Stormwater Plan

Washington State Fair – 125th Anniversary Improvements

110 9th Avenue SW
Puyallup, WA 98374

Prepared by
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April 23, 2024

JMJTEAM

PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Stormwater Plan for the Washington State Fair – 125th Anniversary Improvements in Puyallup has been prepared by me or under my supervision and meets minimum standards of Washington State Department of Ecology, The City of Puyallup, and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

____

Justin Jones, PE

JUSTIN M. JONES
STATE OF WASHINGTON
41829
REGISTERED
PROFESSIONAL ENGINEER

04-23-24

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PROJECT OVERVIEW AND MAPS

The Washington State Fair (WSF) is a 98 acre facility located between 15th Avenue SW to the South; Meridian Street to the East; 9th Avenue SW to the North; and Fairview Drive to the West. The Fair Association is proposing three projects within the fairgrounds, including the demolition of the existing International Village Restaurant and construction of a new restaurant with associated site improvements; demolition of Barn M, which includes leaving the existing pavement areas and hydroseeding the stall area; demolition of Rodeo Barn, which will be replaced with a grass field. See Project Map below.

International Village

The new 14,214 SF International Village Restaurant will be constructed in place of the demolished old International Village Restaurant. The Lot Coverage of the building will increase from the original 8,600 SF to 14,214 SF, including Roof Overhangs and Decks.

Barn M

All of the Barn M structures will be demolished, but the existing pavements underneath the Barn M Structure will be maintained. Any dirt from the animal stalls will be hydroseeded. The existing sewer/stormwater system for the barn will be revised to convey all runoff to the stormwater system.

Rodeo Barn

The existing Rodeo Barn structure will be demolished, and the existing dirt underneath the structure will be hydroseeded.

EXISTING CONDITIONS SUMMARY

The WSF is made up of two main parcels. The International Village and Barn M are located in TPN: 0420331121 and the Rodeo Barn is located in TPN: 0420331136.

International Village

The International Village project site is 66,716 SF. Stormwater runoff in the project area is currently collected by catch basins and roof downspouts. Stormwater runoff from the catch basins and roof downspouts is subsequently conveyed to the 42-inch city main in 5th Street.

See Project Area Coverage Tables below.

Barn M

The Barn M project site is 74,690 SF. Roof downspouts and catch basins currently collect stormwater runoff. During the Fair, this stormwater runoff is conveyed to the 12-inch Sanitary Sewer Main in 5th Street. When the Fair is not occurring, the stormwater runoff is conveyed to the 42-inch city main in 5th street using the sewer switch system.

See Lot Coverage Tables below.

Rodeo Barn

The Rodeo Barn project site is 24,410 SF. Stormwater runoff in the project area currently infiltrates into native soils.

See Project Area Coverage Tables below.

PROPOSED CONDITIONS SUMMARY

International Village

Complete blank information. [SSP, Pg3]

The International Village project site proposes the construction of a SF two and a half story Restaurant Building with site improvements.

Is 43,809 for the international village? Page 2 mentions a different number for the international village. Verify area counts. [SSP, Pg3]

The proposed development will result in 43,809 SF of impervious surfaces within the project area.

Site improvements include the construction of 24,860 SF of new permeable asphalt pavement, 886 SF of new concrete pavement, 3,117 SF of new asphalt pavement, 22,907 SF of new hydroseeding. The building will also have utility service connections for sewer, water, power, gas, and communications.

Stormwater from the International Village Building will be collect with roof downspouts and conveyed to a proposed infiltration gallery, which will infiltrate 100% of stormwater up to the 100-year storm. Infiltration testing was performed onsite to obtain a design infiltration rate for on-site soils in the vicinity of stormwater infiltration systems, See Appendix A.

Runoff from the proposed pervious asphalt will infiltrate onsite into native soils below the pavements. The pervious pavements are designed to infiltrate 100% of stormwater up to the 100-year storm event.

See Project Area Coverage Tables below.

Barn M

The Barn M project proposes the demolition of the existing 67,660 SF, 4,270 SF, and 2,760 SF Barn M structures.

Since sanitary sewer service is no longer required for the building, the existing sanitary sewer connections will be cut and capped on the Sanitary Sewer line running E-W under the building. New storm lines will be installed in the existing catch basins (on the north side of the building) to convey stormwater runoff to the existing 42-inch city main in 5th Street. The existing catch basins (on the south side of the building) convey runoff to a sanitary sewer manhole to the south. A new storm line will be installed in this manhole to convey runoff to an existing catch basin, where the runoff will be eventually conveyed to the existing 42-inch stormwater main under 5th Street. The existing outlet sewer pipe will be cut and capped.

Any existing dirt areas will be hydroseeded.

See Project Area Coverage Tables below.

Rodeo Barn

The Rodeo Barn project proposes the demolition of the existing 24,410 SF structure.

Stormwater runoff will infiltrate into native soils onsite.

Existing dirt underneath the Rodeo Barn structure will be hydroseeded.

See project area coverage table below.

International Village

Numbers within narrative do not appear to match what the table shows. Consider removing numbers from the narrative and refer to table. [SSP, Pg 4]

Description[a]	Onsite	Offsite	Total
Existing Conditions			
Total Project Area[b] (ft²)	54,500-1.25 ac	0-0 ac	54,500-1.25 ac
Existing hard surface (ft²)	44,212-1.01 ac	0-0 ac	44,212-1.01 ac
Existing vegetation area (ft²)	10,288-0.24 ac	0-0 ac	10,288-0.24 ac
Proposed Conditions			
Total Project Area[b] (ft²)	54,500-1.25 ac	0-0 ac	54,500-1.25 ac
Amount of new hard surface (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of new pollution generating hard surface (PGHS)[c] (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of replaced hard surface (ft²)	44,212-1.01 ac	0-0 ac	44,212-1.01 ac
Amount of replaced PGHS[d] (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of new plus replaced hard surface (ft²)	44,212-1.01 ac	0-0 ac	44,212-1.01 ac
Amount of new + replaced PGHS (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of existing hard surfaces converted to vegetation (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of Land Disturbed (ft²)	54,500-1.25 ac	0-0 ac	54,500-1.25 ac
Vegetation to Lawn/Landscaped (acres)	10,288-0.24 ac	0-0 sf	10,288-0.24 ac
Native Vegetation to Pasture (acres)	0-0 sf	0-0 sf	0-0 sf
Existing hard surface to remain unaltered (ft²)	0-0 ac	0-0 ac	0-0 ac
Existing vegetation area to remain unaltered (ft²)	0-0 ac	0-0 ac	0-0 ac

Barn M

Description[a]	Onsite	Offsite	Total
Existing Conditions			
Total Project Area[b] (ft²)	74,690-1.71 ac	0-0 ac	74,690-1.71 ac
Existing hard surface (ft²)	74,690-1.71 ac	0-0 ac	74,690-1.71 ac
Existing vegetation area (ft²)	0-0 ac	0-0 ac	0-0 ac
Proposed Conditions			
Total Project Area[b] (ft²)	74,690-1.71 ac	0-0 ac	74,690-1.71 ac
Amount of new hard surface (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of new pollution generating hard surface (PGHS)[c] (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of replaced hard surface (ft²)	51,070-1.17 ac	0-0 ac	51,070-1.17 ac
Amount of replaced PGHS[d] (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of new plus replaced hard surface (ft²)	51,070-1.17 ac	0-0 ac	51,070-1.17 ac
Amount of new + replaced PGHS (ft²)	0-0 ac	0-0 ac	0-0 ac
Amount of existing hard surfaces converted to vegetation (ft²)	23,620-0.54 ac	0-0 ac	23,620-0.54 ac
Amount of Land Disturbed (ft²)	74,690-1.71 ac	0-0 ac	74,690-1.71 ac
Vegetation to Lawn/Landscaped (acres)	0-0 sf	0-0 sf	0-0 sf
Native Vegetation to Pasture (acres)	0-0 sf	0-0 sf	0-0 sf
Existing hard surface to remain unaltered (ft²)	0-0 ac	0-0 ac	0-0 ac
Existing vegetation area to remain unaltered (ft²)	0-0 ac	0-0 ac	0-0 ac

Rodeo Barn

Description[a]	Onsite	Offsite	Total
Existing Conditions			
Total Project Area[b] (ft^2)	24,410-0.56 ac	0-0 ac	24,410-0.56 ac
Existing hard surface (ft^2)	24,410-0.56 ac	0-0 ac	24,410-0.56 ac
Existing vegetation area (ft^2)	0-0 ac	0-0 ac	0-0 ac
Proposed Conditions			
Total Project Area[b] (ft^2)	24,410-0.56 ac	0-0 ac	24,410-0.56 ac
Amount of new hard surface (ft^2)	0-0 ac	0-0 ac	0-0 ac
Amount of new pollution generating hard surface (PGHS)[c] (ft^2)	0-0 ac	0-0 ac	0-0 ac
Amount of replaced hard surface (ft^2)	0-0 ac	0-0 ac	0-0 ac
Amount of replaced PGHS[d] (ft^2)	0-0 ac	0-0 ac	0-0 ac
Amount of new plus replaced hard surface (ft^2)	0-0 ac	0-0 ac	0-0 ac
Amount of new + replaced PGHS (ft^2)	0-0 ac	0-0 ac	0-0 ac
Amount of existing hard surfaces converted to vegetation (ft^2)	24,410-0.56 ac	24,410-0.56 ac	24,410-0.56 ac
Amount of Land Disturbed (ft^2)	24,410-0.56 ac	24,410-0.56 ac	24,410-0.56 ac
Vegetation to Lawn/Landscaped (acres)	0-0 sf	0-0 sf	0-0 sf
Native Vegetation to Pasture (acres)	0-0 sf	0-0 sf	0-0 sf
Existing hard surface to remain unaltered (ft^2)	0-0 ac	0-0 ac	0-0 ac
Existing vegetation area to remain unaltered (ft^2)	0-0 ac	0-0 ac	0-0 ac

