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Technical Memorandum

Date:	October 9, 2015	**From:**	Danika M. Globokar, E.I.T., G.I.T. DMG
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Project No:	KE140579A	**Project Name:**	Nouri Short Plat
Subject:	Dry Well Infiltration Considerations		

This memorandum addresses the concern for the use of dry-wells at the Nouri project site and the potential effect to ground water levels as a result of infiltration. This memorandum provides additional details and information to supplement the hydrogeology descriptions and recommendations presented in our "Subsurface Exploration, Geologic Hazard, and Preliminary Geotechnical Engineering Report," dated October 17, 2014, and our "Report on Infiltration Testing and Ground Water Mounding Analysis," dated December 23, 2014.

In our previous reports, we conducted a subsurface exploration and infiltration testing program in accordance with standard geotechnical and hydrogeologic practices and the Washington State Department of Ecology *Stormwater Management Manual for Western Washington* 2012, as amended in December 2014 (Ecology Manual) (Ecology, 2012). We also performed a mounding analysis using the MODRET software based on discussions with and guidance from the King County Department of Permitting and Environmental Review. Detailed results of our infiltration test and mounding analysis are provided in our aforementioned reports.

Dry Well Use in Western Washington and King County

It is our understanding that the City of Redmond follows the 2012 Ecology Manual for residential dry wells, and the City of Kirkland defaults to the 2009 *King County Surface Water Design Manual* (2009 KCSWDM). Both manuals use the same figure of a typical dry well infiltration system (Ecology Figure 3.1.4, KCSWDM Figure C.2.2.C) as well as stormwater best management practices (BMPs) for implementation of dry wells on properties. This design is used by engineers and hydrogeologists throughout Western Washington and King County. The Nouri short plat will use this design for the proposed infiltration dry wells. Associated Earth Sciences, Inc. (AESI) has successfully completed numerous projects using downspout/rooftop infiltration and dry wells, including single-family home and multi-lot residential projects in Redmond and Kirkland.

Copies of Ecology Figure 3.1.4 and KCSWDM Figure C.2.2.C are attached to our original reports and to this technical memorandum.

Effects on Infiltration Ground Water Level

It is our opinion that the effect of proposed on-site stormwater infiltration to local ground water levels will be negligible. Key hydrogeologic considerations that substantiate our opinion are presented below:

- Based on our water level monitoring on-site in well MW-1 (Figure 2), seasonal high water level is at approximate elevation of 442 feet above sea level (asl), or 15 feet below ground surface (bgs). Based on our other explorations on site and at nearby Rose Hill Middle School, ground water flows east at an approximate gradient between 0.04 and 0.06 feet per feet (ft/ft). The ground water table generally dips more steeply than ground surface between the Nouri property and Rose Hill Middle School. Our electronic tape and pressure transducer water level measurements plotted with rainfall from both the Nouri property and Rose Hill Middle School are attached.

- Current project plans include infiltration of roof runoff into on-site dry wells. Clean roof runoff would be the only water directed to the infiltration facilities. Water from pollutant-generating surfaces, such as driveways, would not be infiltrated. As such, the total volume of water infiltrated into the subsurface will be low.

- During the simulated maximum-volume hydrograph scenario, our mounding analysis conservatively simulates a mound of about 10 feet in height forming at a dry well infiltration location. Five feet from the infiltration facility, the mound dissipates to a height of 5 feet. The simulated mound completely dissipates 40 feet from the site of the infiltration dry well. These simulated mound heights are interpreted to overestimate the actual mound height under the maximum volume scenario since the MODRET analysis assumes a flat water table and incorporates a factor of safety of 2. Figures 3 and 4, attached, show ground water levels and simulated mound height.

Attachments: Figure 2: Site and Exploration Plan
Figure 3: Geologic Cross Section A-A'
Figure 4: Mounding Analysis Cross-Section
Nouri Short Plat MW-1 Water Levels
Rose Hill Junior High School MW-1 Water Levels
2012 Ecology Manual, Figure 3.1.4
2009 King County Stormwater Design Manual, Figure C.2.2.C

