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TECHNICAL MEMORANDUM

TO: Kurt Hosman – Cascadia Conservation District **DATE:** September 28, 2007

FR: Jay Pietraszek - Golder **OUR REF:** 053-1000.300

Bob Anderson – Golder

RE: Status report of the floodplain storage project at Cottonwood Flats

ATTACHMENTS:

Figure 1-1 – Site Location Overview Map

Figures 3-1 to 3-4 – Hydrographs

Figures 3-5 to 3-6 – Water Level Gradients

Figures 4-1 to 4-3 – Storage Estimates

Appendix A. Test Pit Logs

Appendix B. Sieve Results

1.0 INTRODUCTION

This memorandum is a project status report for the WRIA 46 Step B Storage Assessment. The Step B Assessment focuses on a floodplain storage project that was implemented on the Entiat River, near the Town of Ardenvoir. The project began in February 2007. To this point the project has consisted of a background study of hydrologic and hydrogeologic conditions on the floodplain. Section 2 of this report details the installation of piezometers that are used to measure groundwater levels. Section 3 details the water level data collected from the piezometers. An estimate of the storage capacity of the floodplain site is provided in Section 4.

This work is being completed under the WRIA 46 Water Storage Assessment under Grant C0500165 between the Washington Department of Ecology (WDOE) and Chelan County Conservation District (CCCD).

1.1 Site Description

The study site is on the southwest side of the Entiat River; approximately ¾ mile downstream of the Stormy Creek confluence (see Figure 1). The parcel is owned by the Chelan Douglas Land Trust, and is known as “Cottonwood Flats”.

The floodplain is bounded by the Entiat River to the North and East and by Tyee Ridge to the South and West. The project site is undeveloped, except for some gravel roads that were built with non-native material on the center portion of the site. In places this non-native was built up more than one foot above the native floodplain material. These roads may act to direct surface flows during high-water periods

A small topographic high runs parallel to the river in center portion of the floodplain. The land surface slopes gently east from the center portion of the floodplain towards the river and west towards a low-lying area adjacent to Tyee Ridge on the southern end of the floodplain. This low-lying area is of particular interest because it may represent a relict side-channel of the Entiat River.

2.0 PIEZOMETERS

2.1 Installation

Nine piezometers were installed on the project site between February 5th and 8th, 2007. Piezometer locations were chosen to best approximate a grid pattern across the floodplain. The location of each piezometer is shown in Figure 1.

The piezometers were installed using a tracked excavator. Batchelor Excavation, of Entiat, WA, was contracted by Golder to perform the excavations. Nine test pits were dug 8-10 feet deep. The depth of each pit was limited by slumping and sloughing on the side walls. Groundwater levels were typically 4-7 ft below ground surface. Double-walled, perforated high density polyethylene (HDPE) pipe was placed in the pit once the maximum depth of the pit was reached. The test pit was then backfilled around the HDPE pipe. Two-inch, schedule 80 PVC pipe was inserted into the HDPE pipe and a pressure transducer was fixed to the PVC.

TABLE 2-1

Piezometer Detail Summary.

Piezometer	Surface Elevation (ft ASL)	Depth of Piezometer (ft)
B1	1,561.6	10.0
B2	1,561.8	10.0
B3	1,563.2	9.0
B4	1,562.2	9.0
B5	1,559.3	9.0
B6	1,562.2	8.5
B7	1,561.9	8.5
B8	1,559.2	7.5
B9	1,560.6	8.5

Pressure transducers were successfully installed in all nine piezometers. CCCD downloaded the data on a monthly basis. Golder compiled and analyzed the data. In August 2007, Golder contracted Pinnacle Surveying of Chelan, WA to survey the piezometer locations and elevations and install several benchmarks on the site.

2.2 Soil Description

Two discreet soil types were observed in each of the test pits: (1) a relatively fine-grained topsoil, and (2) an underlying coarser-grained alluvium. The topsoil was generally fine sands and silts, while the alluvium consisted of coarse to very coarse gravels. In general, topsoil thickness was greater in the test pits located furthest from the river. For example, at test pits B-5 and B-8 the topsoil was up 3 ft thick while less than 1 foot of topsoil was observed at test pits B-1 and B-3. Test pit logs are included in Appendix A.

A particle-size analysis was performed on selected samples from both the topsoil and underlying alluvium. A summary of the results are provided in Table 2-2. The results illustrate that the topsoil is much finer-grained than the alluvium. Particle size distribution plots are provided in Appendix B.

TABLE 2-2

Soil Texture Summary

	Site	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}
Topsoil	B9-A	0.3	0.4	0.7	0.8	6.5
	B3-A	0.2	0.7	6.0	13.0	32.0
	B4-A	0.5	0.6	0.8	1.2	19.0
	B5-A	0.1	0.1	0.1	0.1	0.4
	B7-A	0.2	0.3	0.4	0.5	0.7
	Average	**0.2**	**0.4**	**1.6**	**3.1**	**11.7**
Alluvium	B3-B	1.1	3.2	15.0	23.0	43.0
	B5-B	1.1	4.0	16.0	22.0	50.0
	B7-B	0.8	2.3	9.6	16.0	39.0
	Average	**1.0**	**3.2**	**13.5**	**20.3**	**44.0**

All values are in millimeters.

3.0 PIEZOMETER DATA

3.1 Water Levels

Figures 3-1 to 3-4 show groundwater elevations at the nine piezometers between February 7th and August 21st, 2007. Water levels were at their lowest from February to early March. On March 10th water levels rose quickly then remained relatively stable until the snowmelt runoff began around May 7th. Water levels peaked on June 5th, and then receded sharply until about June 10th. A more gentle sloping recession was observed beginning about June 10th and August 21, 2007.

Figure 3-1 compares the hydrograph from the USGS Entiat River streamflow gage to the hydrographs from the four piezometers (B1, B3, B6, and B9) that are situated closest to the Entiat River on the project site. The USGS streamflow gage (Entiat River at Ardenvoir) is located about 1/3 mile upstream of the project site. The purpose of Figure 3-1 is to show that the water level fluctuations at these four piezometers mirror the water level fluctuations in the river.

Figures 3-2 to 3-4 show hydrographs from all piezometers. The figures are grouped to illustrate the differences in water level fluctuations as the distance from the river increases. The piezometers situated furthest from the river show a delayed response relative to the piezometers closest to the river. This delay is most evident in piezometers B5 (Figure 3-3) and B8 (Figure 3-4) during two smaller storm events between March 24th and April 24th.

3.2 Groundwater Gradients

Gradients were calculated between piezometers in two directions: (1) across the floodplain (perpendicular to the river), and (2) down the floodplain (parallel to the river). Figure 3-5 shows the gradients between various piezometers at selected times during the study period. In general, the gradients parallel to the river (or downstream) are higher than the gradients perpendicular to the river (or cross-stream). In other words, the strongest direction of groundwater flow follows the direction of the river.

Figure 3-6 shows the average downstream gradient and the average cross-stream gradient aver the study period. A positive gradient indicates that groundwater is moving from the floodplain to the river (a river-gaining condition). A negative gradient indicates that groundwater is moving from the river to the floodplain (a river-losing condition). The average cross-stream gradient is positive (gaining) from March to late April, negative (losing) from late April through late July, and neutral during August and September.

4.0 STORAGE CALCULATIONS

Groundwater storage volumes were calculated using the following equation:

Floodplain area (Acres) * Change in water level (feet) * Specific yield (dimensionless)

A description of the methodology used to determine each value is provided in the following subsections.

4.1 Floodplain Area

The floodplain area was calculated using standard GIS tools. The boundary of the floodplain used in the calculation is shown in Figure 1-1. The floodplain area is 16.61 acres.

4.2 Change in Groundwater Level

The change in groundwater level is the difference between the annual minimum groundwater elevations and either the maximum groundwater elevation or the ground surface elevation. The ground surface elevation was used for the six piezometers which recorded maximum water levels above ground surface. Surface water storage is treated as a separate component of the floodplain's storage capacity and is discussed further in Section 4.5.

The average change in groundwater elevations based on the difference between the annual minimum and maximum, is 3.3 feet.

4.3 Specific Yield

Specific yield (SY) is a ratio of the amount of water that is available to drain from a volume of material to the total volume of material. A range of specific yield values from 0.1 to 0.2 were used for the storage calculations. This range is consistent with published values for sands and gravels (Fetter, 1994).

4.4 Groundwater Storage estimates

Using the values discussed above the range of maximum groundwater storage capacities is:

- 16.61 Acres * 3.3 feet * 0.2 SY = **11.0 Ac-ft**

- 16.61 Acres * 3.3 feet * 0.1 SY = **5.5 Ac-ft**

Maximum storage on the floodplain was reached when water elevations peaked on June 5th. Storage volumes declined as water levels receded through the summer, as shown on Figure 4-1. Zero storage was reached when water levels receded to their pre-runoff levels on August 20th.

As shown on Figure 4-1, the floodplain loses water to the river at a rate of about 5 AF per month (0.08 cfs).

4.5 Surface Water Storage estimates

As discussed above, water elevations rose above ground surface at six (B1, B2, B4, B5, B8, and B9) of the nine piezometers. Accurate determination of the surface water storage on the floodplain is difficult because the total area of the floodplain that was underwater, of inundated, was not measured. The transducer data indicate that most of the standing water occurred on the western half of the floodplain, and the average maximum depth of surface water was about 2 feet.

A rough estimate is to assume half of the floodplain (8.3 acres) was inundated during peak runoff and the average depth of the surface water was 2 feet. This nets a surface water storage estimate of 16.6 acre-feet.

Surface water levels across most of the floodplain dropped below ground surface within a few days after water levels peaked on June 5th. Only piezometers B5 and B8, which are situated in the low-lying area on the far west side of the floodplain, had standing water after June 12th. This low-lying portion of the floodplain encompasses approximately 5 acres.

