STORM WATER MANAGEMENT

LDS Church Site - Driggs Idaho Stake

Located in: A portion of the E ½ SW1/4 of Section 35, Twp. 4N, Range 45 E.,B.M. Teton County, Idaho

TETON COUNTY
PLANNING & ZONING
DEC 02 2011
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Idaho Falls, Idaho

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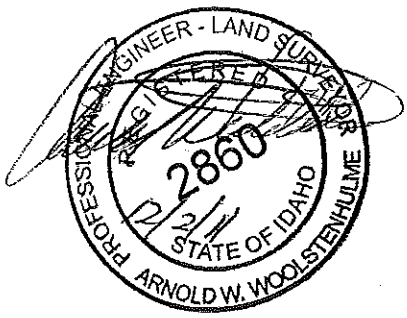

Nov 24, 2011

reports/ Storm water, LDS Church.wpd

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I. GENERAL PROJECT INFORMATION

LOCATION:
Part of SE 1/4 SW 1/4 Section 35, Twp. 4 N, Rng. 45 E.,B.M. Teton County, Idaho.
(see Map M : 1 & 2 in appendix)

DEVELOPER:
LDS Church, Salt Lake City, Utah

PROPERTY OWNER:
Blackfoot Farms LLC
500 Huntsman Way
Salt Lake, City Utah 84108

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ENGINEER / SURVEYOR:
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208-787-2952 email aweng@ida.net

PROPOSAL : The LDS Church of the Driggs, Idaho Stake is proposing to construct a new two ward chapel in the Victor, Idaho area. The church has proposed developing a 5.5 acre site with building and parking on it. The site is outside of City of Victor limits, but it is situated within the city area of impact. The present plan is to connect into the city of Victor water and sewer systems. The water service is about 1 mile away to connect into a new well the city has created. The Victor -Driggs sewer trunk line is about 400 feet east of this building site. The plan at this time is to connect the two entrances from the parking lot onto 7000 South County road. This would place all of the traffic onto a County road that accesses onto the State Highway 33 at the 7000 South intersection.

This project will consist of two separate wards that meet in overlapping wards' time slots at a three hour block meeting schedule. This means on a typical Sunday two wards will overlap their meeting by one hour. Therefore the peak traffic would be during the period when one ward is meeting and the second ward is starting their meetings.

No storm water system exists in this rural area. The farm area has a natural runoff slope of 1 percent to the west that would eventually drain into the Teton River.
No evidence of drainage is present on the site or through this property. No erosion or channeling exists. The county roads do not have any culverts under them and have not shown previous runoff or water collection in the borrow pits.

Many concerns and problems that will be addressed as this project proceeds are discussed in this report. Oversights or problems which are not apparent at this time neither negate the interest of the Engineer or the developer in addressing all concerned problems in a professional manner, nor their interest in having a quality project of which they are proud to be a part.

II. BACKGROUND AND GUIDELINES

The 5.5 acres have been used by the owners for farm ground for the last 100 years to raise hay, grain and for horse and cattle pasture land. This property is surrounded on three sides by farm land and on the east by the Frontage Road, Rails for Trails and State Highway 33. Then to the east side of State Highway 33 is more farm land.

Easements that cross the property are:

1. The prescriptive rights easement for County Road 7000 South.
2. Power and telephone prescriptive rights easements.

A. PROPOSED PLANNED SITE DEVELOPMENT

Total acres in project:	5.5 acres
Roads in project County road right-of-way	0.30 acres
Acres improved or hardened surface	3.13 acres
Acres in farm parcel from which the church site was split	80.0 acres

B. EXISTING CONDITIONS AT BUILDING SITE.

1- Soil is classified as Driggs Gravelly Loam D ra Permeability of 2.5-10"/hr.
2- Percolation of 2.0 to 10 Inches per hour SCS soil Survey
3- Soil tests by AW Engineering in area. Percolation Rate of 6.0 " / hr
4- Existing farm ground good condition - No runoff and good ground cover.

D. AREAS TO ADDRESS FROM STUDY

1. Existing Storm water runoff conditions.
2. Calculated Storm Water runoff from developed site.
3. Proposed Storm water runoff solution.

III. DESIGN CRITERIA AND DATA

The 5.5 acres have been used by the owners for farm ground for the last 100 years to raise hay, grain and for horse and cattle pasture land. This property is surrounded on three sides by farm land and on the east by the Frontage Road, Rails for Trails and State Highway 33. Then on the east side of State Highway 33 is more farm land. No culverts are under the county roads or State Highway. Therefore no runoff or drainage of site is directed are would come onto this property. The 350 feet just east of this property is in farm land and has no indication of storm overflow from this property. Therefore at this time only the developed property will be evaluated.

A. STORM WATER PRESENT RUNOFF

The calculated runoff of 0.50 cfs (See Worksheet in Appendix) for the undeveloped site would have 3600 cu feet of water for the 100 year frequency storm at 2.2 inches of rain and 2 hour storm. The history of this property shows no runoff from existing farming methods.

The adjacent property will not contribute any significant runoff onto this site from the history of the property and observations by A-W Engineering over the past 40 years.
If runoff was to occur it will easily flow around the curb at the parking area and run in its natural drainage away from this site.