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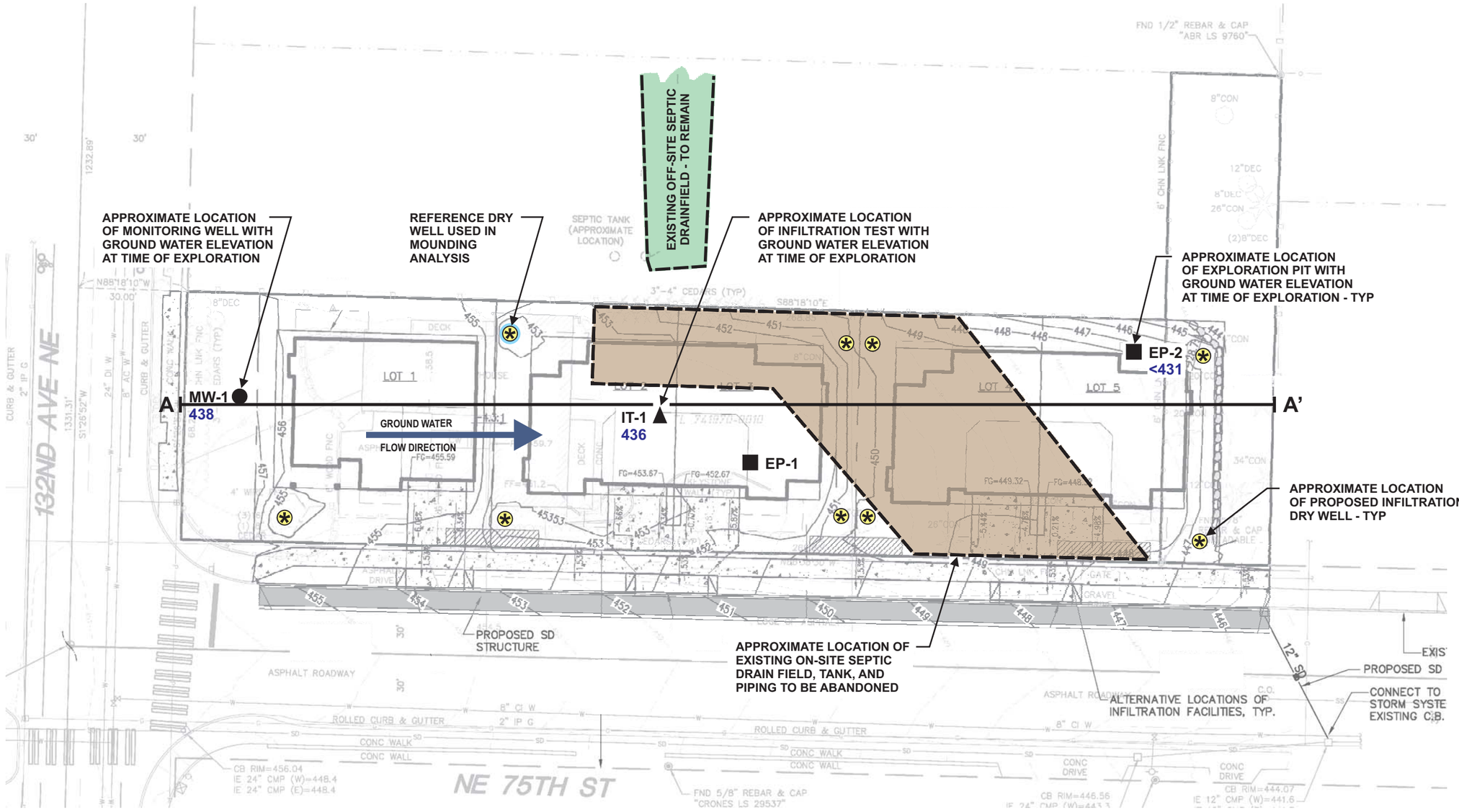