4.6 Potential for Increasing Floodplain Storage

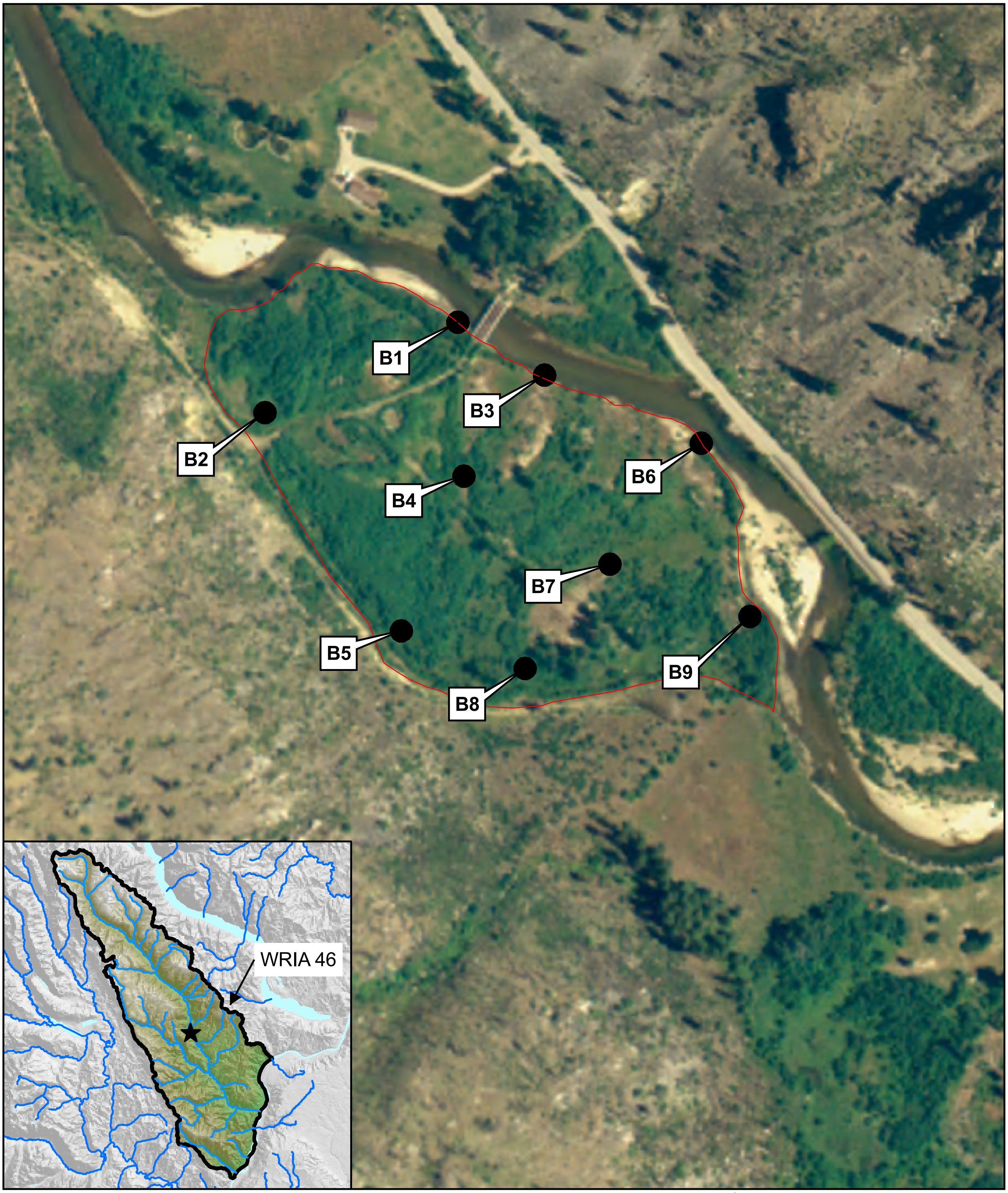
There is potential to increase floodplain storage on the project site. The “storage” would be achieved by reducing the rate that the floodplain discharges back to the river. By keeping this water in the floodplain longer, flows in the Entiat River should increase relative to current conditions during the late summer.

Figure 4-2 shows the current seasonal decline in storage volumes on the floodplain compared to a hypothetical “post-storage” condition. In the hypothetical condition, the seasonal decline in storage volumes is reduced by 50%, to approximately 2.5 AF per month. By slowing the rate of decline, groundwater discharge back to the river is reduced, but the total duration is lengthened and discharge to the river in the late summer is increased.

In order to reduce the rate of floodplain discharge back to the river during the summer, we think it would be possible to construct a relatively small pond in the low-lying area on the southwest side of the floodplain, near piezometer B-9. The pond would increase groundwater heads and reduce the gradient of groundwater flow to the river in this area. It is possible that the pond could also be larger in size and encompass the entire back channel area, extending toward piezometers B-5 and B-8. Figure 4-3 shows the conceptual lay-out of the floodplain channel. The outlet for the pond would require some engineering design to determine the elevation and outlet flow capacity. The design would also allow varying levels of control over the water surface elevations in the pond.

Specific details about the design and implementation of this type of project would be finalized in subsequent phase of work.

FIGURES



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Piezometers
- Project Boundary

0 300
Scale in Feet

N

Map Projection:
Washington State Plane
North Zone NAD 1983

Source: USDA, USGS
Golder Associates, Inc.

FIGURE **1-1**

SITE MAP

CCCD/WRIA 46 STEP A STORAGE/WA

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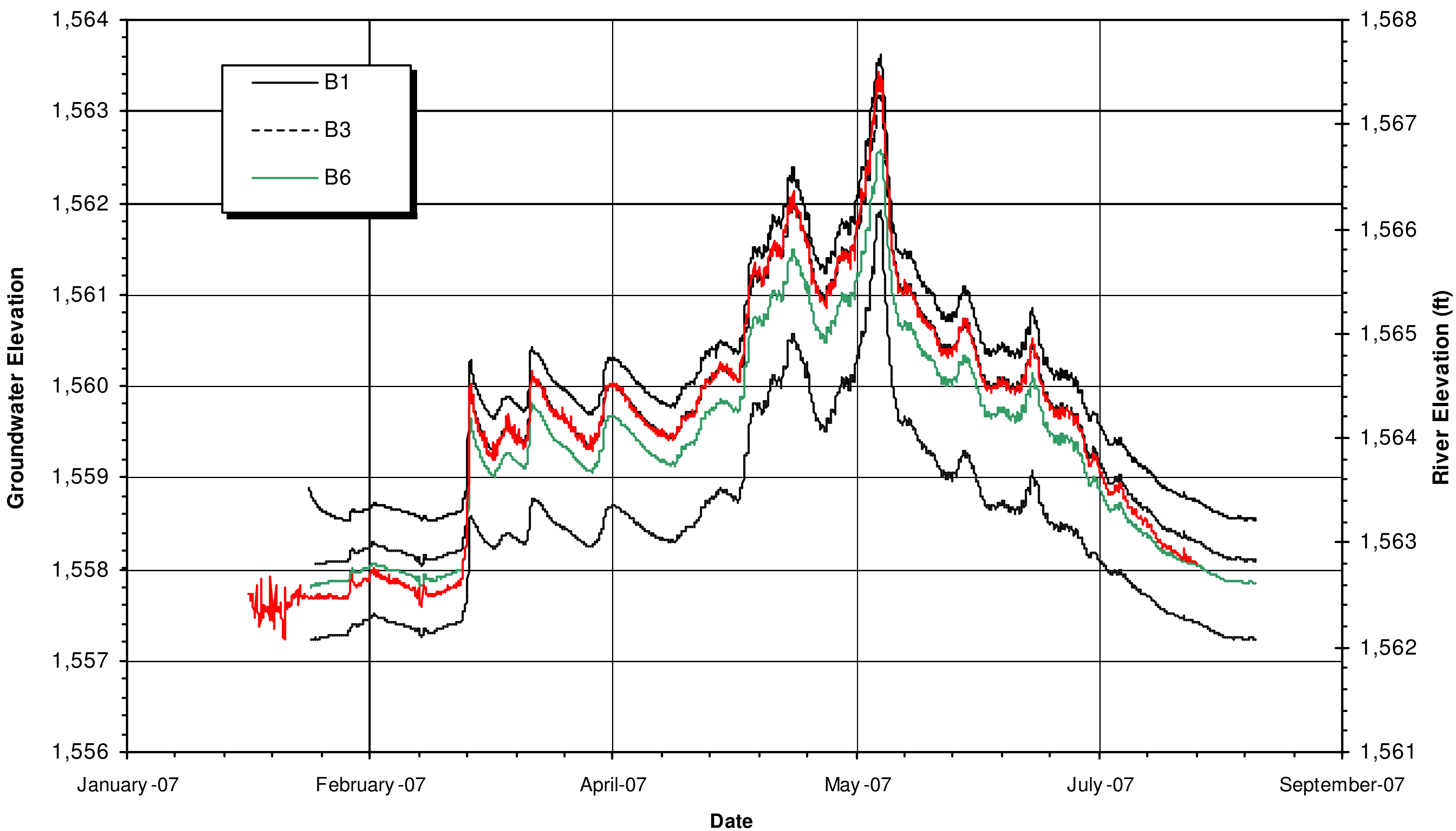
Golder Associates



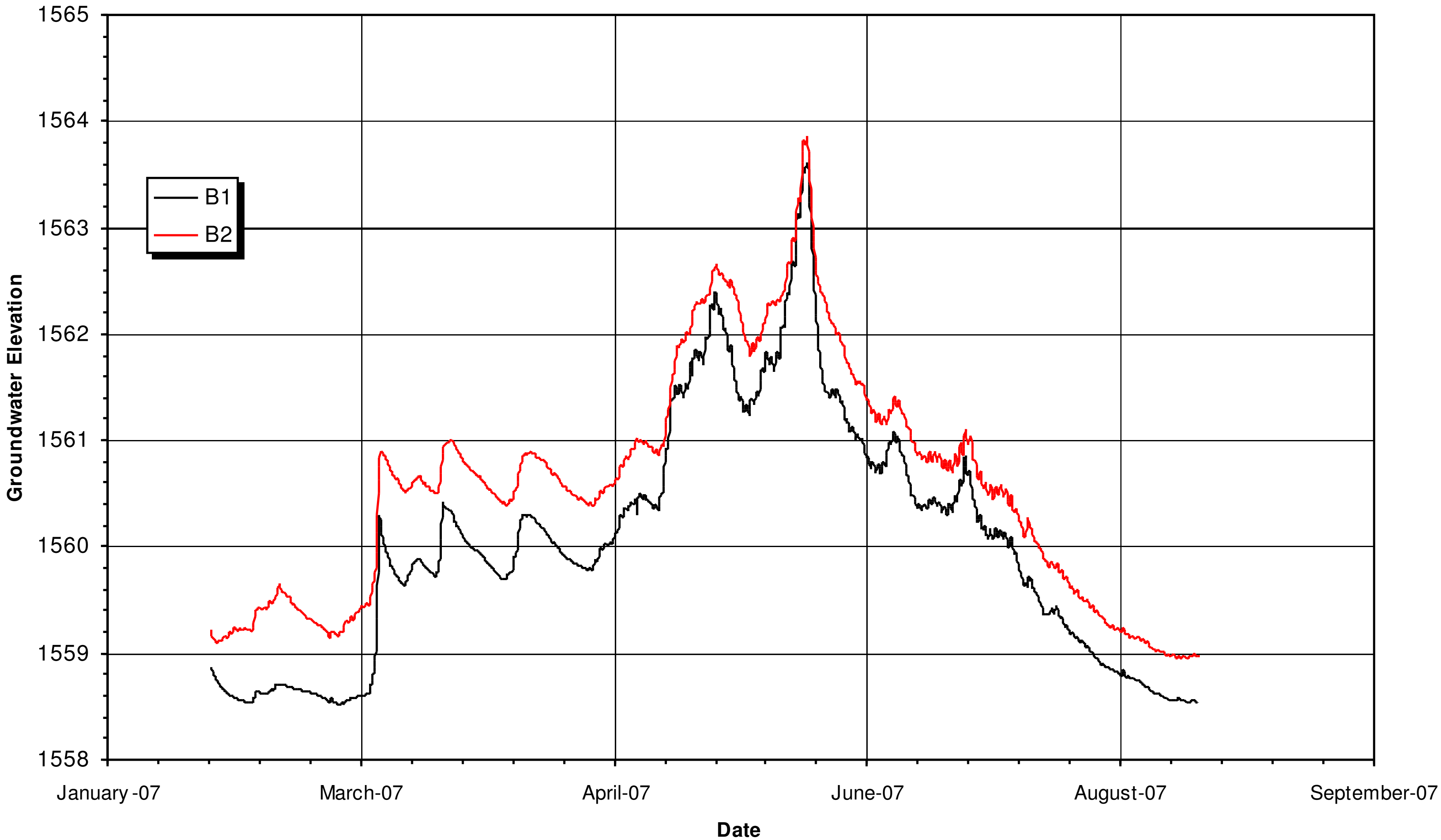
Golder Associates

TITLE

Hydrographs for the Entiat River at Ardenvoir and Piezometers B1, B3, B6, and B9

Chelan County Conservation District
Step B Storage Assessment

DRAWN	JP	DATE	Sep-07	JOB NO.	053-1000.300
CHECKED	RA	SCALE	na	DWG. NO.	na
REVIEWED	RA	FILE NAME	hydrogrpah figures.xls	FIGURE NO.	3-1



