Fork Stillaguamish (Boulder River)
Lewis (Swift Reservoir)	South Fork Stillaguamish (Canyon Creek)
Methow	Suiattle (Darrington)
Moses	Tilton (Bear Canyon Creek)
Muddy (Clear Creek)	Toutle (North and South Fork confluence)
Naches	North Fork Toutle (Green River)
Nisqually (Alder Lake)	Washougal (Washougal)
Nooksack (Glacier Creek)	White (Greenwater River)
South Fork Nooksack (Hutchinson Creek)	Wenatchee
Okanogan	Wind (Carson)
Pend Oreille	Wynoochee (Wishkah River Road Bridge)
Puyallup (Carbon River)	Yakima
Queets (Clearwater River)	
3. Non-fish-bearing streams tributary to Basic Treatment receiving waters	
4. Lakes (county location)	
Banks (Grant)	Silver (Cowlitz)
Chelan (Chelan)	Whatcom (Whatcom)
Moses (Grant)	Washington (King)
Potholes Reservoir (Grant)	Union (King)
Sammamish (King)	
5. Discharges to ground water via rule-authorized underground injection control (UIC) facilities[2]	

48

Washington State Department of Transportation

Lesson 3
MR 5 – Example L3-1

Example L3-1

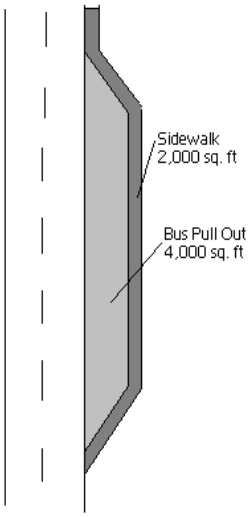
Widen SR 516 for bus pull out & sidewalk.

- **25,000 sq. ft of existing hwy pavement.**
- **6,000 sq. ft of new impervious (2,000 sq. ft sidewalk, 4000 sq. ft. Bus Pull out)**

Assume:

- **0 sq. ft. replaced impervious surfaces.**
- **1 Threshold Discharge Area (TDA)**
- **Future design year ADT is 10,000 vpd.**

Is runoff treatment needed? If so, what type?



49

Washington State Department of Transportation

Lesson 3
MR 5 – Example L3-1

Tier 1

- **Determine which Minimum Requirements apply using Fig 2.1**
- **Determine if Minimum Requirements apply to replaced surfaces.**

Tier 2

- **Step 1: Determine if MR5 is required for the project level**
- **Step 2: Determine Effective PGIS area & If MR5 applies to TDA Level.**
- **Determine what type of treatment is necessary?**

50

Washington State Department of Transportation

Figure 2.1

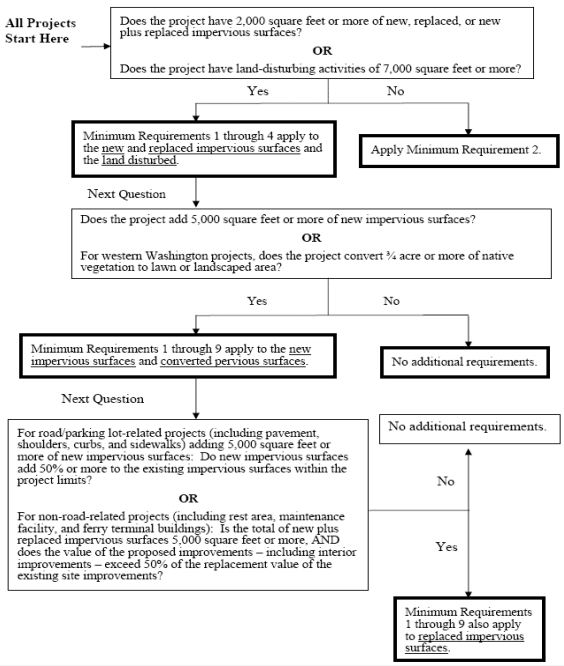
Example L3-1
Tier 1 – Figure 2.1

25,000 sq. ft of existing impervious surface

6,000 sq. ft of new impervious surface

0 sq. ft of replaced impervious surface

6,000 < ½(25,000) sq. ft



Washington State Department of Transportation

Lesson 3
MR 5 - Example L3-1 (Cont.)

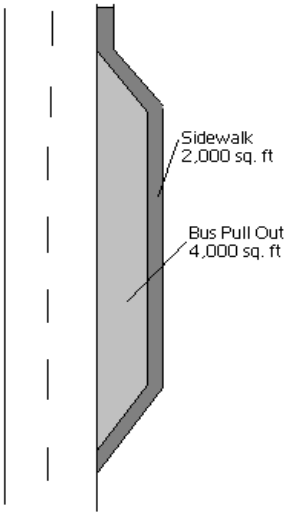
Tier 2 – Step 1 HRM 2-3.5.3

25,000 sq. ft of Existing Pollution Generating Impervious Surface (PGIS)

4,000 sq. ft of New PGIS
- **2,000 sq. ft of sidewalk is non-PGIS**

0 sq. ft of Replaced PGIS

Is New PGIS > 5000 sf?



Washington State Department of Transportation

Lesson 3
MR 5 - Example L3-1 (Cont.)

Tier 2 (Per HRM)

Step 1 - Project level: Minimum Requirement 5 applies to the project if one of the following conditions is exceeded (note that Step 1 differs from Figure 2.1 in that Step 1 looks at PGIS, while Figure 2.1 only looks at "new" impervious surfaces):

- The project adds 5,000 square feet or more of new PGIS **NO STOP!** ; OR
- The project converts more than ¾ acre of native vegetation to PGPS (additional requirement for western WA only).

In addition, when the 5,000 square foot PGIS threshold is met or exceeded:

Road/parking lot-related projects (including pavement, shoulders, curbs, and sidewalks) would also apply Minimum Requirement 5 to any replaced PGIS if the new PGIS is equal to or greater than 50% of the total existing PGIS within the project limits; OR

Non-road-related projects (e.g., rest areas, maintenance facilities, ferry terminal buildings) would also apply Minimum Requirement 5 to any replaced PGIS if the value of the proposed improvements, including interior improvements, exceeds 50% of the replacement value of the existing site improvements

53

Washington State Department of Transportation

Lesson 3
MR 5 - Example L3-1 (Cont.)

Tier 2 (Per HRM)

Step 2 - Threshold Discharge Area (TDA) level: For projects exceeding Step 1 thresholds, each of the following triggers should be evaluated for each TDA in the project to determine whether Minimum Requirement 5 applies to the effective PGIS in that particular TDA:

Effective PGIS (new PGIS plus any applicable replaced PGIS minus any non-effective PGIS) is 5,000 square feet or more in a TDA; OR

PGPS is ¾ of an acre or more in a TDA, and there is a surface discharge in a natural or man-made conveyance system from the site (additional requirement for western WA only).

Equivalent area treatment is allowable for PGIS areas that drain to the same receiving waters and have the same pollutant-loading characteristics. While the equivalent area will receive treatment, the new or expanded discharge also must not cause a violation of surface water quality standards. Additional information on equivalent area treatment is provided in Sections 3-3.1 and 4-3.6.1.

54

Washington State Department of Transportation

Lesson 3
MR 5 – Example L3-1 (Cont.)

Results:

Since project did not meet thresholds in Tier 2 Step 1, runoff treatment (MR 5) is not needed for the project.

55

Washington State Department of Transportation

Lesson 3
MR 5 – Example L3-2

Example L3-2

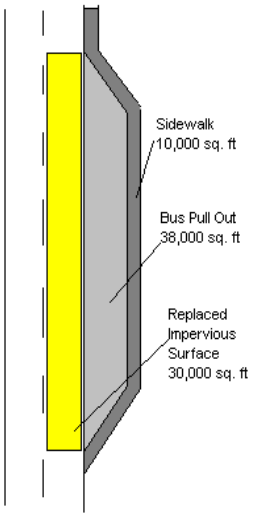
Widen SR 516 for bus pull out & sidewalk.

- **70,000 sq. ft of existing hwy pavement.**
- **48,000 sq. ft of new impervious (10,000 sq. ft. sidewalk; 38000 sq. ft. Bus Pull out)**
- **Existing lane removed to crush surfacing and replaced, 30,000 sq. ft.**

Assume:

- **30,000 sq. ft. replaced impervious surfaces.**
- **1 Threshold Discharge Area (TDA)**
- **Future design year ADT is 10,000 vpd.**

Is runoff treatment needed? If so, what type?



Washington State Department of Transportation

Lesson 3
MR 5 – Example L3-2

Tier 1

- Determine which Minimum Requirements apply using Fig 2.1
- Determine if Minimum Requirements apply to replaced surfaces.

Tier 2

- Step 1: Determine if MR5 is required for the project level
- Step 2: Determine Effective PGIS area & If MR5 applies to TDA Level.
- Determine what type of treatment is necessary?

56

Washington State Department of Transportation

Figure 2.1

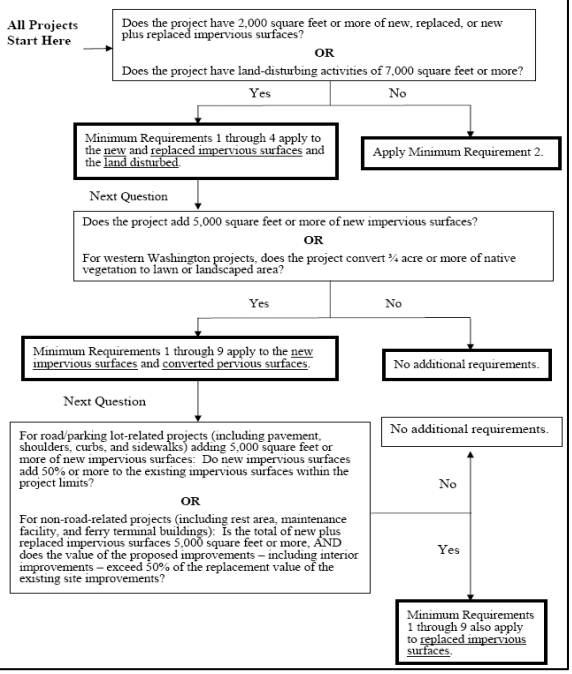
Example L3-2
Tier 1 – Figure 2.1

70,000 sq. ft of existing impervious surface

48,000 sq. ft of new impervious surface

30,000 sq. ft of replaced impervious surface

48,000 > ½(70,000) sq. ft



Washington State Department of Transportation

Lesson 3
MR 5 - Example L3-2 (Cont.)

Tier 2 (Per HRM)

Step 1 - Project level: Minimum Requirement 5 applies to the project if one of the following conditions is exceeded (note that Step 1 differs from Figure 2.1 in that Step 1 looks at PGIS, while Figure 2.1 only looks at "new" impervious surfaces):

- **The project adds 5,000 square feet or more of new PGIS; OR**
- **The project converts more than ¾ acre of native vegetation to PGPS (additional requirement for western WA only).**

In addition, when the 5,000 square foot PGIS threshold is met or exceeded:

Road/parking lot-related projects (including pavement, shoulders, curbs, and sidewalks) would also apply Minimum Requirement 5 to any replaced PGIS if the new PGIS is equal to or greater than 50% of the total existing PGIS within the project limits; OR

Non-road-related projects (e.g., rest areas, maintenance facilities, ferry terminal buildings) would also apply Minimum Requirement 5 to any replaced PGIS if the value of the proposed improvements, including interior improvements, exceeds 50% of the replacement value of the existing site improvements

59

Washington State Department of Transportation

Lesson 3
MR 5 - Example L3-2 (Cont.)

Tier 2 (Per HRM)

Step 2 - Threshold Discharge Area (TDA) level: For projects exceeding Step 1 thresholds, each of the following triggers should be evaluated for each TDA in the project to determine whether Minimum Requirement 5 applies to the effective PGIS in that particular TDA:

Effective PGIS (new PGIS plus any applicable replaced PGIS minus any non-effective PGIS) is 5,000 square feet or more in a TDA; OR

PGPS is ¾ of an acre or more in a TDA, and there is a surface discharge in a natural or man-made conveyance system from the site (additional requirement for western WA only).

Equivalent area treatment is allowable for PGIS areas that drain to the same receiving waters and have the same pollutant-loading characteristics. While the equivalent area will receive treatment, the new or expanded discharge also must not cause a violation of surface water quality standards. Additional information on equivalent area treatment is provided in Sections 3-3.1 and 4-3.6.1.

60

Washington State Department of Transportation

Lesson 3
MR 5 – Example L3-2 (Cont.)

Results:

Minimum Requirements 1-9 apply to effective (in this case, the new and replaced) PGIS for the TDA

Yes, runoff treatment is needed for the TDA (and project since only 1 TDA).

Project needs runoff treatment for 68,000 sq. ft of effective PGIS,

From HRM Table 2-1 and a design year ADT of 10,000:

- **Since ADT < 30,000 vpd, basic runoff treatment is necessary for that TDA (and project).**
- **Project is not at an intersection, no oil control.**
- **Project is not in an area designated as requiring phosphorus control.**

62

Washington State Department of Transportation

Lesson 3
MR 5 – Example L3-2

Summary of Example L3-2

- **Walk through 2 Tier format in HRM**
- **Walk through 2 Step process of MR 5**
- **Use HRM Glossary for terms and definitions**
- **Discuss what is PGIS and what is non-PGIS**
- **Discuss how to determine effective PGIS**
- **Determined what type of runoff treatment was necessary**

Detailed examples are in the Workbook. Talk to region hydraulic contact for questions.