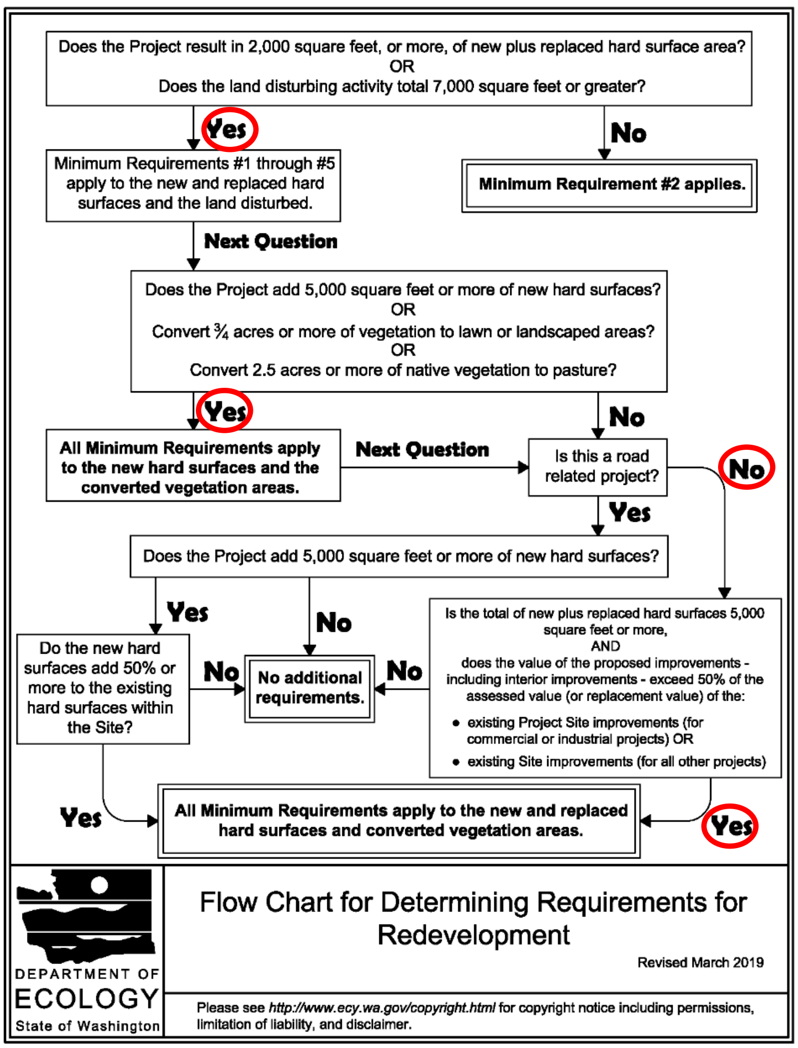
SUMMARY OF MINIMUM REQUIREMENTS

International Village - Redevelopment

The City of Puyallup utilizes the 2019 Department of Ecology Stormwater Manual for Western Washington (manual) for stormwater design. Volume 1 of this manual describes the Minimum Requirements for stormwater management for a redevelopment site.

The International Village project site will have 44,240 of new and replaced hard surfaces upon project completion, and a total of 54,500 of land disturbing activity. The fully developed site will be 35.6% impervious in the final condition. Since the project exceeds 5,000 SF of new plus replaced hard surfaces, the project is subject to all minimum requirements. See Chart below.

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment



2019 Stormwater Management Manual for Western Washington

Volume I - Chapter 3 - Page 90

Barn M

The City of Puyallup utilizes the 2019 Department of Ecology Stormwater Manual for Western Washington (manual) for stormwater design. Volume 1 of this manual describes the Minimum Requirements for stormwater management for a redevelopment site.

The Barn M project proposes the demolition/removal of the existing Barn M Structure. Both the Barn M structure and its footings will be removed. The existing stormwater system under the existing Barn M structure will be rerouted. Since the disturbed area of this project is mainly underground utility work and the footing removal is minimal, this project is only subject to MR2. See 2019 Department of Ecology code below.

Underground Utility Projects

Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics are only subject to I-3.4.2 MR2: Construction Stormwater Pollution Prevention Plan (SWPPP).

The text in this box originates from one or more of the following Permits:
Appendix 1 of the Phase I / Phase II Municipal Stormwater Permits
Construction Stormwater General Permit

Rodeo Barn

The City of Puyallup utilizes the 2019 Department of Ecology Stormwater Manual for Western Washington (manual) for stormwater design. Volume 1 of this manual describes the Minimum Requirements for stormwater management for a redevelopment site.

The Rodeo Barn project proposes the demolition/removal of the existing Rodeo Barn Structure. Both the Rodeo Barn structure and its footings will be removed. Since the disturbed area of this project is mainly underground utility work and the footing removal is minimal, this project is only subject to MR2. See 2019 Department of Ecology code below.

MINIMUM REQUIREMENT 1: PREPARATION OF STORMWATER SITE PLANS

International Village, Barn M, and Rodeo Barn

Preliminary Stormwater Site Plan drawings have been prepared and included with this Preliminary Site Plan submittal. Final stormwater site plans will be submitted with the civil permit drawings.

Stormwater Site Plan drawings have been prepared per the City of Puyallup development codes and the 2019 DOE Manual.

MINIMUM REQUIREMENT 2: CONSTRUCTION STORMWATER POLLUTION PREVENTION

International Village, Barn M, and Rodeo Barn

If Barn M and Rodeo Barn are only subject to MR 2, address them in MR2 and remove them from the rest of the report. [SSP, Pg 7]

Revise to the updated 13 elements. [SSP, Pg 8]

The International Village, Barn M, and Rodeo Barn projects require a Construction Stormwater Pollution Prevention Plan (SWPPP). The SWPPP will comply with all 12 elements per the Doe manual. The SWPPP will be provided with the construction civil permit and will include the construction NPDES.

MINIMUM REQUIREMENT 3: SOURCE CONTROL OF POLLUTION

Source control BMPs will be implemented to minimize stormwater contamination and help comply with the Department of Ecology Stormwater Management Manual for Western Washington. BMP's for the project may include:

International Village

- *Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O & M Improvements.*
- *Clean catch basins when the depth of deposits reaches 60-percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin.*
- *Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.*

Barn M

- *Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O & M Improvements.*
- *Clean catch basins when the depth of deposits reaches 60-percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin.*
- *Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.*

Rodeo Barn

- *Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O & M Improvements.*
- *Clean catch basins when the depth of deposits reaches 60-percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin.*
- *Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.*

MINIMUM REQUIREMENT 4: PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

International Village, Barn M, and Rodeo Barn

There are no natural drainage systems or outfalls within the International Village, Barn M, or Rodeo Barn project sites. Stormwater from the sites will discharge through new conveyance systems to the existing conveyance system in 5th Street, which flows to Meeker Ditch.

MINIMUM REQUIREMENT 5: ONSITE STORMWATER MANAGEMENT

Minimum Requirement #5 states projects shall utilize either On-Site Stormwater Management BMP's from List #2 or demonstrate compliance with the LID Performance Standard. The LID performance standard requires the site to match predeveloped flows through flow control systems for 50% of the 2-year and 50-year storm events. List #2 requires the evaluation of BMP's in the order listed to determine the most appropriate stormwater management system for landscaped areas, roofs, and hard surfaces.

International Village

Each BMP requires varying separation between the bottom of the BMP and the seasonal high groundwater level. Therefore, testing of the stormwater infiltration rate and seasonal high groundwater level was conducted. Excavation was conducted to a depth of 4.0-feet. Pilot Infiltration Test (PIT) was conducted in the grass field west of the existing International Village building. The test recorded an infiltration rate of 4.34 inches per hour, and after applying factors of safety the design infiltration rates is 2.0 inches per hour, see Appendix A for Infiltration Report.

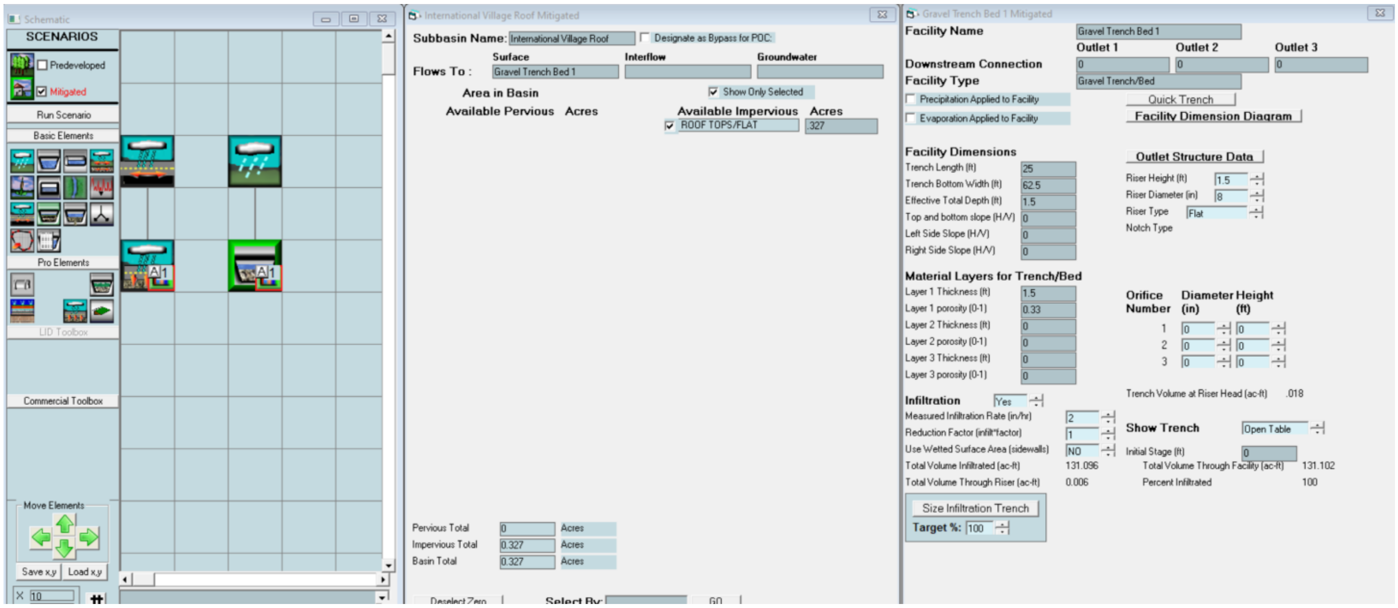
Groundwater was encountered during soil inspections. The observed groundwater level is 3.4' below the existing grade of the testing location. Since the existing grade of the tests is 37.3', BMP's must maintain the required separation between the assumed groundwater level of 33.9'.

