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WASHINGTON STATE MUNICIPAL STORMWATER CONFERENCE

DETERMINING STORMWATER BMP INFILTRATION RATES: REQUIREMENTS, APPROACHES, EMERGING METHODS, AND CURRENT RESEARCH

MAY 16, 2017

Experience Background

- Primarily Eastern Washington
- Focus on stormwater, LID, and the built environment
- Specializing in construction documents for:
  - PS&E on public projects
  - Site design in support of vertical construction
  - Private development

Reference Materials

My experience and approach is primarily based upon the following manuals:

Spokane Regional Stormwater Manual
Chapter 4

WSDOT Highway Runoff Manual
4-5.4

Eastern Washington LID Guidance Manual
Appendix B

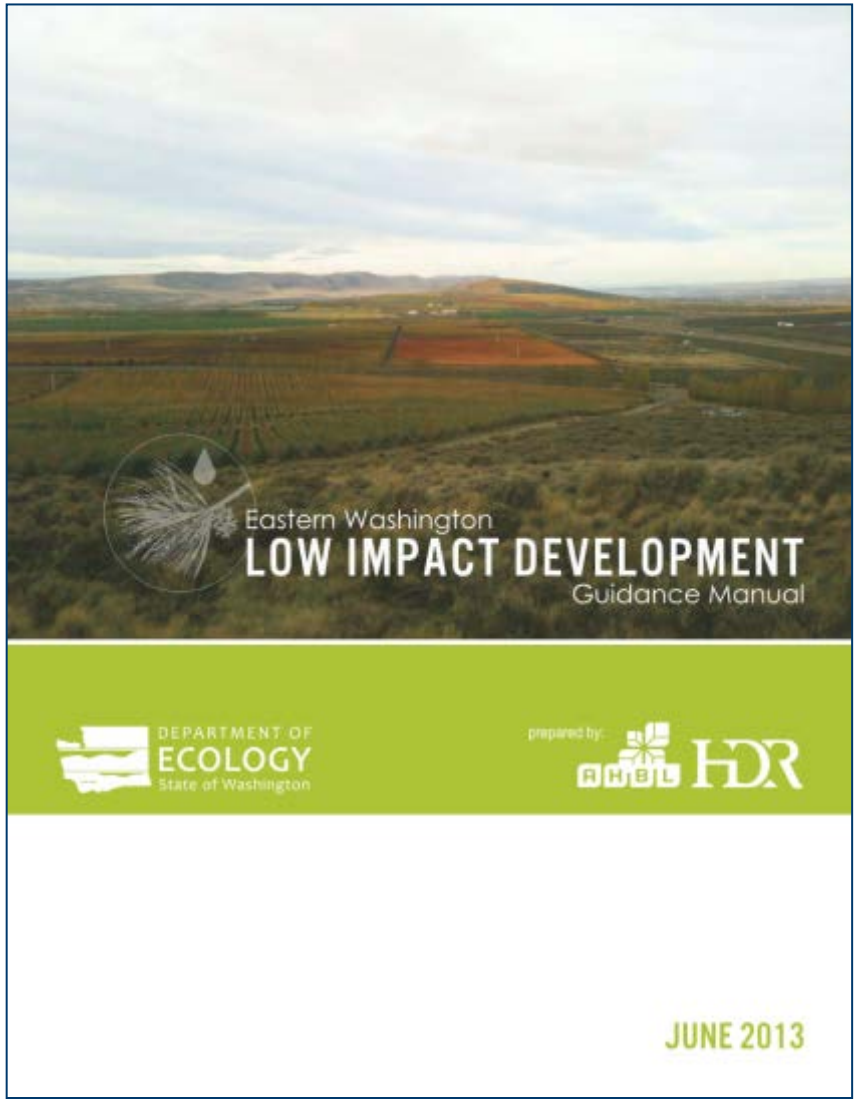
Stormwater Management Manual for Eastern Washington
Table 5.4.1

Spokane Regional Stormwater Manual

- SRSM Chapter 4.3.1
- Spokane 200 method
- Full scale drywell test
- Test pit method
- Single ring infiltrometer test
- Swale flood test

Eastern Washington LID Guidance Manual

- Adapted from SWMMWW
- Small scale PIT
- Large scale PIT
- Soil grain size method