62

Washington State Department of Transportation

Lesson 4: Minimum Requirement 6 Flow Control

Washington State Department of Transportation

Lesson 4
MR 6 – Flow Control

- **Objective**
  - Prevent increases in the stream channel erosion rates; mitigate impacts of prior development and flow modifications.
- **Exemptions**
  - Listed in Section 2-3.6.2
  - Additional exemptions for eastern Washington
  - Exempt surface waters are listed in **Table 2-5**
  - **Caution:** Flow Control exemption **does not** equal runoff treatment exemption
- **See Region Hydraulic Contact for questions**

64

Washington State Department of Transportation

Table 2-5. Flow Control Exempt Surface Waters (Partial list)

Lake Sammamish	
Lake Union	King County
Lake Wenatchee	
Lake Washington	
Lake Whatcom	
Lewis River	Downstream of confluence with Quartz Creek
Lewis River, East Fork	Downstream of confluence with Big Tree Creek
Lightning Creek	Downstream of confluence with Three Fools Creek
Little Spokane River	Downstream of confluence with Deadman Creek
Little White Salmon River	Downstream of confluence with Lava Creek
Lower Crab Creek	Entire reach
Mayfield Lake	
Methow River	Downstream of confluence with Early Winters Creek
Moses Lake	
Muddy River	Downstream of confluence with Clear Creek
Naches River	Downstream of confluence with Bumping River
Naselle River	Downstream of confluence with Johnson Creek
Newaukum River	Downstream of confluence with South Fork Newaukum River
Nisqually River	Downstream of confluence with Big Creek
Nooksack River	Downstream of confluence of North and Middle Forks
Nooksack River, North Fork	Downstream of confluence with Glacier Creek, at USGS gage 12205000
Nooksack River, South Fork	0.1 miles upstream of confluence with Skookum Creek
North River	Downstream of confluence with Vesta Creek
Ohanapecosh River	Downstream of confluence with Summit Creek
Okanogan River	Downstream of Canadian border
Osoyoos Lake	
Pacific Ocean	
Palouse River	Downstream of confluence with South Fork Palouse
Pend Oreille River	Idaho to Canadian border

65

Washington State Department of Transportation

Lesson 4
MR 6 – Flow Control

- **Applicability (See Section 2-3.6.3)**
  - Tier 2 - Step 1, Project Level
    - Project adds >5000 sq. ft of new imp surf

      -or-
    - Converted native vegetation area > 3/4 acres to lawn or landscape, (additional requirement for western WA Only)

If project adds > 5,000 sq. ft of new imp surf,

a) For road related projects, is the new project imp surf > 1/2 (existing project imp surf)?

If yes, apply MR 6 to the new and replaced project imp surf

b) For non-road-related projects, is the value of proposed improvements > ½ (replacement value of existing site improvements)?

If yes, apply MR 6 to the new and replaced project imp surf

66

Washington State Department of Transportation

Lesson 4
MR 6 – Flow Control

- **Applicability (See Section 2-3.6.3)**
  - Tier 2 - Step 2 , TDA Level
    - TDA effective impervious surface >10,000 sf

      -or-
    - TDA converts ¾ acres or more of native vegetation to lawn or landscape and there is a surface discharge in a natural or man-made or conveyance system from the site (additional requirement for western WA only)

      -or-
    - Through a combination of effective impervious surfaces and converted pervious surfaces, the particular TDA causes a 0.1 cfs or more increase in the 100-year recurrence interval flow, as estimated using the MGSFlood or other approved model. This analysis is based on pre-project (what is currently seen at the project site) land cover conditions for the pre-developed modeling condition and the post-construction (after the project is completed) land cover conditions for the developed modeling conditions. (additional requirement for western WA only)

67

Washington State Department of Transportation

Lesson 4
MR 6 – Flow Control

How to determine the effective impervious surface (at TDA level only)

Effective imp surf = (net-new imp surf) + (applicable replaced imp surf) – (non-effective imp surf)

- Net-new imp surf = (new imp surf in the TDA) – (reverted imp surf in the TDA) see HRM 4-3.6.1
- Applicable replaced imp surf is determined at MR 6 Tier 2 – Step 1.
- Non-effective imp surf are those areas that are managed by a dispersion area meeting the BMP requirements in the HRM. See region hydraulic contact for questions.

68

Washington State Department of Transportation

Lesson 4
MR 6 – Example L4-1

Example L4-1

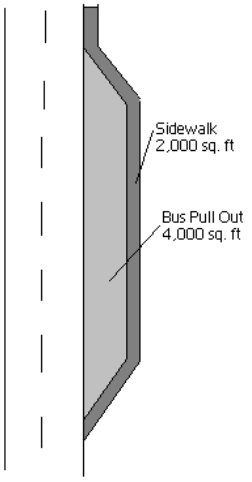
Widen SR 516 for bus pull out & sidewalk.

- 25,000 sq. ft of existing hwy pavement.
- 6,000 sq. ft of new impervious (2,000 sq. ft sidewalk, 4000 sq. ft. Bus Pull out)

Assume:

- 0 sq. ft. replaced impervious surfaces.
- 1 Threshold Discharge Area (TDA)
- Future design year ADT is 10,000 vpd.

Is flow control needed for this project?



69

Washington State Department of Transportation

Lesson 4
MR 6 – Example L4-1

Tier 1

- Determine which Minimum Requirements apply using Fig 2.1
- Determine if Minimum Requirements apply to replaced surfaces.

Tier 2

- Step 1: Determine if MR6 is required for project level.
- Step 2: Determine effective impervious surface & if MR6 is required for TDA level.

70

Washington State Department of Transportation

Figure 2.1

Example L4-1
Tier 1 – Figure 2.1

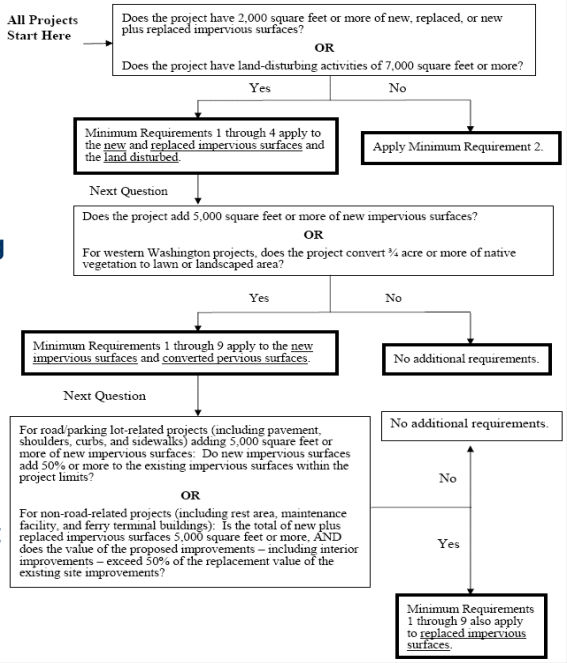
25,000 sq. ft of existing impervious surface

6,000 sq. ft of new impervious surface

0 sq. ft of replaced impervious surface

6,000 < ½(25,000) sq. ft

Is new > ½ existing?



Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-1 (Cont.)

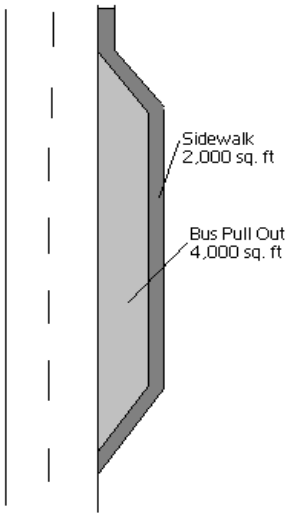
Tier 2 – Step 1 HRM 2-3.6.3

25,000 sq. ft of Existing Impervious Surface

6,000 sq. ft of New Impervious Surface

0 sq. ft of Replaced Impervious Surface

Is New Imp Surface > 5000 sf?



Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-1 (Cont.)

Tier 2 (Per HRM)

Step 1 - Project level: First, Minimum Requirement 6 applies to the project if (note that this is the same process depicted in Tier 1 - Figure 2.1):

- **The project adds 5,000 square feet or more of new impervious surfaces; OR**
- **The project converts more than ¾ acre of native vegetation to lawn or landscaped area (additional requirement for western WA only).**

In addition, when the 5,000 square foot threshold (above) is met or exceeded:

- **Road/parking lot-related projects (including pavement, shoulders, curbs, and sidewalks) also need to apply Minimum Requirement 6 to any replaced impervious surfaces if the new impervious surfaces add > 50% or more to the existing impervious surfaces within the project limits; OR**
- **Non-road-related projects (e.g., rest areas, maintenance facilities, ferry terminal buildings) also need to apply Minimum Requirement 6 to any replaced imperious surfaces if the value of the proposed improvements - including interior improvements - exceed 50% of the replacement value of the existing site improvements**

73

Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-1 (Cont.)

Tier 2 (Per HRM)

Step 2 - Threshold Discharge Area (TDA) level: For projects exceeding Step 1 thresholds, each of the following triggers should be evaluated to determine whether Minimum Requirement 6 applies to each TDA. If any one of the three triggers is exceeded for a given TDA, flow control should be provided for the effective impervious surfaces and converted pervious surfaces in that particular TDA:

- TDA effective impervious surface >10,000 sf

  -or-

- TDA converts ¾ acres or more of native vegetation to lawn or landscape and there is a surface discharge in a natural or man-made or conveyance system from the site (additional requirement for western WA only)

  -or-

- Through a combination of effective impervious surfaces and converted pervious surfaces, the particular TDA causes a 0.1 cfs or more increase in the 100-year recurrence interval flow, as estimated using the MGSFlood or other approved model. This analysis is based on pre-project (what is currently seen at the project site) land cover conditions for the pre-developed modeling condition and the post-construction (after the project is completed) land cover conditions for the developed modeling conditions. (additional requirement for western WA only)

74

Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-1 (Cont.)

Results:

Tier 1

Minimum Requirements 1-9 apply to new surfaces.

Tier 2

Flow control is not needed.

- **TDA (and Project since only 1 TDA) does not need flow control 6,000 sq. ft < 10,000 sf of effective impervious surfaces**
- **Assume that the TDA does not exceed any of the other 2 triggers.**

75

Washington State Department of Transportation

Lesson 4
MR 6 – Example L4-2

Example L4-2

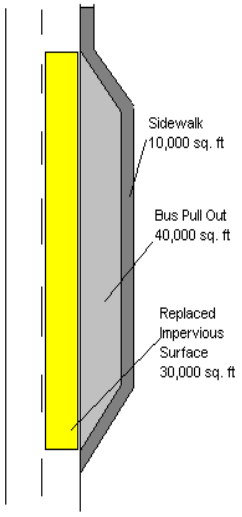
Widen SR 516 for bus pull out & sidewalk.

- **70,000 sq. ft of existing hwy pavement.**
- **50,000 sq. ft of new impervious (10,000 sq. ft. sidewalk; 40000 sq. ft. Bus Pull out)**
- **Existing lane removed to crush surfacing and replaced, 30,000 sq. ft.**

Assume:

- **30,000 sq. ft. replaced impervious surfaces.**
- **1 Threshold Discharge Area (TDA)**
- **Future design year ADT is 10,000 vpd.**

Is flow control needed?



Washington State Department of Transportation

Lesson 4
MR 6 – Example L4-2

Tier 1

- Determine which Minimum Requirements apply using Fig 2.1
- Determine if Minimum Requirements apply to replaced surfaces.

Tier 2

- Step 1: Determine if MR6 is required for project level.
- Step 2: Determine effective impervious surface & if MR6 is required for TDA level.

77

Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-2 (Cont.)

Tier 2 (Per HRM)

Step 1 - Project level: First, Minimum Requirement 6 applies to the project if (note that this is the same process depicted in Tier 1 - Figure 2.1):

- **The project adds 5,000 square feet or more of new impervious surfaces; OR**
- **The project converts more than ¾ acre of native vegetation to lawn or landscaped area (additional requirement for western WA only).**

In addition, when the 5,000 square foot threshold (above) is met or exceeded:

- **Road/parking lot-related projects (including pavement, shoulders, curbs, and sidewalks) also need to apply Minimum Requirement 6 to any replaced impervious surfaces if the new impervious surfaces add > 50% or more to the existing impervious surfaces within the project limits; OR**
- **Non-road-related projects (e.g., rest areas, maintenance facilities, ferry terminal buildings) also need to apply Minimum Requirement 6 to any replaced imperious surfaces if the value of the proposed improvements - including interior improvements - exceed 50% of the replacement value of the existing site improvements**

80

Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-2 (Cont.)

Tier 2 (Per HRM)

Step 2 - Threshold Discharge Area (TDA) level: For projects exceeding Step 1 thresholds, each of the following triggers should be evaluated to determine whether Minimum Requirement 6 applies to each TDA. If any one of the three triggers is exceeded for a given TDA, flow control should be provided for the effective impervious surfaces and converted pervious surfaces in that particular TDA:

- TDA effective impervious surface >10,000 sf

  -or-
- TDA converts ¾ acres or more of native vegetation to lawn or landscape and there is a surface discharge in a natural or man-made or conveyance system from the site (additional requirement for western WA only)

  -or-
- Through a combination of effective impervious surfaces and converted pervious surfaces, the particular TDA causes a 0.1 cfs or more increase in the 100-year recurrence interval flow, as estimated using the MGSFlood or other approved model. This analysis is based on pre-project (what is currently seen at the project site) land cover conditions for the pre-developed modeling condition and the post-construction (after the project is completed) land cover conditions for the developed modeling conditions. (additional requirement for western WA only)

81

Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-2 (Cont.)

Results:

Tier 1

Minimum Requirements 1-9 apply to new and replaced impervious surfaces.

Tier 2

Yes, flow control is needed.

TDA (and Project since only 1 TDA) needs flow control for 80,000 sq. ft of effective impervious surfaces

- 50,000 sq. ft of new imp surf

- 30,000 sq. ft of replaced imp. surf

83

Washington State Department of Transportation

Lesson 4
MR 6 - Example L4-2 (Cont.)

Summary of Example L4-2

- Walk through 2 Tier format in HRM
- Walk through 2 Step process of MR 6
- Use HRM Glossary for terms and definitions
- Discuss how to determine effective impervious surfaces

Detailed examples are in the Workbook. Talk to region hydraulic contact for questions.

83

Washington State Department of Transportation

Lesson 5: Minimum Requirements 7-9

Washington State Department of Transportation

Min. Req. 7: Wetlands Protection

- **Objective**
  - To ensure that wetlands receive the same level of protection as any other water of the state
- **Applicability**
  - Required for projects that meet thresholds for Minimum Requirement 7 by HRM Figures 2.1 and where stormwater discharges into a wetland, directly or indirectly
  - Stormwater treatment facilities within a wetland are discouraged
  - Natural wetlands may not be used as pollution control facilities
  - Thresholds identified in MR5 and MR6 must also be applied to wetlands along with a hydroperiod analysis (Contact Region Permit Coordinator or Wetland Biologist)

86

Washington State Department of Transportation

Minimum Requirement 8: Basin Planning

- **Objectives**
  - To promote the development of watershed based resource plans as a means to develop and implement comprehensive water resource protection measures
  - To reduce pollutant loads and hydrologic impacts to surface and ground waters

86

Washington State Department of Transportation

Minimum Requirement 8: Basin Planning

- **Applicability**
  - Applies where watershed and basin plans are in place as per section 2-2
- **Guidance**
  - The plan must be formally adopted by jurisdictions with responsibilities
  - Basin planning can alter the Minimum Requirements of the WSDOT HRM after being approved by all local governments and Ecology
  - Visit http://www.ecy.wa.gov/watershed/index.html for established basin plans or contact Dick Gersib of the ESO Watershed Group

87

Washington State Department of Transportation

Minimum Requirement 9: O&M

- **Objective (Region Maintenance)**
  - To achieve appropriate preventative maintenance and perform checks to ensure that stormwater control facilities are adequately maintained and properly operated
- **Applicability**
  - Applies to all projects that require stormwater control facilities or BMPs
  - Section 5-5 provides the criteria for determining if BMP maintenance actions are required
  - Maintenance subject to funding by Washington State Legislature

What is the point?