The following Stormwater BMP's in List #2 were evaluated for feasibility with regards to the International Village project:

- Lawn & Landscaped Areas:
  - Post Construction Soil Quality: Post Construction soil quality and depth will be utilized for the International Village project in accordance with BMP T5.13.
- Roofs:
  - Full Dispersion: Full dispersion is feasible if a site maintains 65% of its area in a native vegetated condition. The International Village project does not maintain 65% of the site in a native condition and thus full dispersion was deemed infeasible for roof stormwater management.
  - Downspout Infiltration: Downspout infiltration was evaluated for feasibility for the site, and infiltration was deemed feasible for the site. Proposed roof areas will be routed to the infiltration trench and infiltrate at 100% on site into native soils based on WWHM modeling, see Appendix B. The infiltration trench has been sized utilizing the WWHM Model for a gravel trench bed based on the following criteria:
    - Infiltration rate of 2.0 in/hr
    - Drain Rock Basin with a porosity of 0.33
    - 1.5' Drainage/Storage Layer thickness
    - Minimum 1-foot of separation between the bottom of the infiltration trench and the seasonal high groundwater level

Roof area is above 5,000 sf. and project disturbs more than 1/2 acre. Per Ecology Manual, Downspout BMPs do not apply to commercial projects larger than a typical residential project. City Design standards define what is equivalent to residential project in Section 210. [SSP, Pg 9]

See screenshot below for infiltration trench WWHM Modelling:



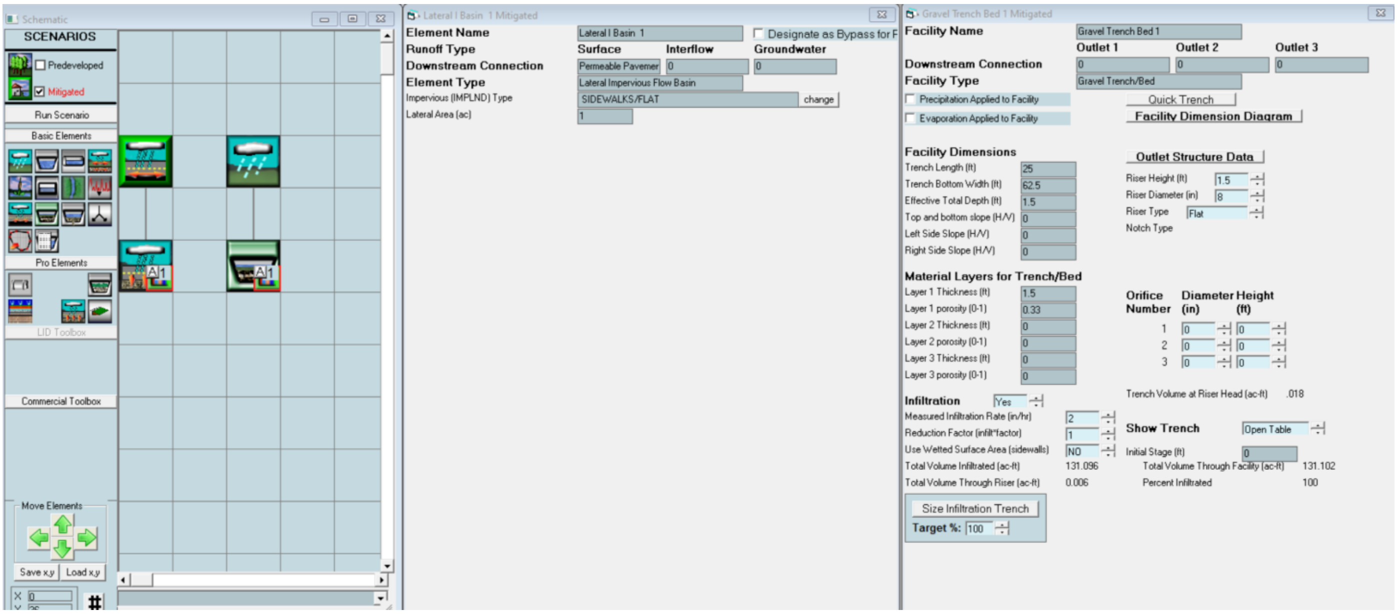
- Other Hard Surfaces:

Revise locations that mention "Kinsman Care" [SSP, Pg 10]

  - Full Dispersion: Full dispersion is feasible if a site maintains 65% of its area in a native vegetated condition. The Kinsman Care project does not maintain 65% of the site in a native condition and thus full dispersion was deemed infeasible for hard surface stormwater management.

  - Permeable Pavement: Permeable Pavements were evaluated for the Kinsman Care site and were determined to be feasible for the project. Proposed permeable pavement areas will infiltrate at 100% on site into native soils based on WWHM modeling, see Appendix B for WWHM report. Permeable Pavements have been sized utilizing the WWHM Model for permeable pavement based on the following criteria:
    - Infiltration rate of 2.0 in/hr
    - Drain Rock Basin with a porosity of 0.33
    - 4" Drainage/Storage Layer thickness
    - Minimum 1-foot of separation between the bottom of the permeable pavement and the seasonal high groundwater level
    - 1-acre lateral flow basin conveyed to permeable pavement from existing adjacent pavement.
  - Permeable Pavements will include the following:
    - 5" minimum ASTM #8 Stone
    - Impermeable geotextile along building walls

See screenshot below for permeable pavement WWHM Modelling:



Based upon the evaluation of the above BMP's, runoff from building roof will be collected from the downspout locations and routed through 6-inch DI pipes along the perimeter of the building and connect into the proposed infiltration gallery. A single gabion block will be used to convey the roof stormwater runoff to the infiltration gallery. Stormwater entering the infiltration trench will infiltrate 100% up to the 100-year storm event. The top of the infiltration gallery will be located 1-foot below the new finish grade of the regraded and hydroseeded lawn.

Permeable pavements located within the International Village project area have been sized to infiltrate 100% of stormwater runoff up to the 100-year storm event. Stormwater runoff in these areas will infiltrate through the pavement surface, and through the storage layer into native soils below. Permeable pavements at the International Village project will abut structures and could introduce risk of water pooling near building foundations. To mitigate this risk, permeable pavements shall be lined with an impermeable geotextile along building footings to convey any stormwater that may pool away from the structures.

Standard asphalt and concrete pavement will be used for the replaced portions of existing asphalt concrete and will maintain existing surface runoff flow characteristics.

The proposed landscaping field to the west will be regraded and hydroseeded in accordance with BMP 5.13.

Barn M

The existing Barn M Structures and footings will be demolished and the existing asphalt and concrete pavements under the structure will be maintained. Existing asphalt or concrete pavement under the structure will be replaced to reroute the existing stormwater system.

Currently during the Spring and Fall Fairs, the WSF experiences significant animal traffic in the Barn. A storm-sewer switch system was installed to route stormwater to the sewer conveyance system when animals are present on-site.

The existing stormwater system will be revised to convey runoff the catch basins collect to the 42-inch city main under 5th St.

Since the only disturbed hard surfaces areas are the footing removal and utility work, the BMP's in List #2 are not applicable.

Any existing dirt areas under the Barn M structures will be hydroseeded in accordance with BMP 5.13.

Rodeo Barn

The existing Rodeo Barn Structures and footings will be demolished and the existing dirt under the structure will be hydroseeded. Since the only disturbed hard surfaces areas are the footing removal the BMP's in List #2 are not applicable to any hard surfaces.

Any existing dirt areas under the Barn M structures will be hydroseeded in accordance with BMP 5.13.

MINIMUM REQUIREMENT 6: WATER QUALITY

International Village

The Department of Ecology Stormwater Management Manual states that any project with a pollution generating threshold discharge area greater than 5,000 SF shall be required to utilize runoff treatment BMPs. The project proposes a 14,214 SF two-story restaurant, 24,860 SF of permeable asphalt, 3,117 SF of asphalt pavement, 886 SF of concrete pavement, and is therefore subject to runoff treatment for pollution generating areas. The proposed pavements are not expected to have heavy vehicle traffic, therefore the International Village project is not proposing any Pollution Generating Hard Surfaces and is exempt from Minimum Requirement #6.

Show limits of pollution generating area per the requested Fair Roads exhibit requested. Low expectations of vehicle traffic is not an Ecology approved exemption. [SSP, Pg 12]

Barn M

The Department of Ecology Stormwater Management Manual states that any project with a pollution generating threshold discharge area greater than 5,000 SF shall be required to utilize runoff treatment BMPs. The project proposes the demolition of the three Barn M structures. The existing pavement underneath the structures is to be maintained. Pavement will be replaced to reroute the stormwater system and remove the structure footings. The replaced pavements are not expected to have vehicle traffic, there the Barn M project is not proposing any Pollution Generating hard Surfaces and is exempt from Minimum Requirement #6.

Rodeo Barn

The Department of Ecology Stormwater Management Manual states that any project with a pollution generating threshold discharge area greater than 5,000 SF shall be required to utilize runoff treatment BMPs. All Rodeo Barn structures will be demolished and the existing dirt under the structures will be hydroseed. Since the project does not propose any pollution generating hard surfaces, Minimum Requirement does not apply to the Rodeo Barn project.

MINIMUM REQUIREMENT 7: FLOW CONTROL

International Village

The International Village project site uses infiltration to meet the requirement of Minimum Requirement 7 Flow Control.

The Department of Ecology Stormwater Management Manual code requires the infiltration trench to be sized using WWHM and to achieve 100 percent infiltration. Stormwater will have an opportunity to infiltrate into native soils, permeable pavements and the infiltration trench were modeled to infiltrate 100% of the flows that they receive.

Per the department of Ecology Stormwater Management Manual, developed discharge durations shall match the predeveloped rates from 50% of the 2-year peak flow up to the full 50-year peak flow. However, per the DOE SWMM, "This standard requirement is waived for sites that will reliably infiltrate all the runoff from hard surfaces and converted vegetation areas". WWHM modeling was conducted to confirm that the infiltration trench and permeable pavements infiltrated 100% of the stormwater runoff up to the 100-year storm event, see Appendix B for WWHM report. Both the infiltration trench and permeable pavements infiltrate 100% of the stormwater runoff up to the 100-year storm event therefore, the site is exempt from matching the predeveloped discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow.

MR7 is not waived. The project must demonstrate the project's TDAs do not meet any of the three thresholds that require the flow control standard. Application of certain LID and/or infiltration BMPs can result in reducing the effective impervious area and the converted vegetation areas such that the TDA Thresholds are not triggered, and a Flow Control BMP is not required. Additionally, this project is apart of a common plan of development [SSP, Pg 13]

Barn M

The Barn M project site uses infiltration to meet the requirement of Minimum Requirement 7 Flow Control.

The Department of Ecology Stormwater Management Manual code requires the infiltration trench to be sized using WWHM and to achieve 100 percent infiltration. Stormwater will have an opportunity to infiltrate into native soils, permeable pavements and the infiltration trench were modeled to infiltrate 100% of the flows that they receive.