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FEET

REFERENCE: PACE ENGINEERS

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

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SITE AND EXPLORATION PLAN

NOURI SHORT PLAT

REDMOND, WASHINGTON

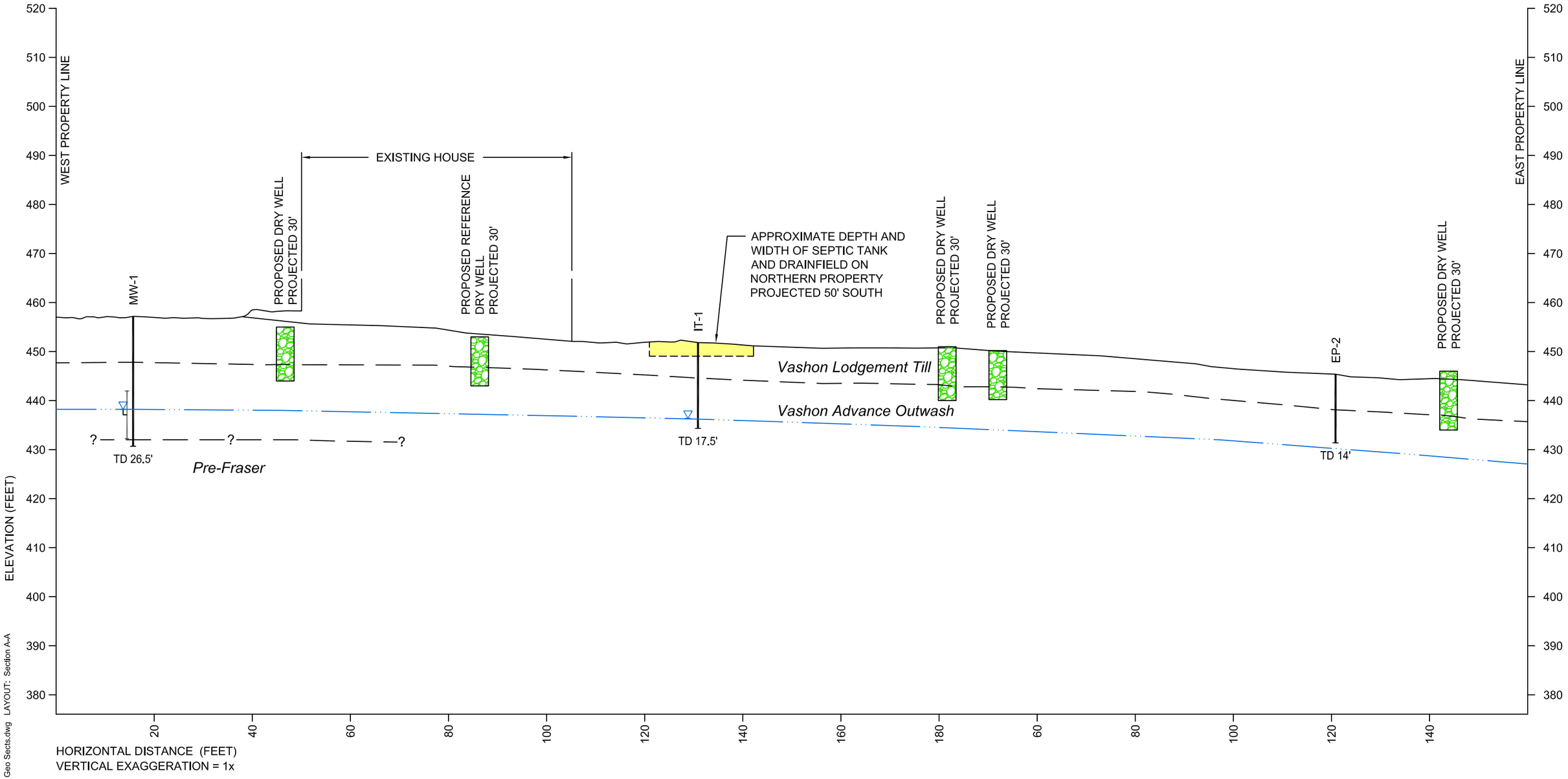
FIGURE 2

DATE 12/14

PROJ. NO. KE140579A

140579 Nouri Short Plat / 140579 Site and Exploration Plan 12-11-2014.cdr

A WEST — EAST A'



