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Washington City
111 North 100 East
Washington UT 84780

00814747 Bk 1539 Pg 0004
RUSSELL SHIRTS * WASHINGTON CO RECORDER
2003 APR 18 11:35 AM FEE \$80.00 BY AMH
FOR: DIXIE TITLE CO

DEVELOPMENT AGREEMENT

This Development Agreement ("Agreement") is entered into effective the 30 day of September 2002, by and between WASHINGTON CITY, a Utah municipal corporation ("City") and PUB GREEN SPRING, L.C., a Utah limited liability company ("PUB")

RECITALS

- A. PUB owns certain real property located within Washington City, Washington County, Utah, and described hereafter, which it desires to use for residential development;
- B. PUB's real property surrounds the Green Springs Golf Course, which golf course is owned by the City;

C. The City desires to protect the Green Springs Golf Course and valuable environmentally sensitive wetlands on the Green Springs Golf Course from any damage which may occur as a result of surface runoff due to area flood plains, and therefore certain drainage measures will need to be implemented prior to the development of PUB's real property;

D. The City desires to enhance the value and accessibility of the City's land north of the Green Springs Golf Course;

E. In accordance with its desire to make its real property available for residential development and alleviate potential flood plain damage, PUB presented a proposed drainage plan relating to its property to the Washington City Council on July 12, 2000, and again on July 26, 2000, and proposed and requested the City accept the proposal by PUB as more fully provided herein;

F. The City approved PUB's proposed drainage plan on July 26, 2000, which plan calls for detention basins and the installation of a system of channeling and piping;

G. PUB represents that it has already begun to implement its drainage plan and has, to date, spent \$247,538.71 thereon;

H. The City and PUB desire to enter into this Agreement to more specifically and fully set forth the rights and duties of the City and PUB as it relates to PUB's drainage plan.

WHEREFORE the parties agree as follows:

AGREEMENT

1. **Subject Property.** The real property owned by PUB, which is the subject of this Agreement ("PUB Property"), comprises approximately 52 acres and is more particularly described in Exhibit A, provided by PUB and attached hereto and incorporated herein by reference.

2. **Drainage Plan.** PUB has had a drainage plan designed and prepared by the engineering and surveying firm of Bush & Gudgeon, Inc., which plan is attached hereto as Exhibit B and hereafter referred to as the "Drainage Plan". PUB has implemented the Drainage Plan by constructing and installing two drainage and flood detention basins, described as "Basin 1" and "Basin 2" in the Drainage Plan, and underground piping and channeling from the detention basins in accordance with the Drainage Plan. PUB has constructed and installed an underground drainage improvement across the Green Springs Golf Course (in such a manner as to minimize interference with golf course play) and concurrently installed a sewer line across the golf course, all in accordance with the City's standards.

3. **Donation of PUB Property for City Park.** PUB will donate that portion of the PUB Property described as Basin 1, which comprises approximately 10 acres and is further described in Exhibit C, to the City for a natural park ("Park"). The City intends that the Park will become a trailhead for a biking and hiking system that will connect to and otherwise become a part of the City's master plan trail system. In addition to donating said property to the City, PUB will provide funds, as further described in this Agreement, for the improvement of the Park. It is hereby acknowledged that there are no dwelling units in the immediate vicinity of the Park and that the Park may not be accessible by road until such time as development allows for the same. Therefore, development of the Park shall take place at a future point in time to be determined by the City in its sole discretion.

4. **Funding.** As consideration for the City's approval of PUB's drainage plan, PUB shall pay the City up to \$300,000.00, payable to the City as follows:

- a. PUB shall, upon the granting of the final plat approval for Silverstone at Greenspring Phase 2 subdivision, pay the City \$100,000.00, which shall be placed in an interest bearing escrow account in the name of the City and in a form to be approved by the City ("Escrow Account").
- b. PUB shall pay the City an additional \$100,000.00, which shall be placed in the Escrow Account at the earlier of the following events: (1) PUB's sale and closing of the first 20 acres of PUB Property, which is not part of the Silverstone at Greenspring Phase 2 subdivision; or (2) January 1, 2005.
- c. PUB shall pay the City an additional \$100,000.00 subject to the following: The City may seek additional funds from developers or landowners whose property may directly benefit from the improvements made by PUB under the terms of this Agreement. Any monies received by the City from said developers or landowners shall act to reduce the \$100,000.00 owed to the City by PUB under this subsection (c) by the amount the City receives from said developers or landowners on the following basis: If the City receives from third-parties less than \$100,000.00, PUB shall contribute an additional \$100,000.00; if the City receives more than \$100,000.00 but less than \$200,000.00, then PUB shall contribute the difference between \$200,000.00 and the total outside funds received by the City; if the City receives more than \$200,000.00, PUB will have no obligation for any further funding into the park escrow. Notwithstanding the above, the City shall have no obligation to collect additional funds from affected developers or landowners and no standard for such collection shall be imposed upon the City hereby. PUB shall be required to pay the City the

funds described in this subsection (c) by June 30, 2008. Nothing herein shall reduce the first \$200,000.00 owed by PUB to the City.

5. Use of Funds. The City may use any of the funds it receives pursuant to subparagraphs 4(a) and 4(b) of this Agreement for the Park described herein or otherwise at its own discretion for the improvement and/or construction of parks and recreational facilities within the City. All funds paid by PUB pursuant to subparagraph 4(c) of this Agreement may only be used by the City for the Park. If the City chooses to use the funds it receives pursuant to subparagraphs 4(a) and 4(b) of this Agreement for purposes other than for the Park, PUB shall be relieved of its obligations to pay the City pursuant to subparagraph 4(c) of this Agreement and any funds paid into the Escrow Account pursuant to subparagraph 4(c) shall be refunded to PUB. The design, construction and maintenance of the Park shall be the responsibility of the City, although nothing in this Agreement shall require the City to design or construct the Park, nor shall such act as a condition of payment to the City by PUB pursuant to this Agreement, except as specifically agreed to regarding subparagraph 4(c) payments in this Paragraph 5.

6. Open Space Credit. In consideration of PUB's donation of PUB Property to the City and payments as described herein, PUB shall receive an open-space credit of 7.2 acres from the City. This open-space credit shall be credited to future development by PUB, which PUB shall determine upon prior notice to the City. The 7.2 acres shall be allocated on a prorated basis of the PUB Property.

7. City Property Reserved to Park. The City shall designate and reserve the 3.57 acres of property set forth in Exhibit D for use and incorporation into the Park and detention Basin 1.

8. FEMA Mapping Revision. The City shall submit a request to the Federal Emergency Management Agency ("FEMA") for a flood mapping revision of the Flood Insurance Rate Map. In its request, the City shall use the drainage plan proposal prepared by Bush & Gudgett attached as Exhibit B. PUB shall cooperate in any manner necessary to allow the City to submit the request to FEMA, and shall otherwise be responsive to the City and/or FEMA in the course of the same without cost or charge to the City.

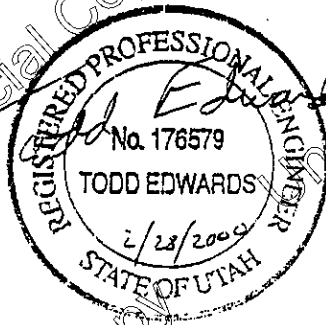
9. Agreement to Run with the Land. This Agreement shall be recorded against the PUB Property as described in Exhibit A hereto, and shall be deemed to run with the land and shall be binding on all successors and assigns of PUB in the ownership or development of any portion of the PUB Property. The recording of this Agreement shall act to secure the City's rights as more fully set forth herein, including but not limited to, its right to receive up to \$300,000.00 in funding from PUB pursuant to Paragraph 4 of this Agreement.