Per the department of Ecology Stormwater Management Manual, developed discharge durations shall match the predeveloped rates from 50% of the 2-year peak flow up to the full 50-year peak flow. However, per the DOE SWMM, "This standard requirement is waived for sites that will reliably infiltrate all the runoff from hard surfaces and converted vegetation areas". WWHM modeling was conducted to confirm that the infiltration trench and permeable pavements infiltrated 100% of the stormwater runoff up to the 100-year storm event, see Appendix B for WWHM report. Both the infiltration trench and permeable pavements infiltrate 100% of the stormwater runoff up to the 100-year storm event therefore, the site is exempt from matching the predeveloped discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow.

Revise Barn M and rodeo barn narratives [SSP, Pg 13]

Rodeo Barn

The International Village project site uses infiltration to meet the requirement of Minimum Requirement 7 Flow Control.

The Department of Ecology Stormwater Management Manual code requires the infiltration trench to be sized using WWHM and to achieve 100 percent infiltration. Stormwater will have an opportunity to infiltrate into native soils, permeable pavements and the infiltration trench were modeled to infiltrate 100% of the flows that they receive.

Per the department of Ecology Stormwater Management Manual, developed discharge durations shall match the predeveloped rates from 50% of the 2-year peak flow up to the full 50-year peak flow. However, per the DOE SWMM, "This standard requirement is waived for sites that will reliably infiltrate all the runoff from hard surfaces and converted vegetation areas". WWHM modeling was conducted to confirm that the infiltration trench and permeable pavements infiltrated 100% of the stormwater runoff up to the 100-year storm event, see Appendix B for WWHM report. Both the infiltration trench and permeable pavements infiltrate 100% of the stormwater runoff up to the 100-year storm event therefore, the site is exempt from matching the predeveloped discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow.

MINIMUM REQUIREMENT 8: WETLANDS PROTECTION

International Village, Barn M, and Rodeo Barn

Any threshold discharge area that discharges stormwater through a conveyance system into a wetland is required to meet the Ecology Manual standards for protecting the wetland. The WSF 125th Anniversary Improvements project will not discharge stormwater into a wetland, and thus is not subject to the wetlands protection standards outlined in Minimum Requirement #8.

MINIMUM REQUIREMENT 9: OPERATION AND MAINTENANCE

International Village, Barn M, and Rodeo Barn

An Operations & Maintenance Manual for all new stormwater BMP's installed with the project will be provided in a future submittal.

APPENDIX A

Infiltration Testing Report

Washington State Fair – International Village

Puyallup, WA

Prepared for

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110 9th Avenue SW
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Prepared by

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206.596.2020
Justin Jones, PE

April 22, 2024

JMJTEAM

PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Infiltration Testing Report for Washington State Fair – International Village Development has been prepared by me or under my supervision and meets minimum standards of the Department of Ecology Stormwater Management Manual for Western Washington.

Justin Jones, PE

JUSTIN M. JONES
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41829
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PROFESSIONAL ENGINEER

04-22-2024

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SUMMARY

This report details the results of infiltration testing for use in the stormwater system design of Washington State Fair International Village located within Puyallup, WA. One Pilot Infiltration Test (PIT) was conducted on site to determine the onsite stormwater infiltration rate. The test hole was excavated and backfilled by a licensed contractor and the PIT was completed in accordance with the Department of Ecology (ECY) Stormwater Management Manual for Western Washington (Stormwater Manual).

The PIT process evaluates the infiltration within a 12 SF area by first measuring the rate of water required to maintain a constant water elevation of approximately 12-inches in the test pit, and second by measuring the drawdown rate of the water within the test pit. The drawdown is done using a data logger. The test pit is excavated to a depth of 5.0-feet below existing grade and observed for groundwater.

The field data is then analyzed, and a factor of safety applied to determine the stormwater design infiltration rate. Below is a summary of the results.

Test Pit Location

Summary of Results

Per the PIT, the site soils are suitable for stormwater infiltration. A soil sample was taken from each PIT, the soil sample has been submitted and is pending results.

Testing	Test PIT	Results	ECY Threshold
Ground Water	Pit Depth	4.0-feet	N/A
	Test Hole 1 Groundwater Level	Ground Water not Observed	N/A
Infiltration Rate	Infiltration Rate Factor of Safety	0.45	N/A
	Test Hole 1 Infiltration Rates	Uncorrected: 4.34 inches per hour	≥ 0.3 inches per hour
		Design: 2.0 Inches per hour	

INFILTRATION TEST PROCEDURES

Below is the process taken for the PIT:

- ☐ Identify PIT locations based on the site survey of existing buildings and utilities as well as the potential locations of infiltration facilities based on the preliminary site plan.
- ☐ Obtain public and private utility locates. Prior to the PIT utility locates will be called to ensure there are no utilities present in the PIT locations.
- ☐ Excavation of PIT holes (approximately 3-feet x 4-feet 4-feet deep). A 3-feet x 4-feet x2-feet tall wood box is inserted into the test hole to ensures that the bottom surface area is exactly 12 SF. The box is backfilled to the top edge to ensure stability and infiltration only through the bottom of the test hole for the duration of the PIT.
- ☐ A soil sample is collected from the bottom of the hole to test treatment capability. A lab tests the cation exchange rate and organic matter content of soils. Lab results confirm if the soil is suitable for treatment based on Stormwater Manual criteria.
- ☐ A float system with a water hose connection is set into the center of the test hole. The float system is equipped with a leveling plate, a measuring ruler for visual inspection of water levels and a perforated pipe housing for the data collector.
- ☐ Using water transfer tanks or hose spigot as available, the test hole is filled to a 12-inch water depth that is maintained. The presoak period ensures that the soils have been fully saturated before conducting the PIT. A 1-hour stabilization test is performed after the presoak period to confirm soil

stabilization. If the test yields 4 constant gallon per minute (GPM) readings that are conducted every 15-minutes, the stabilization of the soil is confirmed.

- ☐ A 1-hour GPM test is conducted per the Stormwater Manual. Using a water meter accurate to the nearest tenth of a gallon, a GPM flow rate is recorded every 15-minutes while the water level is maintained at a 12-inch depth. An infiltration rate (in/hr) can be determined using the GPM flow rate and the 12 SF bottom surface area of the hole.

- ☐ A drawdown test is performed per Stormwater Manual to determine the drawdown infiltration capability of the soil. A CRS451V (Pressure Transducer) is placed into the test hole and set to take pressure (PSI) readings every 10-minutes. The water source is shutoff, and the pressure transducer will measure water drawdown for a 2-hour period. At the end of the period the sensors are removed from the test hole, the data is collected using a PC interface module and the HydroSci program to communicate with the sensor to retrieve the data.

- ☐ The wood box and the float system are removed from the test hole.

- ☐ Over excavate test hole to confirm there is no ground water mounding.

- ☐ The test pit is then backfilled and restored to prior state of excavation.

FINDINGS AND RECOMMENDATIONS

Groundwater Conditions

The Stormwater Manual specifies minimum separations between the seasonal high groundwater elevation and the bottom of the infiltration facility based on different best management practices (BMP):

- **Downspout Infiltration:** 1-foot
- **Permeable Pavement:** 1-foot
- **Infiltration Facility:** 3-foot

Groundwater was encountered during the excavation of the PIT tests. Groundwater was observed 3.4' below the existing grade of the testing location. Since the existing grade of the tests is 37.3', BMP's must maintain the required separation between the assumed groundwater level of 33.9'

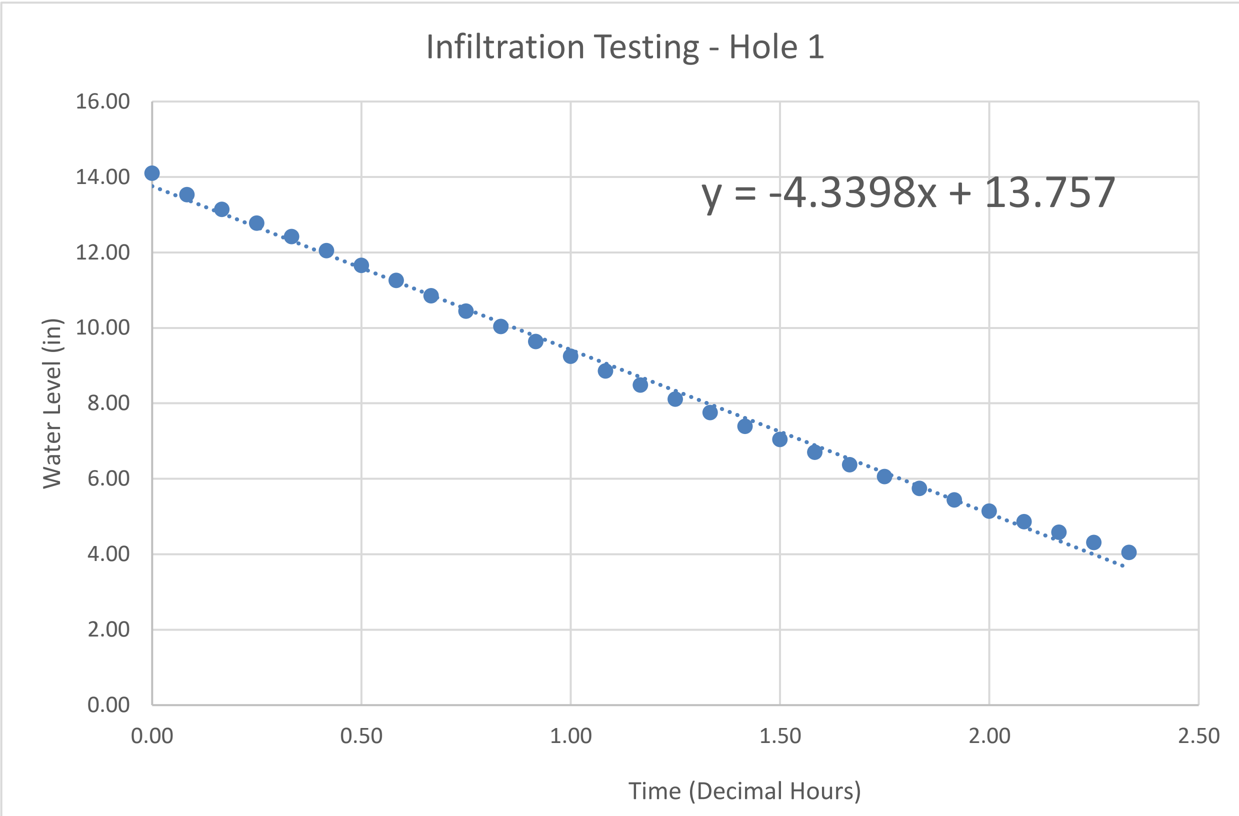
With known groundwater conditions for each test hole, there is adequate spacing between groundwater and BMPs. An overflow should be installed with BMP in case of large storm events.