140579 Nouri Short Plat \ 140579 Geo Sects.dwg LAYOUT: Section A-A

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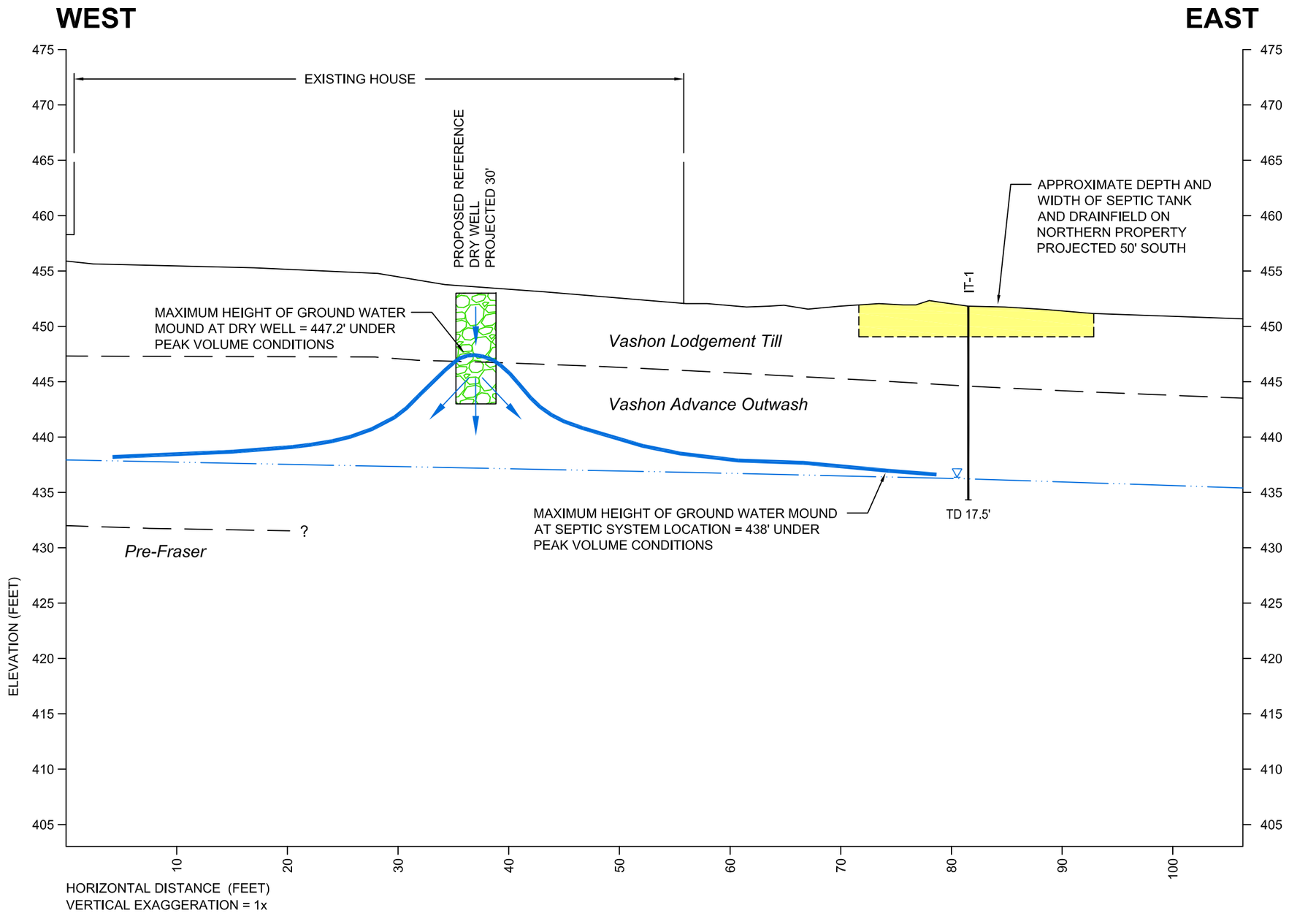
GEOLOGIC CROSS-SECTION A - A'

NOURI SHORT PLAT
REDMOND, WASHINGTON

FIGURE 3

DATE 12/14

PROJECT NO. KE140579A



140579 Nouri Short Plat \ 140579 Geo Sects.dwg LAYOUT: Section Enlarge

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MOUNDING ANALYSIS CROSS-SECTION