B. DEVELOPED SITE:

The developed site calculated runoff of 1.80 cfs (See Worksheet 4, Developed Site in Appendix) would have 12,960 cubic feet of water for the 100 year frequency storm at 2.2 inches of rain and a 2 hour storm. See Teton County storm water Teton Valley of 1.19 inches of rain for 100 year storm and adding 1.0 inches for rain on snow for worst case scenario would total to 2.20 inches of rain / snow runoff for said 100 year storm. This is the worst case situation and the one used for calculating storm water retention.

C. STORM WATER SYSTEM FOR DEVELOPED PROPERTY

The calculated 12,960 cubic feet of water for peak 100 year storm runoff minus the present 3660 cf of water from present condition runoff.

Percolation of 6" per hour would result in cubi feet of water drained into the ground.
6" / hr x 2 hrs x area (50 ft x 70 ft area) 3500 cubic feet of water.

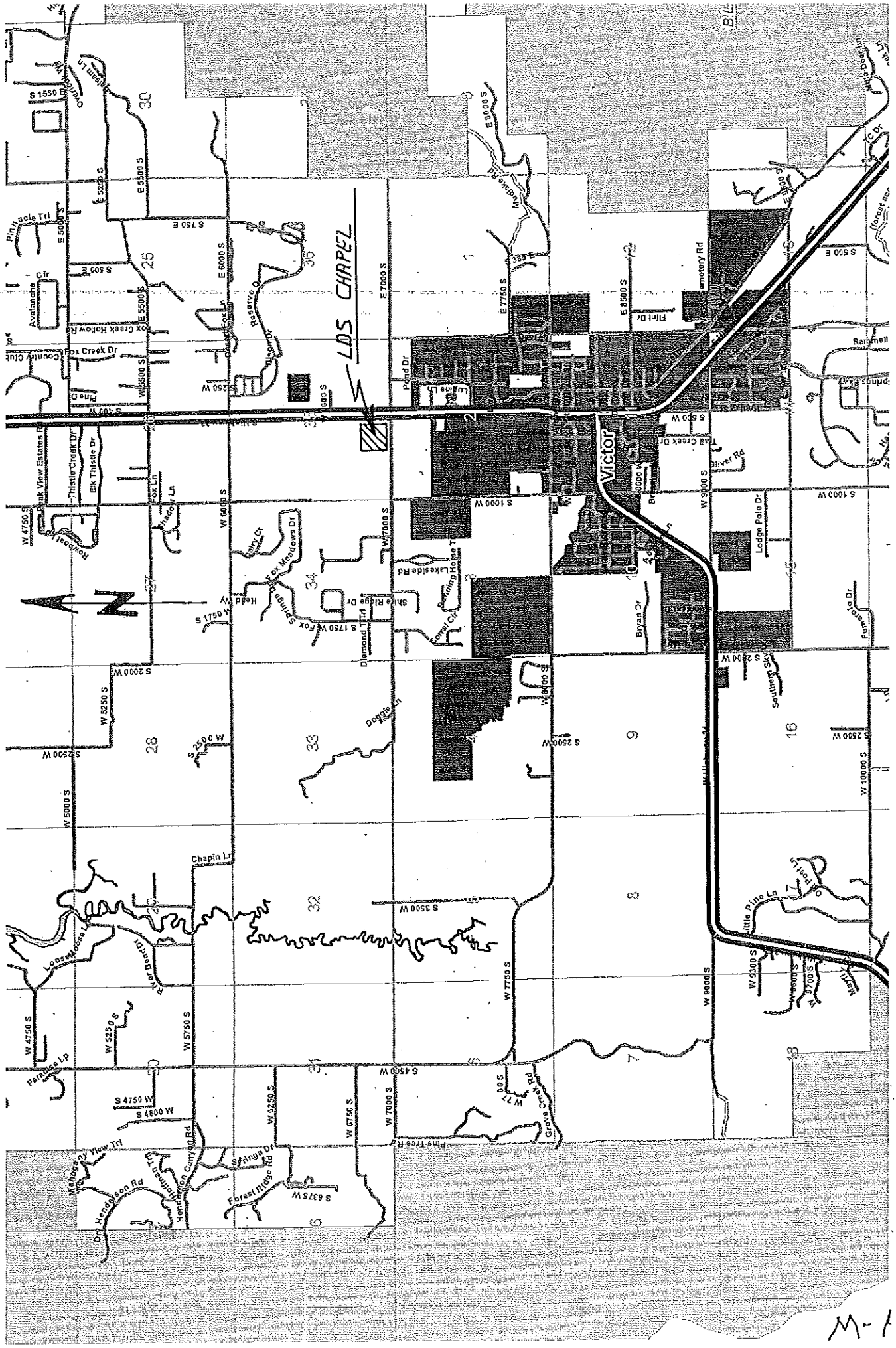
12,960	cu ft design run off
3,660	cu ft of water present condition
3,500	cu ft of percolation into ground
5,800	cu ft retention pond

Design Pond for 6,000 cu feet of water

Pond dimensions 50 feet x 60 feet surface x 4.0 feet depth. = 7300 cu ft.
Pond dimensions 50 feet x 58 feet surface x 3.0 feet depth. = 6000 cu ft.

IV. IMPACTS ON ADJACENT PROPERTIES

The developed 5.5 acres with a 6000 cu feet retention pond would have very little if any impact on the adjacent property. With the percolation rate of 1" in 12 minutes (5" per hour on farm ground) that calculates into 5" /12" x 50 ft x 50 ft would 1040 cu ft of water percolated in take ground per hour. This would require 6 hours hours to percolate out before the next 24 hour storm.
This system is designed to only discharge the 3,660 cu ft of water from the present condition.