10. Binding Effect. This Agreement shall inure to the benefit of and be binding upon the successors and assigns of the parties hereto.

11. Integration. This Agreement contains the entire Agreement with respect to the subject matter hereof and integrates all prior conversations, discussions or understanding of whatever kind or nature and may only be modified by a subsequent writing duly executed by the parties hereto.

12. Severability. If any part or provision of this Agreement shall be determined to be unconstitutional, invalid, or unenforceable by a court of competent jurisdiction, then such a decision shall not affect any other part or provision of this Agreement except that specific provision determined to be unconstitutional, invalid or unenforceable. If any condition, covenant,

PRELIMINARY TECHNICAL DRAINAGE STUDY FOR
 The Links @ Green Springs a Planned Unit
 Development & the P.U.B. property
 Washington, Utah
 B&G #5-7081 (MGS #2 Development Group)
 Located in the Northeast Corner SEC. 10, T. 42 S, R. 15 W, SEB&M



February 28, 2000

Prepared By Curtis R. Chugg
 Reviewed By Todd Edwards PE # 176579

Bush & Gudgell Engineering

205 East Tabernacle #4
 St. George, Utah 84770
 Phone (801) 673-2337

PURPOSE OF STUDY

The intent of this drainage study is to analyze the effects of improving an existing open parcel of ground into a residential development. The main area of focus for this study is developing a plan that will control the offsite storm runoff as it passes through the residential development. This report will discuss the findings from the study and make recommendations by which the project should handle drainage concerns related to this site.

PROJECT LOCATION

The Link @ Green Springs subdivision, consisting of 11.4± acres along with an additional 211.0± acres of future development ground, are located north of the center section line in Section 10, Township 42 South, Range 15 West, Salt Lake Base & Meridian. Additional hundreds of offsite acres consisting of City and habitat ground lay north of these future development areas. The 'Link' site begins at the end of Quail Ridge Road, a street that was platted with Buena Vista Subdivision phase 4. (see Drainage study Map in the appendix).

EXISTING DRAINAGE

Presently 1,779.8± acres of Washington City, permanent open space, 'Green Springs' golf course and also future development ground all drains its storm runoff southeasterly into the Mill Creek wash. The offsite property was considered by this study to be undeveloped and in the event it were, the increased flows must be handled by that development. The Mill Creek wash is an enormous drainage basin in its self without the drainage area in question by this report.

SOIL CONDITIONS

The United States Department of Agriculture Soil Conservation Service has made a survey of Washington County Area in 1977. The survey findings designate each area with varying terrain and soils types with a hydrologic group classification. These classifications were used in determining the composite coefficients for each area. The types of soil found in this area identifies them as being anything from a 'Loamy Fine Sand' (Hydrologic group - A) to having properties too variable to be estimated (Hydrologic group - D).

FLOODPLAIN INFORMATION

The FEMA flood plain maps for this area shows the main wash that runs through the developable property as being in zone 'A', that being a flood hazard but without determining any base flood elevations. The FEMA community panel number for this site is 490182-0015 C. FEMA shows a much larger area inundated by a 100-year storm than what is realistically possible. This report is trying to quantify the amount of runoff that would be generated by a 100 year storm event. A FEMA map revision would be required to avoid the need for flood insurance on each of the individual homes that are with the 100 year storm event.

HYDROLOGY METHODS

The Rational Formula Method was used to determine the peak storm runoff generated by the drainage areas in question. This method was originally developed in 1889 and is general accepted for producing satisfactory results. The Time of Concentrations was determined by using a slope/velocity chart (see appendix). This time was used to establish the rainfall intensity (in/hr). The rainfall intensity used is for short duration precipitation storms. These rainfall intensity numbers were established by Utah State University department of Soils and Brometerology (see appendix for table). A runoff coefficient was determined by the hydrologic soil group and the natural sloping of the existing ground (see appendix).

RESULTS OF COMPUTATIONS

(see the appendix for maps and data information)

Area Description	Area ac	Coef	Tc hrs	Intensity in/hr	Flow cfs
1	1486.7	0.39	1.93	1.13	660.0
2	265.0	0.50	0.67	2.97	387.0

DETENTION BASINS

(see appendix for map data information)

A linear hydrograph was used to calculate the storage required for the proposed detention basins

Required detention basin storage and controlled outlet.**(100 Year Storms)**

Basin	Outlet	Storage	Surface area
#1	90 cfs	2,000,000 cu.ft.	400,000 sq.ft.
#2	64 cfs (additional)	650,000 cu.ft.	150,000 sq.ft.

Note: A combined outlet of 154 cfs will pass through the Links Subdivision in a 42" N-12 smooth wall pipe at 2.0% slope.

DESIGN RECOMMENDATIONS

1. All grading plans in the future for this area should hereby adhere to the requirements as set forth by this drainage report or like manner.
2. Provisions should be made for proper drainage away from all buildings and to be carried out by the contractor who completes the final grading around each home.
3. Detention basins should be properly designed with a large enough spillway to prevent erosion if it overtops. The first basin should be designed with a small outlet pipe to assure it reaches its maximum storage. The second basins outlet pipe should be larger than the first to past additional runoff through. The outlet of the second should then pass through the golf course and the Links subdivision into the Mill Creek wash by way of a pipe. A temporary drainage diversion (ditch or berm) should be constructed to direct the runoff from the westerly side of drainage area 2 along the golf course northeasterly into the second basin.
4. All detention basins should be conservatively designed with additional free board and maximum storage possible.
5. An opening through the Links subdivision should be left clear of walls or any major obstructions to pass any overtopping of the second basin that is not handled by the depressions within the golf course.
6. All grading shall comply with UBC appendix 33 and Washington City construction standards.
7. Series of curb inlet/grates catch basins and pipes shall be used to catch drainage on the public street which access the Links subdivision and should carry its storm runoff to the Mill Creek wash. It is recommended to use the pre-fabricated boxes made by Upwall or like manner. These boxes were used on the Snow Canyon Parkway by Entrada development and will catch more runoff than the typically constructed box because of its larger curb face of nine inches.
8. All developments within this area should be able to handle its storm runoff within the street right of ways.
9. Modified curb & gutter can be used for all private roads.