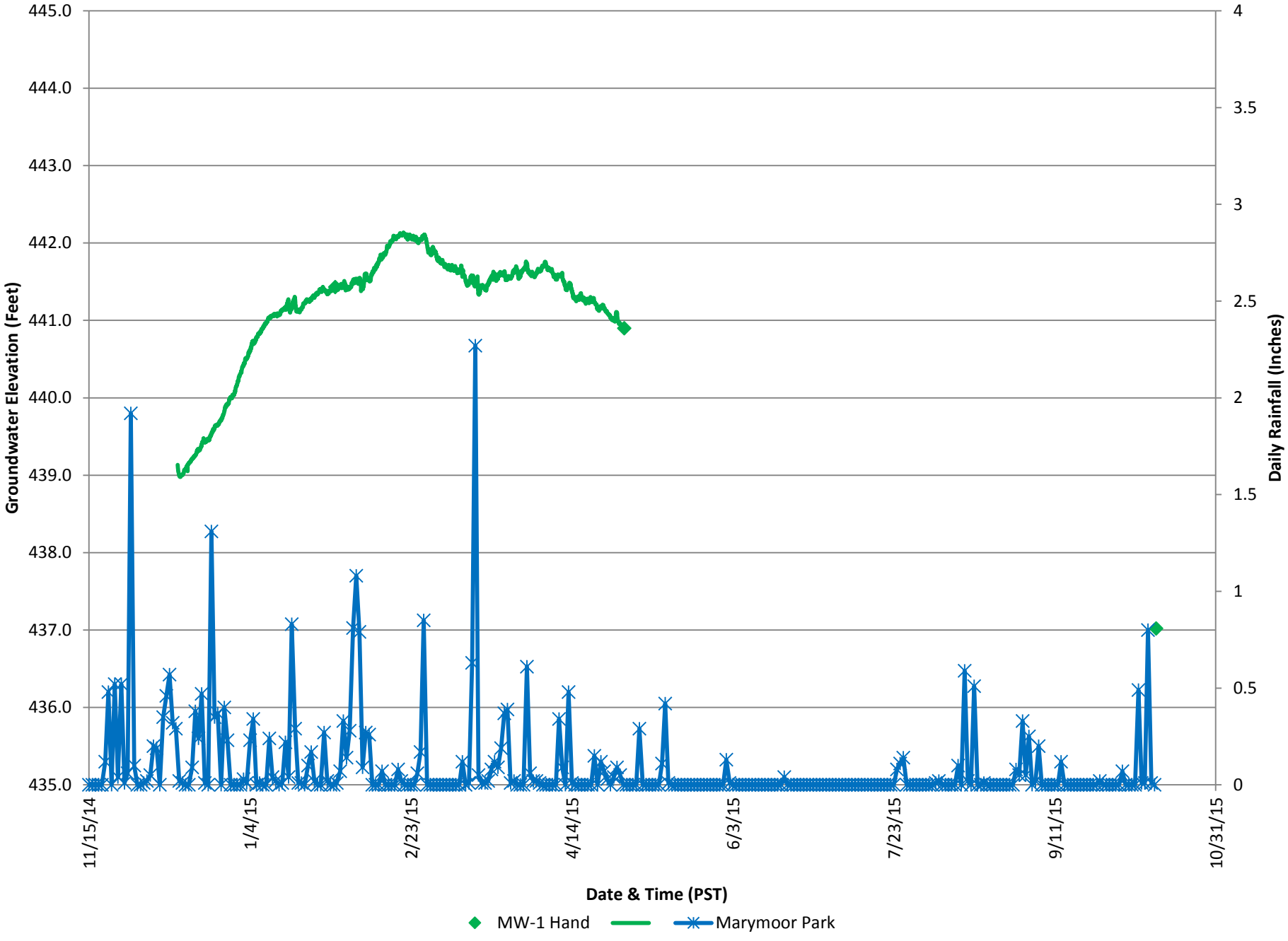
NOURI SHORT PLAT
REDMOND, WASHINGTON

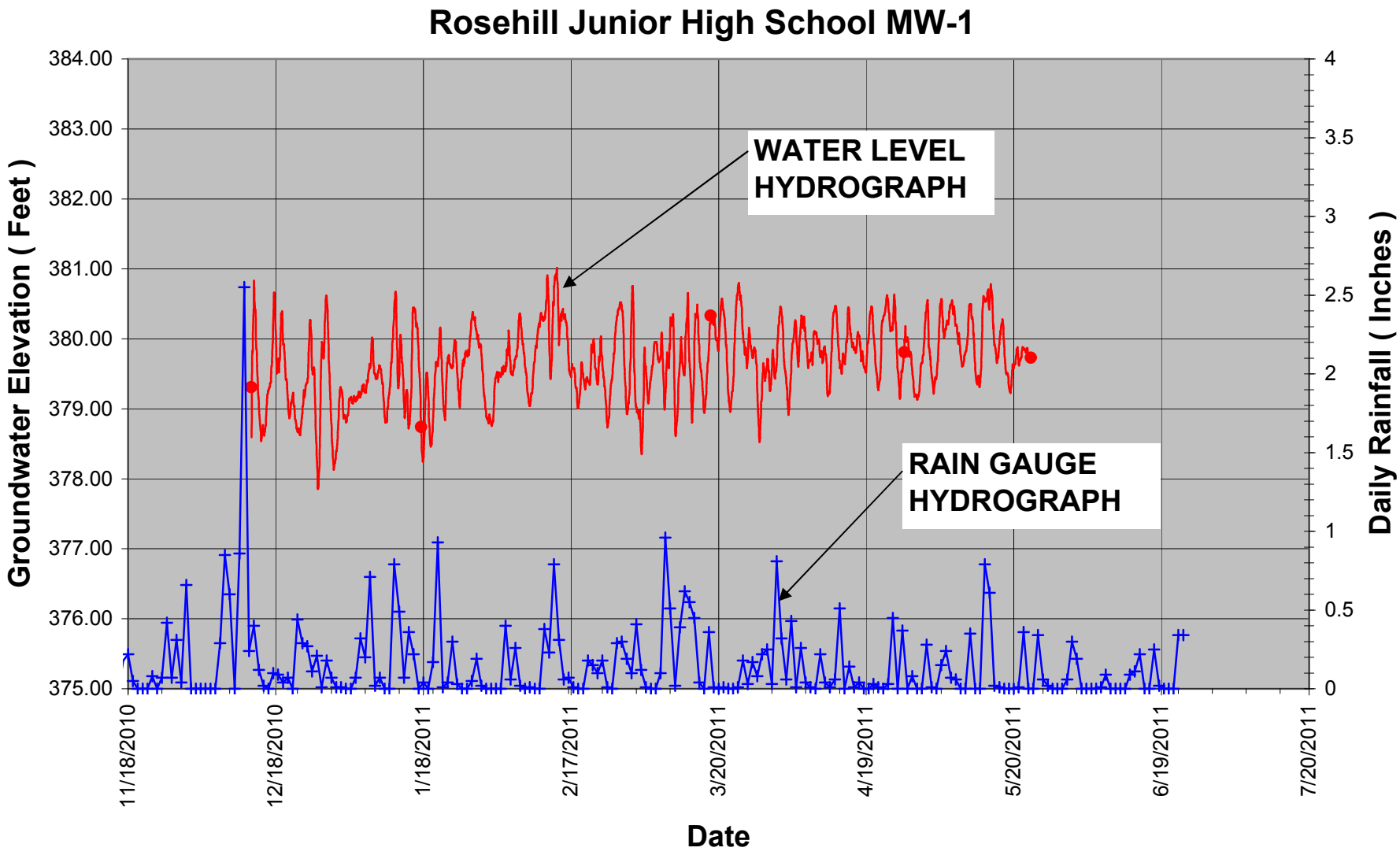
FIGURE 4

DATE 12/14

PROJECT NO. KE140579A

Nouri Short Plat




Rosehill Junior High School MW-1
WATER LEVEL HYDROGRAPH
RAIN GAUGE HYDROGRAPH
Groundwater Elevation (Feet)
Daily Rainfall (Inches)
Date
384.00
383.00
382.00
381.00
380.00
379.00
378.00
377.00
376.00
375.00
4
3.5
3
2.5
2
1.5
1
0.5
0
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6/19/2011
7/20/2011