Keep local maintenance office informed of proposed BMP design.

88

Washington State Department of Transportation

Retrofit Guidance

- Goal is to retrofit existing impervious surfaces where a significant amount of pavement is added on a project
- WSDOT Strategic Planning and Programming established sideboards for when to consider retrofit
- See HRM Chapter 2-4 for detailed discussion on retrofit guidance and when a retrofit is appropriate

89

Washington State Department of Transportation

Wrap Up of HRM Min. Req.

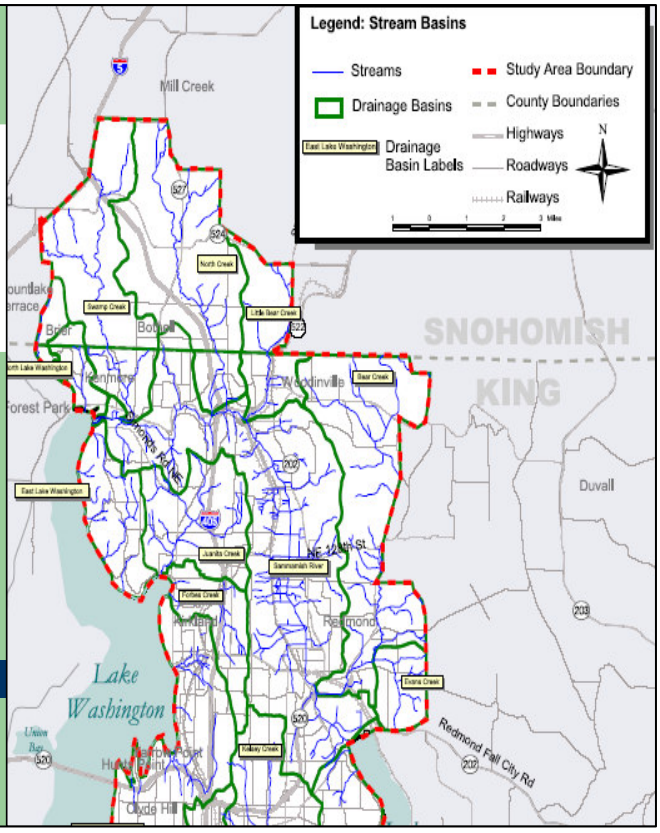
1 - Stormwater planning
2 - Construction stormwater pollution prevention
3 - Source control
4 - Preservation of natural drainage
5 - Runoff treatment
6 - Flow control
7 - Wetland protection
8 - Basin/watershed planning
9 - Operations and maintenance

Questions?

90

Washington State Department of Transportation

Lesson 6: TDA Delineation



Washington State Department of Transportation

Lesson 6
TDA Delineation

What is a TDAs?

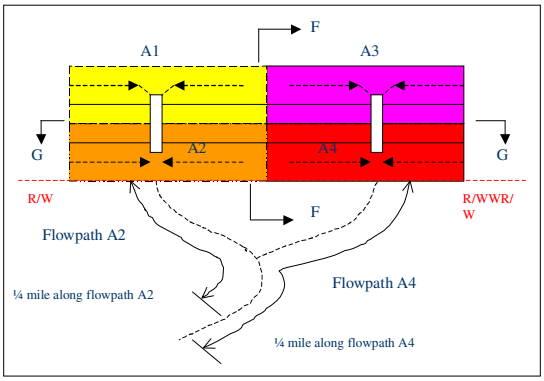
-Threshold discharge area (TDA): An onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within ¼ mile downstream.

93

Washington State Department of Transportation

Lesson 6
TDA Delineation

- Threshold Discharge Areas (Fig 4-2a in HRM)

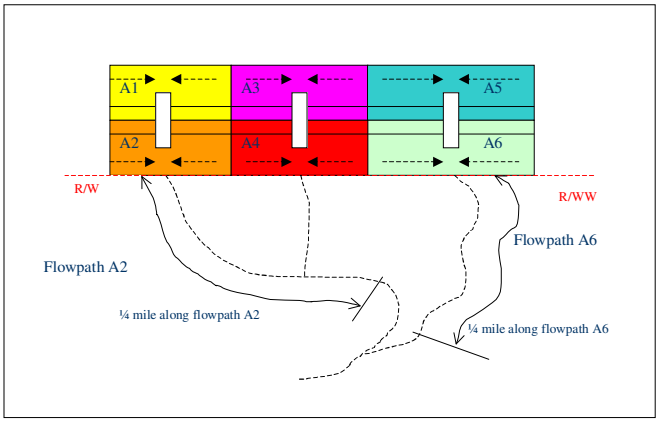


94

Washington State Department of Transportation

Lesson 6
TDA Delineation

- Threshold Discharge Areas (Fig 4-2b in HRM)



95

Washington State Department of Transportation

Lesson 6
TDA Delineation

Why do we need TDAs?

-consistency in determining flows

-determine Minimum Requirements

-identify outfalls

94

Washington State Department of Transportation

Lesson 6
TDA Delineation Exercise

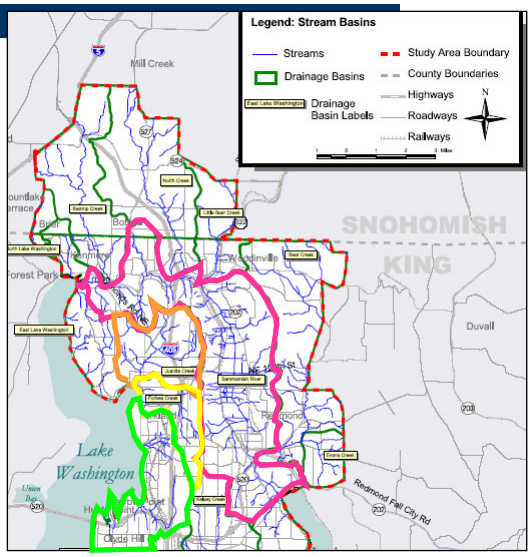
- Directions and guidelines
  - Basin delineations (group)
  - TDA delineation (group, then individual)
  - Project areas characterization (existing, new, replaced, etc. impervious surfaces)
  - Determine minimum requirements

95

Washington State Department of Transportation

Lesson 6
Watershed Basin Delineation

- Watershed basins – project wide



98

Washington State Department of Transportation

Lesson 6
Sub-basin Delineation

- Sub-basins – project wide
  - Evaluate roadway profile relative to basin boundaries

97

Washington State Department of Transportation

Lesson 6
TDA Delineation

- Sammamish River Basin only
  - As a group walk through delineation of TDA "F-1"
  - Individually, delineate the rest of basin "F" into TDAs

100

Washington State Department of Transportation

Lesson 6
Project Area Characterization

- For Basin "F" fill in spreadsheets:
  - FC-1: Flow Control
  - RT-1: Runoff Treatment – Tier 2
  - FC-1: Flow Control Tier 2

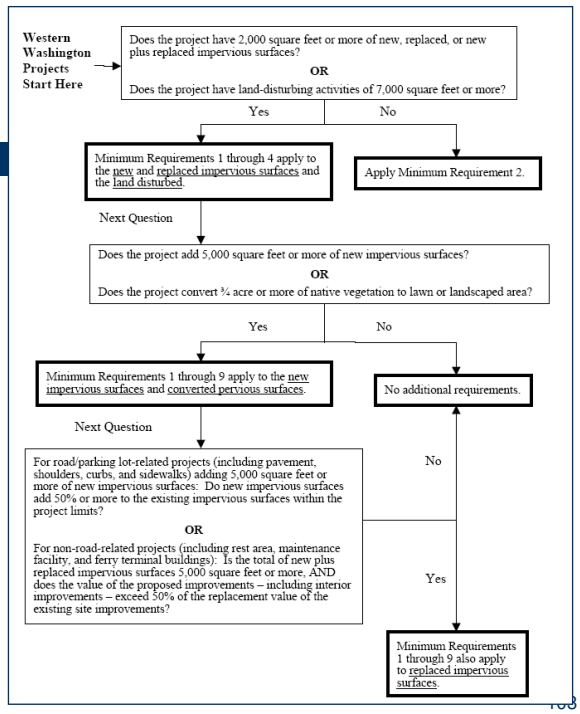
102

Washington State Department of Transportation

I-405 Minimum Requirements

I-405 Example
Tier 1 – Figure 2.1

- **Existing impervious**
  236 acres
- **New impervious**
  15.8 acres
- **Replaced impervious**
  17.0 acres
- **New IS < 50% of Existing IS**



Washington State Department of Transportation

Lesson 6
Minimum Requirements

Results:

Tier 1

- Minimum Requirements 1-9 apply to the new impervious surfaces
- Go to Minimum Requirements 5 and 6 in HRM to determine how they apply to TDAs on the project.

104

Washington State Department of Transportation

Lesson 6
Minimum Requirement 5

Tier 2 (Per HRM)

Step 1 - Project level:

-The project adds over 5,000 square feet of new PGIS

Minimum Requirement 5 applies to new PGIS.

-The project does not add greater than 50% to the total existing PGIS.

Minimum Requirement 6 does not apply to replaced PGIS.

105

Washington State Department of Transportation

Lesson 6
Minimum Requirement 5

Tier 2 (Per HRM)

Step 2 - Threshold Discharge Area (TDA) level:

- TDA exceeds 5,000 sq. ft of effective PGIS
- TDA does not exceed more than ¾ acres of PGPS (additional requirement for western WA only)

RUNOFF TREATMENT IS NEEDED FOR TDA F1 & F2.

106

Washington State Department of Transportation

Lesson 6
Minimum Requirement 5

- Treatment Targets (HRM Tables 2-1 and 2-2)
  - No TMDLs, Water Clean-up plans
  - Average daily traffic on I-405 south of SR 522 is 150,000 vpd
    ➔Enhanced treatment is required
  - Not listed as a Basic Treatment receiving water in Table 2-2
    ➔Enhanced treatment requirement holds.
  - Oil control and phosphorus control are not required for the TDAs within the Sammamish River basin (Table 2-1).

107

Washington State Department of Transportation

Lesson 6
Minimum Requirement 6

- Verify Flow Control Exemptions
  - Not listed as an exempt surface water in Table 2-5.
  - TDA-F1 may be exempt from flow control because it discharges to a wetland.
  - But, flow control may still be required to maintain wetland hydrology in accordance with Minimum Requirements 4 and 7.

108

Washington State Department of Transportation

Lesson 6
Minimum Requirement 6

Tier 2 (Per HRM)

Step 1 - Project level:

-The project adds over 5,000 square feet of new impervious surfaces

Minimum Requirement 6 applies to new impervious surfaces.

-The project does not add greater than 50% to the existing impervious area

Minimum Requirement 6 does not apply to replaced impervious surfaces.

109

Washington State Department of Transportation

Lesson 6
Minimum Requirement 6

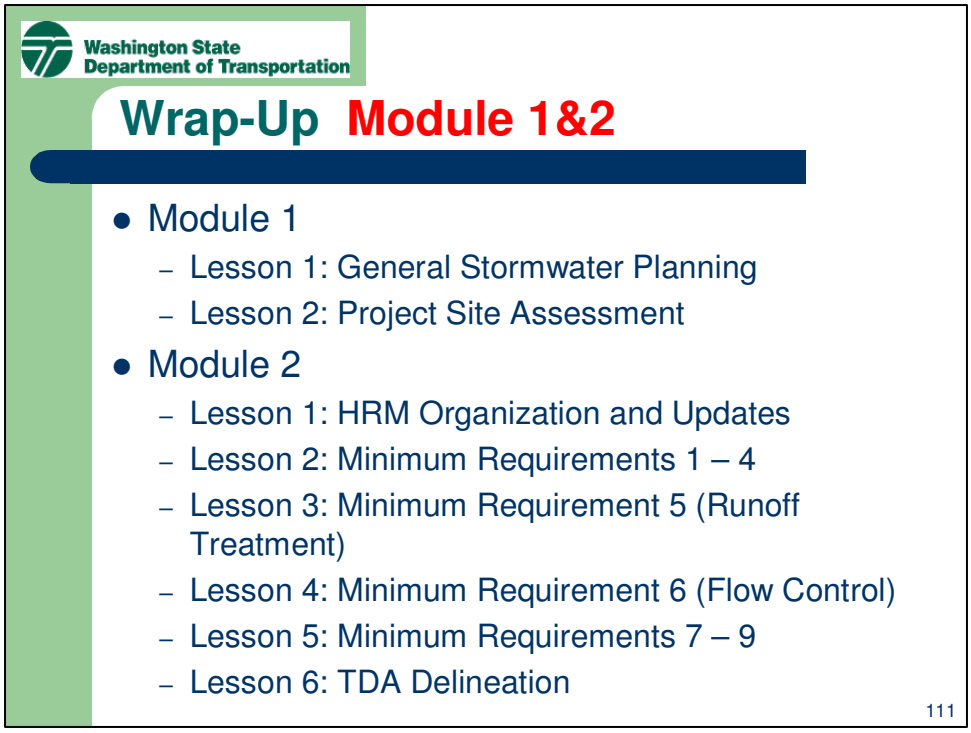
Tier 2 (Per HRM)

Step 2 - Threshold Discharge Area (TDA) level:

- TDA exceeds 10,000 sq. ft of effective imp. surface
- TDA does not convert more than ¾ acres of native vegetation to lawn or landscape (additional requirement for western WA only)
- TDA causes a 0.1 cfs or more increase in the 100-year recurrence interval flow (additional requirement for western WA only)

FLOW CONTROL IS NEEDED FOR TDA F2

110


Washington State
Department of Transportation
Wrap-Up Module 1&2
Module 1
Lesson 1: General Stormwater Planning
Lesson 2: Project Site Assessment
Module 2
Lesson 1: HRM Organization and Updates
Lesson 2: Minimum Requirements 1 – 4
Lesson 3: Minimum Requirement 5 (Runoff Treatment)
Lesson 4: Minimum Requirement 6 (Flow Control)
Lesson 5: Minimum Requirements 7 – 9
Lesson 6: TDA Delineation
111