Appendix

CONTENTS

- Drainage Study Map
- Soils Survey & FEMA Flood maps
- Rational method (100 year storms)
- Hydrograph (Detention basin determination)
- Tables and Charts

Soils Survey & FEMA flood maps

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SOIL SURVEY OF

Washington County Area, Utah



United States Department of Agriculture
Soil Conservation Service and
United States Department of the Interior
Bureau of Land Management and
National Park Service

In cooperation with
Utah Agricultural Experiment Station

Soil series and map symbols	Depth to bedrock or hardpan	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
*Eroded land: EA, EB. Properties too variable to be estimated. For Shalet part, see Shalet series.						
Esplin Mapped only in complex with Pastura soils.	1-2	0-18 18	Loam, clay loam, and silt loam Indurated hardpan over basalt.	CL-ML or CL	A-4 or A-6	0
Fluvaquents and Torrifluvents, sandy: FA. Properties too variable to be estimated.						
Gullied land: GA. Properties too variable to be estimated.						
Hantz: Ha	>5	0-70	Silty clay loam and silty clay	CL	A-7	0
*Harrisburg: HbC, HD For Rock land part of HD, see Rock land.	2-3	0-35 35	Fine sandy loam Indurated hardpan.	SM	A-4 or A-2	0
*Hobog: HG For Rock land part, see Rock land.	1-2	0-13 13	Very cobbly loam Sandstone bedrock.	GM	A-2	15-30
Hogg Mapped only in a complex with Kolob soils.	4-5	0-38 38-52 52	Fine sandy loam Clay Limestone bedrock.	SM CL or ML	A-4 A-6 or A-7	0 0
Ildefonso Mapped only in a complex with Nehar soils.	3-4	0-40 40	Very gravelly sandy loam Limestone bedrock.	GM-GC or GM	A-2	5-10
Isom: IAF	>5	0-60	Cobbly sandy loam and very cobbly sandy loam.	GM or GM-GC	A-2 or A-1	25-40
Ivins: Ib, Ic	>5	0-24 24-64	Loamy fine sand Sandy clay loam and sandy clay	SM SC, SM-SC, CL-ML or CL	A-2 A-6 or A-4	0 0
Junction: JaB, JaC	>5	0-60	Fine sandy loam	SM or SM-SC	A-4	0
*Kinesava: KAE, KBD, KCE For Detra part of KBD, see Detra series. For Kolob part part of KCE, see Kolob variant.	>5	0-39 39-60	Fine sandy loam and sandy clay loam. Clay	SM-SC CL or CH	A-4 A-7	0 0
*Kolob: KD, KHC, KLG For Detra part of KD, see Detra series. For Hogg part of KHC, see Hogg series. For Paunsaugunt part of KLG, see Paunsaugunt series.	3-5	0-10 10-52 52	Fine sandy loam, cobbly fine sandy loam, and very stony silt loam. Very gravelly clay loam, cobbly clay loam, stony clay, and clay loam. Limestone bedrock.	SC or CL GC	A-2, A-4 or A-6 A-2 or A-6	0-30 10-15
Kolob variant Mapped only in complex with Kinesava soils.	2-3	0-30 30	Silt loam, gravelly silty clay loam, and very gravelly silty clay. Shale and limestone bedrock.	CL or ML	A-4 or A-6	0
Lava flows: LA Properties too variable to be estimated.						
Lavate: Lp	>5	0-60	Sandy loam, sandy clay loam, and clay loam.	CL	A-6	0
LaVerkin: LcB, LcC, LdB	>5	0-60	Fine sandy loam and light sandy clay loam.	SM-SC or CL-ML	A-4	0
Leeds: LeA, LeB, LeD	>5	0-15 15-60	Silty clay loam Sandy loam and silt loam	CL ML or CL-ML	A-6 A-4	0 0

WASHINGTON COUNTY AREA, UTAH

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significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic group
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
100	100	80-100	60-85	25-35	5-15	0.6-2.0	0.14-0.20	7.9-9.0	Moderate.	D
100	100	90-100	85-95	40-50	20-30	0.06-0.2	0.14-0.20	7.9-8.4	Moderate to high.	C
100	90-100	85-100	25-50	15-20	NP-5	2.0-6.0	0.10-0.14	7.9-8.4	Low.	C
40-55	35-50	30-45	20-35	20-30	NP-5	0.6-2.0	0.06-0.10	7.9-9.0	Low.	D
100	100	100	35-45	20-30	NP-5	2.0-6.0	0.10-0.14	7.4-7.8	Low.	B
100	100	95-100	70-80	35-45	10-25	0.2-0.6	0.14-0.20	7.4-8.4	High.	B
35-60	30-55	25-40	15-35	25-35	5-10	6.0-20.0	0.07-0.13	7.9-9.0	Low.	B
30-60	25-55	20-45	15-30	20-30	NP-10	2.0-6.0	0.04-0.08	7.9-9.0	Low.	B
100	95-100	90-100	20-30	10-30	NP-7	6.0-20.0	0.08-0.11	7.4-8.4	Low.	C
100	90-100	85-100	35-60	20-40	5-15	0.2-0.6	0.13-0.19	7.4-8.4	Moderate.	C
100	90-100	85-100	35-50	15-30	NP-10	2.0-6.0	0.10-0.14	7.4-7.8	Low.	B
90	100	80-90	35-45	20-30	5-10	2.0-6.0	0.10-0.14	7.4-7.8	Low.	B
100	100	80-90	70-85	40-60	15-30	0.2-0.6	0.14-0.20	7.4-8.4	High.	B
80-100	70-100	50-85	30-65	25-35	10-15	0.2-0.6	0.12-0.20	7.4-8.4	Low to moderate.	C
35-70	25-60	20-50	15-45	30-40	10-15	0.2-0.6	0.08-0.10	7.4-8.4	Low to moderate.	C
70-80	65-75	60-75	50-70	30-40	5-15	0.2-0.6	0.10-0.14	7.4-9.0	Moderate.	C
90-100	80-95	70-85	50-70	30-40	10-15	0.2-0.6	0.13-0.19	7.4-7.8	Moderate.	B
90-100	85-100	75-90	40-60	20-30	5-10	0.6-2.0	0.12-0.18	8.5-9.0	Moderate.	C
100	100	90-100	70-90	30-40	10-20	0.06-0.2	0.14-0.20	7.9-9.0	Moderate.	C
100	100	90-100	70-85	20-30	NP-10	0.6-2.0	0.14-0.20	8.5-9.0	Moderate.	C

Soil series and map symbols	Depth to bedrock or hardpan	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
Rock outcrop: RT. Properties too variable to be estimated.		In				
Rough broken land: RU. Properties too variable to be estimated.						
St. George: Sa, Sb, ¹ Sc, Sd, Se, ¹	>5	0-60	Loam, silty clay loam, very fine sandy loam, and silt loam.	CL-ML or CL	A-4 or A-6	0
Schmutz: SH	>5	0-60	Loam	ML or CL-ML	A-4	0
Shalet Mapped only in complex with Eroded land.	1/2-2	0-12 12	Clay loam Shale (rippable) bedrock.	CL	A-6	0
Spens: SPD	>5	0-14 14-64	Very fine sandy loam and fine sandy loam. Fine sandy clay loam and clay loam.	SM CL-ML or ML	A-4 A-6 or A-4	0 0
Sterville: SrC	>5	64 0-60	Sandstone. Clay	CL or CH	A-7	0
Stony colluvial land: SY. Properties too variable to be estimated.						
Tacan: TAG	4-5	0-80	Very stony sandy loam, very gravelly sandy clay loam, and very gravelly fine sandy clay loam.	GC	A-2	15-30
Tobish: TBF	2-3	0-35 35	Very cobbly clay loam, cobbly clay loam, gravelly clay loam, and gravelly light clay loam. Sandstone bedrock.	SC	A-6 or A-2	10-15
Tobler: Tc, Td	>5	0-60	Fine sandy loam	SM or SM-SC	A-4	0
Toquerville Mapped only in complex with Pintura soils.	1-2	0-16 16	Fine sand Sandstone bedrock.	SP-SM	A-3	0
*Tortugas: TG For Rock land part, see Rock land.	1-2	0-19 19	Very gravelly loam Fractured limestone bedrock.	GM-GC	A-2 or A-4	10-15
Vekol: VeA, VED	>5	0-16 0-60	Sandy loam Sandy clay loam, silty clay loam, sandy clay, and silty clay.	SM-SC CL or ML	A-2 or A-4 A-6 or A-7	0 0
*Veyor: VND, VPD For Carhollow part of VHO and Pastura part of VPD, see their respective series.	1-2	0-19 19	Cobbly loam, cobbly clay loam, and very cobbly clay. Indurated hardpan over basalt.	CL or GC	A-7	15-30
Weiring: WAG For Tortugas part, see Tortugas series. For Rock outcrop part, see Rock outcrop.	1-2	0-19 19	Very gravelly loam and gravelly loam Fractured limestone.	GM-GC	A-2	0-10
Winkel: WBD, WCF For Rock outcrop part of WCF, see Rock outcrop.	1-2	0-16 16	Gravelly fine sandy loam, very cobbly fine sandy loam, and very gravelly fine sandy loam. Indurated hardpan over basalt.	GM or GM-GC	A-2 or A-1	0-10
Yaki: YAF, YZF For Zukan part, see Zukan series.	1-2	0-19 19	Very cobbly loam Limestone bedrock.	GM-GC	A-2	0-10
Zukan Mapped only in complex with Yaki soils.	1-2	0-16 16	Loam, fine sandy loam, and very fine sandy loam. Limestone bedrock.	CL-ML or CL	A-4 or A-6	0