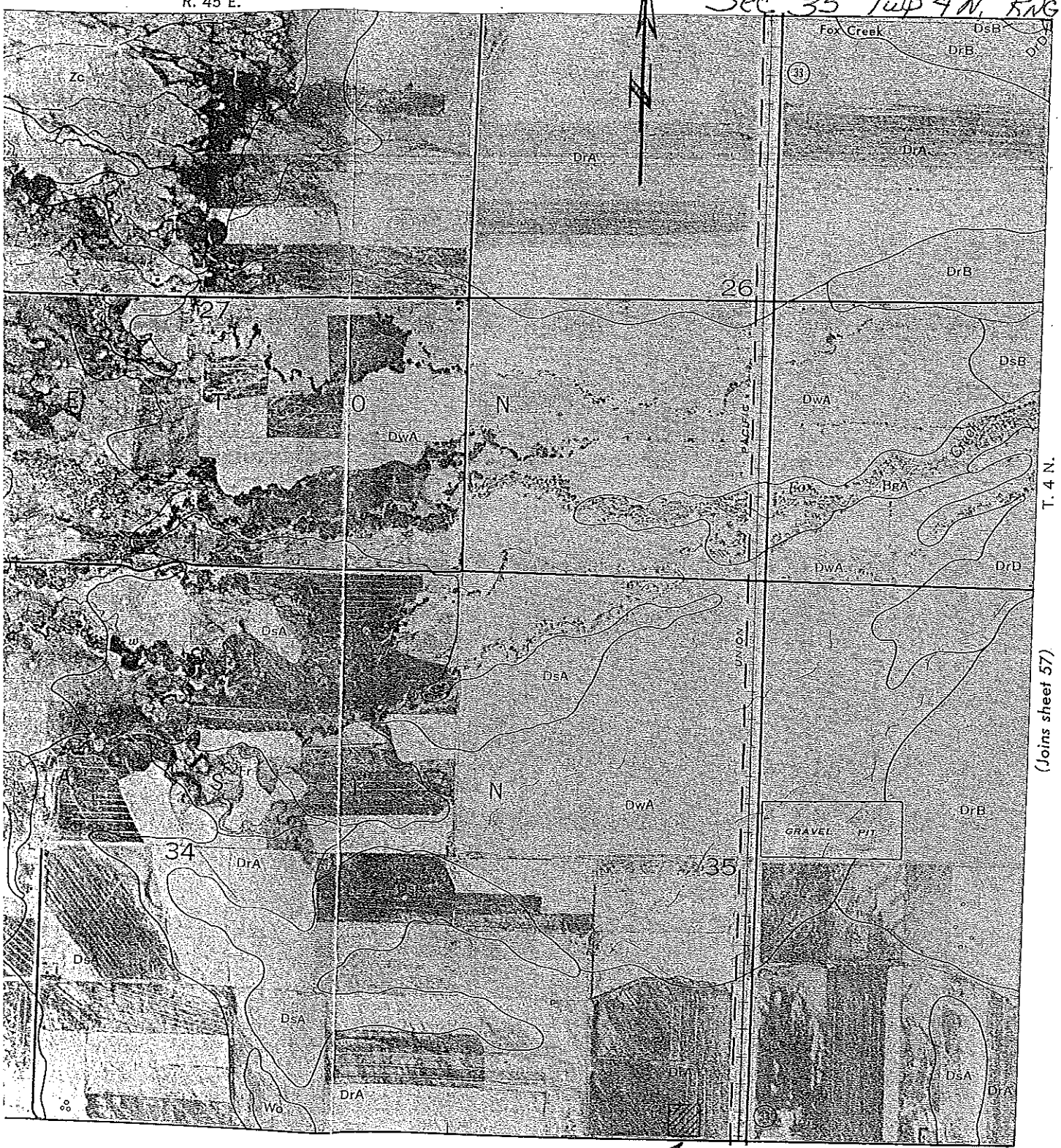

LDS CHAPEL
Victor
Fox Creek Dr
Fox Creek Hollow Rd
Avalanche Cir
Pinnacle Trl
Thistle Creek Dr
Elk Thistle Dr
Peak View Estates Rd
Rowboat Ln
Fox Ln
Shadow Ln
Fox Meadows Dr
Fox Springs Dr
Shire Ridge Dr
Diamond Trl
Lakeside Rd
Forral Cir
Pond Dr
Lugine Ln
Flint Dr
Tail Creek Dr
Oliver Rd
Lodge Pole Dr
Bryan Dr
Southern Sky
Fumarole Dr
Rammell
Chapin Ln
Loose Moose Ln
River Bend Dr
Paradise Lp
Mahogany View Trl
Dry Henderson Rd
Hollman Trl
Henderson Canyon Rd
Springa Dr
Forest Ridge Rd
Pine Tree Rd
Grove Creek Rd
Little Pine Ln
Mayfly
Mule Deer Ln
Mudlake Rd
Reserve Dr
Elson Dr
Cemetery Rd
Hedd Wy
Doggie Ln
S 1530 E
E 5500 S
E 5250 S
S 750 E
S 500 E
E 6000 S
E 7000 S
E 7750 S
E 8500 S
E 9000 S
S 1000 W
S 2000 W
S 2500 W
S 3500 W
S 4500 W
S 4750 W
S 4600 W
S 6375 W
W 4750 S
W 5000 S
W 5250 S
W 5750 S
W 6250 S
W 6750 S
W 7000 S
W 7750 S
W 8000 S
W 9000 S
W 9300 S
W 10000 S
S 1750 W
S 2500 W
S 3500 W
S 400 W
S 500 W
S 1000 W
S 2000 W
S 2500 W
S 3500 W
S 4500 W
S 4750 W
S 4600 W
S 6375 W
W 5250 S
W 5750 S
W 6250 S
W 6750 S
W 7000 S
W 7750 S
W 9000 S
W 9300 S
W 10000 S
N

M-1

AREA, IDAHO - WYOMING — SHEET NUMBER 56

Teton County, Idaho

Sec. 35 Twp 4N, Rng 45E



Church Proj.