Field Measured Infiltration Rate

The infiltration rate was collected using two methods in during the PIT. The first method is to measure the gallons per minute flowrate required to maintain a constant water level in the test pit. The average of the flowrate measurements taken over an hour timeframe.

The second method is to measure the drawdown rate of the test pit. Measurements were taken both visually and with a data logger. The average of the drawdown measurements resulted in an infiltration rate of resulted in the following infiltration rates:

- Test Hole 1: 4.34 inches per hour



Design Infiltration Rate

Per the Stormwater Manual a minimum design infiltration rate of 0.3 inches per hour is required for onsite infiltration. The design infiltration rate takes the field measured infiltration rate and applies a factor of safety based on three correction factors. The three corrections are based on site variability, test method, and degree of influent control (See Appendix D).

Issue	Partial Correction Factor
Site variability and number of locations tested	CF_v = 0.33 to 1.0
Test Method	
• Large-scale PIT • Small-scale PIT • Other small-scale (e.g. Double ring, falling head) • Grain Size Method	CF_t = 0.75 = 0.50 = 0.40 = 0.40
Degree of influent control to prevent siltation and bio-buildup	CF_m = 0.9

Total Correction Factor, $CF_T = CF_v \times CF_t \times CF_m$

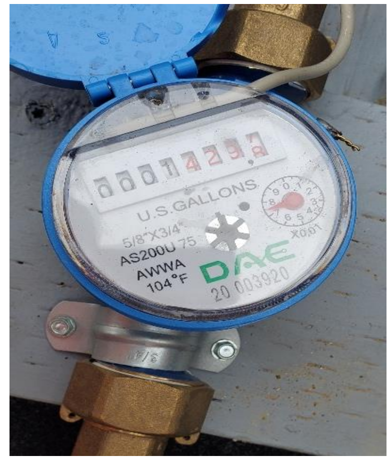
Based on multiple geotechnical reports from nearby projects, soils are known to be consistent in this area. Per the Stormwater Manual, a site variability correction of 1 is used. A correction of 0.5 for the small-scale PIT and 0.9 for the degree of influent are also used. A total correction factor of 0.45 is applied to the measured infiltration rate yielding a recommended design infiltration rates as follows:

- Test Hole 1: 2.0 inches per hour

TEST PIT PHOTO DOCUMENTATION – TEST HOLE 1

3-feet x 4-feet x 18-inches

Test Pit Pre-soak at 12-inches



1-hour GPM Test

Pressure Transducer Drawdown Test

Over Excavation to observe if Groundwater is Mounding

Backfill Test Hole

APPENDIX A

APPENDIX B

PRODUCT

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

CRS451V

Stainless-Steel Vented Stand-Alone Pressure Transducer

Pressure Transducer Combined with a Recorder

High resolution and accuracy

Overview

The CRS451V consists of a submersible water-level and water-temperature sensor with its own time clock and memory to store the collected data—in a compact stainless-steel case. This data logging capability frees users to place the sensor in remote sites and let it collect data for long periods. HydroSci software is included and elegantly supports test setup, data retrieval, and data display. Long battery life and rugged construction mean you can trust the CRS451V to collect important data. Low cost and ease of use make it a good choice in a variety of applications. The CRS456V is the same as this, but with a titanium case.

Benefits and Features

- Sensors and data-collection features in one instrument case
- Rugged stainless-steel case protects piezoresistive sensor
- Quality construction ensures product reliability
- Fully temperature-compensated
- Fast scan rate
- Large data-storage capacity
- Long battery life
- Easy-to-use software

Detailed Description

The CRS451V has several pressure range options.

HydroSci software is available for download. This software simplifies the process of configuring the CRS451V. Users can configure the CRS451V to monitor surface water, ground water, or a standard pump test.

HydroSci software will display the data in tabular or graphical formats.

Specifications

Venting	Vented	Measurement Time	< 1.0 s

APPENDIX C

INFILTRATION TEST

The Washington State Department of Ecology Stormwater Manual provides testing procedures and best practices, which are described below.

- Testing should occur between December 1 and April 1.
- The horizontal and vertical locations of the PIT shall be surveyed by a licensed land surveyor and accurately shown on the design drawings.
- Excavate the test pit to the estimated elevation of the proposed infiltration into the native soil. Note that for some proposed BMPs, such as and BMP T5.15: Per- meable Pavements, this will be below the proposed finished grade. If the native soils will have to meet a minimum subgrade compaction requirement (for example, the road subgrade if using BMP T5.15: Permeable Pavements), compact the native soil to that requirement prior to testing. Lay back the slopes sufficiently to avoid caving and erosion during the test. Altern- atively, consider shoring the sides of the test pit.
- The horizontal surface area of the bottom of the test pit should be approximately 100 square feet. Document the size and geometry of the test pit.
- Install a vertical measuring rod (long enough to measure the ponded water depth, minimum 5- ft. long) marked in half-inch increments in the center of the pit bottom.
- Use a rigid 6-inch diameter pipe with a splash plate on the bottom to convey water to the test pit and reduce side-wall erosion or excessive disturbance of the test pit bottom. Excessive erosion and bottom disturbance will result in clogging of the infiltration receptor and yield lower than actual infiltration rates.
- Add water to the pit at a rate that will maintain a water level between 6 and 12 inches above the bottom of the pit. A rotameter can be used to measure the flow rate into the pit.

The depth should not exceed the proposed maximum depth of water expected in the completed BMP. For infiltration BMPs serving large drainage areas, designs with multiple feet of standing water can have infiltration tests with greater than 1 foot of standing water.

- Every 15-30 min, record the cumulative volume and instantaneous flow rate in gallons per minute necessary to maintain the water level at the same point on the measuring rod.
- Keep adding water to the pit until one hour after the flow rate into the pit has stabilized (constant flow rate; a goal of 5% or less variation in the total flow) while maintaining the same pond water level. The total of the pre-soak time plus one hour after the flow rate has stabilized should be no less than 6 hours.
- After the flow rate has stabilized for at least one hour, turn off the water and record the rate of infiltration (the drop rate of the standing water) in inches per hour from the measuring rod data, until the pit is empty. Consider running this falling head phase of the test several times to estimate the

dependency of the infiltration rate with head.

- At the conclusion of testing, over-excavate the pit to see if the test water is mounded on shallow restrictive layers or if it has continued to flow deep into the subsurface. The depth of excavation varies depending on soil type and depth to the hydraulic restricting layer, and is determined by the engineer or certified soils professional. Mounding is an indication that a mounding analysis is necessary.

DATA ANALYSIS

Calculate and record the initial K_{sat} rate in inches per hour in 30 minutes or one-hour increments until one hour after the flow has stabilized.

Use statistical/trend analysis to obtain the hourly flow rate when the flow stabilizes. This would be the lowest hourly flow rate. *Example:*

The area of the bottom of the test pit is 8.5-ft. by 11.5-ft. (97.75 sq. ft.).

Water flow rate was measured and recorded at intervals ranging from 15 to 30 minutes throughout the test. Between 400 minutes and 1,000 minutes the flow rate stabilized between 10 and 12.5 gal- lons per minute or 600 to 750 gallons per hour, or 80.2 to 100 ft^3 per hour. Dividing this rate by the surface area gives an initial K_{sat} of 9.8 to 12.3 inches per hour.

K_{sat} Determination Option 2: Small Scale Pilot Infiltration Test (PIT)

A small-scale PIT can be substituted for Ksat Determination Option 1: Large Scale Pilot Infiltration Test (PIT) in any of the following instances:

- The drainage area to the infiltration BMP is less than 1 acre.
- The testing is for BMP T7.30: Bioretention or BMP T5.15: Permeable Pavements that either serve small drainage areas and/or are widely dispersed throughout a project site.
- The site has a high infiltration rate (>4 in/hr), making a large scale PIT difficult, and the site geo- technical investigation suggests uniform subsurface characteristics.

INFILTRATION TEST

Use the same procedures described above in Ksat Determination Option 1: Large Scale Pilot Infiltra-tion Test (PIT), with the following changes:

- The horizontal surface area of the bottom of the test pit should be 12 to 32 square feet. It may be circular or rectangular. Document the size and geometry of the test pit.
- The rigid pipe with a splash plate used to convey water to the pit may be a 3-inch diameter pipe for

pits on the smaller end of the recommended surface area, or a 4-inch pipe for pits on the larger end of the recommended surface area.

- Pre-soak period: Add water to the pit so that there is standing water for at least 6 hours. Maintain the pre-soak water level at least 12 inches above the bottom of the pit.
- At the end of the pre-soak period, add water to the pit at a rate that will maintain a 6-12 inch water level above the bottom of the pit over a full hour. The depth should not exceed the pro- posed maximum depth of water expected in the completed facility.
- Every 15 minutes, record the cumulative volume and instantaneous flow rate in gallons per minute necessary to maintain the water level at the same point (between 6 inches and 1 foot) on the measuring rod. The specific depth should be the same as the maximum designed pond- ing depth (usually 6 – 12 inches).

After one hour, turn off the water and record the rate of infiltration (the drop rate of the standing water) in inches per hour from the measuring rod data, until the pit is empty.

- A self-logging pressure sensor may also be used to determine water depth and drain-down.
- At the conclusion of testing, over-excavate the pit to see if the test water is mounded on shallow restrictive layers or if it has continued to flow deep into the subsurface. The depth of excavation varies depending on soil type and depth to the hydraulic restricting layer, and is determined by the engineer or certified soils professional. The soils professional should judge whether a mounding analysis is necessary.

APPENDIX D

CALCULATED DESIGN INFILTRATION RATE:

Site variability and number of locations tested (CF_v) - The number of locations tested must be capable of producing a picture of the subsurface conditions that fully rep- resents the conditions throughout the proposed location of the infiltration BMP. The partial correction factor used for this issue depends on the level of uncertainty that adverse subsurface conditions may occur. If the range of uncertainty is low - for example, conditions are known to be uniform through previous exploration and site geological factors

- one pilot infiltration test (or grain size analysis location) may be adequate to justify a partial correction factor at the high end of the range.

If the level of uncertainty is high, a partial correction factor near the low end of the range may be appropriate. This might be the case where the site conditions are highly variable due to conditions such as a deposit of ancient landslide debris, or buried stream channels. In these cases, even with many explorations and several pilot infiltration tests (or several grain size test locations), the level of uncertainty may still be high.