¹ NP= Nonplastic.
² The surface mantle contains 50 to 80 percent cobbles, more than 3 inches in diameter, by volume.

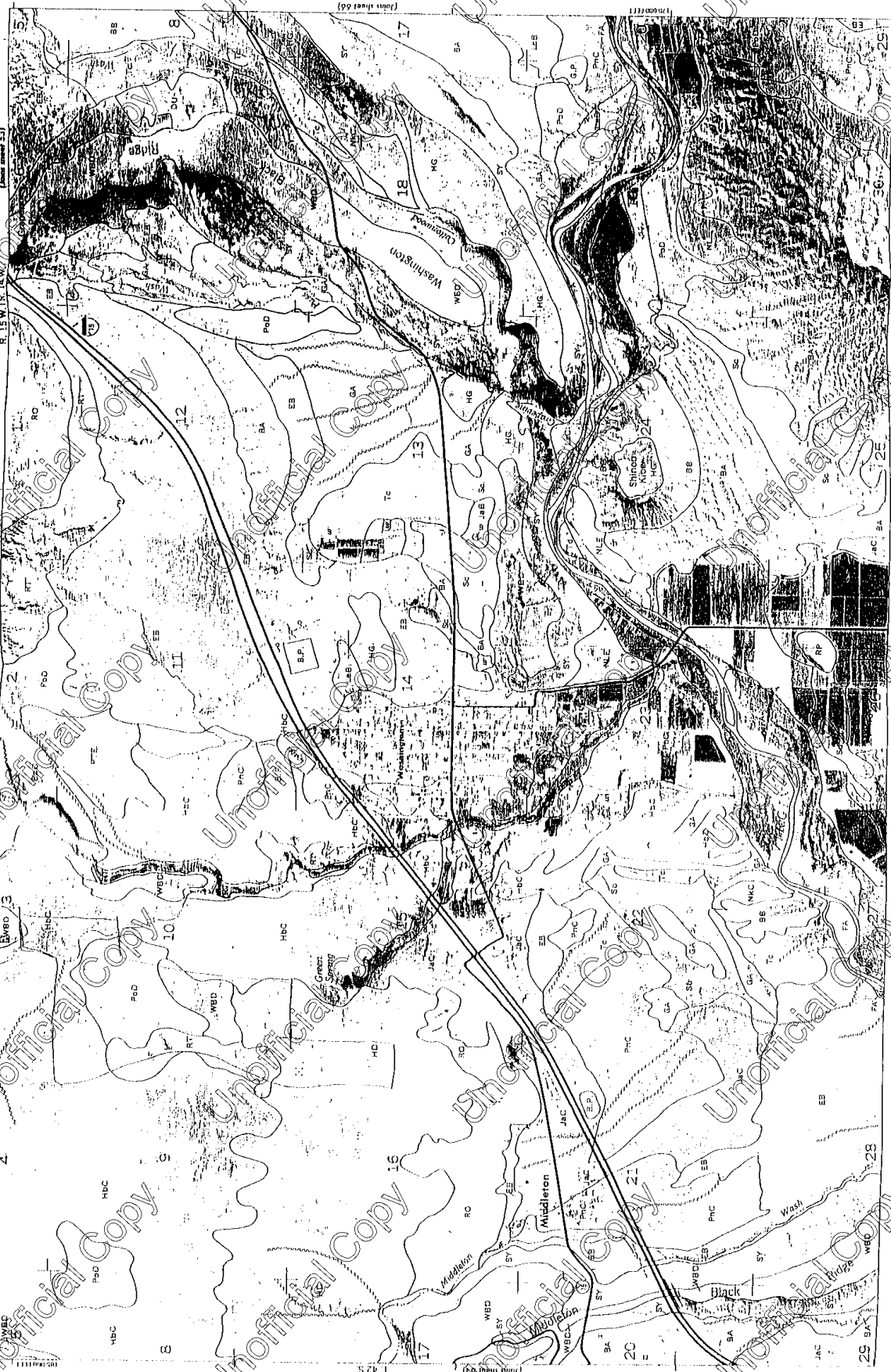
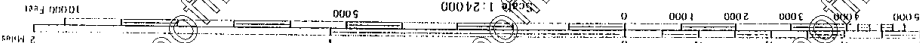
WASHINGTON COUNTY AREA, UTAH

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic group
No. 4 (4.75 mm)	No. 10 (2.0 mm)	No. 40 (0.425 mm)	No. 200 (0.075 mm)							
				Pct		In per hr	In per in of soil	pH		
100	90-100	90-100	60-90	20-40	5-15	0.2-0.6	0.12-0.20	7.4-8.4	Moderate.	
100	70-100	60-90	50-65	25-35	5-10	0.6-2.0	0.13-0.19	7.9-9.0	Moderate.	B
90-100	85-100	80-100	50-70	30-40	10-20	0.06-0.2	0.14-0.20	8.5-9.0	Moderate.	D
100	100	95-100	40-50	10-20	NP-5	0.6-2.0	0.10-0.14	6.6-7.3	Low.	B
100	100	90-100	50-70	20-40	5-15	0.2-0.6	0.13-0.20	6.6-9.0	Moderate.	
100	95-100	80-95	75-90	40-55	20-30	<0.06	0.14-0.20	7.9-9.0	High.	D
35-70	30-65	25-55	15-35	30-40	10-15	0.6-2.0	0.08-0.10	7.4-8.4	Low.	B
70-80	65-75	55-65	25-40	30-40	10-15	0.06-0.2	0.11-0.15	7.4-8.4	Moderate.	C
100	90-100	85-100	35-50	15-25	NP-10	2.0-6.0 in Tc 0.2-0.6 in Td	0.10-0.12	7.9-8.4	Low.	B in Tc C in Td
100	90-100	70-95	5-10		NP	>20.0	0.05-0.08	8.6-7.3	Low.	D
40-70	30-60	25-55	20-45	20-30	5-10	2.0-6.0	0.07-0.10	7.4-8.4	Low.	D
100	90-100	55-65	30-40	20-30	5-10	0.6-2.0	0.10-0.13	7.9-8.4	Low.	C
100	90-95	75-90	50-75	35-45	10-20	0.06-0.2	0.14-0.20	7.9-9.0	Moderate.	
55-70	50-65	45-60	40-55	40-50	15-30	0.06-0.2	0.08-0.10	7.4-8.4	Moderate.	D
25-50	20-45	20-40	15-30	20-30	5-10	0.6-2.0	0.07-0.10	7.4-8.4	Low.	D
35-60	30-55	20-40	15-25	15-25	NP-10	0.6-2.0	0.07-0.09	8.5-9.0	Low.	D
35-50	30-45	25-40	20-35	25-30	5-10	2.0-6.0	0.07-0.11	7.9-9.0	Low.	D
90-100	90-100	85-95	50-60	20-35	5-15	0.6-2.0	0.10-0.18	7.9-9.0	Low.	D

³ Seasonal high water table at a depth of 36 to 60 inches.