Golder Associates	TITLE **Hydrographs for Piezometers B1 and B2**					
Chelan County Conservation District Step B Storage Assessment	DRAWN	JP	DATE	Sep-07	JOB NO.	053-1000.300
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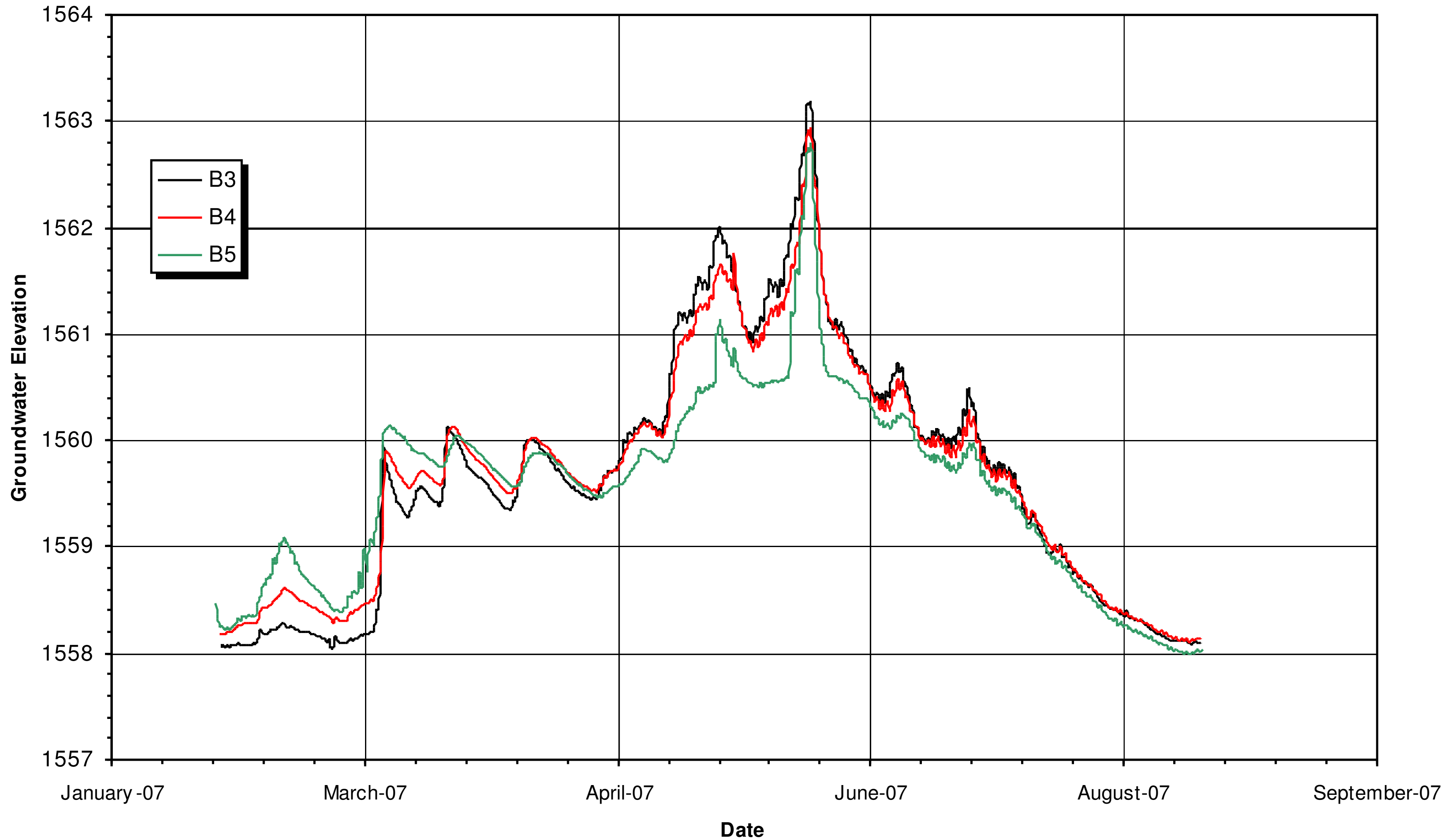

Golder Associates

TITLE

Hydrographs for Piezometers B3, B4 and B5

Chelan County Conservation District
Step B Storage Assessment

DRAWN	JP	DATE	Sep-07	JOB NO.	053-1000.300
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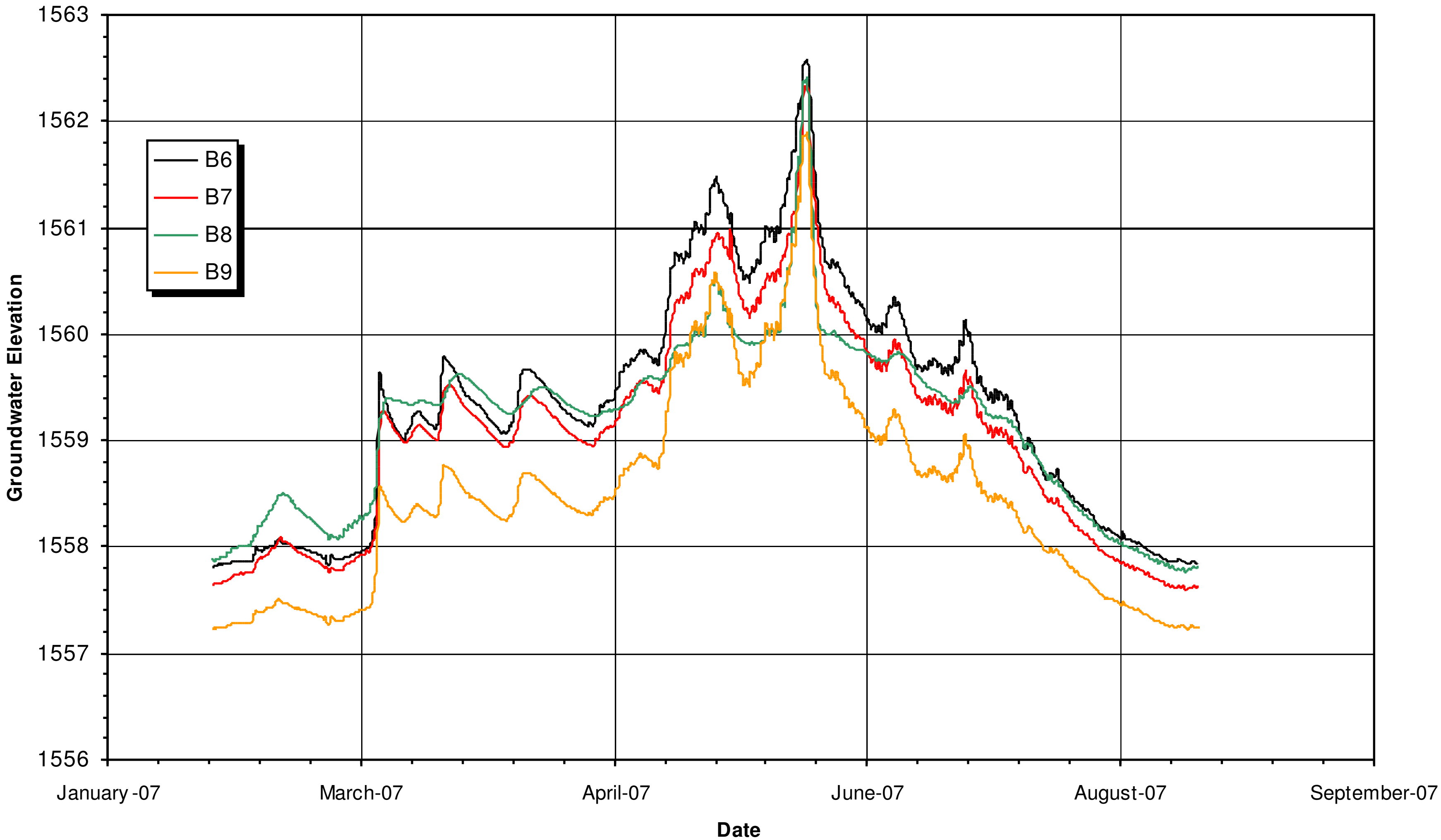