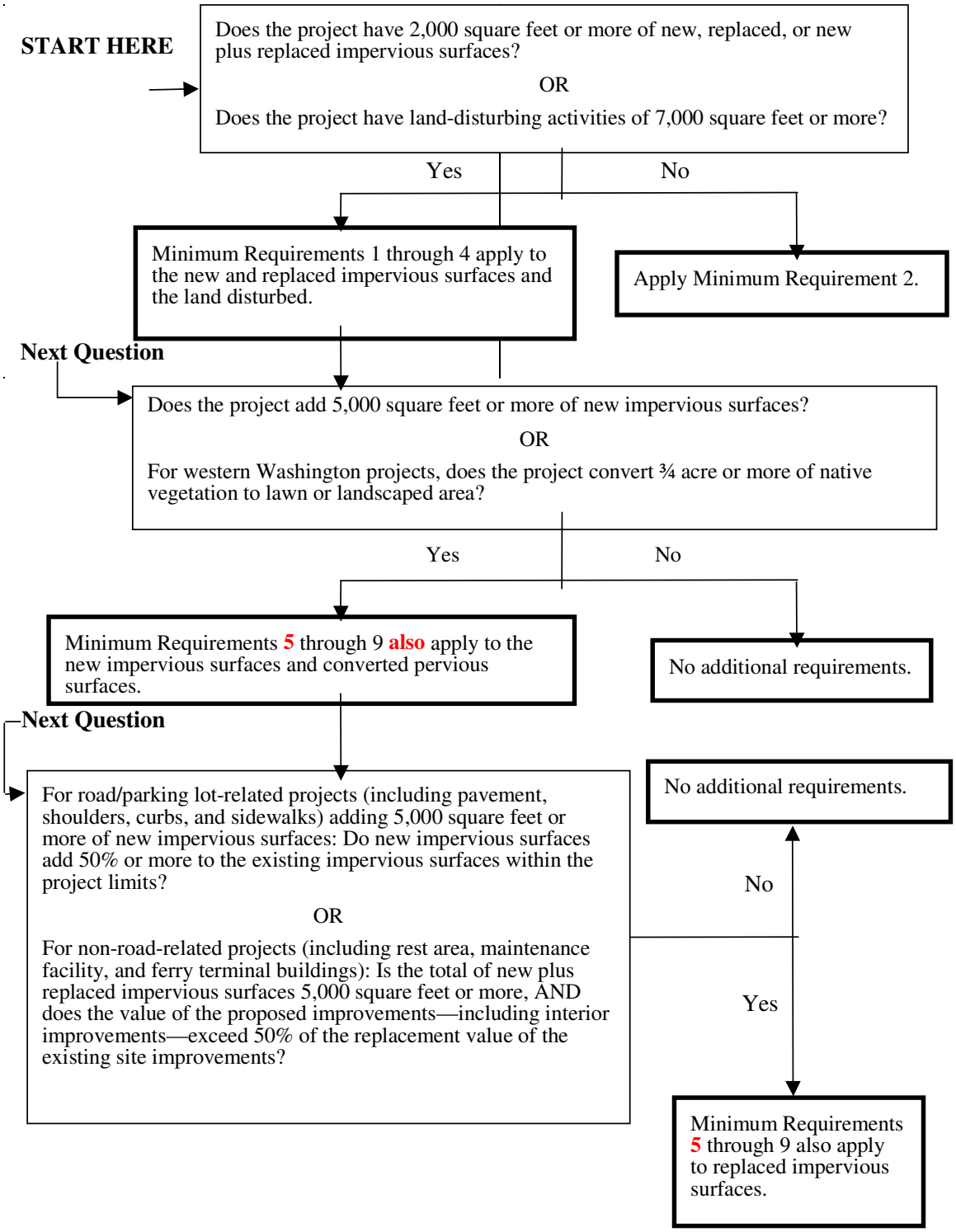


Figure 2.1. Flow chart for evaluating minimum project requirements.

VI. Lesson 6 TDA Delineation Exercise

Lesson 6 – TDA Delineation Exercise – 75 minutes

See Figure 4. Instructor will distribute additional figures as the exercises progress

Watershed Basins - 5 minutes

Project Sub-Basins - 5 minutes

Threshold Discharge Areas (TDAs) - 45 minutes

The TDAs for the Sammamish River basin (Basin "F") will be delineated in this exercise. The instructor will begin by spending approximately 15 minutes delineating TDA-F1 while explaining each step of the process.

TDA F-1 Details – Instructor to delineate and distribute figures. See Figures 8, 9a, 9b, and 9c

TDA-F1 includes an area of highway mainline, the 160th Street interchange and adjacent ROWs. The existing drainage system for TDA-F1 allows runoff to sheet flow off the western edge of the freeway into a roadside ditch. Runoff then flows down gradient, to the north, to collect in catch basins and a pipe network running adjacent to the freeway. Runoff collected in the median also joins this pipe network. Runoff from the eastern side of the freeway sheet flows to a ditch where it joins with runoff from the northbound off-ramp to 160th Street. The flow then runs through a cross culvert near the 160th bridge structure at station 4364+00 (MP 22.60) and joins the pipe network on the western side of the freeway. The flow is then conveyed west through the northwest quadrant of the NE 160th interchange and discharges to a wetland just west of the ROW. Runoff from the northwestern quadrant of the interchange sheet flows to curbs and gutters and is then conveyed to a detention facility. Stormwater flowing from the detention pond joins the freeway runoff and is discharged to a wetland.

This TDA is bound on the south by the Sammamish River basin boundary as it runs across I-405 at station 4385+00 (MP 22.48). Along the east side of the project, TDA-F1 runs along the eastern 116th Ave NE ROW until MP 22.57. The TDA-F1 boundary then crosses 116th Ave NE and the northbound I-405's off-ramp to 160th St. At the southeast corner of the intersection of the northbound onramp and 160th Street, the boundary of TDA-F1 turns and follows 160th Street to the southwest until directly over I-405 (station 9392+20, MP 22.60). TDA-F1 crosses I-405 with a slight northwest direction and hits I-405's western shoulder at MP 22.61. From the western shoulder of I-405, the TDA-F1 boundary heads west and slightly south until the southbound I-405 off-ramp where it intersects the shoulder and turns northeast along the off-ramp. The TDA crosses the off-ramp at station 22.65. The TDA boundary then crosses the northern edge of 115th Ave NE and runs southwest along the western edge of the roadway. TDA-F1 crosses 160th Street at its intersection with 115th Ave NE; it then follows the southern edge of 160th Street until it begins heading south along the southbound I-405 onramp. It follows the onramp until the Sammamish River basin boundary. Runoff to this area is generated almost entirely by roadway surfaces and embankments.

Remaining TDAs – Participants to delineate, See Figures 8, 9a, 9b, and 9c

Quantify Areas and Determine Minimum Requirements - 20 minutes

Instructor will distribute copies of Figures 10, 11a, 11b, and 11c before proceeding.

FC-1: Flow Control.

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
I-405 Project				236 ac
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
I-405 Project				15.8 ac
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
I-405 Project				17 ac
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
To new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

RT-1: Runoff Treatment Tier 2

New Pollution Generating Impervious Surface (PGIS) Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
F-1				
F-2				
F-3				
			New PGIS	

Effective PGIS

Effective PGIS =	New PGIS +	Replace PGIS -	Non-Effective PGIS	
F-1				
F-2				
F-3				
			Effective PGIS	

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response
New PGIS project level		5,000 ft^2		
New PGIS add 50% or more to the existing PGIS within the project limit				
Effective PGIS TDA		5,000 ft^2		
F-1				
F-2				
F-3				
Summary of All Minimum Requirements				

Runoff Treatment targets and applications for roadways Requirement Chart

Treatment Target	Threshold	Project or TDA	Decision Response
Basic Treatment	Min 5 applies		
Enhance Treatment	ADT >30,000		
Oil Control	I/S>15,000ADT or Cross Rd > 25,000 ADT		
Phosphorus Control	List on basin plan or TMDL list		

FC-1: Flow Control Tier 2

Net new impervious Area

Description	New Impervious -	Reverted Impervious	Area (ft^2)
F-1			
F-2			
F-3			
		Net New Impervious	

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
F-1				
F-2				
F-3				
			Replaced Impervious Area	

Effective Impervious

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	
F-1				
F-2				
F-3				
			Effective Impervious	

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response
New impervious project level		5,000 ft^2	1	
New Impervious add 50% or more to the existing impervious within the			1	
Effective Impervious TDA		10,000 ft2	2	
F-1				
F-2				
F-3				
Summary of All Minimum Requirements				

VII. Example Problems

W1-A: Project Thresholds *(Emphasizes gravel and replaced surfaces)*

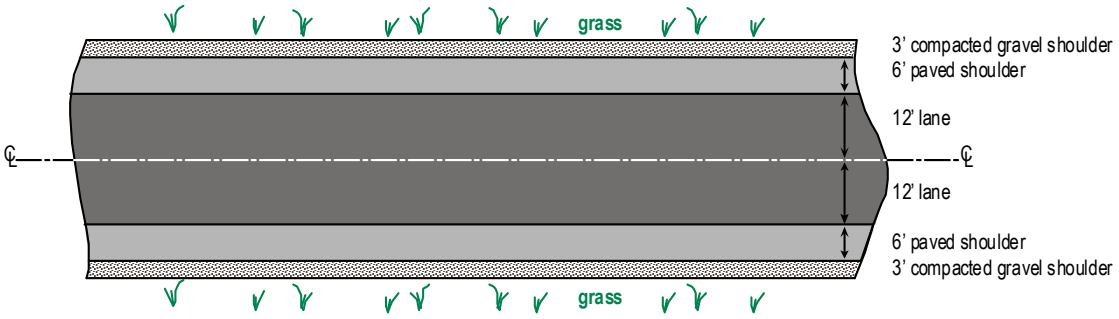
Given:

The existing condition is a two-lane concrete roadway (12-foot lanes) with two 6-foot paved shoulders. There are compacted gravel areas adjacent to the paved shoulders on both sides of the roadway. These areas are 3 feet in width and run the length of the project. The area adjacent to the gravel areas is comprised of grass. Assume the project is within one Threshold Discharge Area (TDA).

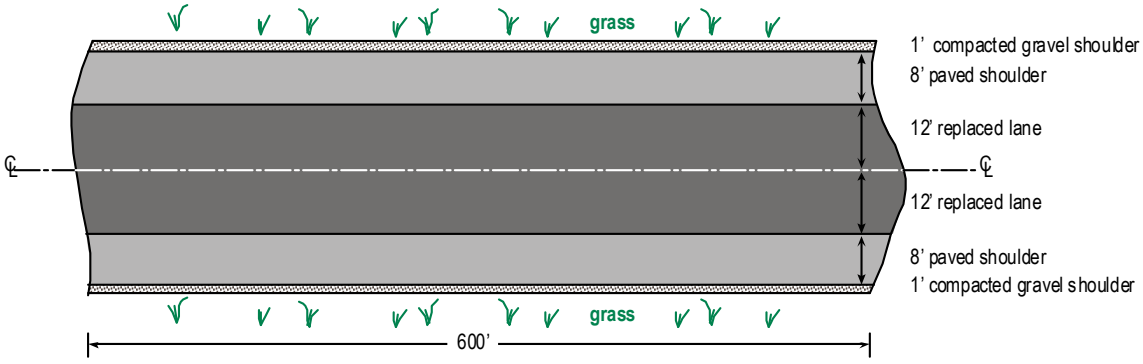
The proposed condition is to pave 2 feet of the adjacent gravel areas on each side of the roadway to make 8-foot shoulders. Also, due to settling problems along the entire length of the project, the roadbed needs to be excavated and repaired and all concrete panels need to be replaced. The project area length covers 600 feet.

Determine which Minimum Requirements apply to this project.

Existing Conditions



Proposed Conditions



Example W1-A: Project Threshold – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing Paved Shoulder				
Existing Gravel Area				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
New Paved Shoulder				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replaced Highway Lanes				
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example W1-A: Project Threshold – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	600	14,400
Existing Paved Shoulder	2	6	600	7,200
Existing Gravel Area	2	3	600	3,600
Existing Impervious Area				**25,200**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
New Paved Shoulder	2	2	600	2,400
New Impervious Area				**2,400**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replaced Highway Lanes	2	12	600	14,400
Replaced Impervious Area				**14,400**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	16,800 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	2,400 ft^2	5,000 ft^2	2	no	
Conversion of Native to Lawn	0	3/4 Acres	2	no	
Summary of All Minimum Requirements			**1-4**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

W1-B: Project Threshold *(Emphasizes land-disturbance and over 50% new impervious surface compared to existing)*

Given:

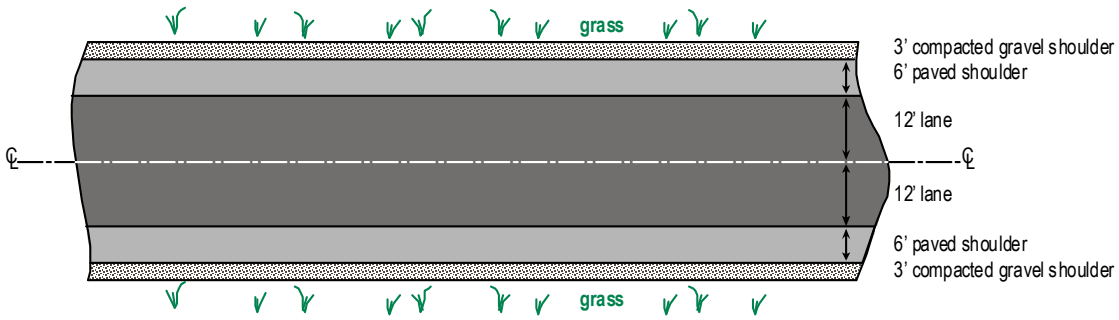
With everything else the same for the previous example, if the project also proposes two 12-foot lanes along the length of the project via symmetrical widening, determine which Minimum Requirements apply to this project.