⁴ Seasonal high water table at depths between 0 and 40 inches.



STEEZ NUMBER 65

R. 15 W. 18. 14 N. W. 33

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Rational Method
(100 Year Storms)

Rational Method – 100 year storm

Drainage area 1

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Area (A) = 1496.7 acres

Coefficient (C) = 0.39

Time of Concentration (Tc) = $15 \text{ min.} + \frac{[10,120/4.8] + [3930/3.0] + [5746/2.2]}{60}$
= 15 min. + 100.5 min.
= 1.93 hrs.

Intensity (I) = 1.13 in/hr

Peak Flow (Q) = CIA
= $0.39 * (1.13) * (1496.7)$
= **660 cfs**

Drainage area 2

Area (A) = 265 acres

Coefficient (C) = 0.50

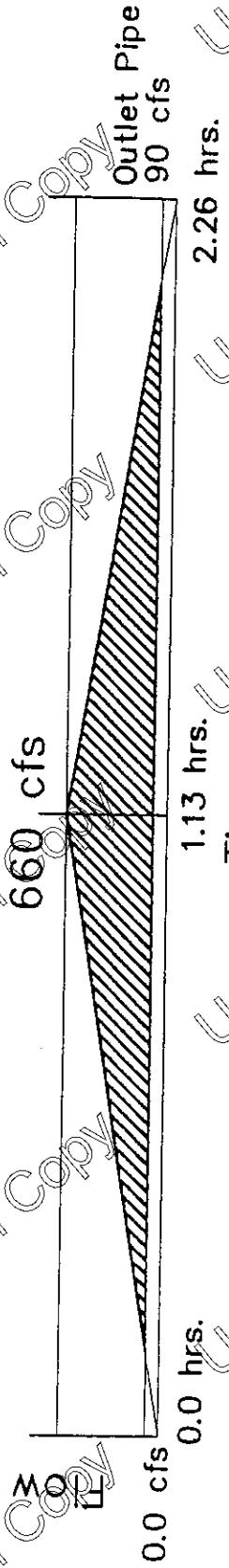
Time of Concentration (Tc) = $15 \text{ min.} + \frac{4442/3.0}{60}$
= 15 min. + 24.7 min.
= 0.67 hrs.

Intensity (I) = 2.97 in/hr

Peak Flow (Q) = CIA
= $0.5 * (2.97) * (387)$
= **387 cfs**

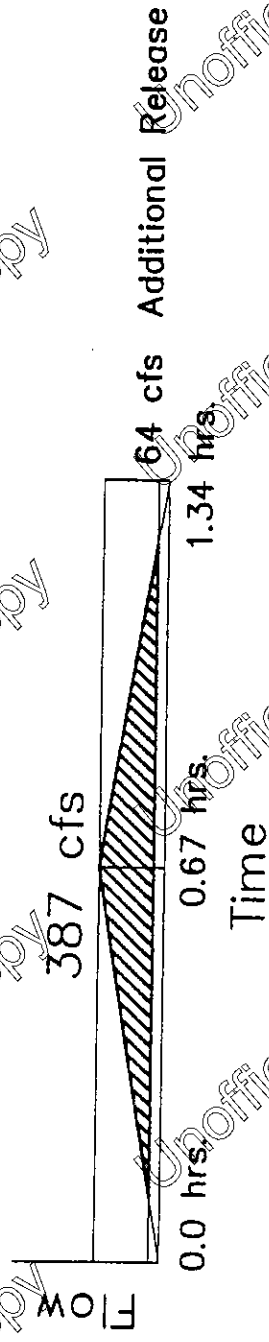
Hydrograph (Rational Method) (100 Year Peak Flow)

Drainage Area 1



Required Storage - 2,000,000 cu.ft.

Drainage Area 2



Required Storage - 650,000 cu.ft.

Note: The total release from basins 1 & 2 combined is 154 cfs

TABLE 14.9 Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope Range

Table with columns A, B, C, D and sub-columns for slope ranges (0-2%, 2-6%, 6%+). Rows include Land Use categories like Cultivated Land, Pasture, Meadow, Forest, Residential Lot, Industrial, Commercial, Streets, Open Space, and Parking.

Source: Kibler, D.F. et al. 1982. Recommended Hydrologic Procedures for Computing Urban Runoff in Pennsylvania Commonwealth of Pa. Harrisburg, Pa. Dept. of Environmental Resources.

* Runoff coefficients for storm recurrence intervals less than 25 years
* Runoff coefficients for storm recurrence intervals of 25 years or more

10 and 30 minutes for flow paths between 100 and 500-feet.

There are numerous empirical methods to determine the time of concentration. The method selected depends on the information available and any preferences dictated by local review agencies. Some of the various methods are listed in table 14.10. Two of these methods are subsequently discussed.

One of the better-known methods that relates the overland flow time to slope and length parameters is the Kirpich equation. Initially, the equation was developed for small agricultural watersheds with drainage areas less than 200 acres.

Adjustment factors are applied to the equation for application to pavement surfaces (see table 14.10). The Kirpich equation is

t_c = 0.073 (L^0.77 / S^0.385) (14.14)

where t_c is the time of concentration in minutes, L is the length of the flow path in feet, and S is the average slope of the flow path = ΔElev/L.

The use of Manning's kinematic equation can be used to compute sheet flow travel time. The equation is in the