Golder Associates

TITLE

Hydrographs for Piezometers B6, B7, B8 and B9

Chelan County Conservation District
Step B Storage Assessment

DRAWN	JP	DATE	Sep-07	JOB NO.	053-1000.300
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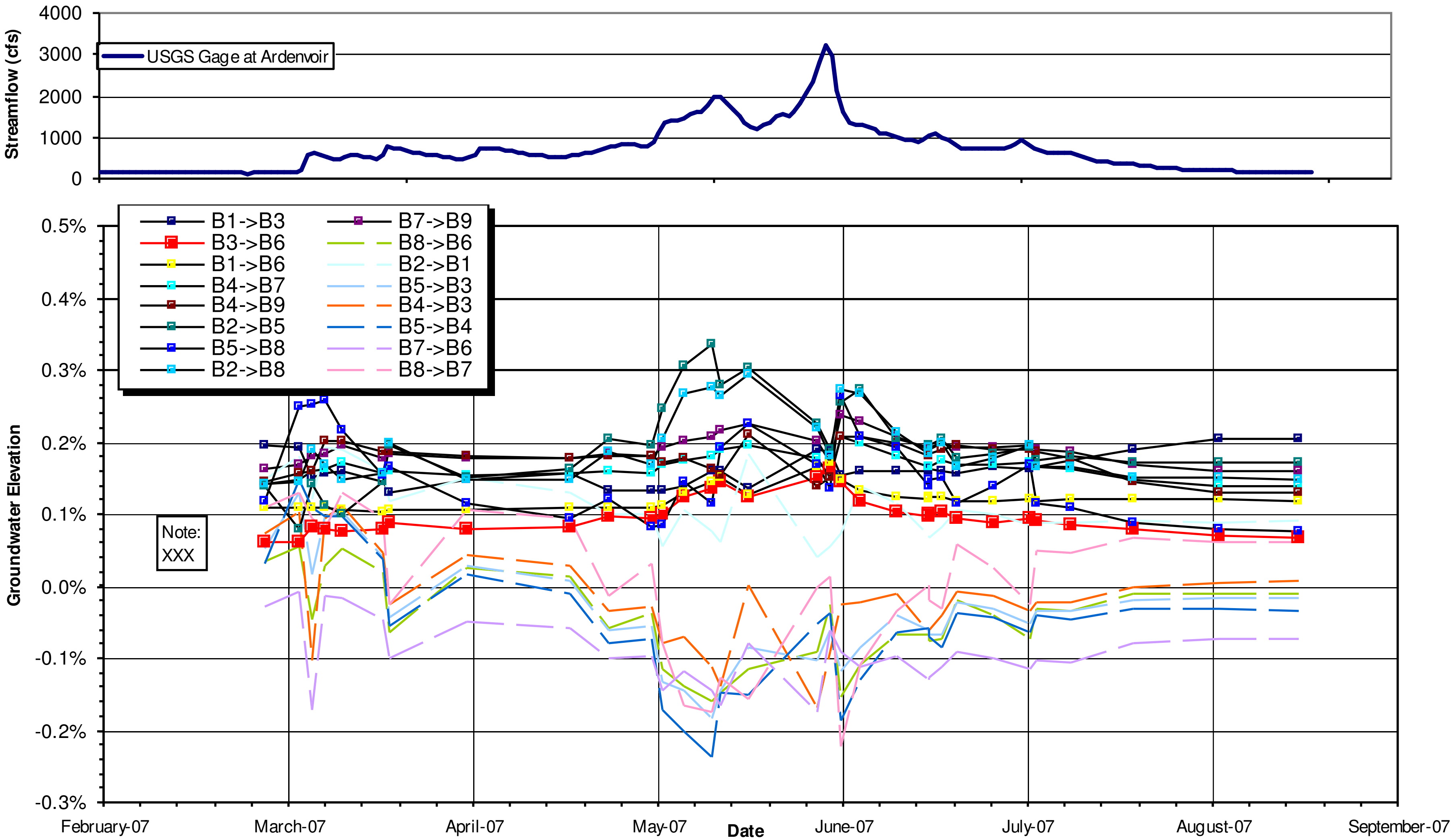
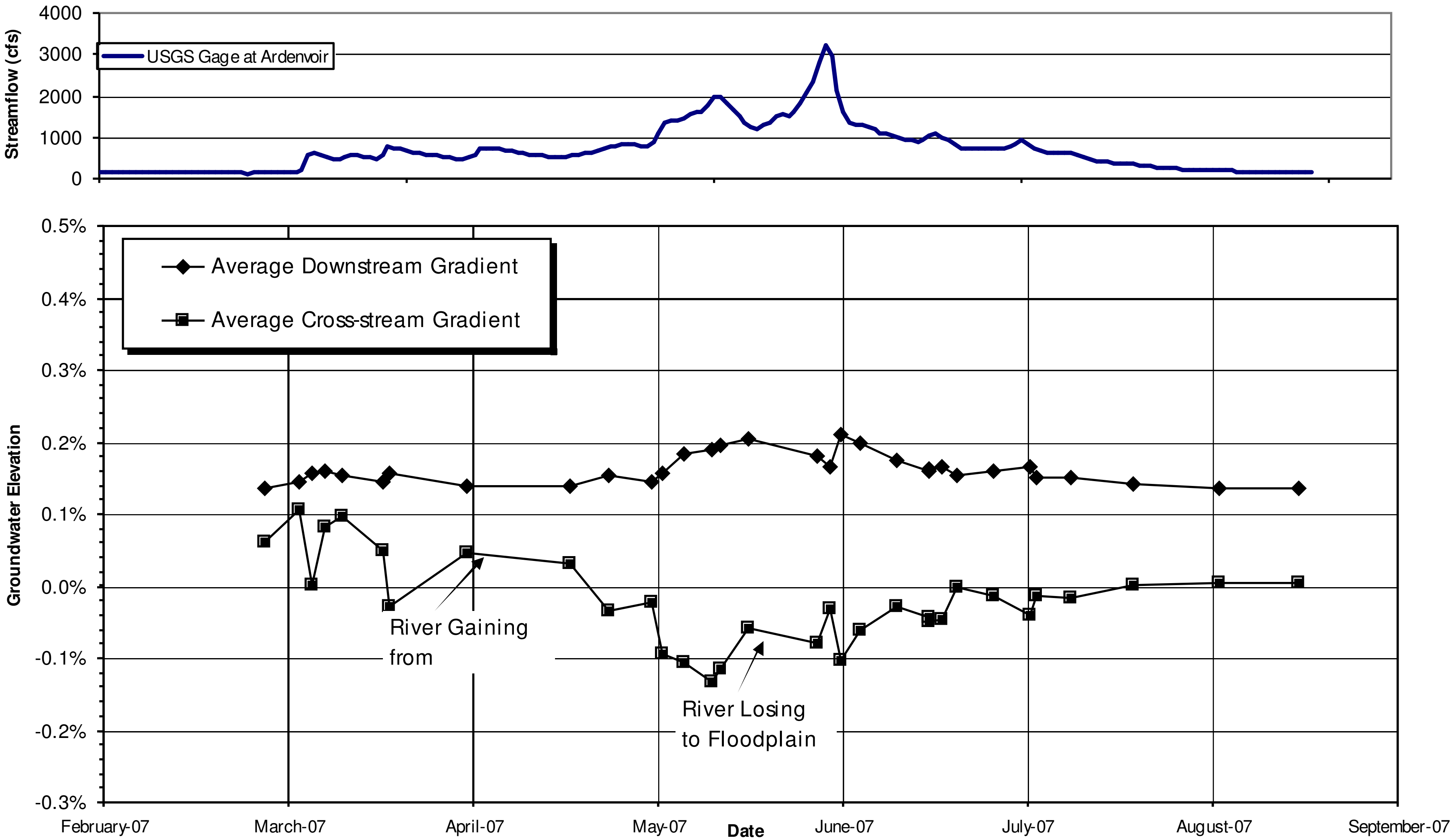
REVIEWED	RA	FILE NAME	hydrogrpah figures.xls	FIGURE NO.	**3-4**



Golder Associates	TITLE **Groundwater Gradients**				
Chelan County Conservation District **Step B Storage Assessment**	DRAWN JP	DATE Sep-07		JOB NO. 053-1000.300	
	CHECKED RA	SCALE na		DWG. NO. na	
	REVIEWED RA	FILE NAME Gradient figures.xls		FIGURE NO. 3-5	



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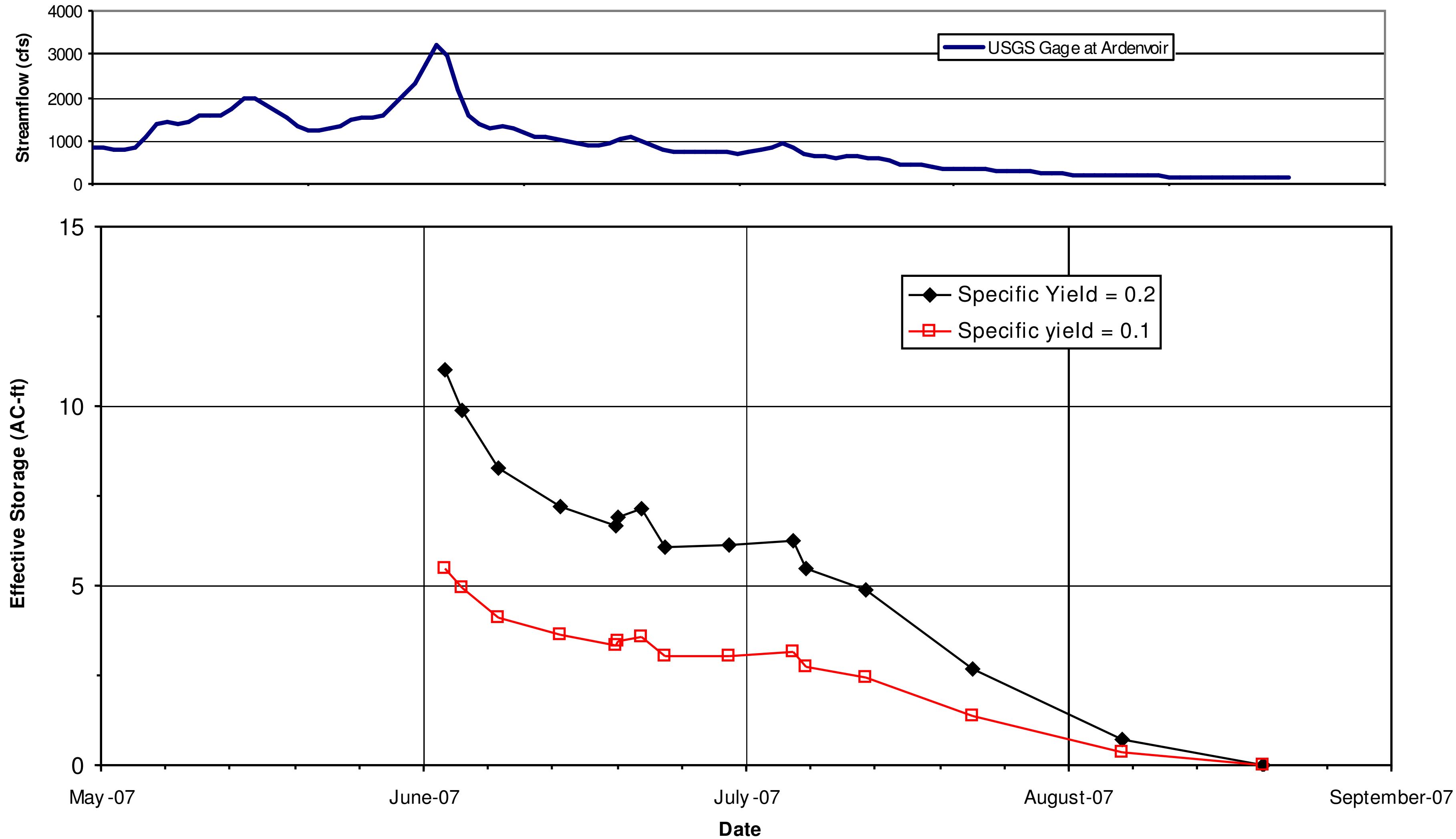
TITLE

Average Cross-stream and Downstream Groundwater Gradients

Chelan County Conservation District
Step B Storage Assessment

DRAWN	JP	DATE	Sep-07	JOB NO.	053-1000.300
CHECKED	RA	SCALE	na	DWG. NO.	na
REVIEWED	RA	FILE NAME	Gradient figures.xls	FIGURE NO.	**3-6**



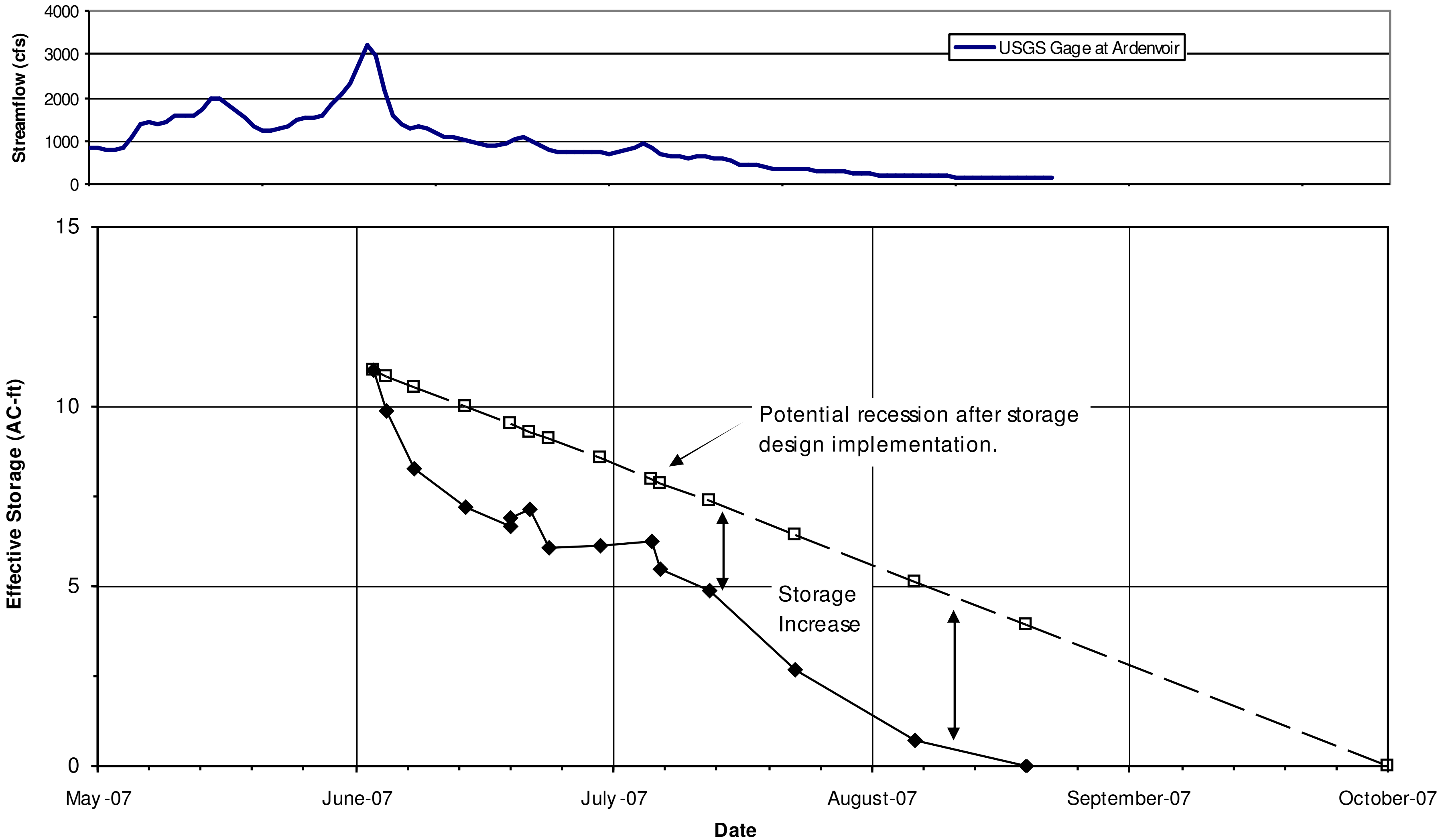
Golder Associates

TITLE

Groundwater Storage Estimates

Chelan County Conservation District
Step B Storage Assessment

DRAWN	JP	DATE	Sep-07	JOB NO.	053-1000.300
CHECKED	RA	SCALE	na	DWG. NO.	na
REVIEWED	RA	FILE NAME	storage figures.xls	FIGURE NO.	**4-1**