Assume:

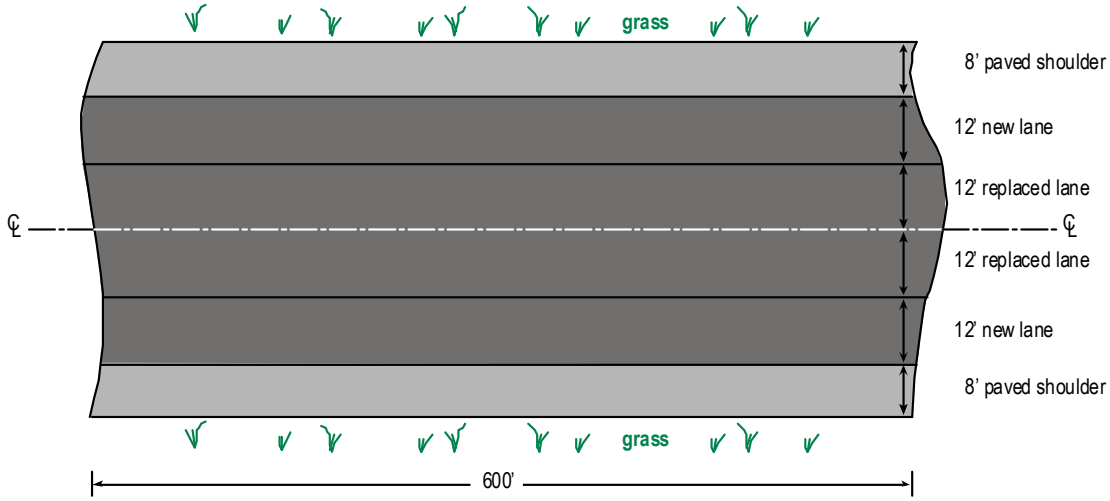
Existing conditions are the same as Example 1-A.

Developed conditions are the same as Example 1-A with the addition of two new 12-foot lanes.

Existing Conditions



Proposed Conditions



Example W1-B: Project Threshold – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing Paved Shoulder				
Existing Gravel Area				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
New Paved Highway Lanes				
New Paved Shoulder				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replaced Highway Lanes				
Replaced Existing Shoulder				
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example W1-B: Project Threshold – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	600	14,400
Existing Paved Shoulder	2	6	600	7,200
Existing Gravel Area	2	3	600	3,600
Existing Impervious Area				**25,200**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
New Paved Highway Lanes	2	6	600	7,200
New Paved Shoulder	2	8	600	9,600
New Impervious Area				**16,800**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replaced Highway Lanes	2	12	600	14,400
Replaced Existing Shoulder	2	6	600	7,200
Replaced Impervious Area				**21,600**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	38,400 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	16,800 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	16800>12600		3	yes	1-9 for replaced surfaces
Summary of All Minimum Requirements			**1-9 for new and replaced surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

RT-1: Runoff Treatment *(Emphasizes PGIS vs NPGIS)*

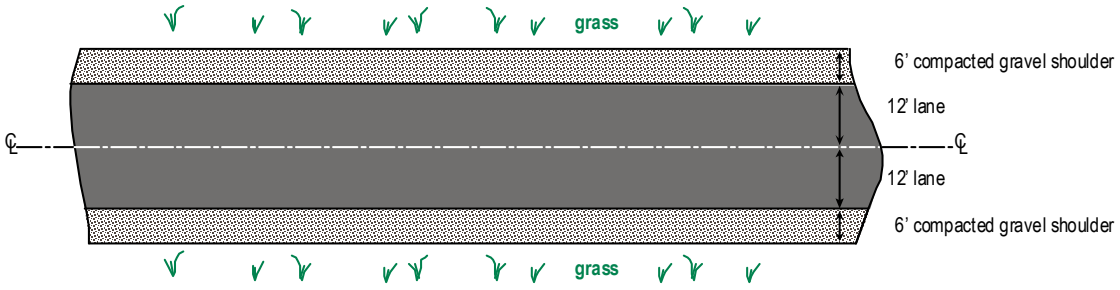
Given:

The existing condition is a two lane concrete highway (12-foot lanes) with 6-foot compacted gravel shoulders on each side. Both sides have grass adjacent to the compacted gravel shoulders. Assume the project is within one threshold discharge area (TDA). The current ADT is 18,000 vpd.

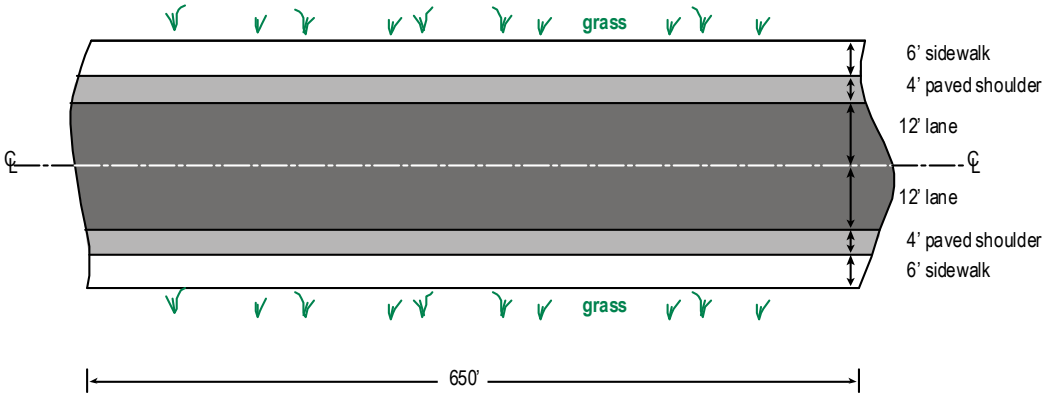
The proposed condition is to add curbs, gutters, and sidewalks to both sides of the roadway. The proposed sidewalks will be 6 feet wide, paved, and will be sloped towards the street. The proposed new shoulders will be paved and will be reduced from 6 feet to 4 feet wide. The project length is 650 feet. Future design year ADT is 28,000 vpd.

Determine if Minimum Requirement #5 (Runoff Treatment) applies to this project. If applicable, which surfaces (new PGIS or new PGIS and replaced PGIS) require runoff treatment? If applicable, which level of runoff treatment is necessary?

Existing Conditions



Proposed Conditions



Example RT1: Runoff Treatment – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing Gravel Shoulder				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to ACP				
Gravel to Sidewalk				
Grass to Sidewalk				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example RT1: Runoff Treatment – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	650	15,600
Existing Gravel Shoulder	2	6	650	7,800
			Existing Impervious Area	**23,400**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to ACP	2	4	650	5,200
Gravel to Sidewalk	2	2	650	2,600
Grass to Sidewalk	2	4	650	5,200
			New Impervious Area	**13,000**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
			Replaced Impervious Area	**0**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	13,000 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	13,000 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	13,000>11,700		3	yes	No replaced surfaces no additional requirements
Summary of All Minimum Requirements			**1-9 for new impervious surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example RT1: Runoff Treatment – Tier 2

STEP 1-New Pollution Generating Impervious Surface (PGIS) Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to ACP				
			New PGIS	

STEP 2-Effective PGIS Area

Effective PGIS =	New PGIS +	Replace PGIS -	Non-Effective PGIS	Area (ft^2)
TD1-Effective PGIS				
			Effective PGIS	

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New PGIS project level		5,000 ft^2			
New PGIS add 50% or more to the existing PGIS within the project limit					
Effective PGIS TDA		5,000 ft^2			
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Runoff Treatment targets and applications for roadways Requirement Chart

Treatment Target	Threshold	Project or TDA	Decision Response
Basic Treatment	Min 5 applies		
Enhance Treatment	ADT >30,000		
Oil Control	I/S>15,000ADT or Cross Rd > 25,000 ADT		
Phosphorus Control	List on basin plan or TMDL list		

Example RT1: Runoff Treatment – Tier 2

STEP 1-New Pollution Generating Impervious Surface (PGIS) Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to ACP	2	4	650	5,200
			New PGIS	**5,200**

STEP 2- Effective PGIS Area

Effective PGIS =	New PGIS +	Replace PGIS -	Non-Effective PGIS	Area (ft^2)
TD1-Effective PGIS	5200	0	0	5,200
			Effective PGIS	**5,200**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New PGIS project level	5,200 ft^2	5,000 ft^2	1	yes	5
New PGIS add 50% or more to the existing PGIS within the project limit	5,200>11,700		1	no	No replaced surfaces no additional requirements
Effective PGIS TDA	5,200 ft^2	5,000 ft^2	2	yes	5
Summary of All Minimum Requirements			**5 for new PGIS and Effective PGIS**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Runoff Treatment targets and applications for roadways Requirement Chart

Treatment Target	Threshold	Project or TDA	Decision Response
Basic Treatment	Min 5 applies	yes	yes
Enhance Treatment	ADT >30,000	ADT 28,000	no
Oil Control	I/S>15,000ADT or Cross Rd > 25,000 ADT	na	no
Phosphorus Control	List on basin plan or TMDL list	na	no

RT-2: Runoff Treatment *(Emphasizes TDA differences, and treatment type)*

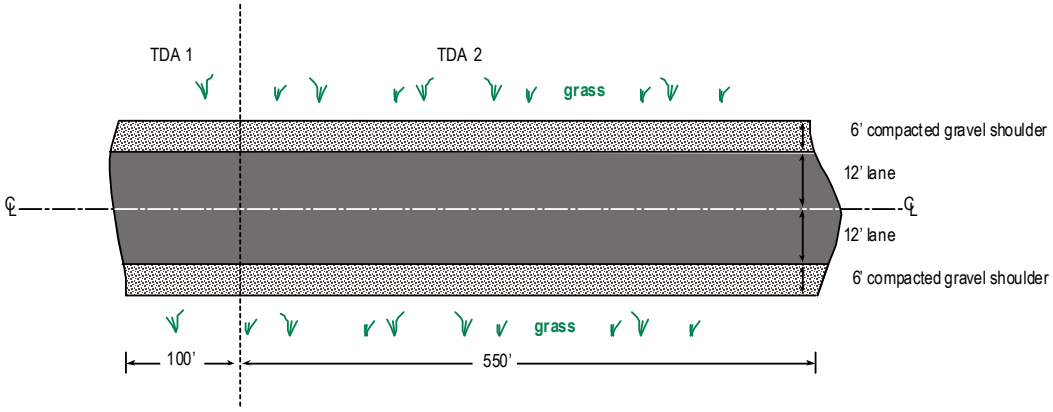
Given:

The existing condition is a two lane concrete highway (12-foot lanes) with 6-foot compacted gravel shoulders on each side. Both sides have grass adjacent to the compacted gravel shoulders. Assume that 100 feet of the project discharges to TDA 1 and 550 feet of the project discharges to TDA 2. The current ADT is 28,000 vpd.

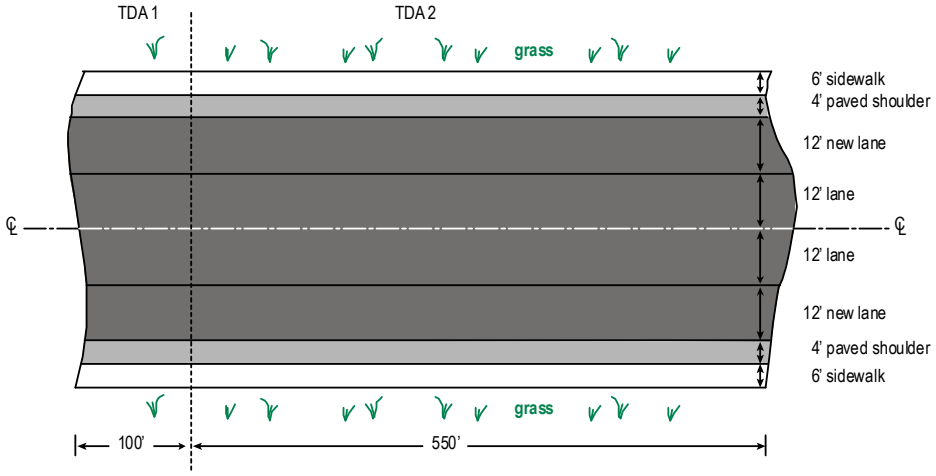
The proposed condition is to add 1 lane (12-foot) in each direction and add curbs, gutters, and sidewalks to both sides of the roadway. The proposed sidewalks will be 6 feet wide, paved, and will be sloped towards the street. The proposed new shoulders will be paved and will be reduced from 6 feet to 4 feet wide. The project length is 650 feet. Future design year ADT is 40,000 vpd.

Determine if Minimum Requirement #5 (Runoff Treatment) applies to this project. If applicable, which surfaces (new PGIS or new PGIS and replaced PGIS) require runoff treatment? If applicable, which level of runoff treatment is necessary?

Existing Conditions



Proposed Conditions



Example RT2: Runoff Treatment – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing Gravel Shoulder				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to Lane				
Grass to Lane				
Grass to Shoulder				
Grass to Sidewalk				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
To new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example RT2: Runoff Treatment – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	650	15,600
Existing Gravel Shoulder	2	6	650	7,800
Existing Impervious Area				**23,400**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to Lane	2	6	650	7,800
Grass to Lane	2	6	650	7,800
Grass to Shoulder	2	4	650	5,200
Grass to Sidewalk	2	6	650	7,800
New Impervious Area				**28,600**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replaced Impervious Area				**0**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	28,600 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	28,600 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	28600>11,700		3	yes	No replaced surfaces no additional requirements
Summary of All Minimum Requirements			**1-9 for new impervious surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example RT2: Runoff Treatment – Tier 2

STEP 1-New Pollution Generating Impervious Surface (PGIS) Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to ACP				
			New PGIS	

STEP 2-Effective PGIS Area

Effective PGIS =	New PGIS +	Replace PGIS -	Non-Effective PGIS	Area (ft^2)
TD1-Effective PGIS				
			Effective PGIS	

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New PGIS project level		5,000 ft^2			
New PGIS add 50% or more to the existing PGIS within the project limit					
Effective PGIS TDA		5,000 ft^2			
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Runoff Treatment targets and applications for roadways Requirement Chart

Treatment Target	Threshold	Project or TDA	Decision Response
Basic Treatment	Min 5 applies		
Enhance Treatment	ADT >30,000		
Oil Control	I/S>15,000ADT or Cross Rd > 25,000 ADT		
Phosphorus Control	List on basin plan or TMDL list		

Example RT2: Runoff Treatment – Tier 2

STEP 1-New Pollution Generating Impervious Surface (PGIS) Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to Lane	2	6	650	7,800
Grass to Lane	2	6	650	7,800
Grass to Shoulder	2	4	650	5,200
			New PGIS	**20,800**

STEP 2- Effective PGIS Area

Effective PGIS =	New PGIS +	Replace PGIS -	Non-Effective PGIS	Area (ft^2)
TD1-Effective PGIS	3200	0	0	3,200
TD2-Effective PGIS	17600	0	0	17,600
			Effective PGIS	**20,800**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New PGIS project level	20,800 ft^2	5,000 ft^2	1	yes	5
New PGIS add 50% or more to the existing PGIS within the project limit	20,800>11,700		1	yes	5 applies new and replaced PGIS in TDA 2
Effective PGIS TDA1	3,200 ft^2	5,000 ft^2	2	no	no min 5 on TDA1
Effective PGIS TDA2	17,600 ft^2	5,000 ft^2	2	yes	5
Summary of All Minimum Requirements			**5 for new PGIS and Effective PGIS in TDA 2 only**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Runoff Treatment targets and applications for roadways Requirement Chart