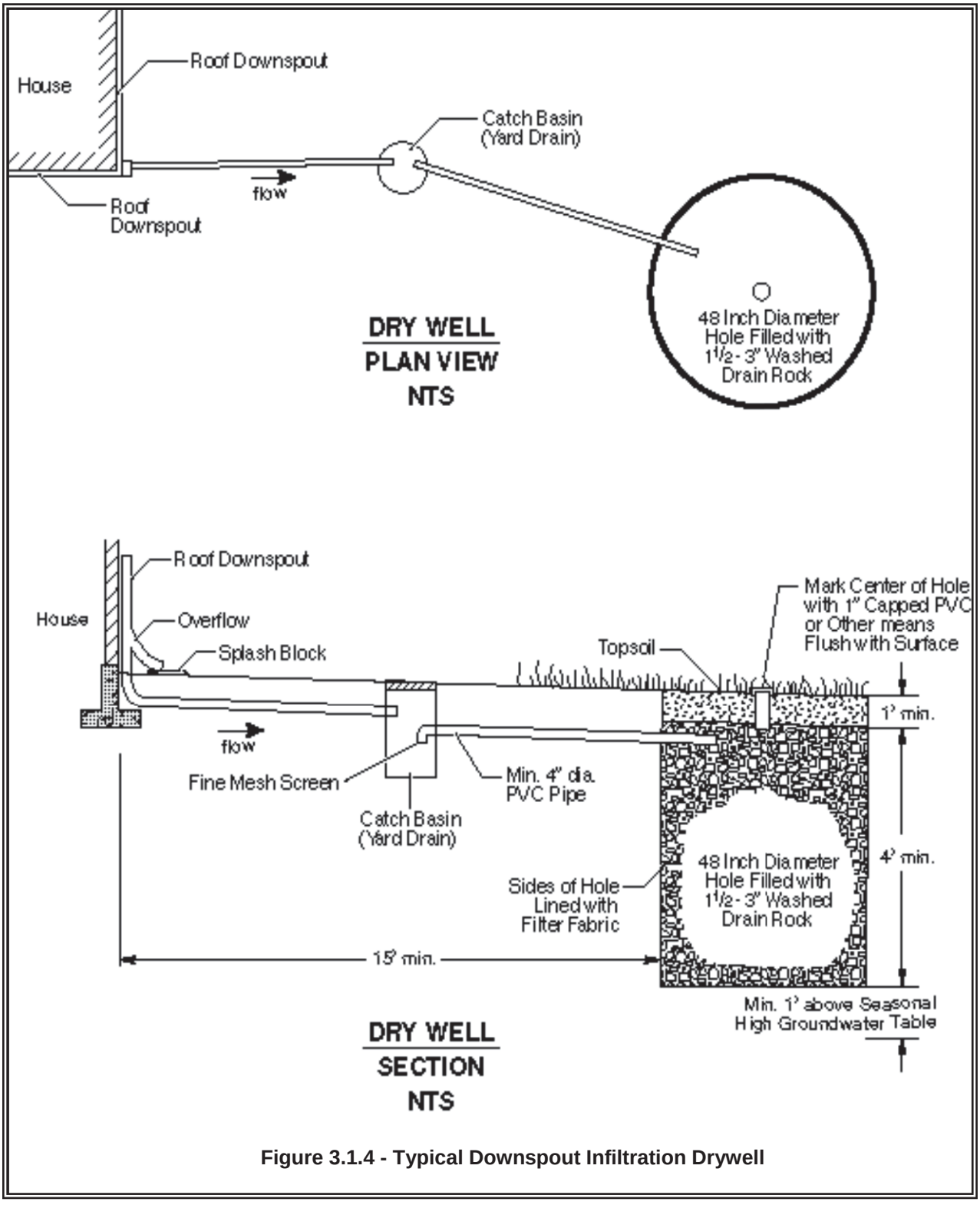
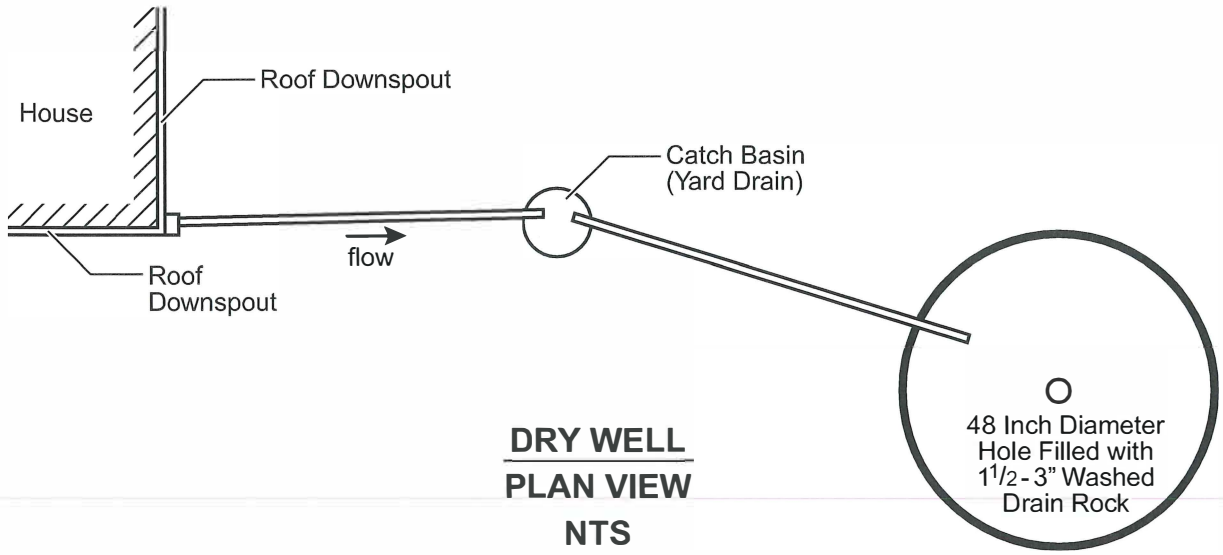