Golder Associates	TITLE **Potential Storage Benefit**				
Chelan County Conservation District Step B Storage Assessment	DRAWN	JP	DATE	Sep-07	JOB NO. 053-1000.300
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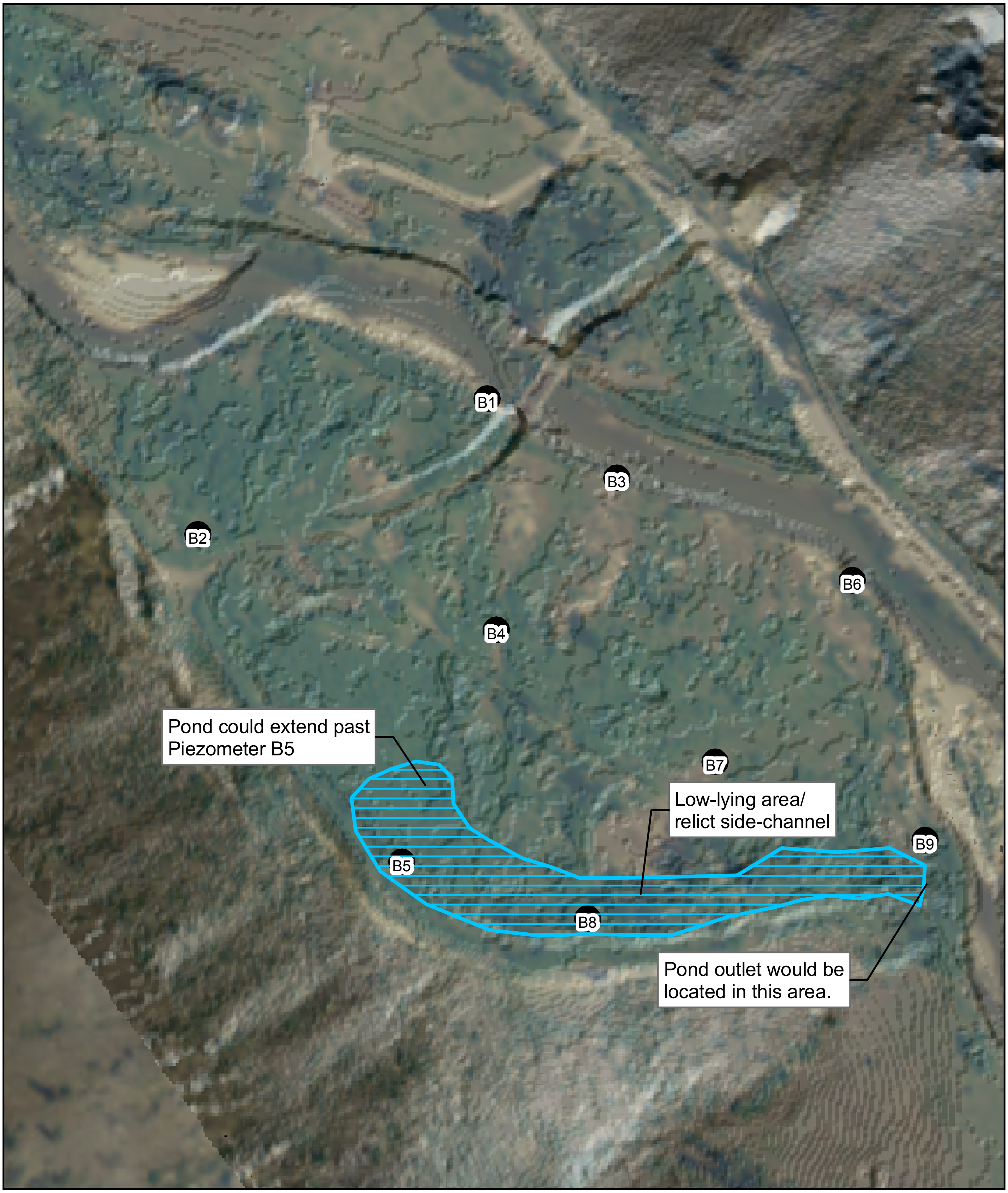
	REVIEWED	RA	FILE NAME	storage figures.xls	FIGURE NO. **4-2**



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

Piezometers

Storage Pond

0 200

Scale in Feet

Map Projection:
Washington State Plane
North Zone NAD 1983

Source: USDA, USGS
Golder Associates, Inc.

N

FIGURE **4-3**

CONCEPTUAL PROJECT DESIGN

CCCD/WRIA 46 STEP A STORAGE/WA

APPENDIX A

TEST PIT LOGS

Test Pit: B1 Location: Entiat Floodplain_ Date Installed: 5 Feb 07 15:31
Engineer: Pietraszek Contractor: Batchelor Excavation_

INSTALLATION NOTES

Depth (ft bgs)	Description
0-2.5	Brown (f-m) SAND, sm silt, sm organic material, lt-sm cobbles, lt-tr clay. (Topsoil)
2.5-6	Brown speckled (c) GRAVEL and COBBLES, lt-sm (c) sand, lt wood. (Coarse Alluvium)
6-10	Same as above but with sm (m-c) sand and lt-sm silt (Alluvium)

Samples	
No	Depth
1	5
2	10

Special Notes:
Hit water at 2.5 feet. Very coarse material intersected at 2.5 feet. Material became slightly finer at about 6 feet.

Time	Depth of Hole (ft bgs)
15:30	0
16:00	10
16:30	0

INSTALLATION PICTURES




Test Pit: B2 Location: Entiat Floodplain_ Date Installed: 5 Feb 07 14:30
Engineer: Pietraszek Contractor: Batchelor Excavation_

INSTALLATION NOTES

Depth (ft bgs)	Description
0-2	Brown (f-m) SILT, sm sand, sm organic material, lt-sm gravel. (Topsoil)
2-5	Brownish-black (f-c) Sand and GRAVEL, sm silt, loose (Medium Alluvium)
5-10	Gray (f-c) SAND and GRAVEL, sm cobbles, tr wood (m-c Alluvium)

Samples	
No	Depth
	None

Time	Depth of Hole (ft bgs)
14:30	0
14:50	10
15:15	0

Special Notes:
Hole began caving at about 6 feet bgs
Water at 5 feet bgs

INSTALLATION PICTURES




Test Pit: B3 Location: Entiat Floodplain_ Date Installed: 6 Feb 07 15:20
Engineer: Pietraszek Contractor: Batchelor Excavation_

INSTALLATION NOTES

Depth (ft bgs)	Description
0-0.5	Brown (f-m) Topsoil
0.5-1	Light brown (c) SAND and (f-c) GRAVEL, sm cobbles, loose, dry, weakly stratified (Coarse Alluvium)
1-2	(m-c) SAND, sm gravel
2-9	SAME AS 0.5-1 (Coarse Alluvium)

Samples	
No	Depth (ft)
1	0-1
2	8

Time	Depth of Hole (ft bgs)
15:30	0
15:45	9
16:00	0

Special Notes: Water encountered 6.5 feet bgs

INSTALLATION PICTURES

Test Pit: B4 Location: Entiat Floodplain_ Date Installed: 6 Feb 07 13:13
Engineer: Pietraszek Contractor: Batchelor Excavation_

INSTALLATION NOTES

Depth (ft bgs)	Description
0-1.5	Medium brown (f-c) SILT and (f) SAND, sm organic material, little stiff (Topsoil)
1.5-7	Brown (m-c) SAND, lt-sm (f-c) gravel, lt-tr cobbles, weakly stratified
7-9	Grayish-brown (c) SAND and (f-c) GRAVEL, sm cobbles (Coarse Alluvium)

Samples	
No	Depth (ft)
1	1.5-3
2	8-9

Time	Depth of Hole (ft bgs)
13:15	0
13:50	9
14:05	0

Special Notes: Hit water at 6-7 feet bgs

INSTALLATION PICTURES

Test Pit: B5 Location: Entiat Floodplain_ Date Installed: 6 Feb 07 14:30
Engineer: Pietraszek Contractor: Batchelor Excavation_

INSTALLATION NOTES

Depth (ft bgs)	Description
0-1	Dark brown (f-c) SILT sm organic material, moderately stiff (Topsoil)
1-3	Medium brown (f-c) SILT lt (f) sand, moderately stiff
3-7	Gray (f) SAND, sm silt
7-9	Grayish-brown (c) SAND and (f-c) GRAVEL, sm cobbles (Coarse Alluvium)

Samples	
No	Depth (ft)
1	0-1
2	8-9

Time	Depth of Hole (ft bgs)
14:30	0
14:45	9
15:00	0

Special Notes: Hit water at 7 feet bgs

INSTALLATION PICTURES




Test Pit: B6 Location: Entiat Floodplain_ Date Installed: 6 Feb 07 08:30
Engineer: Pietraszek Contractor: Batchelor Excavation_ Project: 053-1000.300

INSTALLATION NOTES

Depth (ft bgs)	Description
0-2	Dark (m-c) SAND (top-soil), lt-sm (f-c) gravel and cobbles, sm organic material, loose
2-4	Brown SAND and GRAVEL, sm cobbles
4-7	Brown (c) SAND and (c) GRAVEL, cm cobbles (coarse alluvium) slightly coarser than above
7-8.5	(m-c) GRAVEL and COBBLES, sm SAND, wet (coarse alluvium)

Samples	
No	Depth (ft)
1	0-1
2	5-7

Time	Depth of Hole (ft bgs)
08:45	0
9:05	8.5
9:25	0

Special Notes:
Hit water at about 5 feet bgs.
Material appears weakly stratified below 5 feet bgs. All material is loose. Hole begins caving below 6 feet.

INSTALLATION PICTURES




Test Pit: B7 Location: Entiat Floodplain_ Date Installed: 6 Feb 07 10:30
Engineer: Pietraszek Contractor: Batchelor Excavation_ Project: 053-1000.300

INSTALLATION NOTES

Depth (ft bgs)	Description
0-1	Brown (f-m) SAND, sm organic material, loose (topsoil)
1-2	Brown (m-c) SAND and (f-c) GRAVEL, sm cobbles
2-3.5	Brown (m-c) SAND, sm (f-c) gravel (slightly finer than above)
3.5-8.5	Brown (m-c) SAND and (f-c) GRAVEL, sm cobbles (loose, clean) (coarse alluvium)

Samples	
No	Depth (ft)
1	0-1
2	8

Special Notes: Water at 5 feet. Weakly stratified below 3 feet.