½ Mile

Scale 1:15840

0 3 000 Feet

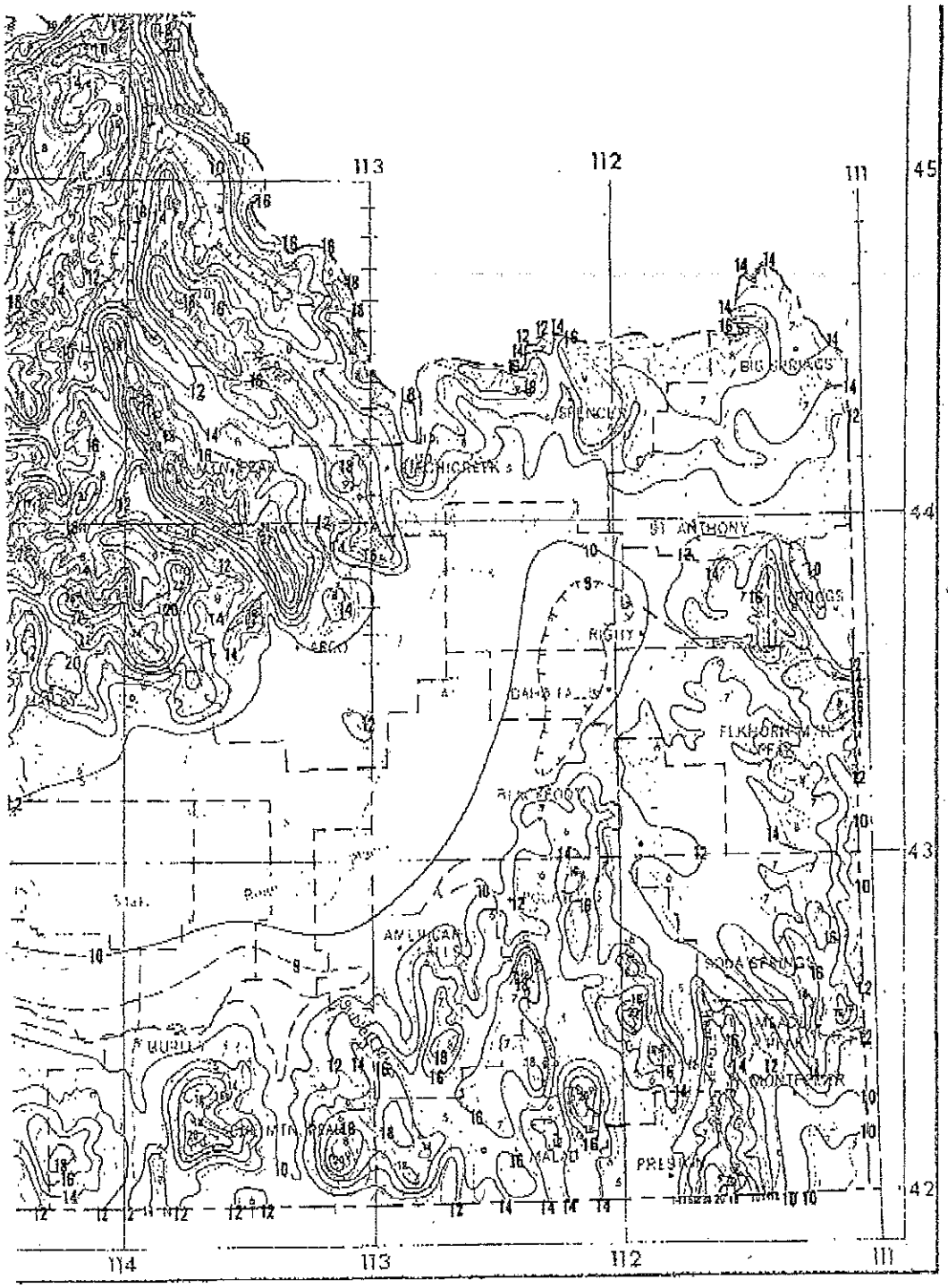
M-2

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Depth from surface	Classification	
		USDA texture	Unified
Dranyon (DgG, DgF).	*Inches* 2 to 0 0 to 47 47	Organic material Stony loam Fractured sandstone	Pt ML or CL
Driggs (DsA, DtA, DsB, DsC, DrA, DrB, DrD, DoA, DwA). For Wiggleton part of DwA, see Wiggleton series.	0 to 25 25 to 35 35	Silt loam or gravelly or cobbly loam Very gravelly coarse sandy loam Sand and gravel	SM, ML, or CL GM GW
Felt (FlA, FlB, FlC, FlD, FeD).	0 to 34 34	Loam or gravelly loam Sand and gravel	SM, ML, or CL GP or GW
Feltonia (FnA, FnB, FoB, FoD).	0 to 36 36 to 49 49	Loam Very gravelly loam Sand and gravel or sand	ML or CL GM or SM SW or SM
Foxcreek (Fs, Fr).	0 to 19 19	Loam or gravelly loam Loose sand and gravel	SM, SC, ML, or CL GW, GP, or GM
Foxcreek, shallow variant (Ft, Fu).	0 to 11 11	Loam or gravelly loam Sand and gravel	SM or SC GW
Foxcreek, heavy subsoil variant (Fv).	2 to 0 0 to 30 30	Organic matter Silty clay loam Sand and gravel	Pt MH GP or GM
Furniss (Fx, Fw).	2 to 0 0 to 30 30 to 35 35	Organic matter Silty clay loam Heavy fine sandy loam Sand and gravel	Pt MH SM or SC GP or GM