Treatment Target	Threshold	Project or TDA	Decision Response
Basic Treatment	Min 5 applies	yes TDA 2	yes to TDA2, no TDA 1
Enhance Treatment	ADT >30,000	ADT 32,000	yes to TDA2, no TDA 1
Oil Control	I/S>15,000ADT or Cross Rd > 25,000 ADT	na	no
Phosphorus Control	List on basin plan or TMDL list	na	no

RT-3: Runoff Treatment *(Emphasizes Replaced PGIS and effective PGIS)*

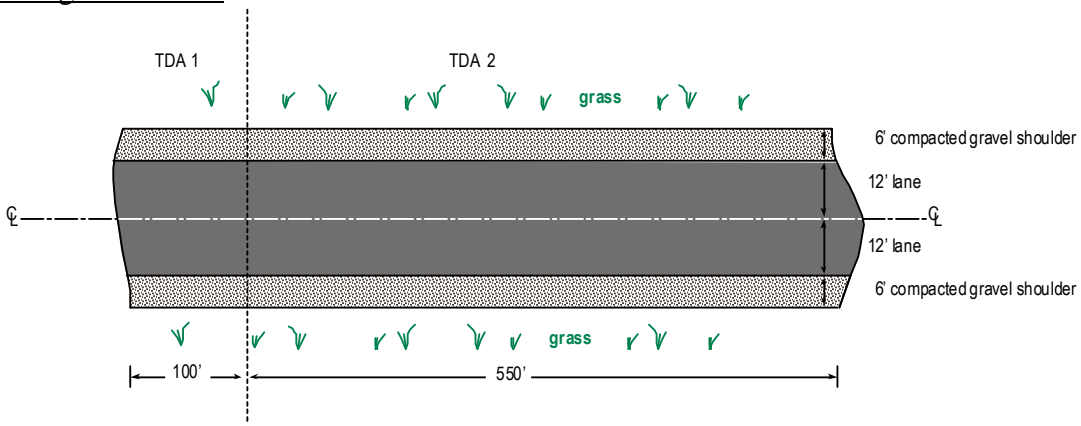
Given:

The existing condition is a two lane concrete highway (12-foot lanes) with 6-foot compacted gravel shoulders on each side. Both sides have grass adjacent to the compacted gravel shoulders. Assume that 100 feet of the project discharges to TDA 1 and 550 feet of the project discharges to TDA 2. The current ADT is 28,000 vpd.

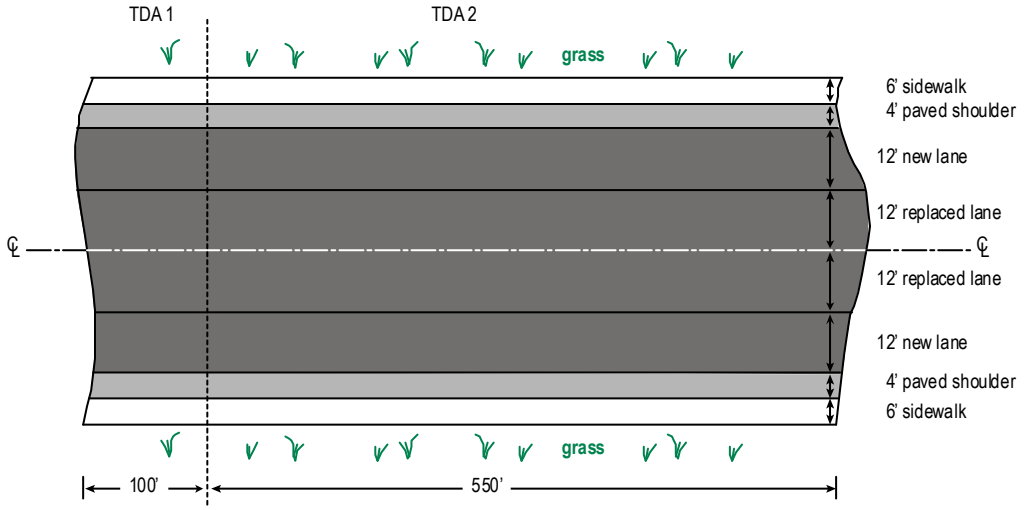
The proposed condition is to add 1 lane (12-foot) in each direction and add curbs, gutters, and sidewalks to both sides of the roadway. The proposed sidewalks will be 6 feet wide, paved, and will be sloped towards the street. The proposed new shoulders will be paved and will be reduced from 6 feet to 4 feet wide. All existing concrete panels within the project limits will be replaced due to cracking. The project length is 650 feet. Future design year ADT is 40,000 vpd.

Determine if Minimum Requirement #5 (Runoff Treatment) applies to this project. If applicable, which surfaces (new PGIS or new PGIS and replaced PGIS) require runoff treatment? If applicable, which level of runoff treatment is necessary?

Existing Conditions



Proposed Conditions



Example RT3: Runoff Treatment – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing Gravel Shoulder				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to Lane				
Grass to Lane				
Grass to Shoulder				
Grass to Sidewalk				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replace Concrete Panels (to base course)				
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example RT3: Runoff Treatment – Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	650	15,600
Existing Gravel Shoulder	2	6	650	7,800
Existing Impervious Area				**23,400**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to Lane	2	6	650	7,800
Grass to Lane	2	6	650	7,800
Grass to Shoulder	2	4	650	5,200
Grass to Sidewalk	2	6	650	7,800
New Impervious Area				**28,600**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replace Concrete Panels (to base course)	2	12	650	15,600
Replaced Impervious Area				**15,600**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	44,200 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	28,600 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	28600>11700		3	yes	1-9 on replaced surfaces
Summary of All Minimum Requirements			**1-9 on new and replaced surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example RT3: Runoff Treatment – Tier 2

STEP 1-New Pollution Generating Impervious Surface (PGIS) Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to Lane				
Grass to Lane				
Grass to Shoulder				
			New PGIS	

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replace Concrete Panels (to base course)				
			Replaced Impervious Area	

STEP 2- Effective PGIS Area

Effective PGIS =	New PGIS +	Replace PGIS -	Non-Effective PGIS	Area (ft^2)
TD1-Effective PGIS				
TD2-Effective PGIS				
			Effective PGIS	

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New PGIS project level		5,000 ft^2	1		
New PGIS add 50% or more to the existing PGIS within the project limit			1		
Effective PGIS TDA1		5,000 ft^2	2		
Effective PGIS TDA2		5,000 ft^2	2		
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Runoff Treatment targets and applications for roadways Requirement Chart

Treatment Target	Threshold	Project or TDA	Decision Response
Basic Treatment	Min 5 applies		
Enhance Treatment	ADT >30,000		
Oil Control	I/S>15,000ADT or Cross Rd > 25,000 ADT		
Phosphorus Control	List on basin plan or TMDL list		

Example RT3: Runoff Treatment – Tier 2

STEP 1-New Pollution Generating Impervious Surface (PGIS) Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Gravel to Lane	2	6	650	7,800
Grass to Lane	2	6	650	7,800
Grass to Shoulder	2	4	650	5,200
			New PGIS	**20,800**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Replace Concrete Panels (to base course)	2	12	650	15,600
			Replaced Impervious	**15,600**

STEP 2- Effective PGIS Area

Effective PGIS =	New PGIS +	Replace PGIS -	Non-Effective PGIS	Area (ft^2)
TD1-Effective PGIS	3200	2400	0	5,600
TD2-Effective PGIS	17600	13200	0	30,800
			Effective PGIS	**36,400**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New PGIS project level	20,800 ft^2	5,000 ft^2	1	yes	5
New PGIS add 50% or more to the existing PGIS within the project limit	20,800>11,700		1	yes	5 applies new and replaced PGIS in TDA 1&2
Effective PGIS TDA1	5,600 ft^2	5,000 ft^2	2	yes	yes min 5 to TDA1
Effective PGIS TDA2	30,800 ft^2	5,000 ft^2	2	yes	yes min 5 to TDA2
Summary of All Minimum Requirements			**5 for new PGIS and Effective PGIS in TDA 1&2**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Runoff Treatment targets and applications for roadways Requirement Chart

Treatment Target	Threshold	Project or TDA	Decision Response
Basic Treatment	Min 5 applies	yes TDA 1&2	yes to TDA1&2
Enhance Treatment	ADT >30,000	ADT 40,000	yes to TDA1&2
Oil Control	I/S>15,000ADT or Cross Rd > 25,000 ADT	na	no
Phosphorus Control	List on basin plan or TMDL list	na	no

FC-1: Flow Control

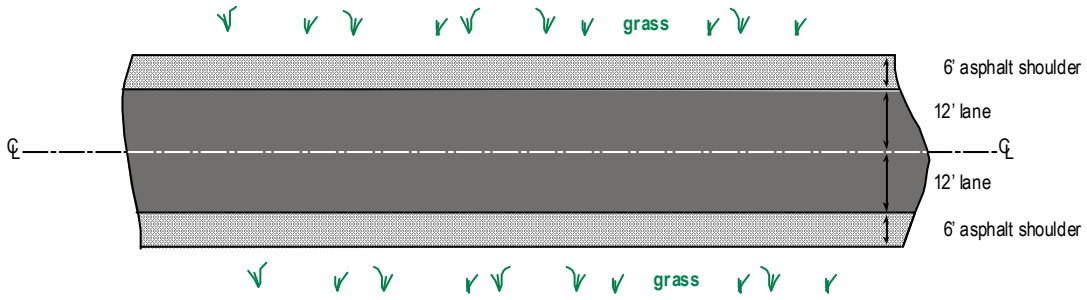
Given:

The existing condition is a two lane concrete highway (12-foot lanes) with 6-foot asphalt shoulders on each side. Both sides have grass adjacent to the shoulders. Due to settlement problems, the existing shoulders need to be excavated and rebuilt. Assume the project is within one threshold discharge area (TDA).

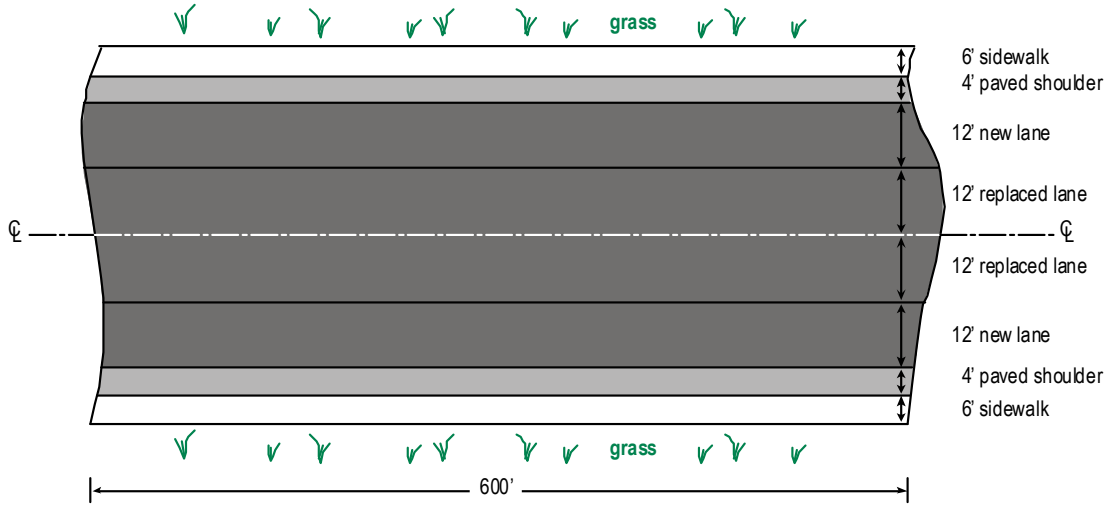
The proposed condition is add an additional 12-foot concrete lane in each direction along with curb, gutter, and sidewalks to both sides of the roadway. The proposed sidewalks will be 6 feet wide, paved, and will be sloped towards the street. The proposed new shoulders will be paved and will be reduced from 6 feet to 4 feet wide. The project length is 600 feet.

Determine if Minimum Requirement 6 (Flow Control) applies to this project. If applicable, which surfaces require flow control? Assume no flow control exemption can apply to the project.

Existing Conditions



Proposed Conditions



Example FC1: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing ACP Shoulder				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
Grass to Sidewalk				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC1: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	600	14,400
Existing ACP Shoulder	2	6	600	7,200
Existing Impervious Area				**21,600**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	4	600	4,800
Grass to Sidewalk	2	6	600	7,200
New Impervious Area				**19,200**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
Replaced Impervious Area				**7,200**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	26,400 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	19,200 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	19,200>10,800		3	yes	1-9 for replaced surfaces
Summary of All Minimum Requirements			**1-9 for new and replaced surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC1: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
Grass to Sidewalk				
			Net new Impverious	**0**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
			Replaced Impervious	**0**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	Area (ft^2)
TD1-Effective Impervious				
*Net new imperverious = new impervious -reverted impervious				
			Effective Impervious	**0**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New impervious project level		5,000 ft^2	1		
New Impervious add 50% or more to the existing impervious within the project limit			1		
Effective Impervious TDA1		10,000 ft^2	2		
West Wa -Land coversion> 3/4 acrea		3/4 acre	2		
West Wa- Increase in 100yr MRI >0.1cfs		0.1 cfs	2		
	Summary of All Minimum Requirements				

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC1: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	4	600	4,800
Grass to Sidewalk	2	6	600	7,200
			Net new Impervious	**19,200**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
			Replaced Impervious	**7,200**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	Area (ft^2)
TD1-Effective Impervious	19200	7200	0	26,400
*Net new imperverious = new impervious -reverted impervious				
			Effective Impervious	**26,400**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New impervious project level	19,200 ft^2	5,000 ft^2	1	yes	6
New Impervious add 50% or more to the existing impervious within the project limit	19,200>10,800		1	yes	6 applies new and replaced impervious in TDA 1
Effective Impervious TDA1	26,400 ft^2	10,000 ft^2	2	yes	yes min 6 to TDA1
West Wa -Land coversion> 3/4 acrea	0	3/4 acre	2	no	trigger above
West Wa- Increase in 100yr MRI >0.1cfs	0	0.1 cfs	2	no	trigger above
Summary of All Minimum Requirements			**6 for Net new and Effective Impervious in TDA 1**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

FC-2: Flow Control *(Reverted and net-new impervious)*

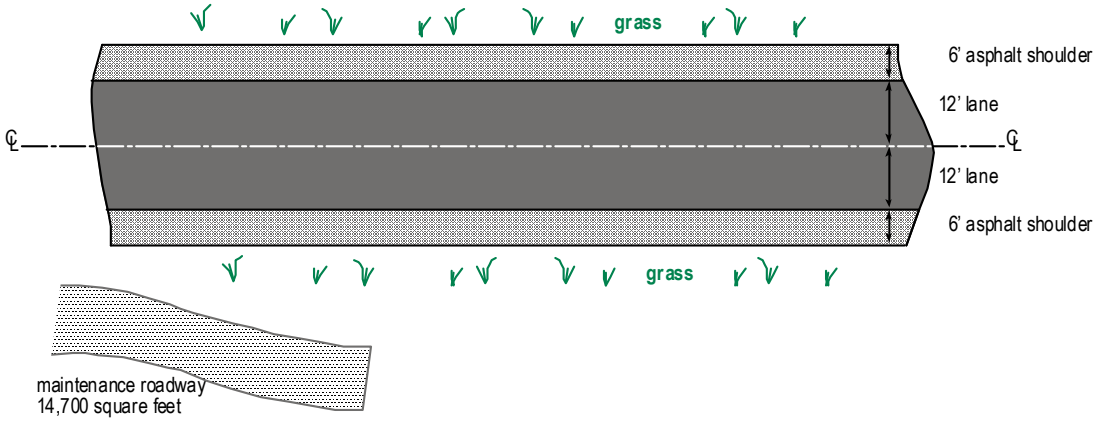
Given:

The existing condition is a two lane concrete highway (12-foot lanes) with 6-foot asphalt shoulders on each side. Both sides have grass adjacent to the shoulders. Due to settlement problems, the existing shoulders need to be excavated and rebuilt. Assume the project is within one threshold discharge area (TDA).