Time	Depth of Hole (ft bgs)
10:35	0
10:50	8.5
11:15	0

INSTALLATION PICTURES

Test Pit: B8 Location: Entiat Floodplain_ Date Installed: 6 Feb 07 11:30
Engineer: Pietraszek Contractor: Batchelor Excavation_ Project: 053-1000.300

INSTALLATION NOTES

Depth (ft bgs)	Description
0-3	Dark Brown SILT, sm organic material, sm (f) sand (little plastic, firm) (topsoil)
3-3.5	Gray (m-c) sand, loose
3.5-7.5	Brown (m-c) SAND, sm (f-c) gravel, little cobbles (alluvium)

Samples	
No	Depth (ft)
1	0-2
2	7

Time	Depth of Hole (ft bgs)
12:00	0
12:15	7.5
12:40	0

Special Notes: Hit water at 5 feet. Hole collapsed below 7.5 feet. Could not excavate below 7.5 feet.

INSTALLATION PICTURES




Test Pit: B9   Location: Entiat Floodplain_   Date Installed: 6 Feb 07 9:45
Engineer: Pietraszek   Contractor: Batchelor Excavation_ Project: 053-1000.300

INSTALLATION NOTES

Depth (ft bgs)	Description
0-1	Brown (f-m) SAND (topsoil)
1-4	Light Brown (m-c) SAND, sm (f-c) gravel, tr silt (loose) (alluvium)
4-8.5	Brown (c) SAND and (f-c) GRAVEL, sm cobbles, loose (coarse alluvium)

Samples	
No	Depth (ft)
1	1-2
2	8

Special Notes: Hit water at 4.5 feet. Hole collapsed at 8.5 feet.