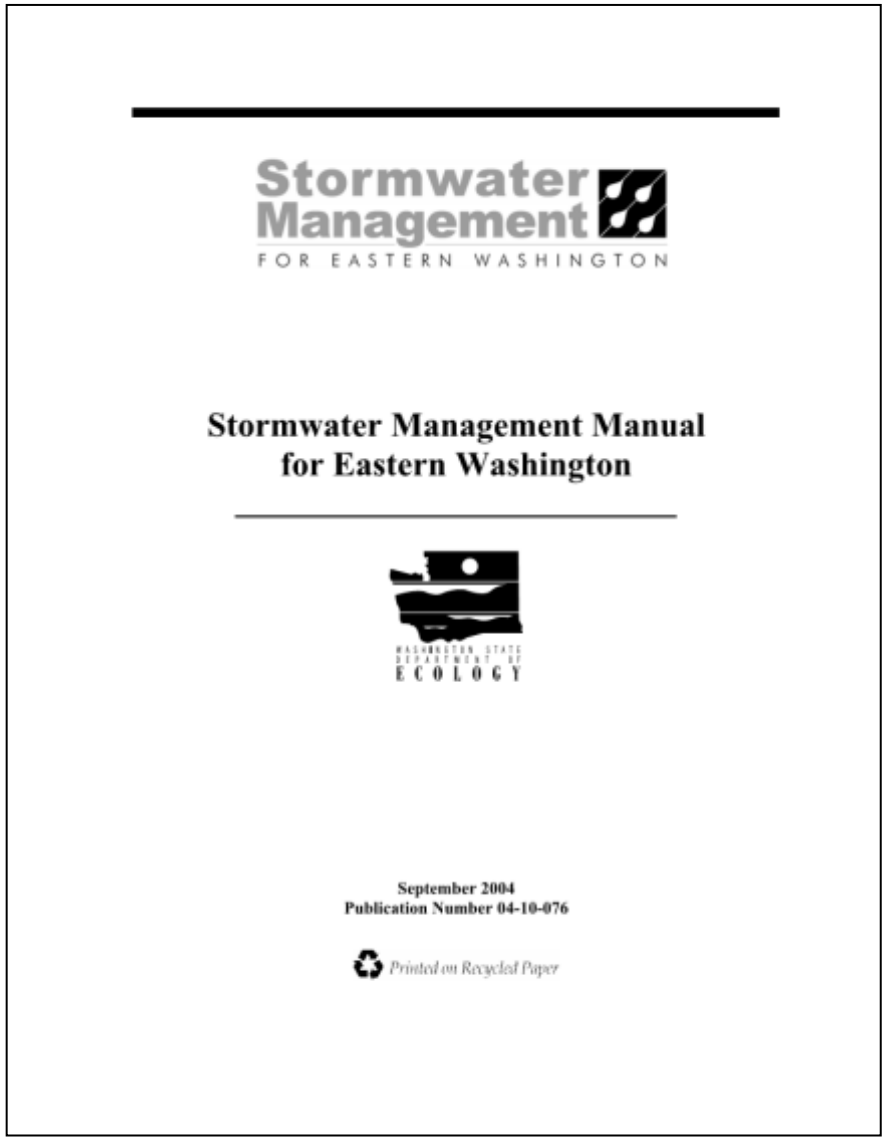
WSDOT HRM

- WSDOT HRM Section 4-5.4

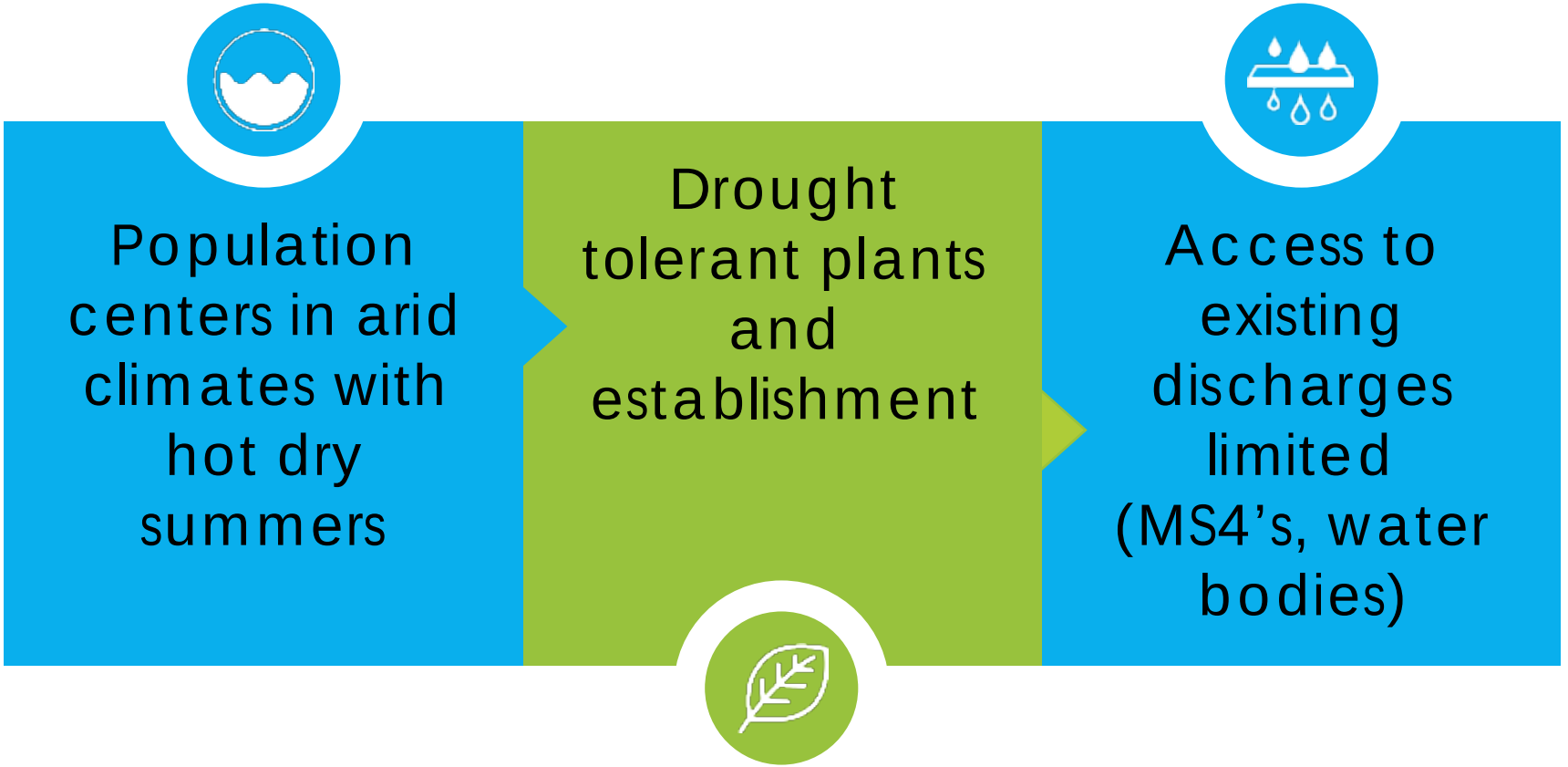
1. **Detailed Approach for Determining Infiltration Rates.** A detailed analysis that allows you to consider the type of hydrograph used (continuous or single-event); the depth to the groundwater table; the K_{sat} of the underlying soils of the facility; the site-specific hydraulic gradient for the facility; and the facility geometry.
2. **Simplified Approach for Determining Infiltration Rates.** This method generally follows Ecology's SWMMWW and commonly produces a more conservative facility size.
3. **Determining Infiltration Rates for Soil Amendment BMPs.** This method follows a standard ASTM and has been accepted by Ecology.

SWMMEW

- Presumptive rates per Table 5.4.1
- Appendix 6B
  - Flow chart for reference
  - Generally refers to Spokane County Guidelines for Stormwater Management which has been superseded by the SRSM



Eastern Washington Concerns



Design Process

- Review NRCS web soil survey
- Review nearby well logs
- Speak to experts knowledgeable about site vicinity drainage
- Consider limited subsurface explorations
- Conceptual design and modeling
- Prepare an exploration plan
- Refine and update design

System Sensitivity Summary

1 ACRE IMPERVIOUS SITE

DRAINING TO A 2000 SF INFILTRATION POND

SPOKANE COUNTY SCS TYPE II 25 YEAR 24 HOUR STORM

0.25 IPH	1 IPH	4 IPH
3.05 ft max depth 6,100 cf storage required	2.15 ft max depth 4,300 cf storage required 400% increase 30% reduction	1.40 ft max depth 2,800 cf storage required 800% increase 54% reduction