properties of the soils—Continued

Classification—Continued	Percentage passing sieve			Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
				Inches per hour 5. 00–10. 00	*Inches per inch of soil*	*pH value* 5. 6–6. 0	
A–4 or A–6	80–90	70–80	50–70	0. 20–0. 80	0. 10–0. 12	5. 6–6. 0	Low.
A–4 or A–6	80–100	60–95	40–85	0. 80–2. 50	0. 10–0. 20	6. 6–7. 3	Low to moderate.
A–1	40–60	20–40	5–15	>10	0. 05–0. 06	6. 6–7. 8	Low.
A–1	25–35	15–25	0–5	>10	0. 04–0. 05	6. 6–7. 8	Low.
A–4 or A–6	80–95	60–95	40–70	0. 80–2. 50	0. 10–0. 14	7. 4–8. 4	Low.
A–1	30–45	25–35	0–5	>10	0. 04–0. 05	7. 4–8. 4	Low.
A–4 or A–6	90–100	95–100	50–60	0. 80–2. 50	0. 14–0. 16	7. 4–8. 4	Low.
A–1 or A–2	50–60	20–50	10–20	5. 0–10. 0	0. 06–0. 10	7. 4–8. 4	Low.
A–1, A–2, or A–3	30–100	25–100	0–25	>10	0. 04–0. 05	7. 5–8. 5	Low.
A–4 or A–6	80–95	60–95	40–70	0. 80–2. 50	0. 10–0. 16	6. 6–7. 3	Low.
A–1	35–50	25–40	0–15	>10	0. 04–0. 05	7. 4–8. 4	Low.
A–4 or A–6	80–95	60–95	40–50	0. 80–2. 50	0. 10–0. 16	7. 4–8. 4	Low.
A–1	20–30	15–25	0–5	>10	0. 04–0. 05	7. 4–8. 4	Low.
							Weathering shale or sandstone