Time	Depth of Hole (ft bgs)
9:45	0
10:15	8.5
10:25	0

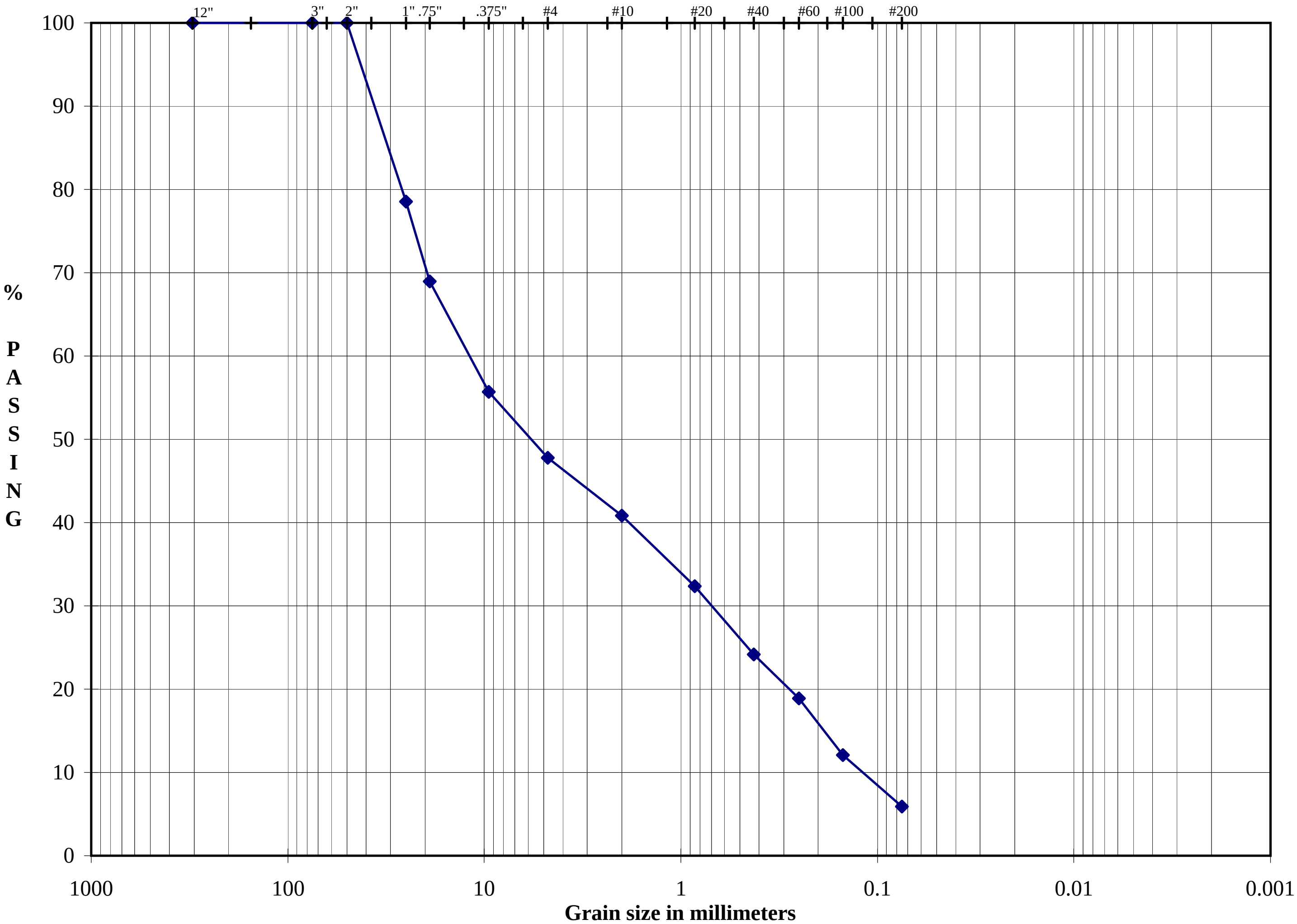
INSTALLATION PICTURES




APPENDIX B

SIEVE RESULTS

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		**SAND**			**FINES**

SAMPLE ID	B3-B 0
SAMPLE TYPE	Grab
SAMPLE DEPTH	0

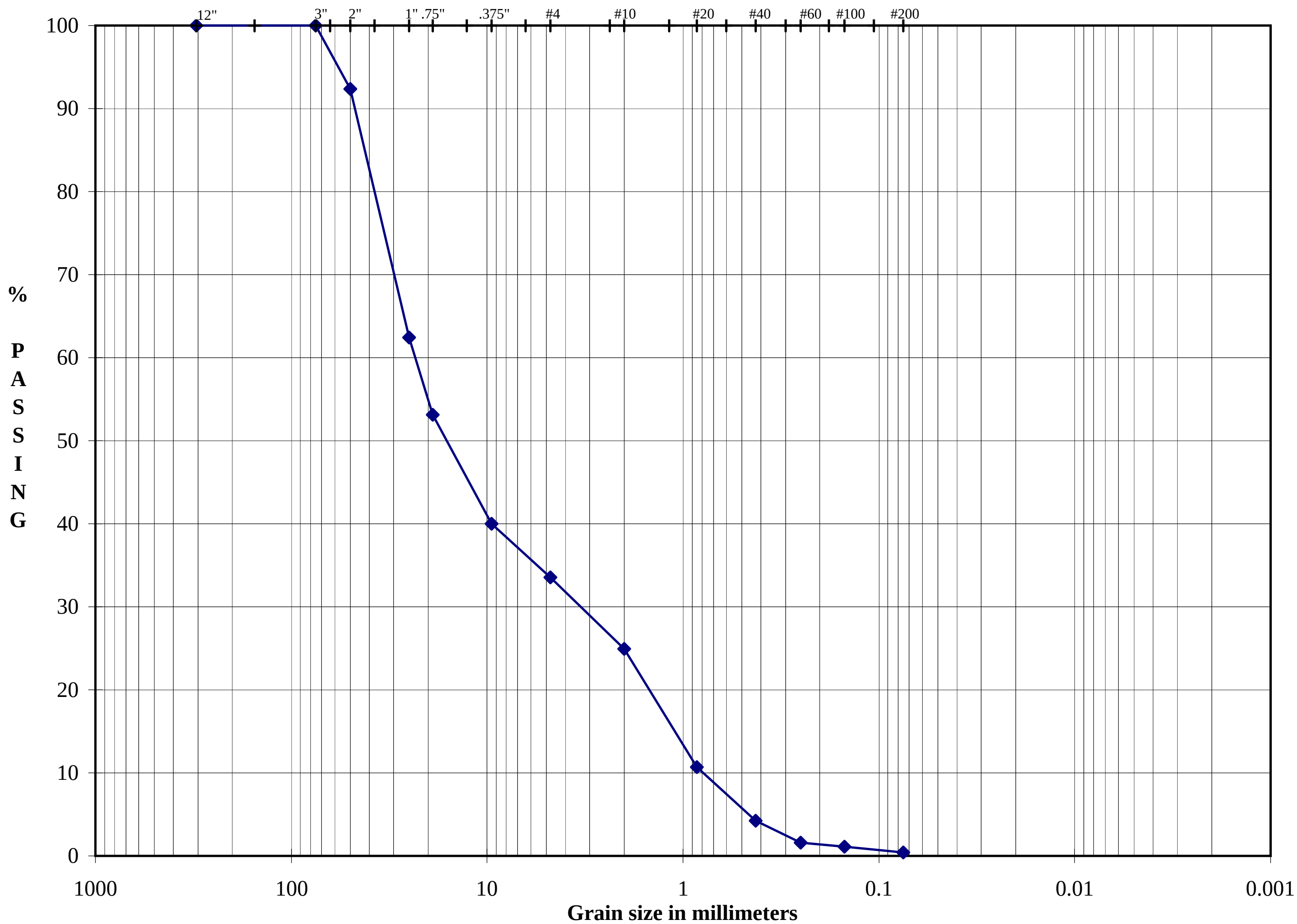
LL	-
PL	-
PI	-

DESCRIPTION	C-F GRAVEL and C-F SAND little silt
USCS	GP/GM

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		**SAND**			**FINES**

SAMPLE ID	B3-B	0
SAMPLE TYPE	Grab	
SAMPLE DEPTH	0	

LL	-
PL	-
PI	-

DESCRIPTION C-F GRAVEL and C-F SAND
trace silt

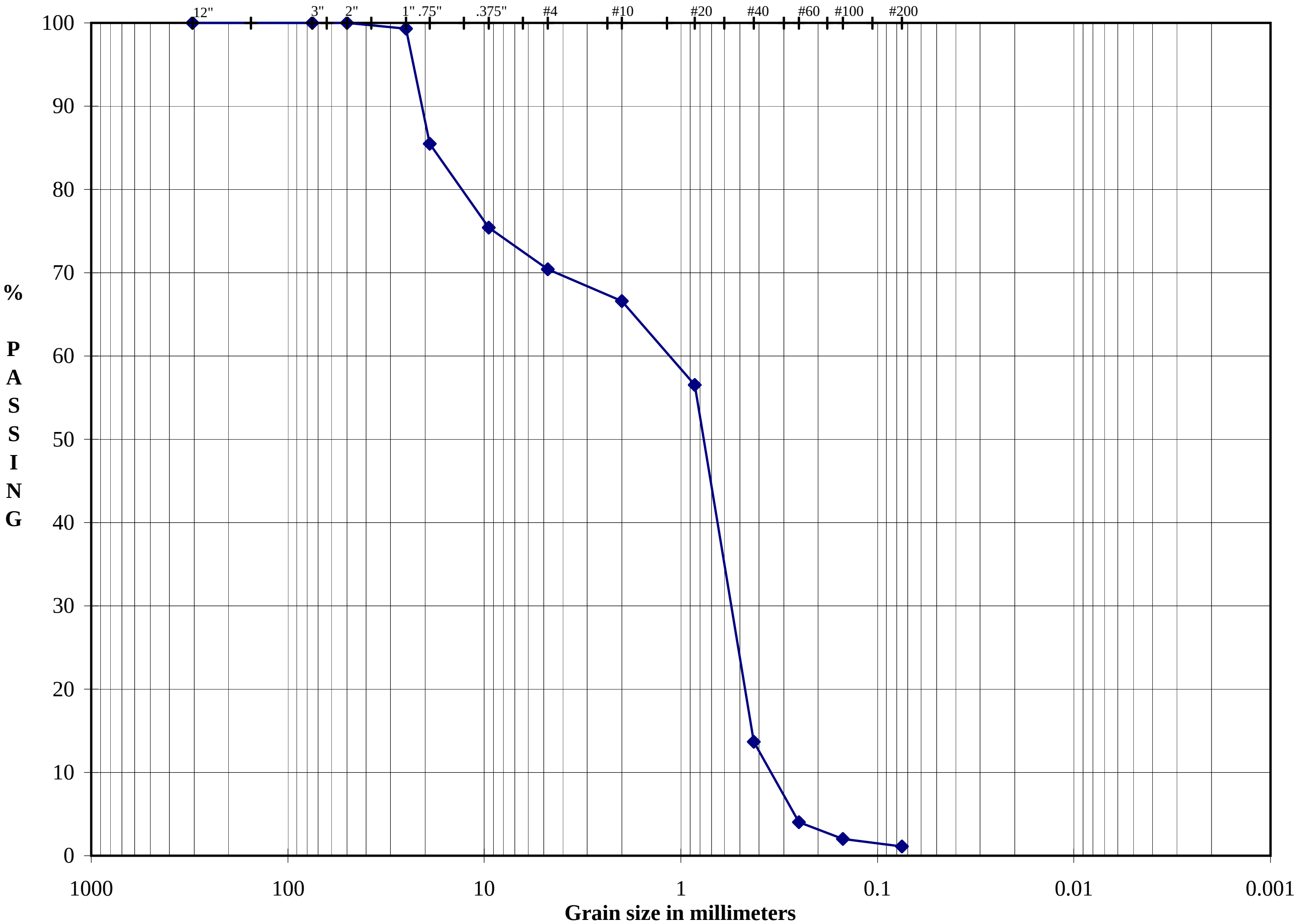
USCS GP

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA

Golder Associates Inc.

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		**SAND**			**FINES**

SAMPLE ID	B4-A	0
SAMPLE TYPE	Grab	
SAMPLE DEPTH	0	

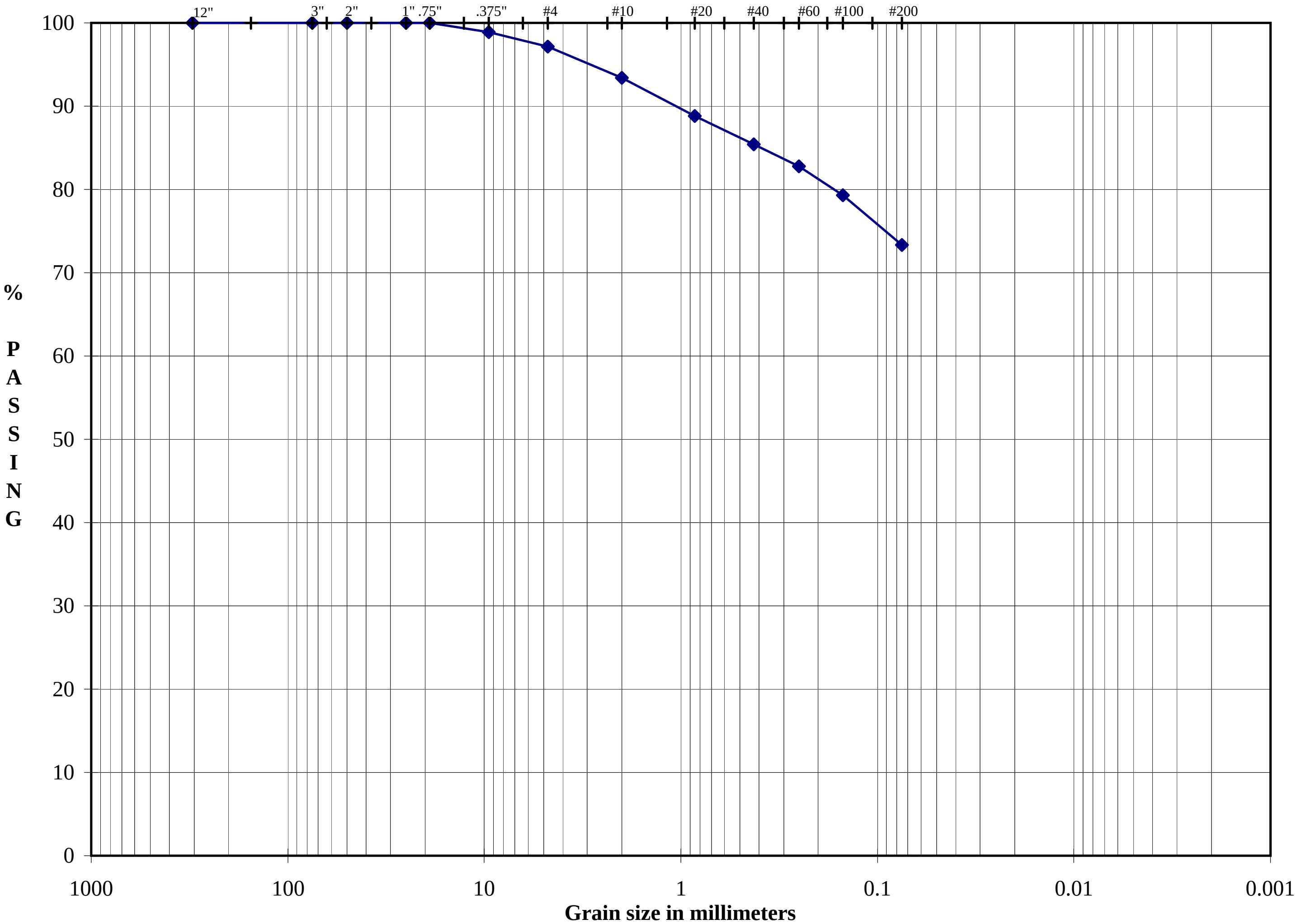
LL	-
PL	-
PI	-

DESCRIPTION	C-F SAND and C-F GRAVEL trace silt
USCS	SP

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		**SAND**			**FINES**

SAMPLE ID	B5-A	0
SAMPLE TYPE	Grab	
SAMPLE DEPTH	0	

LL	-
PL	-
PI	-

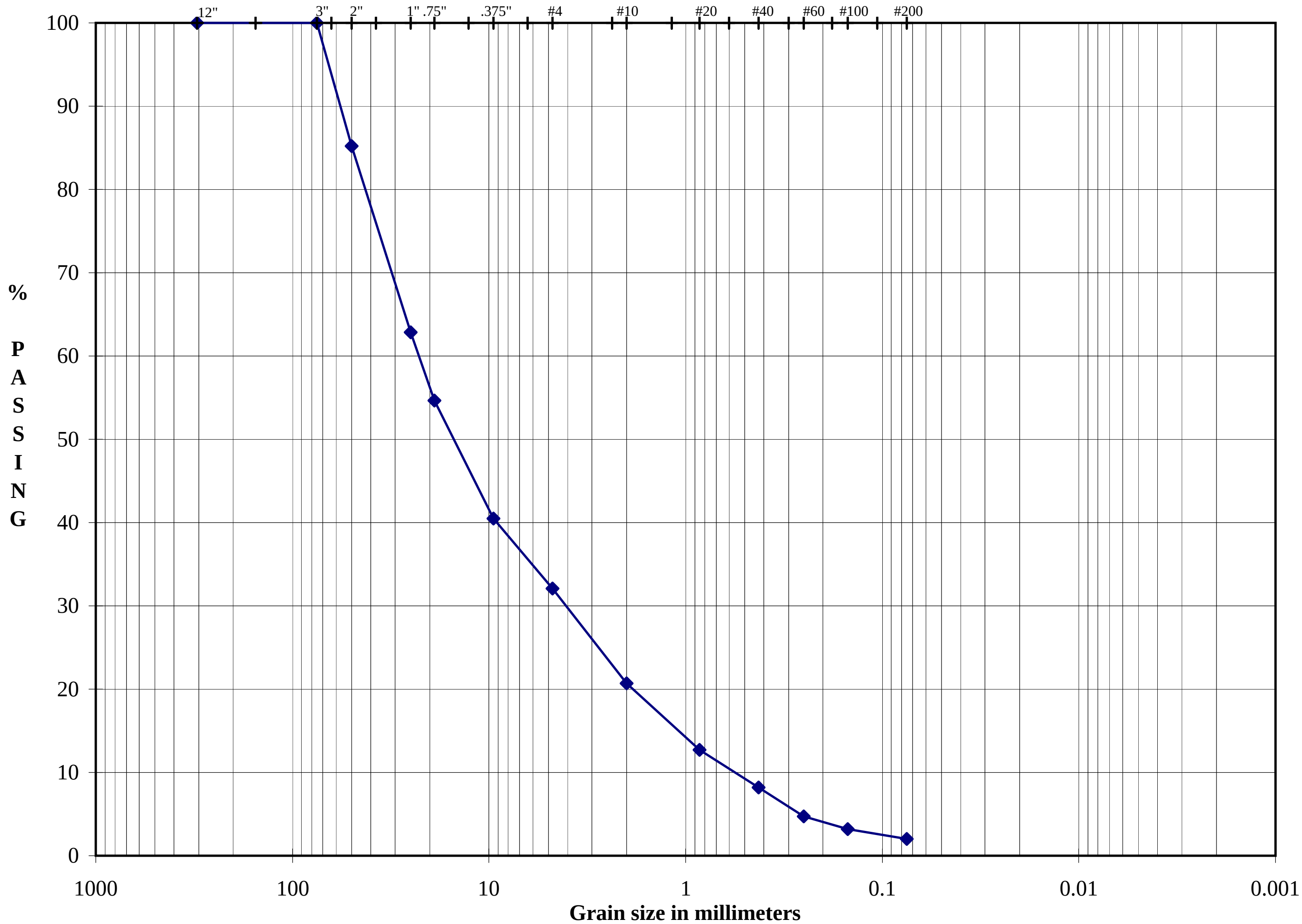
DESCRIPTION SILT
some c-f sand, trace f gravel