A partial correction factor near the low end of the range could be assigned where conditions have a more typical variability, but few explorations and only one pilot infiltration test (or one grain size analysis location) is conducted. That is, the number of explorations and tests conducted do not match the degree of site variability anticipated.

- **Uncertainty of test method (CF_t)** accounts for uncertainties in the testing methods. For the full scale PIT method, CF_t = 0.75; for the small-scale PIT method, CF_t = 0.50; for smaller-scale infiltration tests such as the double-ring infiltrometer test, CF_t = 0.40; for grain size analysis, CF_t = 0.40. These values are intended to represent the difference in each test's ability to estimate the actual saturated hydraulic conductivity. The assumption is the larger the scale of the test, the more reliable the result.
- **Degree of influent control to prevent siltation and bio-buildup (CF_m)** Even with a pre-settling basin or a basic treatment BMP for pre-treatment, the soil's initial infiltration rate will gradually decline as more and more stormwater, with some amount of suspended material, passes through the soil profile. The maintenance schedule calls for removing sediment when the BMP is infiltrating at only 90% of its design capacity. Therefore, a correction factor, CF_m, of 0.9 is called for.

Table V-5.1: Correction Factors to be Used With In-Situ Saturated Hydraulic Conductivity Measurements to Estimate Design Rates

Issue	Partial Correction Factor
Site variability and number of locations tested	CF_V = 0.33 to 1.0
Test Method	
• Large-scale PIT • Small-scale PIT • Other small-scale (e.g. Double ring, falling head) • Grain Size Method	CF_t = 0.75 = 0.50 = 0.40 = 0.40
Degree of influent control to prevent siltation and bio-buildup	CF_m = 0.9

Total Correction Factor, $CF_T = CF_V \times CF_t \times CF_m$

Total Correction Factor, $CF_T = 1.0 \times 0.5 \times 0.9$

$CF_T = 0.45$

APPENDIX B

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Infiltration Gallery Modeling

Site Name:	
Site Address:	
City:	
Report Date:	4/1/2024
Gage:	38 IN CENTRAL
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Mitigated Land Use

International Village Roof

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.327
Impervious Total	0.327
Basin Total	0.327

Lateral I Basin 1

Bypass:	No
Impervious Land Use	acre
SIDEWALKS FLAT	1

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	25.00 ft.
Bottom Width:	62.50 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	1.5
Pour Space of material for first layer:	0.33
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	131.096
Total Volume Through Riser (ac-ft.):	0.006
Total Volume Through Facility (ac-ft.):	131.102
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0

Discharge Structure
Riser Height: 1.5 ft.
Riser Diameter: 8 in.
Element Flows To:
Outlet 1 Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.035	0.000	0.000	0.000
0.0167	0.035	0.000	0.000	0.072
0.0333	0.035	0.000	0.000	0.072
0.0500	0.035	0.000	0.000	0.072
0.0667	0.035	0.000	0.000	0.072
0.0833	0.035	0.001	0.000	0.072
0.1000	0.035	0.001	0.000	0.072
0.1167	0.035	0.001	0.000	0.072
0.1333	0.035	0.001	0.000	0.072
0.1500	0.035	0.001	0.000	0.072
0.1667	0.035	0.002	0.000	0.072
0.1833	0.035	0.002	0.000	0.072
0.2000	0.035	0.002	0.000	0.072
0.2167	0.035	0.002	0.000	0.072
0.2333	0.035	0.002	0.000	0.072
0.2500	0.035	0.003	0.000	0.072
0.2667	0.035	0.003	0.000	0.072
0.2833	0.035	0.003	0.000	0.072
0.3000	0.035	0.003	0.000	0.072
0.3167	0.035	0.003	0.000	0.072
0.3333	0.035	0.003	0.000	0.072
0.3500	0.035	0.004	0.000	0.072
0.3667	0.035	0.004	0.000	0.072
0.3833	0.035	0.004	0.000	0.072

0.4000	0.035	0.004	0.000	0.072
0.4167	0.035	0.004	0.000	0.072
0.4333	0.035	0.005	0.000	0.072
0.4500	0.035	0.005	0.000	0.072
0.4667	0.035	0.005	0.000	0.072
0.4833	0.035	0.005	0.000	0.072
0.5000	0.035	0.005	0.000	0.072
0.5167	0.035	0.006	0.000	0.072
0.5333	0.035	0.006	0.000	0.072
0.5500	0.035	0.006	0.000	0.072
0.5667	0.035	0.006	0.000	0.072
0.5833	0.035	0.006	0.000	0.072
0.6000	0.035	0.007	0.000	0.072
0.6167	0.035	0.007	0.000	0.072
0.6333	0.035	0.007	0.000	0.072
0.6500	0.035	0.007	0.000	0.072
0.6667	0.035	0.007	0.000	0.072
0.6833	0.035	0.008	0.000	0.072
0.7000	0.035	0.008	0.000	0.072
0.7167	0.035	0.008	0.000	0.072
0.7333	0.035	0.008	0.000	0.072
0.7500	0.035	0.008	0.000	0.072
0.7667	0.035	0.009	0.000	0.072
0.7833	0.035	0.009	0.000	0.072
0.8000	0.035	0.009	0.000	0.072
0.8167	0.035	0.009	0.000	0.072
0.8333	0.035	0.009	0.000	0.072
0.8500	0.035	0.010	0.000	0.072
0.8667	0.035	0.010	0.000	0.072
0.8833	0.035	0.010	0.000	0.072
0.9000	0.035	0.010	0.000	0.072
0.9167	0.035	0.010	0.000	0.072
0.9333	0.035	0.011	0.000	0.072
0.9500	0.035	0.011	0.000	0.072
0.9667	0.035	0.011	0.000	0.072
0.9833	0.035	0.011	0.000	0.072
1.0000	0.035	0.011	0.000	0.072
1.0167	0.035	0.012	0.000	0.072
1.0333	0.035	0.012	0.000	0.072
1.0500	0.035	0.012	0.000	0.072
1.0667	0.035	0.012	0.000	0.072
1.0833	0.035	0.012	0.000	0.072
1.1000	0.035	0.013	0.000	0.072
1.1167	0.035	0.013	0.000	0.072
1.1333	0.035	0.013	0.000	0.072
1.1500	0.035	0.013	0.000	0.072
1.1667	0.035	0.013	0.000	0.072
1.1833	0.035	0.014	0.000	0.072
1.2000	0.035	0.014	0.000	0.072
1.2167	0.035	0.014	0.000	0.072
1.2333	0.035	0.014	0.000	0.072
1.2500	0.035	0.014	0.000	0.072
1.2667	0.035	0.015	0.000	0.072
1.2833	0.035	0.015	0.000	0.072
1.3000	0.035	0.015	0.000	0.072
1.3167	0.035	0.015	0.000	0.072
1.3333	0.035	0.015	0.000	0.072
1.3500	0.035	0.016	0.000	0.072

1.3667	0.035	0.016	0.000	0.072
1.3833	0.035	0.016	0.000	0.072
1.4000	0.035	0.016	0.000	0.072
1.4167	0.035	0.016	0.000	0.072
1.4333	0.035	0.017	0.000	0.072
1.4500	0.035	0.017	0.000	0.072
1.4667	0.035	0.017	0.000	0.072
1.4833	0.035	0.017	0.000	0.072
1.5000	0.035	0.017	0.000	0.072

Permeable Pavement 1

Pavement Area:0.5709 acre.Pavement Length:	157.70 ft.
Pavement Width:	157.70 ft.
	Pavement slope 1:0 To 1
Pavement thickness:	0.33
Pour Space of Pavement:	0.33
Material thickness of second layer:	0.1
Pour Space of material for second layer:	0.33
Material thickness of third layer:	0.42
Pour Space of material for third layer:	0.33
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	611.124
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	611.124
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	20.778

Analysis Results

POC 1

POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

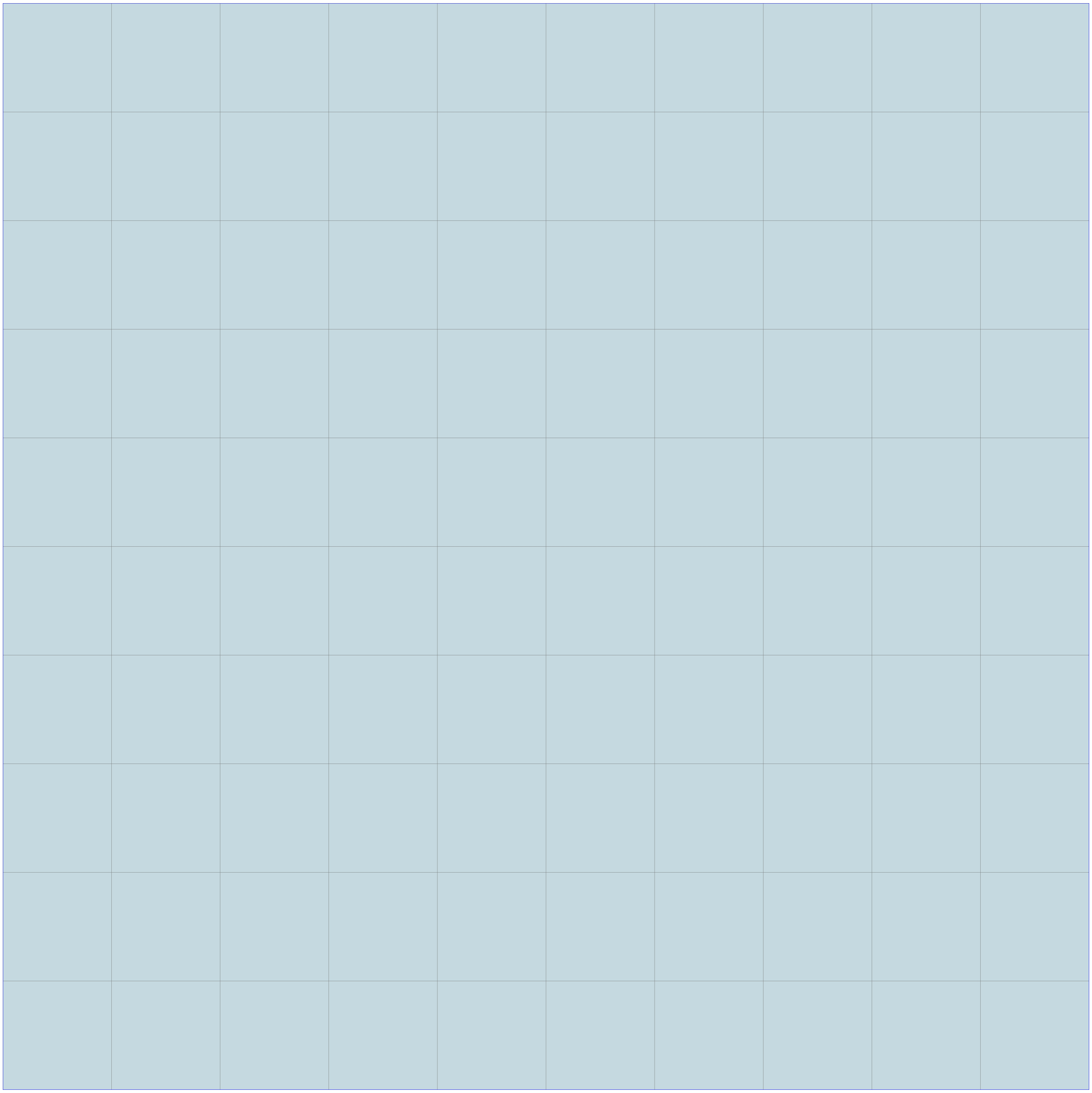
PERLND Changes

No PERLND changes have been made.