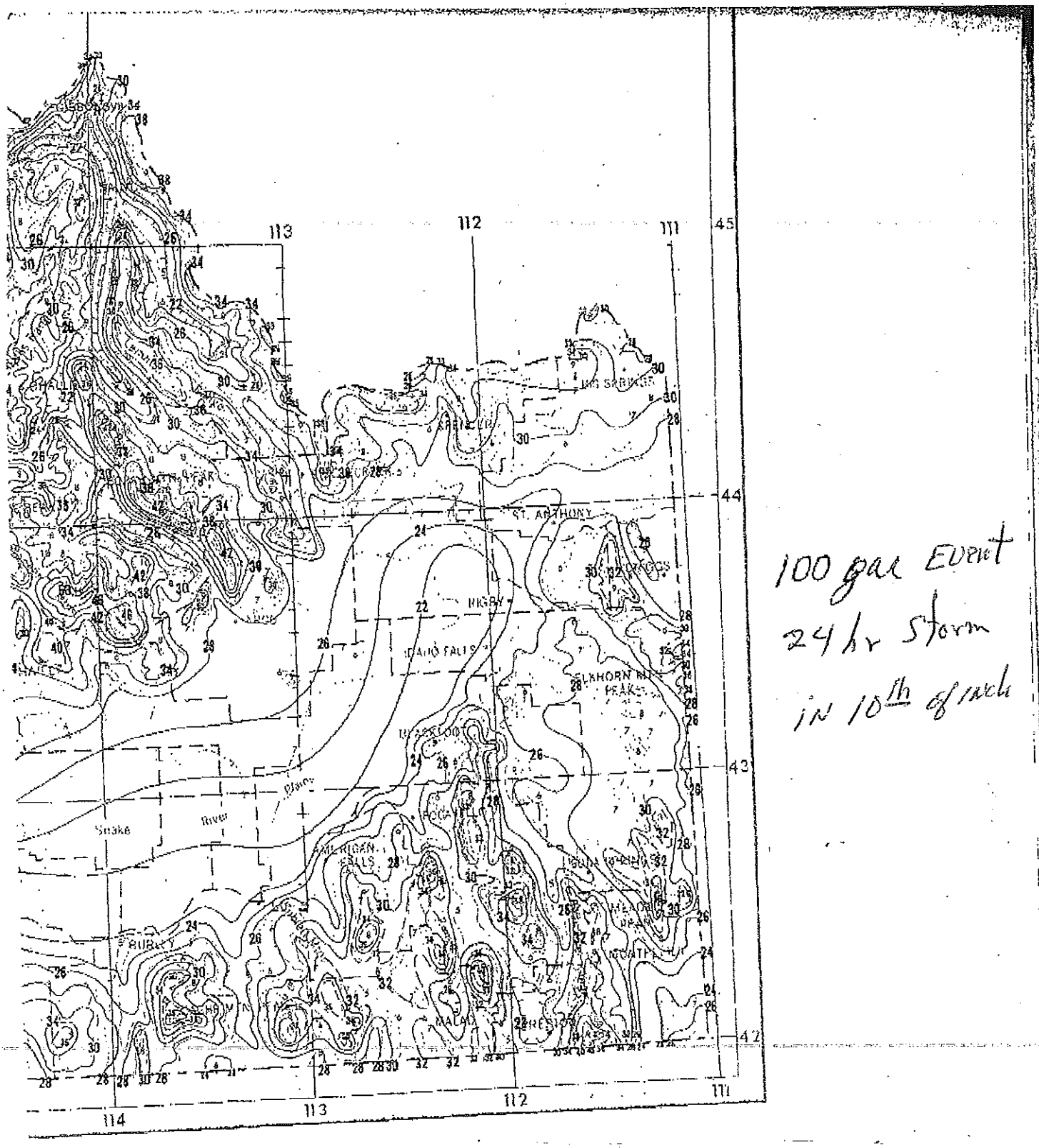
2 year
24 hour
event

IN 10th of inch

0 12" in Victor

Use 1 20" Summer rain fall

P-1

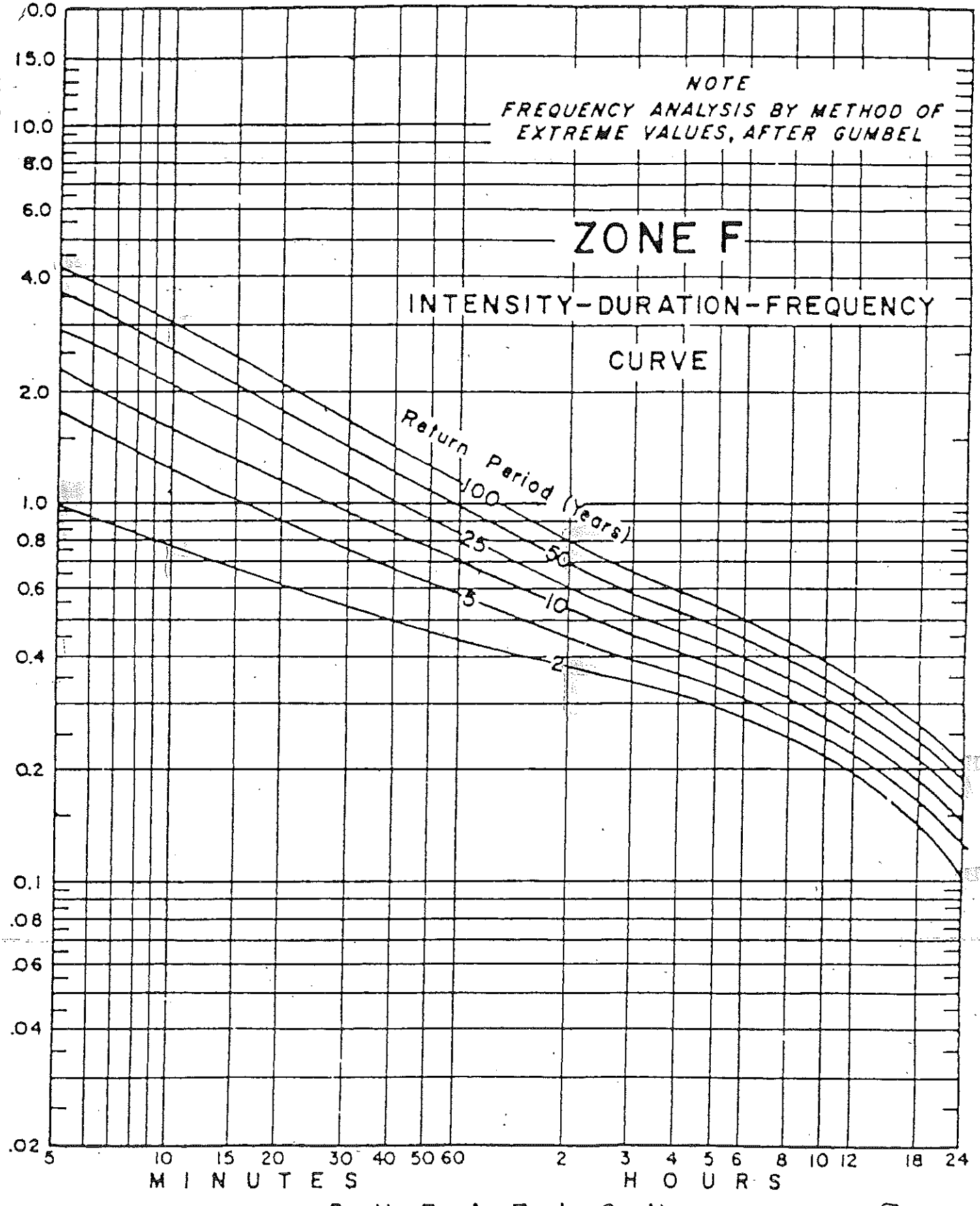


100 yr Event
24 hr Storm
in 10th of inch

From Records use 2.20"
1.19" + 1.6" snow = 2.20"

P-2

ZONE F, INTENSITY-DURATION-FREQUENCY CURVE
(IDAHO TRANSPORTATION DEPARTMENT)



P-3

5. **Design Runoff** Major channels and outfall facilities, (including culverts, open channels, roadside swales, and curbed street flows less than 1.0' in depth), and also detention and retention basins, shall be designed for the greater of the 100 year rainfall runoff event or the 100 year rainfall-snowmelt event, per procedures explained elsewhere in this document. Curbed street flow below inundation limits, street catch basin inlets, and most local storm drains shall be adequate to handle 25% of the design runoff.