USCS SM

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		**SAND**			**FINES**

SAMPLE ID	B5-B 0	**LL**	-
SAMPLE TYPE	Grab	**PL**	-
SAMPLE DEPTH	0	**PI**	-

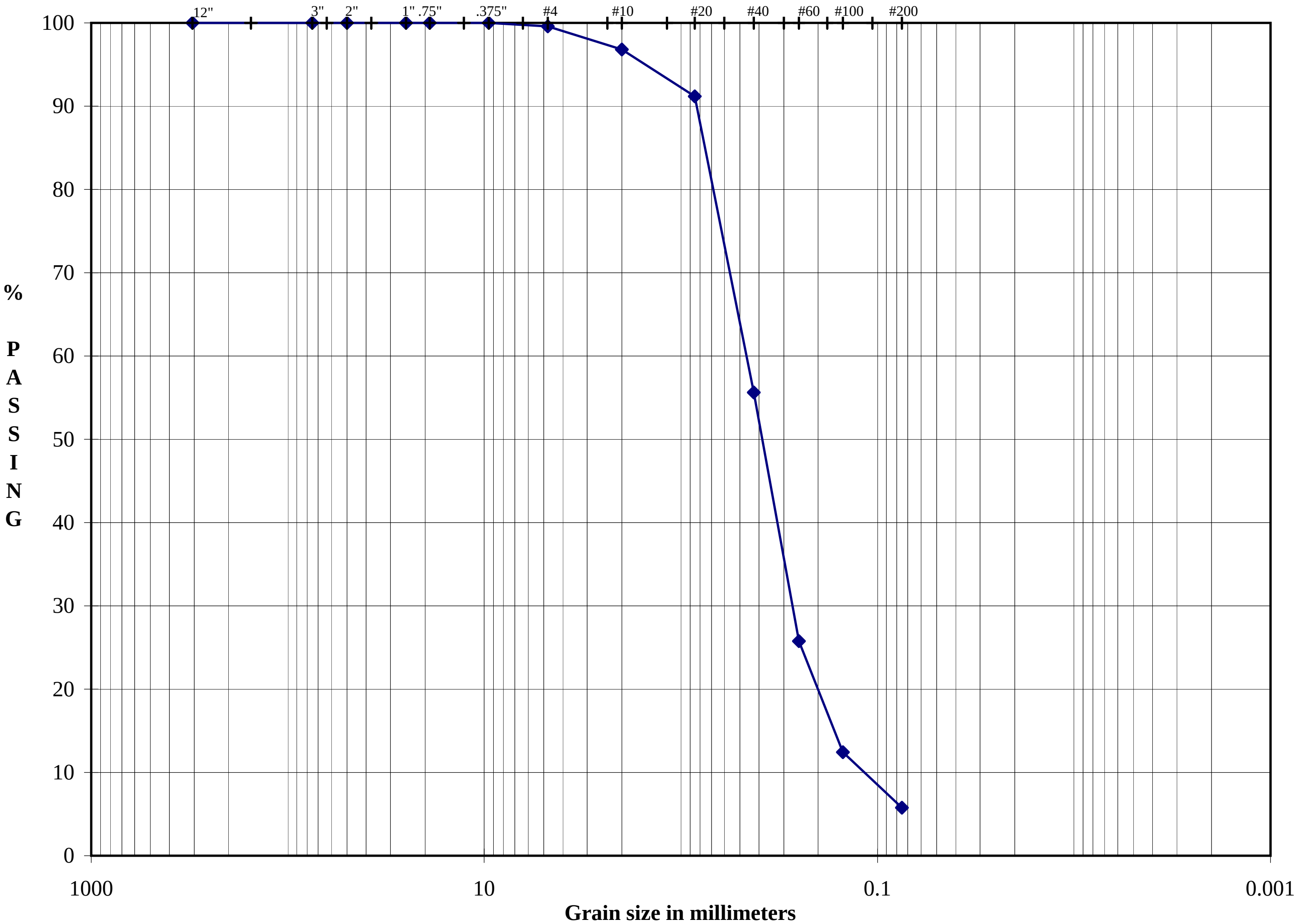
DESCRIPTION C-F GRAVEL and C-F SAND
trace silt

USCS GW

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		**SAND**			**FINES**

SAMPLE ID	B7-A	0
SAMPLE TYPE	Grab	
SAMPLE DEPTH	0	

LL	-
PL	-
PI	-

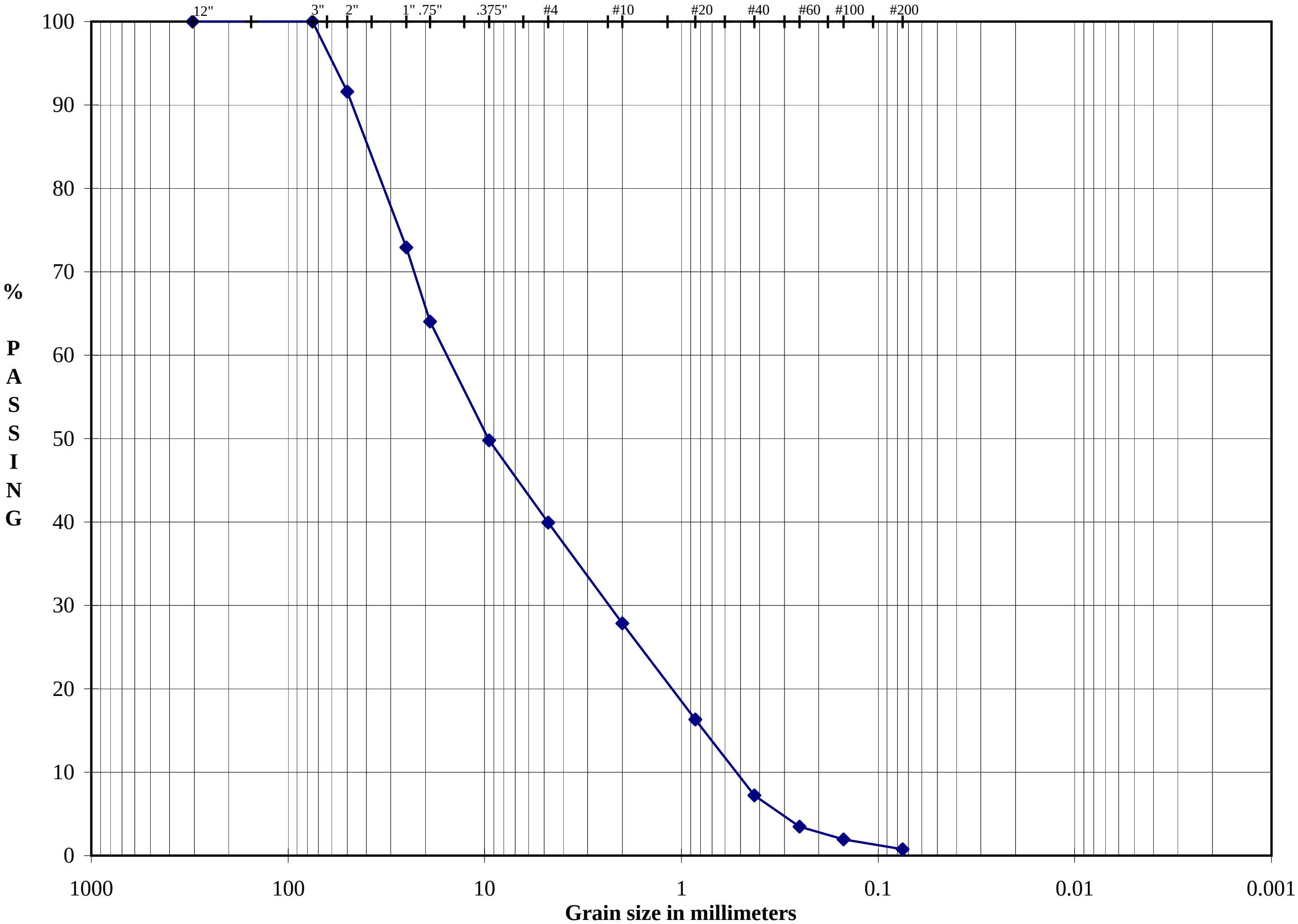
DESCRIPTION C-F SAND
little silt, trace f gravel

USCS SP/SM

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		**SAND**			**FINES**

SAMPLE ID	B7-B	0
SAMPLE TYPE	Grab	
SAMPLE DEPTH	0	

LL	-
PL	-
PI	-

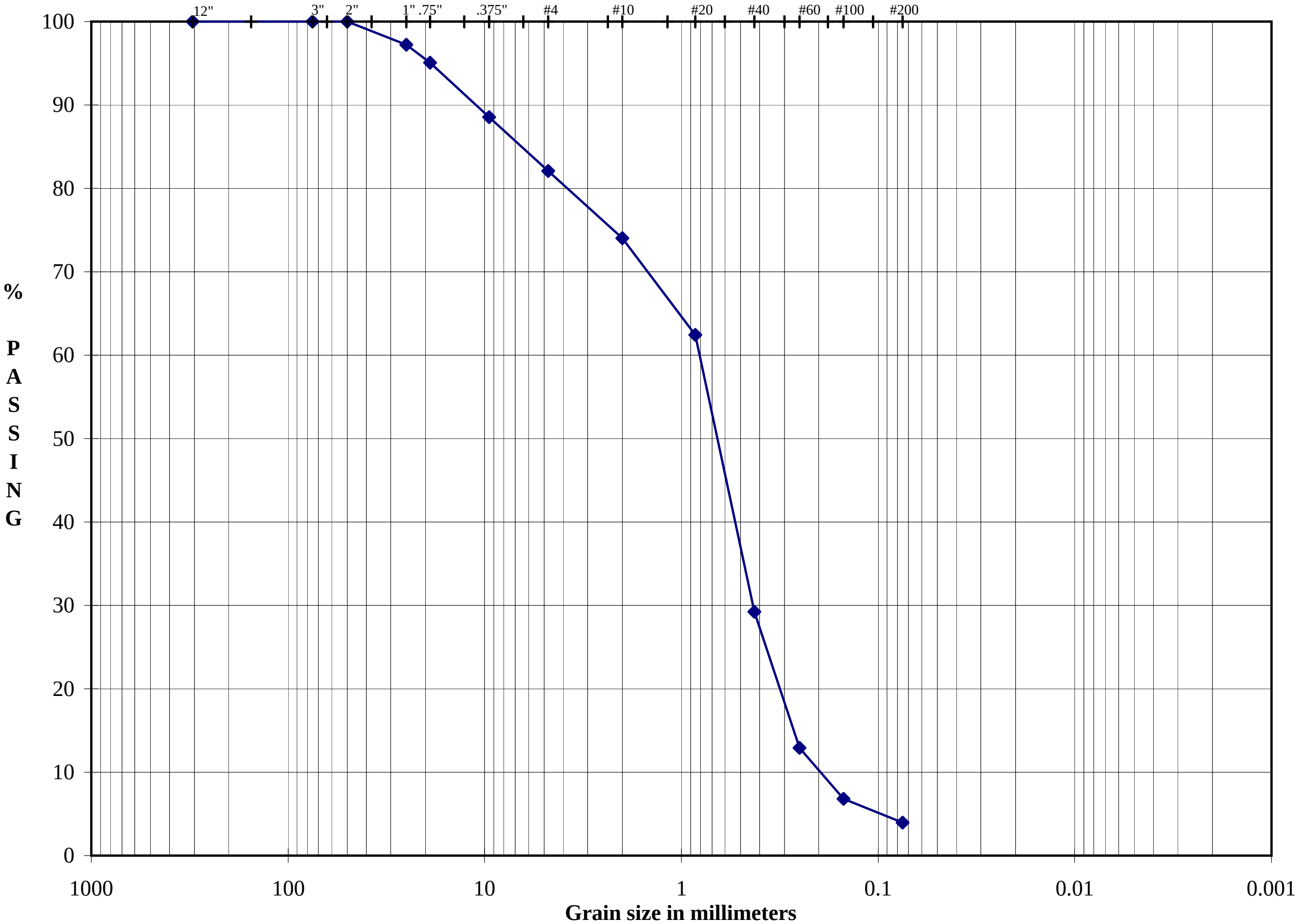
DESCRIPTION C-F GRAVEL and C-F SAND
trace silt

USCS GP

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		**SAND**			**FINES**

SAMPLE ID	B9-A 0	**LL**	-
SAMPLE TYPE	Grab	**PL**	-
SAMPLE DEPTH	0	**PI**	-

DESCRIPTION C-F SAND
some c-f gravel, trace silt

USCS SP

CCCD/WRIA 46 Step A Storage/WA
053-1000.300

TECH	CM
DATE	7/5/07
CHECK	JP
REVIEW	RA