System Sensitivity Summary

1 ACRE IMPERVIOUS SITE

DRAINING TO A 2000 SF INFILTRATION POND

SPOKANE COUNTY SCS TYPE IA 25 YEAR 24 HOUR STORM

0.25 IPH	1 IPH	4 IPH
3.02 ft max depth 6,040 cf storage required	1.58 ft max depth 3,160 cf storage required 400% increase 48% reduction	0.32 ft max depth 640 cf storage required 800% increase 89% reduction

System Sensitivity Summary

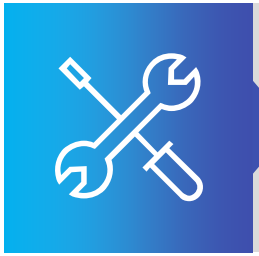
1 ACRE IMPERVIOUS SITE

DRAINING TO A 2000 SF INFILTRATION POND

RICHLAND SCS TYPE IA 25 YEAR 24 HOUR STORM

0.25 IPH	1 IPH	4 IPH
1.98 ft max depth **3,960 cf storage required**	**0.78 ft max depth** **1,560 cf storage required** **400% increase** **60% reduction**	**0.14 ft max depth** **280 cf storage required** **800% increase** **93% reduction**

Preferred Methodology



Based upon BMP, hydraulic loading, and soil

Appropriate timing and phasing

Appropriate for the project

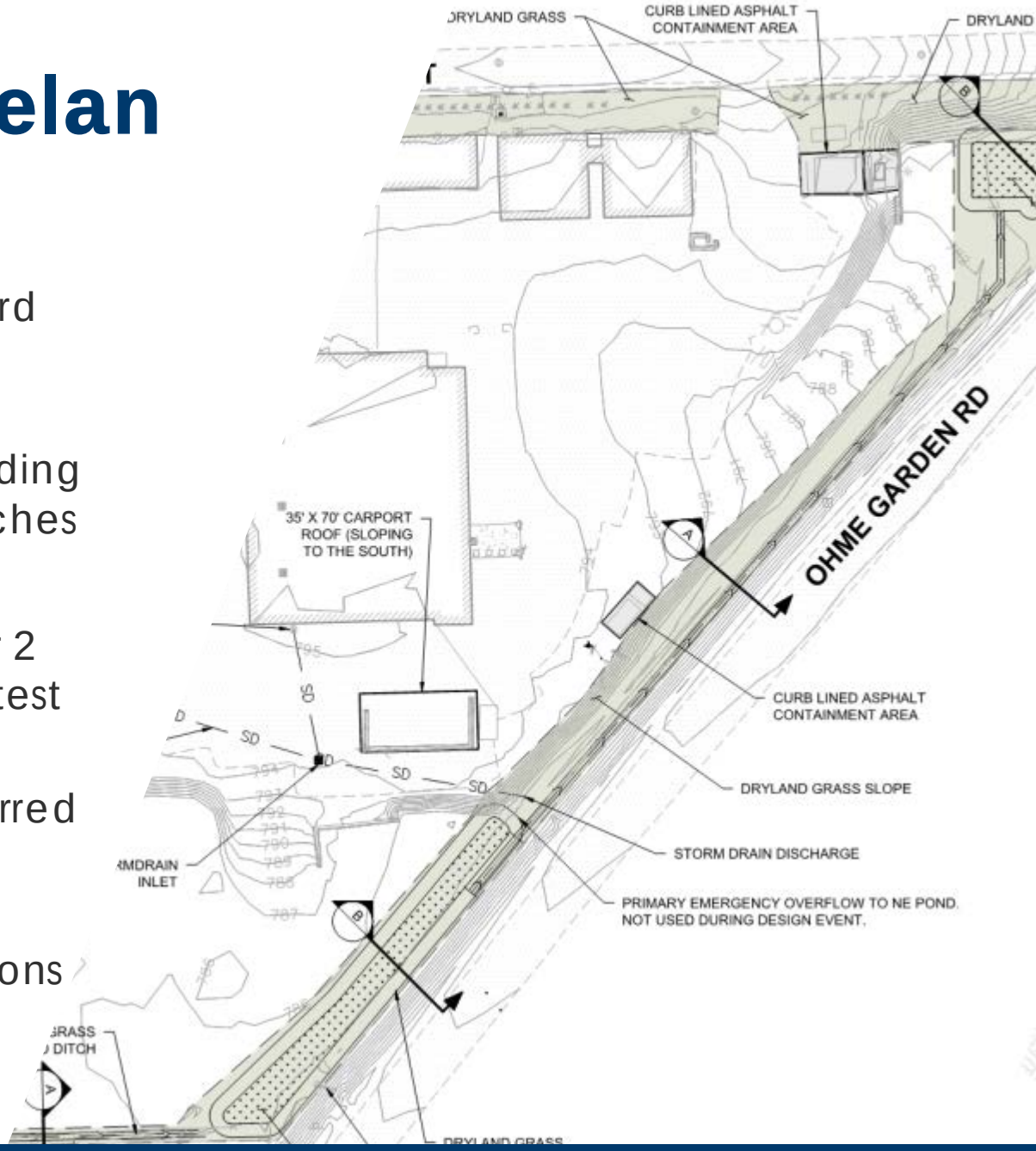
Test Methodology:	Considerations:
a. Grain size analysis	▪ Doesn't account for site conditions (soil structure, restrictive layers…) ▪ Relatively inexpensive ▪ Testing at multiple depths possible
b. Single ring infiltrometer	▪ Accounts for site conditions ▪ Relatively inexpensive ▪ Primarily suitable for surface testing ▪ Results may not be applicable if significant disturbance
c. In-place test (drywell and swale flood test)	▪ Accounts for site conditions ▪ Increased cost if facilities require construction ▪ Results most easily correlated to similar facilities ▪ Timing can be difficult. Requires existing facility ▪ Primarily useful for phased projects
d. PIT test	▪ Accounts for site conditions ▪ More time consuming, generally more expensive ▪ Requires significant water sources ▪ May be difficult to complete on site with high infiltration
e. Presumptive rates	▪ Doesn't account for site conditions ▪ Very inexpensive ▪ Requires detailed knowledge of general area geology