B. HYDROLOGY

1. **Watershed Delineation** Use the entire watershed that drains to and from the Site as noted above.

2. **Precipitation Rates** The NOAA Atlas 2 for Idaho was published in 1973, and is based on limited years of rainfall data before that, and does not reflect better design storm precipitation rates that can be estimated using 36 years worth of data since. Consequently, values out of the NOAA Atlas 2 should not be used except where better information is unavailable.

   a. **Teton Valley Floor** The most complete and longest-running official rain gauge in the Teton Valley is located in Driggs. A 2008 statistical analysis of rainfall resulted in the rainfall amounts shown below.

Teton Valley Floor Precipitation		
Season	**Approximate Months**	**100 Yr Rainfall (Inches)**
Winter	December through February	1.19
Early Spring	March and April	1.14
Late Spring	May and June	1.92
Thundershower	July through October	1.52

   b. **Big Hole Mountains Area** For Teton County areas in the Big Hole Mountains to the west of the valley, the most complete and longest-running official rain gauge that may be representative is located at the

Worksheet 2: Runoff curve number and runoff

Project	By	Date
LDS Church Site, Driggs	A. Woolstenhulme	Nov 18, 11
Location	**Checked**	**Date**
SW¼ Sec 35 T4N R45E		

Check one: ☐ Present ☒ Developed

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
Driggs, Good "B"	Co Road - Dirt R-o-W	35			0.16	5.6
	Grassland Open	70			2.22	155.4
	Paved / developed Site	98			3.13	307

[1] Use only one CN source per line

Totals ➡ 5.51 | 468

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{468}{5.51} = 84.9$; **Use CN** ➡ 85

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2 Yr	100 yr	
Rainfall, P (24-hour)	in	1.20"	2.20"	
Runoff, Q	in	0.21	0.95	

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

R-6

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
LDS Church Site, Driggs	Arnold Woolstenhulme	Nov 18, 11
Location	**Checked**	**Date**
SW¼ Sec 35, T4N, R45E		

Check one: ☐ Present ☒ Developed

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

	Segment ID	Parking	
1.	Surface description (table 3-1)	Paved	
2.	Manning's roughness coefficient, n (table 3-1)	0.11	
3.	Flow length, L (total L † 300 ft) ft	150'	
4.	Two-year 24-hour rainfall, P_2 in	1.2"	
5.	Land slope, s ft/ft	0.01	
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.38 +	= 38

Shallow concentrated flow

	Segment ID	Parking	
7.	Surface description (paved or unpaved)	Paved	
8.	Flow length, L ft	200'	
9.	Watercourse slope, s ft/ft	0.01	
10.	Average velocity, V (figure 3-1) ft/s	1.90	
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.29 +	= 0.29

Channel flow

	Segment ID	Gutter	
12.	Cross sectional flow area, a ft^2	1.60	
13.	Wetted perimeter, p_w ft	3.20	
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft	0.5	
15	Channel slope, s ft/ft	0.01	
16.	Manning's roughness coefficient, n	0.11	
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s	0.84	
18.	Flow length, L ft	200'	
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.06 +	= 0.06
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr		0.73

A-5

Worksheet 4: Graphical Peak Discharge method

Project	By	Date
LDS Church Site Drives	A. Wahlstrahulme	Nov 18, 11
Location	**Checked**	**Date**
SW¼ Sec 35, T4N, R45E		

Check one: ☐ Present ☒ Developed

1. Data

Drainage area ..... S.S/A A_m = 0.008 mi^2 (acres/640)

Runoff curve number ..... CN = 85 (From worksheet 2)

Time of concentration ..... T_c = 0.73 hr (From worksheet 3)

Rainfall distribution ..... = I (I, IA, II III)

Pond and swamp areas sprea throughout watershed ..... = 0 percent of A_m (0 acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	24 yr	100 yr	
3. Rainfall, P (24-hour)	in	1.2	2.2	
4. Initial abstraction, I_a (Use CN with table 4-1)	in	0.353	0.353	
5. Compute I_a/P		0.29	0.16	
6. Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4–)	csm/in	153	220	
7. Runoff, Q (From worksheet 2) Figure 2-6	in	0.21	0.95	
8. Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.)		1	1	
9. Peak discharge, q_p	ft^3/s	0.28	1.80	

(Where $q_p = q_u A_m Q F_p$)

cfs 1.8 X 2hrs = 12,960 CF water Runoff developed

R-4

Area Paved

Area 316 x 930	=	133,300	
Inlet Cuts - 55 x 150'	=	- 8,250	
Driveway + 25 x 170	=	4250	
cuRd + 15' x 466	=	6900	= 0.16
	=	136,200 /	3.13 Ac
Total 5.57 Ac - 3.13 paved	=	2.44 Ac	

C-1

Present - CN = 73

$$Q = \frac{(P - 0.25)^2}{P + 0.8S}$$

P = 1.2" for 2yr
= 2.2" " 100 yr

$$S = \frac{1000}{CN} - 10 = 3.70$$

2yr $Q = \frac{(1.2 - .2(3.70))^2}{1.2 + .8(3.70)} = \frac{0.21}{4.16} = 0.05$

100yr $Q = \frac{(2.2 - .2(3.70))^2}{2.2 + .8(3.7)} = \frac{2.13}{6.51} = 0.33$ ←