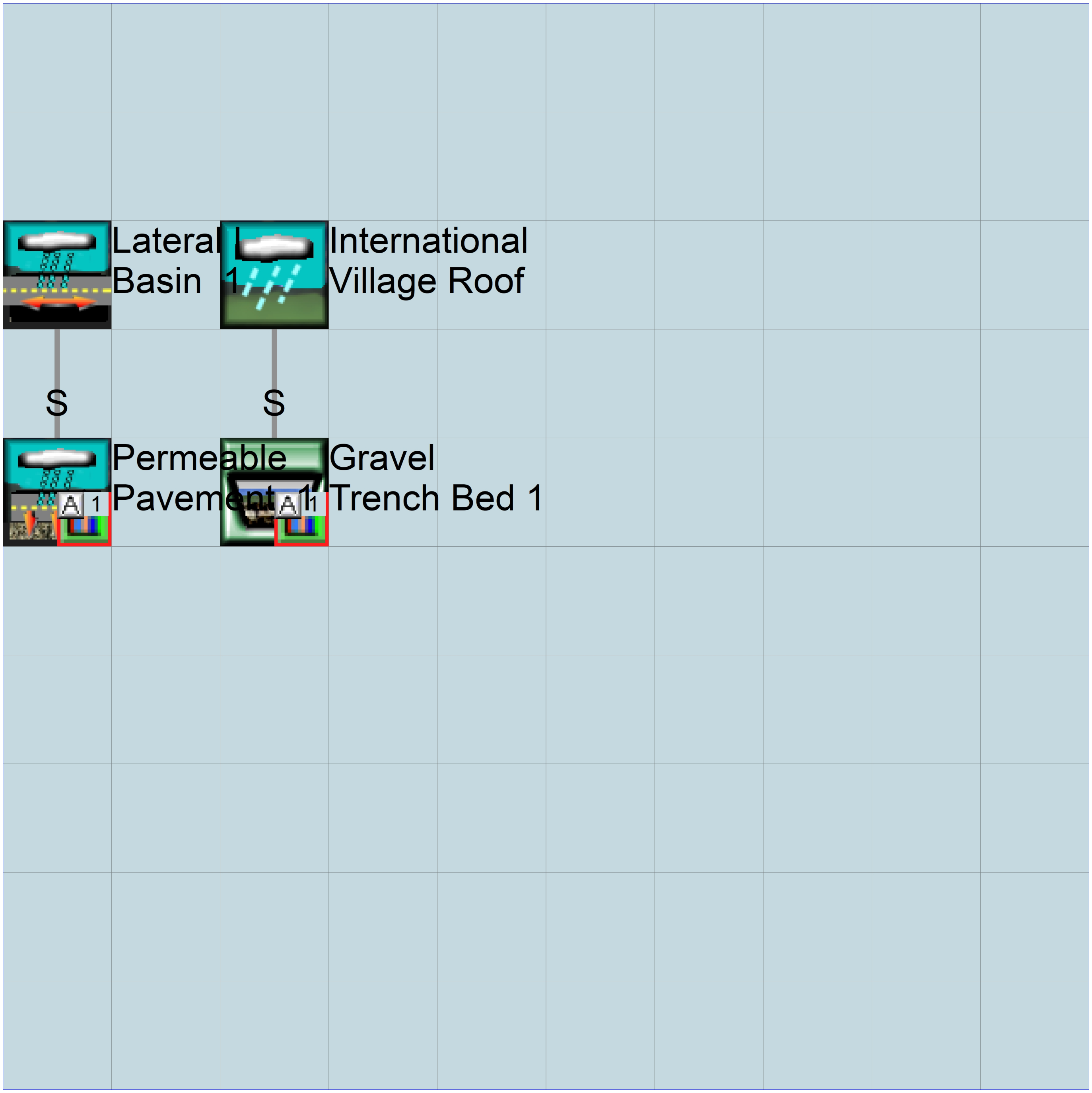
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2059 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   Infiltration Gallery Modeling.wdm
MESSU      25   MitInfiltration Gallery Modeling.MES
           27   MitInfiltration Gallery Modeling.L61
           28   MitInfiltration Gallery Modeling.L62
           30   POCInfiltration Gallery Modeling1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      IMPLND      17
      RCHRES       1
      IMPLND      16
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Gravel Trench Bed 1         MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
     4      ROOF TOPS/FLAT        1    1    1   27    0
    17      SIDEWALKS/FLAT        1    1    1   27    0
    16      Porous Pavement       1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
     4         0    0    1    0    0    0
    17         0    0    1    0    0    0
    16         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
     4         0    0    4    0    0    4    1    9
    17         0    0    4    0    0    0    1    9
    16         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI      ***
     4         0    0    0    0    0
    17         0    0    0    0    0
    16         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
     4           400      0.01       0.1       0.1
    17           400      0.01       0.1       0.1
    16           400      0.01       0.1       0.1
```

```
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4             0         0
   17             0         0
   16             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4             0         0
   17             0         0
   16             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
International Village Roof***
IMPLND   4                       0.327     RCHRES   1      5
IMPLND  16                      0.5709     RCHRES   2      5
Lateral I Basin  1***
IMPLND  17                      1.7516     IMPLND  16     53