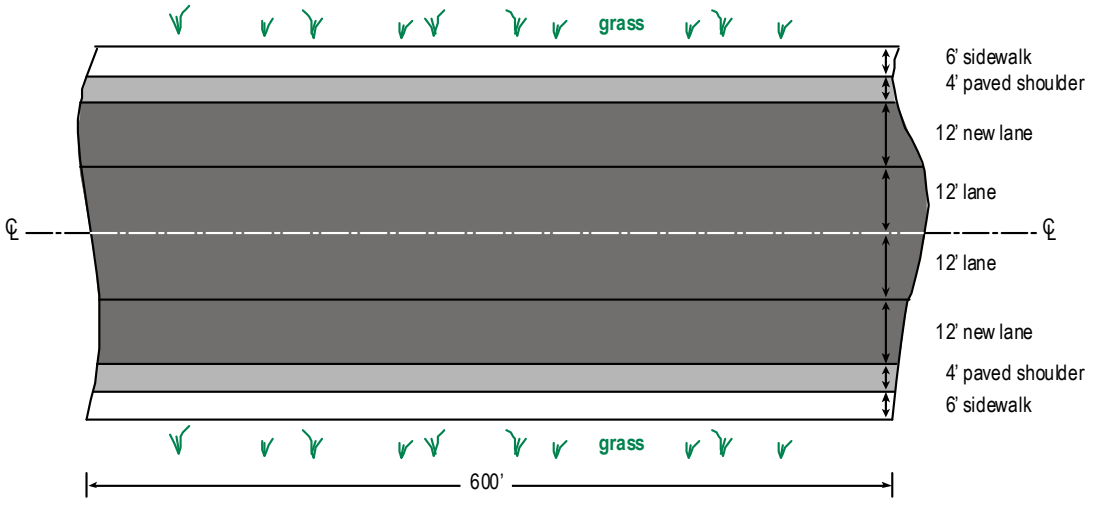
The proposed condition is to add an additional 12-foot concrete lane in each direction along with curb, gutter, and sidewalks to both sides of the roadway. The proposed sidewalks will be 6 feet wide, paved, and will be sloped towards the street. The proposed new shoulders will be paved and will be reduced from 6 feet to 4 feet wide. The project length is 600 feet. A maintenance roadway will be removed and reverted back to a pervious condition per HRM Appendix 5-A. The area of the roadway is 14,700 sf.

Determine if Minimum Requirement 6 (Flow Control) applies to this project. If applicable, which surfaces require flow control? Assume no flow control exemption can apply to the project.

Existing Conditions



Proposed Conditions



Example FC2: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing ACP Shoulder				
Maintenance Road				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
Grass to Sidewalk				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
Replaced Impervious Area				

Reverted Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Mainteance road to pervious surface				
Reverted Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC2: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	600	14,400
Existing ACP Shoulder	2	6	600	7,200
Maintenance Road				14,700
Existing Impervious Area				**36,300**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	4	600	4,800
Grass to Sidewalk	2	6	600	7,200
New Impervious Area				**19,200**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
eplaced Impervious Area				**7,200**

Reverted Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Maintenace road to pervious				14,700
Replaced Impervious Area				**14,700**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	26,400 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	19,200 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	19,200>18,150		3	yes	1-9 replaced surfaces
Summary of All Minimum Requirements			**1-9 for new and replaced surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC2: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
Grass to Sidewalk				
			Net new Impervious	**0**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
			Replaced Impervious	**0**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	Area (ft^2)
TD1-Effective Impervious				
*Net new imperverious = new impervious -reverted impervious				
			Effective Impervious	**0**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New impervious project level		5,000 ft^2	1		
New Impervious add 50% or more to the existing impervious within the project limit			1		
Effective Impervious TDA1		10,000 ft^2	2		
West Wa -Land coversion> 3/4 acrea		3/4 acre	2		
West Wa- Increase in 100yr MRI >0.1cfs		0.1 cfs	2		
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC2: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	4	600	4,800
Grass to Sidewalk	2	6	600	7,200
			Net new Impervious	**19,200**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
			Replaced Impervious	**7,200**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	on-Effective Impervio	Area (ft^2)
TD1-Effective Impervious	19200-14700	7200	0	11,700
*Net new imperverious = new impervious -reverted impervious				
			Effective Impervious	**11,700**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
Net new impervious project level	19,200 ft^2	5,000 ft^2	1	yes	6
New Impervious add 50% or more to the existing impervious within the project limit	19,200>18,150		1	yes	6 applies new and replaced impervious in TDA 1
Effective Impervious TDA1	11,700 ft^2	10,000 ft^2	2	yes	yes min 6 to TDA1
West Wa -Land coversion> 3/4 acrea	0	3/4 acre	2	no	trigger above
West Wa- Increase in 100yr MRI >0.1cfs	0	0.1 cfs	2	no	trigger above
Summary of All Minimum Requirements			**6 for Net new and Effective Impervious in TDA 1**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

FC-3: Flow Control *(Emphasizes non-effective impervious)*

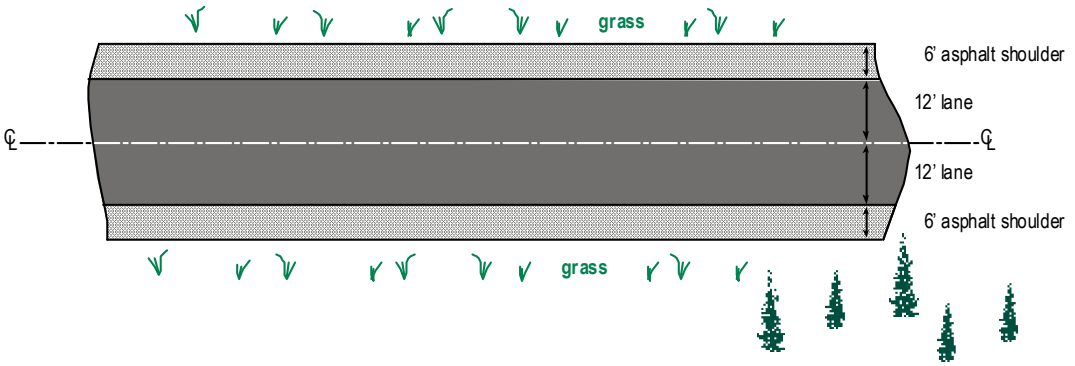
Given:

The existing condition is a two lane concrete highway (12-foot lanes) with 6-foot asphalt shoulders on each side. Both sides have grass adjacent to the shoulders. Due to settlement problems, the existing shoulders need to be excavated and rebuilt. Assume the project is within one threshold discharge area (TDA).

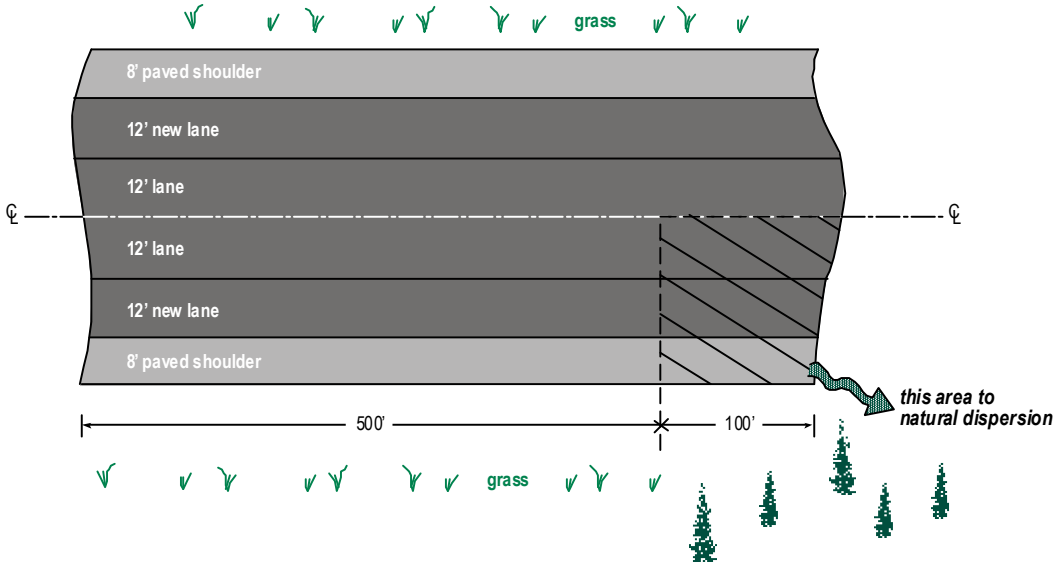
The proposed condition is to add an additional concrete lane in each direction. The proposed new shoulders will be paved and will be increased from 6 to 8 feet wide. At one end of the project, 100 linear ft of the project flows into an area meeting the natural dispersion criteria in Chapter 5 of the HRM. The pavement area going to natural dispersion is 100 feet long and includes one existing lane, one new lane, and the new shoulder. The total project length is 600 feet.

Determine if Minimum Requirement 6 (Flow Control) applies to this project. If applicable, which surfaces require flow control? Assume no flow control exemption can apply to the project.

Existing Conditions



Proposed Conditions



Example FC3: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing ACP Shoulder				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC3: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	600	14,400
Existing ACP Shoulder	2	6	600	7,200
			Existing Impervious Area	**21,600**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	8	600	9,600
			New Impervious Area	**16,800**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
			Replaced Impervious Area	**7,200**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	24,000 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	16,800 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	16,800>10,800		3	yes	1-9 for replaced surfaces
Summary of All Minimum Requirements			**1-9 for new and replaced surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC3: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
Grass to Sidewalk				
			Net new Impervious	**0**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
			Replaced Impervious	**0**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	Area (ft^2)
TD1-Effective Impervious				
*Net new imperverious = new impervious -reverted impervious				
**Non-Effective impervious = 100x32=3200				
			Effective Impervious	**0**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New impervious project level		5,000 ft^2	1		
New Impervious add 50% or more to the existing impervious within the project limit			1		
Effective Impervious TDA1		10,000 ft^2	2		
West Wa -Land coversion> 3/4 acrea		3/4 acre	2		
West Wa- Increase in 100yr MRI >0.1cfs		0.1 cfs	2		
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC3: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	8	600	9,600
			Net new Impervious	**16,800**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
			Replaced Impervious	**7,200**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	Area (ft^2)
TD1-Effective Impervious	16800	7200	3200	20,800
*Net new imperverious = new impervious -reverted impervious				
**Non-Effective impervious = 100x32=3200				
			Effective Impervious	**20,800**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New impervious project level	16,800 ft^2	5,000 ft^2	1	yes	6
New Impervious add 50% or more to the existing impervious within the project limit	16,800>10,800		1	yes	6 applies new and replaced impervious in TDA1
Effective Impervious TDA1	20,800 ft^2	10,000 ft^2	2	yes	yes min 6 to TDA1
West Wa -Land coversion> 3/4 acrea	0	3/4 acre	2	no	trigger above
West Wa- Increase in 100yr MRI >0.1cfs	0	0.1 cfs	2	no	trigger above
Summary of All Minimum Requirements			**6 for Net new and Effective Impervious in TDA 1**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

FC-4: Flow Control *(Emphasizes effective impervious for TDA's)*

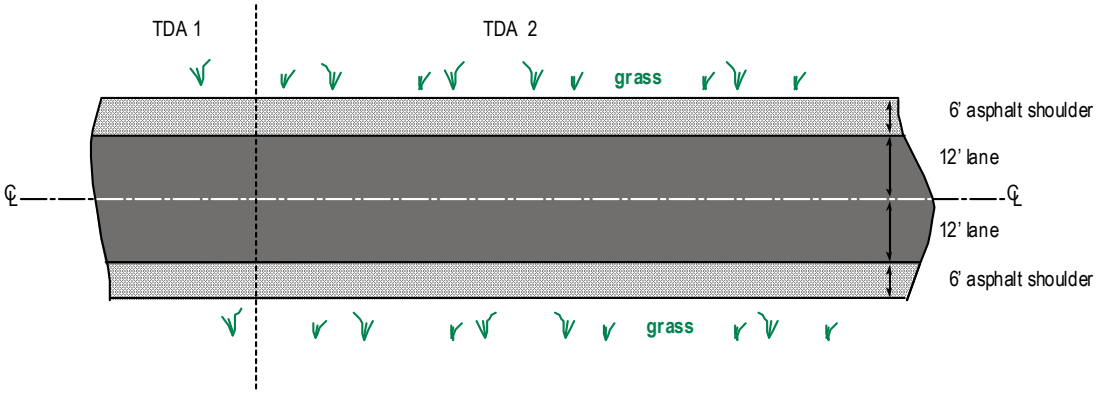
Given:

The existing condition is a two lane concrete highway (12-foot lanes) with 6-foot asphalt shoulders on each side. Both sides have grass adjacent to the shoulders. Due to settlement problems, the existing shoulders need to be excavated and rebuilt. 100 ft of the project flows into TDA 1 while 500 ft of the project flows into TDA 2.