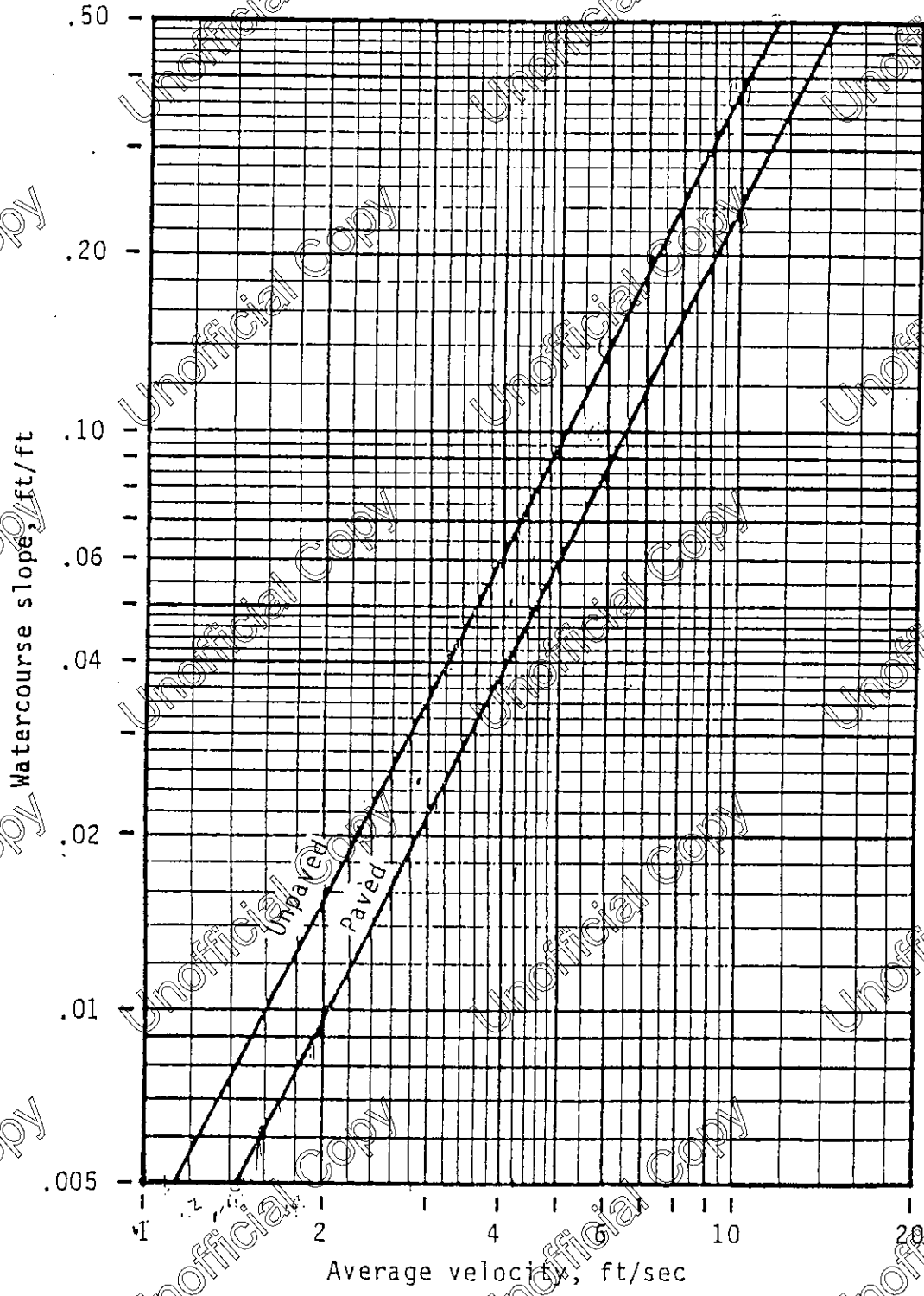


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

TABLE 4

CIRCULAR PIPE FLOW CAPACITY
Full Flow (cubic feet per second)

Mannings "n" = 0.012

Dia. *Conv.
(in.)

Dia. *Conv. (in.)	Factor	% Slope (feet per 100 feet)															
		0.02	0.05	0.10	0.20	0.35	0.50	0.75	1.00	1.25	1.50						
3	0.957	0.003	0.021	0.030	0.043	0.057	0.068	0.083	0.096	0.107	0.12	0.13	0.14	0.16	0.21	0.30	0.43
4	2.062	0.029	0.046	0.065	0.092	0.122	0.146	0.179	0.206	0.231	0.25	0.27	0.29	0.33	0.46	0.55	0.92
5	3.738	0.053	0.084	0.118	0.167	0.221	0.264	0.324	0.374	0.418	0.46	0.49	0.53	0.59	0.84	1.18	1.67
6	6.079	0.086	0.136	0.192	0.272	0.360	0.430	0.526	0.608	0.680	0.74	0.80	0.86	0.96	1.36	1.92	2.72
8	13.091	0.185	0.293	0.414	0.585	0.774	0.926	1.134	1.309	1.464	1.60	1.73	1.85	2.07	2.93	4.14	5.85
10	23.74	0.34	0.53	0.75	1.06	1.40	1.68	2.06	2.37	2.65	2.91	3.14	3.36	3.75	5.31	7.51	10.61
12	38.60	0.55	0.86	1.22	1.73	2.28	2.73	3.34	3.86	4.32	4.73	5.11	5.46	6.10	8.63	12.21	17.26
15	69.98	0.99	1.56	2.21	3.13	4.14	4.95	6.06	7.00	7.82	8.57	9.26	9.90	11.06	15.65	22.13	31.30
18	113.80	1.61	2.54	3.60	5.09	6.73	8.05	9.86	11.38	12.72	13.94	15.05	16.09	17.99	25.46	35.99	50.89
21	171.65	2.43	3.84	5.43	7.68	10.16	12.14	14.87	17.17	19.19	21.02	22.71	24.28	27.14	38.38	54.28	76.77
24	245.08	3.47	5.48	7.75	10.96	14.50	17.33	21.22	24.51	27.40	30.02	32.42	34.66	38.75	54.80	77.59	109.60
27	335.51	4.74	7.50	10.61	15.00	19.85	23.72	29.06	33.55	37.51	41.09	44.38	47.45	53.06	75.0	106.1	160.0
30	444.35	6.28	9.94	14.05	19.87	26.29	31.92	38.48	44.44	49.68	54.42	58.78	62.84	70.26	99.4	140.5	198.7
36	722.57	10.22	16.16	22.85	32.31	42.75	51.09	62.58	72.26	80.79	88.50	95.59	102.19	114.25	161.6	228.5	323.1
42	1089.9	15.41	24.37	34.47	48.74	64.5	77.1	94.4	109.0	121.9	133.5	144.2	154.1	172.3	243.7	344.7	487.4
48	1556.1	22.01	34.80	49.21	69.59	92.1	110.0	134.8	155.6	174.0	190.6	205.9	220.1	246.0	340.0	492.1	695.9