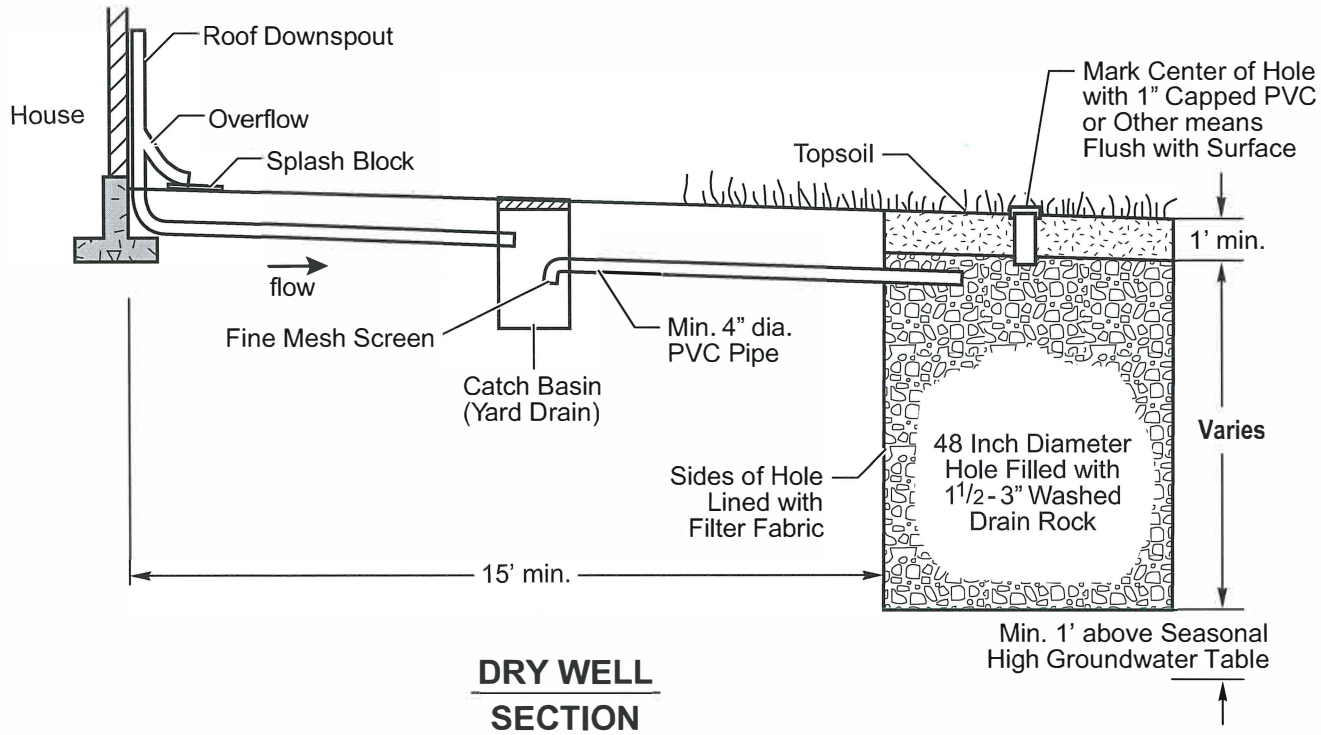
Figure 3.1.4 - Typical Downspout Infiltration Drywell

Source: King County

FIGURE C.2.2.C TYPICAL DRYWELL INFILTRATION SYSTEM



DRY WELL
PLAN VIEW
NTS



DRY WELL
SECTION
NTS