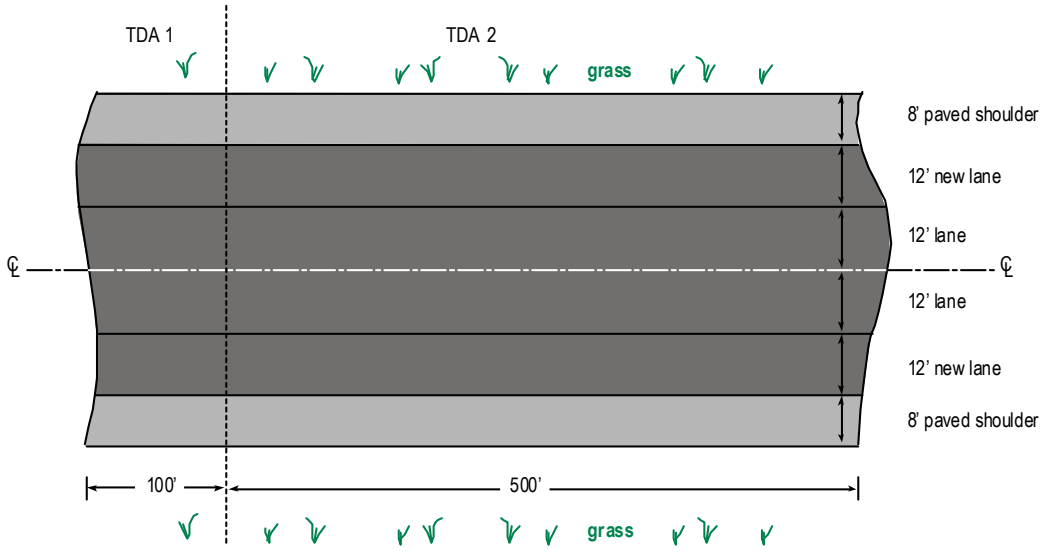
The proposed condition is to add an additional concrete lane in each direction. The proposed new shoulders will be paved and will be increased from 6 to 8 feet wide. The project length is 600 feet.

Determine if Minimum Requirement 6 (Flow Control) applies to this project. If applicable, which surfaces require flow control? Assume no flow control exemption can apply to the project.

Existing Conditions



Proposed Conditions



Example FC4: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes				
Existing ACP Shoulder				
Existing Impervious Area				

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
New Impervious Area				

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
Replaced Impervious Area				

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface		2,000 ft^2			
Land Disturbing Activities		7,000 ft^2			
New Impervious Surface Added		5,000 ft^2			
Conversion of Native to Lawn		3/4 Acres			
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit					
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC4: Flow Control– Tier 1

Existing Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Existing Paved Highway lanes	2	12	600	14,400
Existing ACP Shoulder	2	6	600	7,200
			Existing Impervious Area	**21,600**

New Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	8	600	9,600
			New Impervious Area	**16,800**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
			Replaced Impervious Area	**7,200**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Flow Chart	Decision Response	Minimum Requirements
New and Replace Impervious Surface	24,000 ft^2	2,000 ft^2	1	yes	1-4
Land Disturbing Activities	0 ft^2	7,000 ft^2	1	no	trigger above
New Impervious Surface Added	16,800 ft^2	5,000 ft^2	2	yes	1-9
Conversion of Native to Lawn	0	3/4 Acres	2	no	trigger above
Do new impervious surfaces add 50% or more to the existing impervious surfaces within the project limit	16,800>10,800		3	yes	1-9 for replaced surfaces
Summary of All Minimum Requirements			**1-9 for new and replaced surfaces**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC4: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane				
Grass to ACP Shoulder				
Grass to Sidewalk				
			Net new Impervious	**0**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane				
			Replaced Impervious	**0**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	Area (ft^2)
TD1-Effective Impervious				
TD2-Effective Impervious				
			Effective Impervious	**0**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New impervious project level		5,000 ft^2	1		
New Impervious add 50% or more to the existing impervious within the project limit			1		
Effective Impervious TDA1		10,000 ft^2	2		
Effective Impervious TDA2		10,000 ft^2	2		
West Wa -Land coversion> 3/4 acrea		3/4 acre	2		
West Wa- Increase in 100yr MRI >0.1cfs		0.1 cfs	2		
Summary of All Minimum Requirements					

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

Example FC4: Flow Control– Tier 2

STEP 1-Net new Imprevious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
Grass to PCCP Lane	2	6	600	7,200
Grass to ACP Shoulder	2	8	600	9,600
			Net new Impervious	**16,800**

Replaced Impervious Area

Description	Lanes			Area (ft^2)
	Number	Width(ft)	Length(ft)	
ACP shoulder to PCCP Lane	2	6	600	7,200
			Replaced Impervious	**7,200**

STEP 2- Effective Impervious Area

Effective Impervious =	Net New Impervious +	Replace -	Non-Effective Impervious	Area (ft^2)
TD1-Effective Impervious	2800	1200	0	4,000
TD2-Effective Impervious	14000	6000	0	20,000
			Effective Impervious	**24,000**

Minimum Requirement Chart

Description	Surface Area	Threshold Area	Step Decision Box	Decision Response	Minimum Requirements
New impervious project level	16,800 ft^2	5,000 ft^2	1	yes	6
New Impervious add 50% or more to the existing impervious within the project limit	16,800>10,800		1	yes	6 applies new and replaced impervious in TDA 1
Effective Impervious TDA1	4,000 ft^2	10,000 ft^2	2	no	no min 6 to TDA1
Effective Impervious TDA2	20,000 ft^2	10,000 ft^2	2	yes	yes min 6 to TDA2
West Wa -Land coversion> 3/4 acrea	0	3/4 acre	2	no	trigger above
West Wa- Increase in 100yr MRI >0.1cfs	0	0.1 cfs	2	no	trigger above
Summary of All Minimum Requirements			**6 for Net new and Effective Impervious in TDA 2 only**		

MR #	Minimum Requirements	MR #	Minimum Requirements
1	Stormwater Planning	6	Flow Control (Quantity)
2	Construction Stormwater Pollution	7	Wetland Protection
3	Source Control of Pollutants	8	Incorporating Watershed-Based/Basin
4	Maintaining the Natural Drainage	9	Operations and Maintenance
5	Runoff Treatment (quality)		

VIII. Terminology and Abbreviations

Converted pervious surface: Land cover changed from native vegetation to lawn, landscape, or pasture.

Cubic feet per second (cfs).

Effective impervious surface: An impervious surface that is connected via sheet flow or discrete conveyance to a drainage system. Runoff is considered ineffective in certain applications if it is dispersed through at least 100 feet of native vegetation.

Effective pollution generating impervious surface (PGIS): For a particular TDA, the new PGIS plus applicable replaced PGIS minus those new PGIS and applicable replaced PGIS areas that are non-effective PGIS.

Equivalent area: An existing impervious surface area for which stormwater runoff treatment and flow control can be provided in place of treatment and flow control for an area of new impervious surface. Equivalent means equal in size, located in the same drainage basin, and having similar characteristics (e.g., average daily traffic [ADT]).

Existing roadway prism: The limit of embankment or excavation work required to construct the roadway. This limit is further defined as the catch point of a cut or fill with the existing ground.

Impervious surface: A hard surface area that either prevents or retards the entry of water into the soil mantle as occurs under natural conditions (prior to development), and from which water runs off at an increased rate of flow or in increased volumes. Common impervious surfaces include but are not limited to rooftops, walkways, parking lots, gravel roads, and concrete or asphalt paving.

Land-disturbing activity: Any activity that results in a movement of earth or a change in the existing soil cover or the existing soil topography, including but not limited to clearing, grading, filling, compaction, and excavating.

Low-impact development (LID): An evolving approach to land development and stormwater management that uses a site's natural features and specially designed BMPs to manage stormwater; involves assessing and understanding the site, protecting native vegetation and soils, and minimizing stormwater at the source. Low-impact development practices are appropriate for a variety of development types.

National Pollutant Discharge Elimination System (NPDES): The part of the federal Clean Water Act that requires point source dischargers to obtain permits, called NPDES permits, which in Washington state are administered by the Department of Ecology.

Native vegetation: Vegetation consisting of plant species other than noxious weeds that are indigenous to the region and that reasonable could be expected to occur naturally on the site.

Net-new impervious surface: The total area of new impervious surface being added to the TDA minus the total area of reverted impervious surface in the TDA. The reverted impervious surface area must meet the criteria specified in "Reversion of Existing Impervious Surface Areas" Section 4-3.6.1. The concept of net-new impervious surface

only applies at the threshold discharge area level for Minimum Requirement 6 (Flow Control).

New impervious surfaces: Those surfaces that expand the existing roadway prism and those surfaces that are upgraded from gravel to bituminous surface treatment (BST), asphalt, or concrete pavement. For the purpose of conducting a flow control analysis, the representative predeveloped land cover directly below the new impervious surface shall be based on the predominant land cover adjacent to the existing roadway prism.

Non-effective impervious surfaces: Those new, applicable replaced, or existing impervious surfaces that are being managed by dispersion areas meeting the dispersion BMP criteria in the HRM. The equivalent area concept generally applies to engineered dispersion areas and may apply to natural dispersion areas (as described in the following): The existing site currently collects runoff in a ditch or pipe and discharges it to a surface water. By changing this condition to a natural dispersion situation through sheet flow or channelized flow dispersion, a surface discharge is eliminated resulting in a flow control improvement. Equivalent area trades for natural dispersion are allowed for this specific case.

Non-effective pollution-generating impervious surface (PGIS): Those new, applicable replaced, or existing PGIS surfaces that are being managed by dispersion areas meeting the dispersion BMP criteria in the *Highway Runoff Manual*. The equivalent area concept generally applies to engineered dispersion areas and may apply to natural dispersion areas, as described in the following: The existing site currently collects runoff in a ditch or pipe and discharges to a surface water. By changing this condition to a natural dispersion situation through sheet flow or channelized flow dispersion, a surface discharge is eliminated resulting in a flow control improvement. Equivalent area trades for natural dispersion are allowed for this specific case.

Non-pollution generating impervious surface (NPGIS): A surface that, based on its use, is an insignificant or low source of pollutants in stormwater runoff; for example, roofs that are subject only to atmospheric deposition or have normal heating, ventilation, and air conditioning vents; paved bicycle pathways and pedestrian sidewalks that are separated from and not subject to drainage from roads for motor vehicles; fenced fire lanes; infrequently used maintenance access roads; and in-slope areas of roads. Sidewalks that are regularly treated with salt or other deicing chemicals are not considered non-pollution generating impervious surfaces.

Non-road related project: A project involving structures, including rest areas, maintenance facilities, and ferry terminal buildings.

Pollution-generating impervious surface (PGIS): An impervious surface that is considered a significant source of pollutants in stormwater runoff, including surfaces that receive direct rainfall and are subject to vehicular use, industrial activities, or storage of erodable or leachable materials or those with chemicals or substances that measurably alter the physical or chemical characteristics of the rainfall runoff.

Pollution-generating pervious surface (PGPS): Any nonimpervious surface subject to the ongoing use of pesticides and fertilizers or loss of soil, such as lawns, landscaped areas, golf courses, parks, cemeteries, and sports fields.

Project limits: For road projects, the beginning project station to the end project station and from right-of-way line to right-of-way line. For non-road projects, the legal boundaries of land parcels that are subject to project development.

Replaced impervious surface: Those roadway areas that are excavated to a depth at or below the top of the crushed surfacing directly below the pavement layer (ACP, PCCP, and BST) and replaced in kind. Pavement repair work is excluded from this definition if it falls under the stipulations of HRM 2-2.2. If the removal and replacement of existing pavement does not go below the pavement layer, as with typical PCCP grinding, ACP planing, or "paver" projects, the new surfacing is not considered "replaced impervious surface." A new impervious surface that overlaps another impervious surface is also considered a replaced impervious surface. An example of this type of replaced impervious surface is where a new elevated roadway, ramp, or structure flies over another impervious surface where the new elevated impervious surface will receive rainfall. Another example would be where a project proposes to raise the roadway profile or prism. Those surfaces which are overlapped and do not receive rainfall should not be counted towards thresholds for determining Minimum Requirements in the HRM. For the purpose of conducting a flow control analysis, the representative predeveloped land cover of the replaced impervious surface shall be based on the predominant land cover adjacent to the existing roadway prism.

Reverted impervious surface: Taking an existing impervious surface and changing it into a pervious surface. This concept only applies to Minimum Requirement 6 Flow Control. How the impervious is changed into a pervious surface will determine the type of benefit to the project. Potentially, the area of reverted impervious surface could be subtracted from the amount of new impervious surface (i.e., net-new impervious surface). Otherwise, the reverted impervious surface would gain the benefit of being modeled as a different land cover in the post-developed condition. See Section 4-3.6.1 for details on reversion of existing impervious surface areas.

Runoff treatment: Pollutant removal to a specified level via engineered or natural stormwater management systems. Formerly called *water quality treatment [see Appendix 3B]*.

Stormwater: That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via Horton overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body or a constructed infiltration facility.

Threshold discharge area (TDA): An onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within ¼ mile downstream.

Total maximum daily load (TMDL) – Water Cleanup Plan: A calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. A TMDL (also known as a Water Cleanup Plan) is the sum of allowable loads of a single pollutant from all contributing point sources and nonpoint sources. The calculation must include a margin of safety to ensure that the water body can be used for the purposes the state has designated. The calculation must also account for seasonal variation in water quality. Water quality standards are set by states, territories, and tribes. They identify the uses for each water body (for example, drinking water supply, contact recreation [such as swimming], and aquatic support [such as fishing]) and the scientific criteria to support each use. The federal Clean Water Act, section 303, establishes the water quality standards and TMDL programs.

IX. Web Links

WSDOT HRM

http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manual/HighwayRunoff2004.pdf

WSDOT HRM Revisions

http://www.wsdot.wa.gov/environment/wqec/HRMRevision.htm

United States Environmental Protection Agency

www.epa.gov

Washington Administrative Code

www.leg.wa.gov/WAC/

Puget Sound Action Team LID Technical Guidance Manual for Puget Sound

http://www.psat.wa.gov/Publications/LID_tech_manual05/LID_manual2005.pdf

Washington State Department of Ecology Stormwater Management Manual for Western Washington

http://www.ecy.wa.gov/programs/wq/stormwater/manual.html#How_to_Find_the_Stormwater_Manual_on_the

Washington State Department of Ecology Stormwater Management Manual for Eastern Washington

http://www.ecy.wa.gov/biblio/0410076.html