* Conversion Factor = (1.486 x 92.4) x A / n

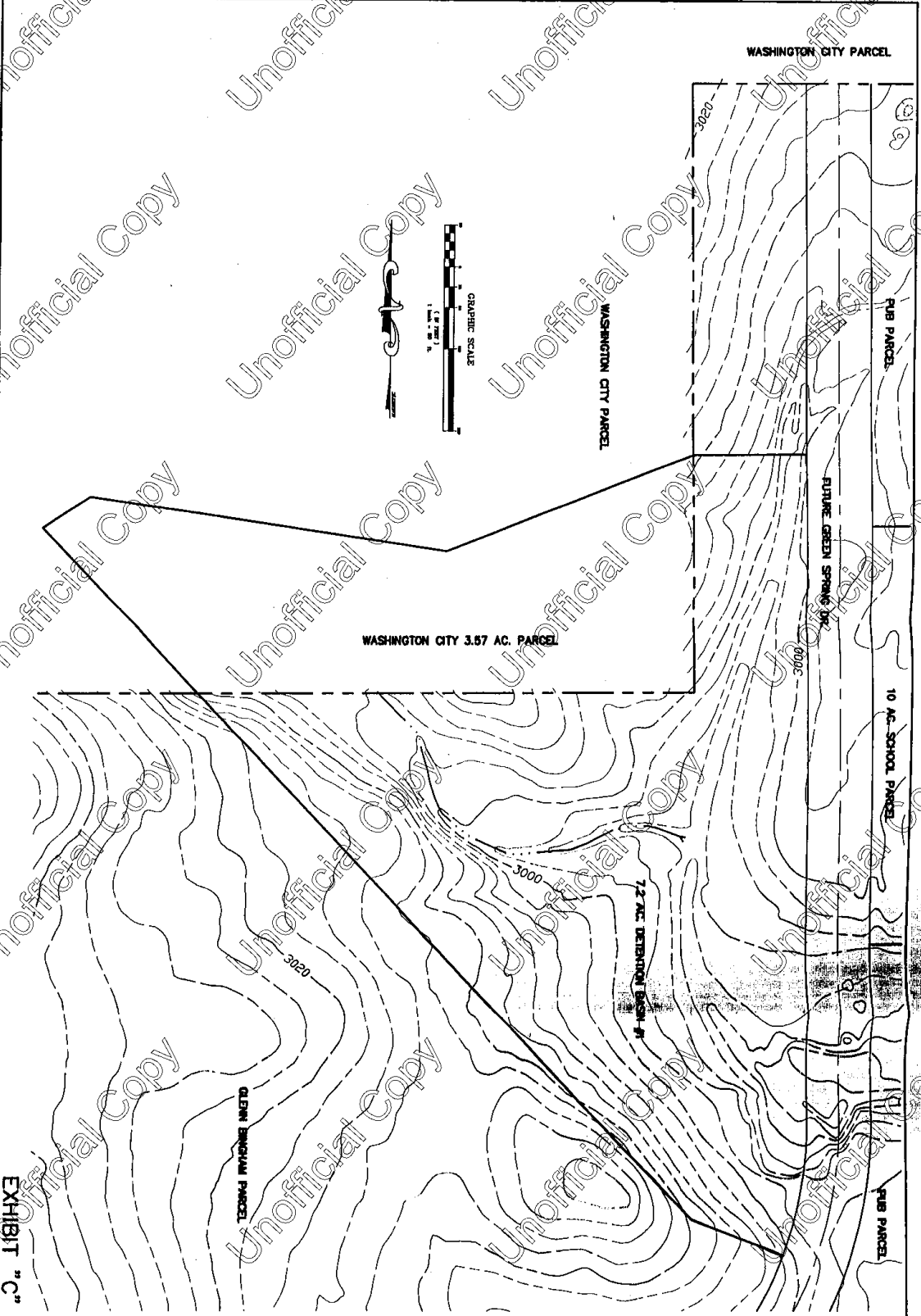


EXHIBIT "C"

	EXHIBIT "C" 7.2 AC. PARK PROPERTY LOCATED IN WASHINGTON, UTAH	Date: 1.14.02 Date: 1.20.02 Drawn: J.S.M. Checked: J.S.M. Title: J.S.M. Job No: 1.2.0008		BUSH & GUDGELL, INC. Engineers - Planners - Surveyors 506 East Towergate Blvd. #4 St. George, Utah 84770 Phone (435) 675-5857 / Fax (435) 675-8191 Email: bush@gudgell.com	Scale: 1" = 100'
	1" = 100'	1" = 100'	1" = 100'	1" = 100'	1" = 100'



Sec 10, T42S, R15W, SLB&M

April 27, 2000
Revised May 18, 2000

**Legal Descriptions
Prepared For
PUB / DMBA
Flood Control Parcels**

Washington City Parcel

Beginning at a point on the North line of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian, said point being located N 89°42'20" E along the section line 1103.47 feet from the Northwest corner of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian and running thence N 43°50'58" W 276.75 feet; thence N 56°19'14" E 69.25 feet; thence S 81°41'57" E 446.15 feet; thence N 68°38'59" E 329.62 feet; thence S 0°39'24" E 290.42 feet to a point on the North line of said Section 10; thence S 89°42'20" W along the section line 617.71 feet to the point of beginning. Contains 3.37 acres.

DMBA Parcel

Beginning at a point on the North line of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian, said point being located N 89°42'20" E along the section line 1103.47 feet from the Northwest corner of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian and running thence N 89°42'20" E along the section line 617.71 feet; thence S 0°39'24" W 290.42 feet; thence N 89°20'36" E 140.32 feet; thence S 0°39'24" E 813.33 feet to a point on a 460.00 foot radius curve to the right, the radius point of which bears S 89°20'36" W and with a central angle 16°53'41"; thence along the arc of said curve 135.64 feet; thence N 68°55'43" W 109.17 feet; thence N 46°25'00" W 888.79 feet to the point of beginning. Contains 7.20 acres.