Examples

- Spokane Valley PIT test
  - Water supply insufficient to maintain water surface
  - Soils in mapped “pre-approved” location
- Pillar Rock Estates
  - Vicinity largely shallow bedrock
  - County staff aware of paleochannel
  - Targeted borings established pond location

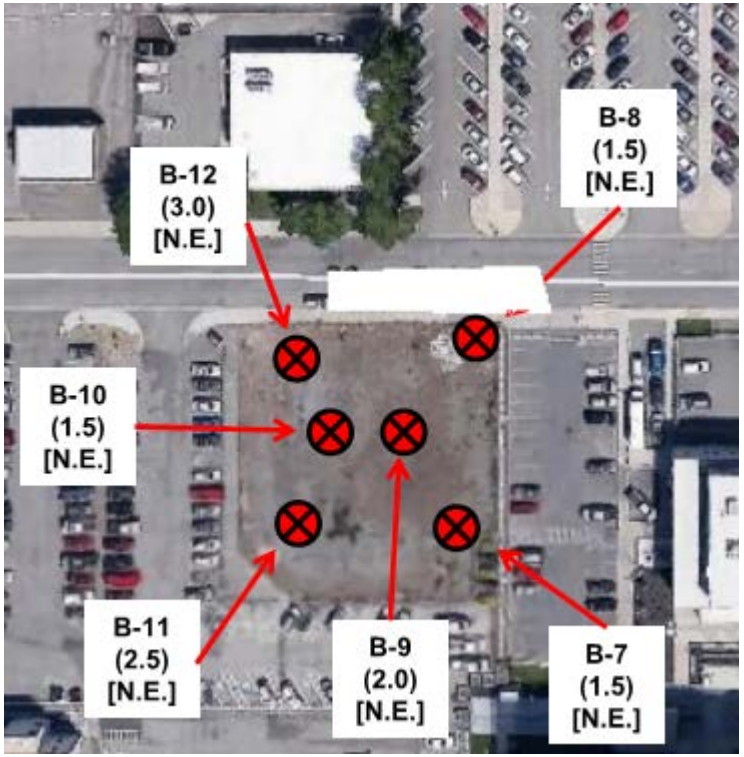
Example – Chelan Sunnyslope

- 10 acre maintenance yard with limited stormwater infrastructure
- Offsite discharges exceeding capacity of roadside ditches
- Limited budget
- Geotech had budget for 2 PIT tests, 2 observational test pits
- Concept identified preferred solution
- One day of field work provided recommendations



Example – Detail

- Project located where presumptive approach is commonly implemented
- 0.5 acres of impervious surface
- Key site concern was groundwater depth, anticipated at 15 feet BGS
- Observed infiltration rate of 36 IPH
- Alternative methodology?




QUESTIONS?