******Routing******
IMPLND   4                       0.327     COPY     1     15
IMPLND  17                           1     COPY     1     15
RCHRES   1                           1     COPY   501     17
RCHRES   2                           1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                         in  out                             ***
    1     Gravel Trench Be-004    2    1    1    1   28    0    1
    2     Permeable Paveme-005    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                         ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    2        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.01       0.0       0.0       0.5       0.0
    2             2      0.03       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                            ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1          0          4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2          0          4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)     (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.035870  0.000000  0.000000  0.000000
  0.016667  0.035870  0.000197  0.000000  0.072338
  0.033333  0.035870  0.000395  0.000000  0.072338
  0.050000  0.035870  0.000592  0.000000  0.072338
  0.066667  0.035870  0.000789  0.000000  0.072338
  0.083333  0.035870  0.000986  0.000000  0.072338
  0.100000  0.035870  0.001184  0.000000  0.072338
  0.116667  0.035870  0.001381  0.000000  0.072338
  0.133333  0.035870  0.001578  0.000000  0.072338
  0.150000  0.035870  0.001776  0.000000  0.072338
  0.166667  0.035870  0.001973  0.000000  0.072338
  0.183333  0.035870  0.002170  0.000000  0.072338
  0.200000  0.035870  0.002367  0.000000  0.072338
  0.216667  0.035870  0.002565  0.000000  0.072338
  0.233333  0.035870  0.002762  0.000000  0.072338
  0.250000  0.035870  0.002959  0.000000  0.072338
  0.266667  0.035870  0.003157  0.000000  0.072338
  0.283333  0.035870  0.003354  0.000000  0.072338
  0.300000  0.035870  0.003551  0.000000  0.072338
  0.316667  0.035870  0.003748  0.000000  0.072338
  0.333333  0.035870  0.003946  0.000000  0.072338
  0.350000  0.035870  0.004143  0.000000  0.072338
  0.366667  0.035870  0.004340  0.000000  0.072338
  0.383333  0.035870  0.004538  0.000000  0.072338
  0.400000  0.035870  0.004735  0.000000  0.072338
  0.416667  0.035870  0.004932  0.000000  0.072338
  0.433333  0.035870  0.005129  0.000000  0.072338
  0.450000  0.035870  0.005327  0.000000  0.072338
  0.466667  0.035870  0.005524  0.000000  0.072338
  0.483333  0.035870  0.005721  0.000000  0.072338
  0.500000  0.035870  0.005919  0.000000  0.072338
  0.516667  0.035870  0.006116  0.000000  0.072338
  0.533333  0.035870  0.006313  0.000000  0.072338
  0.550000  0.035870  0.006510  0.000000  0.072338
  0.566667  0.035870  0.006708  0.000000  0.072338
  0.583333  0.035870  0.006905  0.000000  0.072338
  0.600000  0.035870  0.007102  0.000000  0.072338
```

0.616667	0.035870	0.007300	0.000000	0.072338
0.633333	0.035870	0.007497	0.000000	0.072338
0.650000	0.035870	0.007694	0.000000	0.072338
0.666667	0.035870	0.007891	0.000000	0.072338
0.683333	0.035870	0.008089	0.000000	0.072338
0.700000	0.035870	0.008286	0.000000	0.072338
0.716667	0.035870	0.008483	0.000000	0.072338
0.733333	0.035870	0.008681	0.000000	0.072338
0.750000	0.035870	0.008878	0.000000	0.072338
0.766667	0.035870	0.009075	0.000000	0.072338
0.783333	0.035870	0.009272	0.000000	0.072338
0.800000	0.035870	0.009470	0.000000	0.072338
0.816667	0.035870	0.009667	0.000000	0.072338
0.833333	0.035870	0.009864	0.000000	0.072338
0.850000	0.035870	0.010062	0.000000	0.072338
0.866667	0.035870	0.010259	0.000000	0.072338
0.883333	0.035870	0.010456	0.000000	0.072338
0.900000	0.035870	0.010653	0.000000	0.072338
0.916667	0.035870	0.010851	0.000000	0.072338
0.933333	0.035870	0.011048	0.000000	0.072338
0.950000	0.035870	0.011245	0.000000	0.072338
0.966667	0.035870	0.011443	0.000000	0.072338
0.983333	0.035870	0.011640	0.000000	0.072338
1.000000	0.035870	0.011837	0.000000	0.072338
1.016667	0.035870	0.012034	0.000000	0.072338
1.033333	0.035870	0.012232	0.000000	0.072338
1.050000	0.035870	0.012429	0.000000	0.072338
1.066667	0.035870	0.012626	0.000000	0.072338
1.083333	0.035870	0.012824	0.000000	0.072338
1.100000	0.035870	0.013021	0.000000	0.072338
1.116667	0.035870	0.013218	0.000000	0.072338
1.133333	0.035870	0.013415	0.000000	0.072338
1.150000	0.035870	0.013613	0.000000	0.072338
1.166667	0.035870	0.013810	0.000000	0.072338
1.183333	0.035870	0.014007	0.000000	0.072338
1.200000	0.035870	0.014205	0.000000	0.072338
1.216667	0.035870	0.014402	0.000000	0.072338
1.233333	0.035870	0.014599	0.000000	0.072338
1.250000	0.035870	0.014796	0.000000	0.072338
1.266667	0.035870	0.014994	0.000000	0.072338
1.283333	0.035870	0.015191	0.000000	0.072338
1.300000	0.035870	0.015388	0.000000	0.072338
1.316667	0.035870	0.015586	0.000000	0.072338
1.333333	0.035870	0.015783	0.000000	0.072338
1.350000	0.035870	0.015980	0.000000	0.072338
1.366667	0.035870	0.016177	0.000000	0.072338
1.383333	0.035870	0.016375	0.000000	0.072338
1.400000	0.035870	0.016572	0.000000	0.072338
1.416667	0.035870	0.016769	0.000000	0.072338
1.433333	0.035870	0.016967	0.000000	0.072338
1.450000	0.035870	0.017164	0.000000	0.072338
1.466667	0.035870	0.017361	0.000000	0.072338
1.483333	0.035870	0.017558	0.000000	0.072338
1.500000	0.035870	0.017756	0.000000	0.072338
1.516667	0.035870	0.018354	0.015217	0.072338

END FTABLE 1
FTABLE 2
91 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.570920	0.000000	0.000000	0.000000		
0.008333	0.570920	0.001570	0.000000	1.151356		
0.016667	0.570920	0.003140	0.000000	1.151356		
0.025000	0.570920	0.004710	0.000000	1.151356		
0.033333	0.570920	0.006280	0.000000	1.151356		
0.041667	0.570920	0.007850	0.000000	1.151356		
0.050000	0.570920	0.009420	0.000000	1.151356		
0.058333	0.570920	0.010990	0.000000	1.151356		
0.066667	0.570920	0.012560	0.000000	1.151356		
0.075000	0.570920	0.014130	0.000000	1.151356		

0.083333	0.570920	0.015700	0.000000	1.151356
0.091667	0.570920	0.017270	0.000000	1.151356
0.100000	0.570920	0.018840	0.000000	1.151356
0.108333	0.570920	0.020410	0.000000	1.151356
0.116667	0.570920	0.021980	0.000000	1.151356
0.125000	0.570920	0.023550	0.000000	1.151356
0.133333	0.570920	0.025120	0.000000	1.151356
0.141667	0.570920	0.026691	0.000000	1.151356
0.150000	0.570920	0.028261	0.000000	1.151356
0.158333	0.570920	0.029831	0.000000	1.151356
0.166667	0.570920	0.031401	0.000000	1.151356
0.175000	0.570920	0.032971	0.000000	1.151356
0.183333	0.570920	0.034541	0.000000	1.151356
0.191667	0.570920	0.036111	0.000000	1.151356
0.200000	0.570920	0.037681	0.000000	1.151356
0.208333	0.570920	0.039251	0.000000	1.151356
0.216667	0.570920	0.040821	0.000000	1.151356
0.225000	0.570920	0.042391	0.000000	1.151356
0.233333	0.570920	0.043961	0.000000	1.151356
0.241667	0.570920	0.045531	0.000000	1.151356
0.250000	0.570920	0.047101	0.000000	1.151356
0.258333	0.570920	0.048671	0.000000	1.151356
0.266667	0.570920	0.050241	0.000000	1.151356
0.275000	0.570920	0.051811	0.000000	1.151356
0.283333	0.570920	0.053381	0.000000	1.151356
0.291667	0.570920	0.054951	0.000000	1.151356
0.300000	0.570920	0.056521	0.000000	1.151356
0.308333	0.570920	0.058091	0.000000	1.151356
0.316667	0.570920	0.059661	0.000000	1.151356
0.325000	0.570920	0.061231	0.000000	1.151356
0.333333	0.570920	0.062801	0.000000	1.151356
0.341667	0.570920	0.064371	0.000000	1.151356
0.350000	0.570920	0.065941	0.000000	1.151356
0.358333	0.570920	0.067511	0.000000	1.151356
0.366667	0.570920	0.069081	0.000000	1.151356
0.375000	0.570920	0.070651	0.000000	1.151356
0.383333	0.570920	0.072221	0.000000	1.151356
0.391667	0.570920	0.073791	0.000000	1.151356
0.400000	0.570920	0.075361	0.000000	1.151356
0.408333	0.570920	0.076932	0.000000	1.151356
0.416667	0.570920	0.078502	0.000000	1.151356
0.425000	0.570920	0.080072	0.000000	1.151356
0.433333	0.570920	0.081642	0.000000	1.151356
0.441667	0.570920	0.083212	0.000000	1.151356
0.450000	0.570920	0.084782	0.000000	1.151356
0.458333	0.570920	0.086352	0.000000	1.151356
0.466667	0.570920	0.087922	0.000000	1.151356
0.475000	0.570920	0.089492	0.000000	1.151356
0.483333	0.570920	0.091062	0.000000	1.151356
0.491667	0.570920	0.092632	0.000000	1.151356
0.500000	0.570920	0.094202	0.000000	1.151356
0.508333	0.570920	0.095772	0.000000	1.151356
0.516667	0.570920	0.097342	0.000000	1.151356
0.525000	0.570920	0.098912	0.000000	1.151356
0.533333	0.570920	0.100482	0.000000	1.151356
0.541667	0.570920	0.102052	0.000000	1.151356
0.550000	0.570920	0.103622	0.000000	1.151356
0.558333	0.570920	0.105192	0.000000	1.151356
0.566667	0.570920	0.106762	0.000000	1.151356
0.575000	0.570920	0.108332	0.000000	1.151356
0.583333	0.570920	0.109902	0.000000	1.151356
0.591667	0.570920	0.111472	0.000000	1.151356
0.600000	0.570920	0.113042	0.000000	1.151356
0.608333	0.570920	0.114612	0.000000	1.151356
0.616667	0.570920	0.116182	0.000000	1.151356
0.625000	0.570920	0.117752	0.000000	1.151356
0.633333	0.570920	0.119322	0.000000	1.151356
0.641667	0.570920	0.120892	0.000000	1.151356
0.650000	0.570920	0.122462	0.000000	1.151356
0.658333	0.570920	0.124032	0.000000	1.151356

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  0.666667  0.570920  0.125602  0.000000  1.151356
  0.675000  0.570920  0.127173  0.000000  1.151356
  0.683333  0.570920  0.128743  0.000000  1.151356
  0.691667  0.570920  0.130313  0.000000  1.151356
  0.700000  0.570920  0.131883  0.000000  1.151356
  0.708333  0.570920  0.133453  0.000000  1.151356
  0.716667  0.570920  0.135023  0.000000  1.151356
  0.725000  0.570920  0.136593  0.000000  1.151356
  0.733333  0.570920  0.138163  0.000000  1.151356
  0.741667  0.570920  0.139733  0.000000  1.151356
  0.750000  0.570920  0.141303  0.000000  1.151356
  END FTABLE  2
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              RCHRES   2     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
RCHRES   2 HYDR   RO     1 1        1      WDM   1004 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      1 1        1      WDM   1005 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      2 1        1      WDM   1006 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1007 STAG     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17

  MASS-LINK       53
IMPLND     IWATER SURO                     IMPLND         EXTNL  SURLI
  END MASS-LINK   53


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1952/ 1/10  9:15

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1          V2         VOL
92  773.45     799.50     812.88
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1952/ 1/10  9:15

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 3125.0     -4.730E+03    1.5135  1.5135E+00      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1952/ 1/10  9:30

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1          V2         VOL
92 7.7345E+02  799.50     822.60
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1952/ 1/10  9:30

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 3125.0     -5.897E+03    1.8870  1.8870E+00      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1952/ 1/10  9:45

RCHRES:     1
```

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
92	7.7345E+02	799.50	827.21

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 9:45

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	3125.0	-6.449E+03	2.0638	2.0638	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 10: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
92	773.45	799.50	829.29

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 10: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	3125.0	-6.699E+03	2.1437	2.1437	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 10:15

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
92	773.45	799.50	805.38

ERROR/WARNING ID: 341   5

DATE/TIME: 1952/ 1/10 10:15

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	3125.0	-3.831E+03	1.2258	1.2258E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1972/ 6/10 18:15

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
92	7.7345E+02	799.50	800.99

ERROR/WARNING ID: 341   5

DATE/TIME: 1972/ 6/10 18:15

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	3125.0	-3.304E+03	1.0573	1.0573E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1972/ 6/10 18:30

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
92	7.7345E+02	799.50	829.61

ERROR/WARNING ID: 341   5

DATE/TIME: 1972/ 6/10 18:30

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0).

Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

```
A          B          C       RDEP1      RDEP2  COUNT
0.0000E+00 3125.0     -6.737E+03    2.1558  2.1558E+00      2
```

ERROR/WARNING ID: 341   6

DATE/TIME: 1972/ 6/10 18:45

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition.
Relevant data are:

```
NROWS         V1          V2        VOL
92 7.7345E+02  799.50     836.90
```

ERROR/WARNING ID: 341   5

DATE/TIME: 1972/ 6/10 18:45

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

```
A          B          C       RDEP1      RDEP2  COUNT
0.0000E+00 3125.0     -7.612E+03    2.4358  2.4358E+00      2
```

ERROR/WARNING ID: 341   6

DATE/TIME: 1972/ 6/10 19: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition.
Relevant data are:

```
NROWS         V1          V2        VOL
92 7.7345E+02  799.50     835.99
```

ERROR/WARNING ID: 341   5

DATE/TIME: 1972/ 6/10 19: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

```
A          B          C       RDEP1      RDEP2  COUNT
0.0000E+00 3125.0     -7.502E+03    2.4007  2.4007E+00      2
```

ERROR/WARNING ID: 341   6

DATE/TIME: 1972/ 6/10 19:15

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
92	7.7345E+02	799.50	805.79

ERROR/WARNING ID: 341 5

DATE/TIME: 1972/ 6/10 19:15

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	3125.0	-3.880E+03	1.2415	1.2414E+00	2

Disclaimer

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