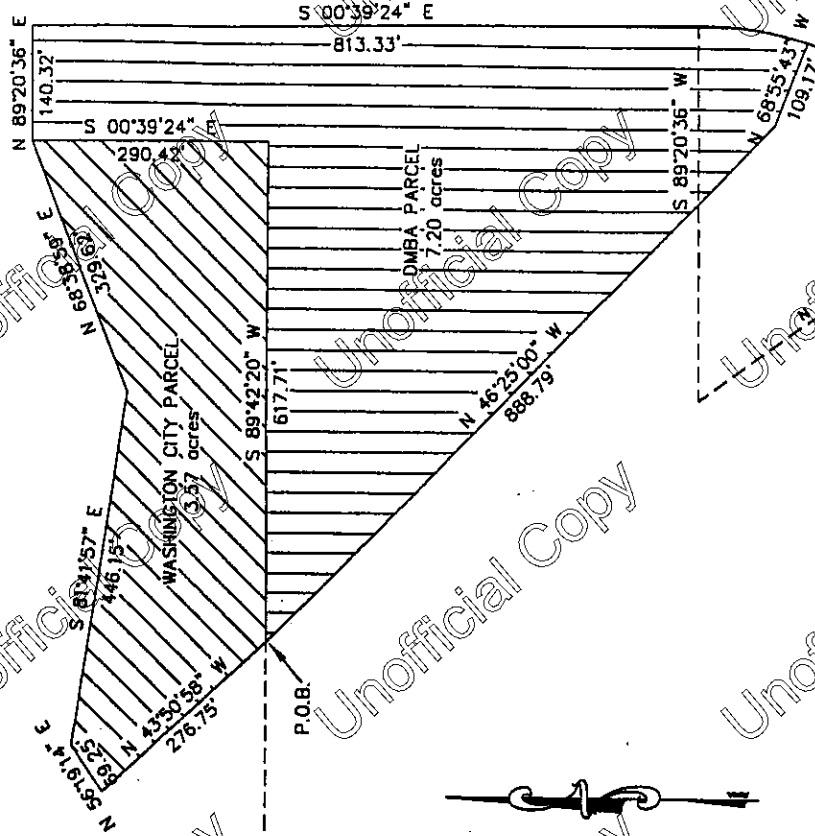
JR/lg

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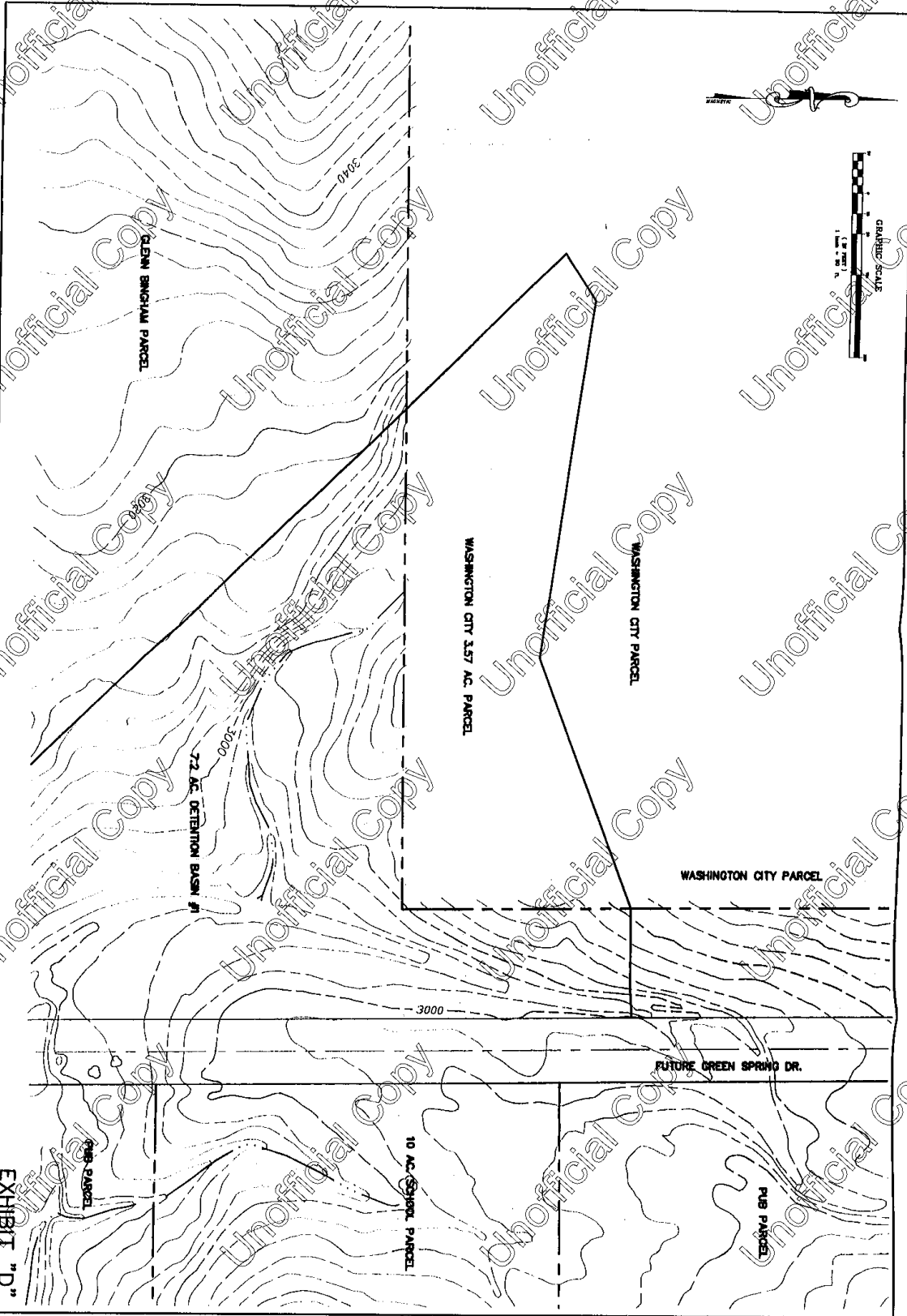
Detention Area Sites D.M.B.A. and Washington City


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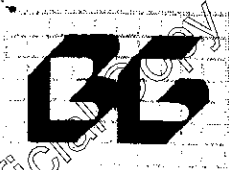
Δ = 1653.41'
R = 460.00'
T = 68.32'
T = 135.64'



Revised May 18, 2000



SHEET 1 OF 1	EXHIBIT "D" 3.57 AC. CITY PROPERTY LOCATED IN WASHINGTON, UTAH	Drawn: S.L.K. Date: 1/24/02		BUSH & GUDGELL, INC. Engineers - Planners - Surveyors 810 East Tabernacle Suite #4 St. George, Utah 84770 Phone (435) 873-2337 / Fax (435) 873-3161 Email: bushgud@netnet.com	Title: Date: By:
		Checked: Date:			



Sec 10, T42S, R15W, SLB&M

April 27, 2000
Revised May 18, 2000

**Legal Descriptions
Prepared For
PUB / DMBA
Flood Control Parcels**

Washington City Parcel

Beginning at a point on the North line of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian, said point being located N 89°42'20" E along the section line 1103.47 feet from the Northwest corner of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian and running thence N 43°50'58" W 276.75 feet; thence N 56°19'14" E 69.25 feet; thence S 81°41'57" E 446.15 feet; thence N 68°38'59" E 329.62 feet; thence S 0°39'24" E 290.42 feet to a point on the North line of said Section 10; thence S 89°42'20" W along the section line 617.71 feet to the point of beginning. Contains 3.57 acres.

DMBA Parcel

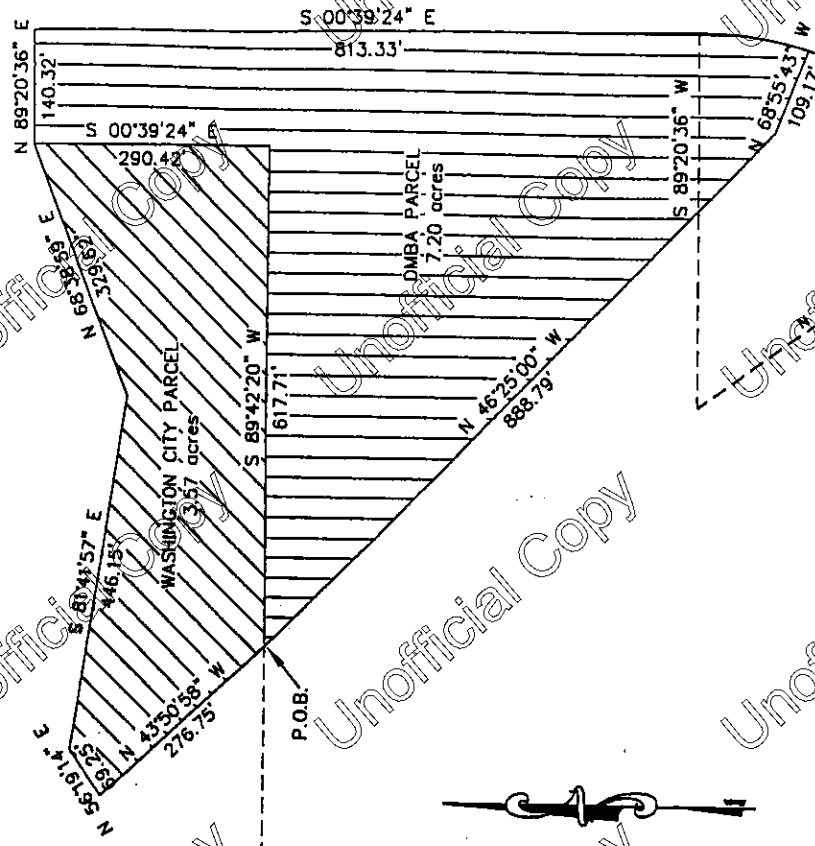
Beginning at a point on the North line of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian, said point being located N 89°42'20" E along the section line 1103.47 feet from the Northwest corner of Section 10, Township 42 South, Range 15 West, Salt Lake Base and Meridian and running thence N 89°42'20" E along the section line 617.71 feet; thence N 0°39'24" W 290.42 feet; thence N 89°20'36" E 140.32 feet; thence S 0°39'24" E 813.33 feet to a point on a 460.00 foot radius curve to the right, the radius point of which bears S 89°20'36" W and with a central angle 16°53'41"; thence along the arc of said curve 135.64 feet; thence N 68°55'43" W 109.17 feet; thence N 46°25'00" W 888.79 feet to the point of beginning. Contains 7.20 acres.

JR/lg

5-7008

~~00814747~~
 $\Delta = 1653.41'$
 $R = 469.00'$
 $T = 68.32'$
 $H = 135.84'$
Bk 1539 Pg 0039

Detention Area Sites D.M.B.A. and Washington City



NORTHWEST CORNER
SECTION 10, T-42-S, R-15-W
SALT LAKE-BASE AND MERIDIAN

Revised May 18, 2000

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