Future Developed CN = 85

$S = 1.76$

$Q_{2yr} = \frac{(1.2 - .2(1.76))^2}{1.2 + 0.8(1.76)} = \frac{0.72}{2.60} = 0.28$ ←

$Q_{100yr} = \frac{2.2 - .2(1.76)^2}{2.2 + .8(1.76)} = \frac{3.42}{3.60} = 0.95$

$$T_T = \frac{.007(nL)^{.8}}{P_2^{1/2} S^{.4}} = \frac{.007(16.5)^{.8}}{(1.2)^{.5}(0.01)^{.4}} = \frac{0.066}{(1.09)(.16)} = 0.38$$ ← hr

C-2

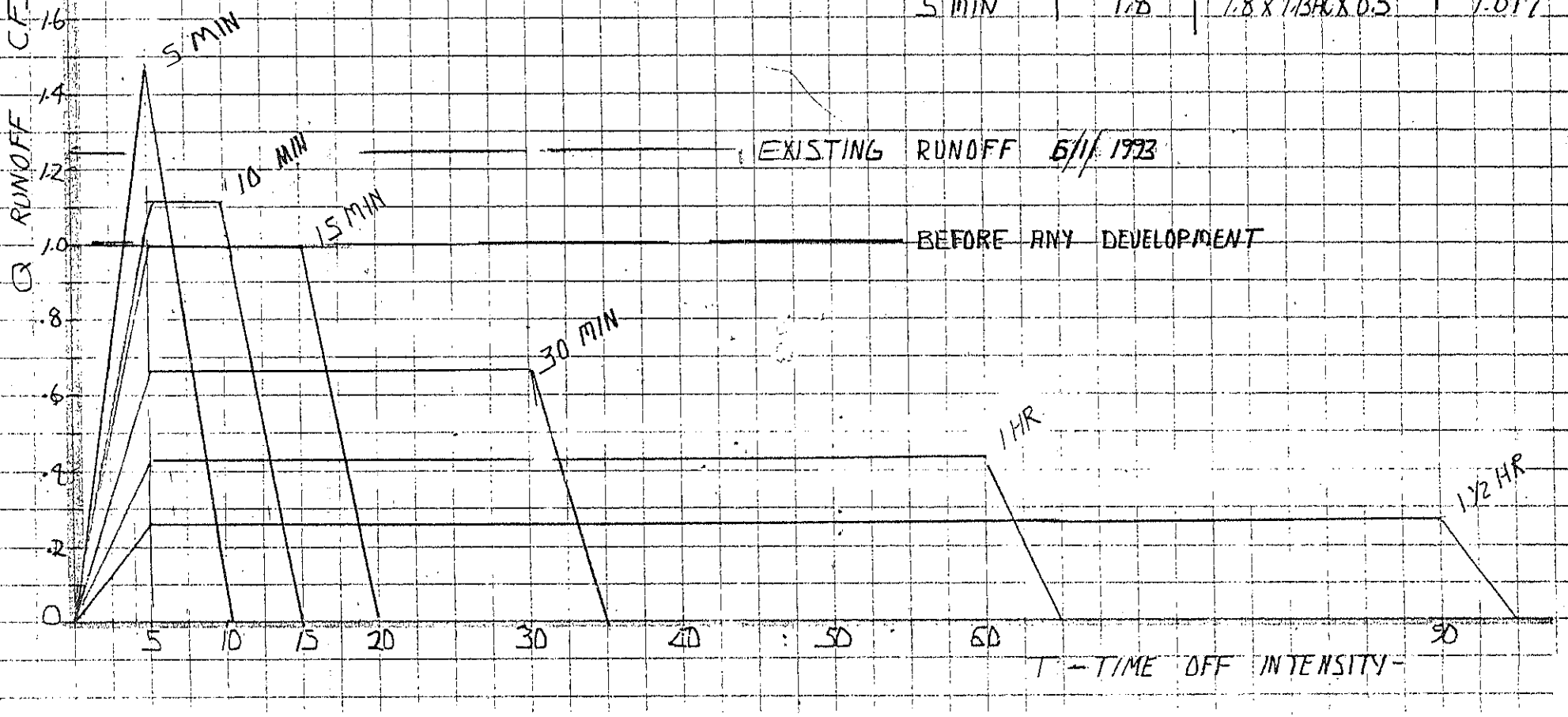
T_c = 5 MIN

	IMPERV.	GRASS
EXISTING	19,000	30,206
PROPOSED	30,000	19,200

$Q = C I_T A$ A = .43 A = .70 A = 1.13

STORM DURATION	I IN/HR INTENSITY	Q GRASS C=0.5 ·215	Q IMPER C = 0.85 · .6	Q TOT
5 MIN	1.8	.39	1.08	1.47
10 MIN	1.38	.30	0.83	1.13
15 MIN	1.20	.26	0.72	0.98
30 MIN	0.82	.18	0.49	.67
1 HR	0.52	.11	0.31	.042
2 HR	0.32	.07	.19	.26

RUNOFF	Cu. FT Water
5 MIN	1.2 CF
10 MIN	0.8 CF

PREDEVELOPMENT 10 YR STORM - 5MIN DUR

5 MIN	1.8	.61	.66	1.27
5 MIN	1.8	1.8 x 1.13AC X 0.5		1.017