

2005P066

**POWER ROAD
GUADALUPE ROAD TO BASELINE ROAD**



**Contract No. CY 2004-88, Work Order No. 68969
RBF Consulting Project No. 45102080**

**SUPPLEMENT TO
FINAL DRAINAGE REPORT**

(PREPARED BY SVERDRUP CIVIL, INC. DATED NOVEMBER 2000)

JULY 2005

**Prepared for
MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION**

Prepared by

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A024.317

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This document is a supplement to the Final Drainage Report for Power Road, Guadalupe Road to Baseline Road, prepared by Sverdrup Civil, Inc. dated November 2000 (Contract CY 2000-22). This report documents the hydrologic and hydraulic analyses for the existing drainage and proposed drainage improvements and facilities in areas where new development has occurred within the project limits. The sections outlined in this report directly correspond to the sections in the original Sverdrup report and only those sections that have been changed or appended are shown. All other criteria, maps, designs, calculations, text, and appendices in the Final Drainage report are factual current unless mentioned herein:

1.0 INTRODUCTION

The following is hereby added to the end of this section:

1.4 PREVIOUS STUDIES

Drainage Report for Proposed Life School, Dated October 30, 2001, City of Mesa

The Life School property is located south of Guadalupe Road, along the east side of Power Road. The original Sverdrup Civil design completed in 2001, showed this parcel as undeveloped. Sverdrup designed a roadside drainage ditch with scuppers to convey the roadway runoff from the east side of Power Road into a proposed retention basin located on the Life School Property. Since the Sverdrup design was completed in 2001 the property has been developed, and as a result, Sverdrup's proposed drainage and retention basin design will no longer function as designed work due to the construction of the Life School parking lot. The existing basin on the Life School Property was designed to retain the runoff generated along the east half of Power Road along the frontage of the property. The Drainage Report for the Proposed Life School, Dated March 21, 2002 was used as a basis to analyze the existing catch basin, outlet pipe and retention basin design. It was necessary to determine the impacts that

the additional flows to the existing drainage structure had from the installation of curb and gutter along Power Road to the north of the Life School.

The following section is amended as follows:

1.7 FIELD RECONNAISSANCE

Aerial photography of Power Road from Guadalupe Road to Baseline Road was taken from *Aerial Express Viewer, AEView4.2, Phoenix* and the Maricopa County Assessors GIS page. RBF Consulting personnel visited the site in August and October of 2004, and May of 2005 for the purpose of obtaining additional survey information, photo documentation, observe existing drainage structures and determine changes in drainage patterns as a result of new developments.

2.0 HYDROLOGY

The following section is amended as follows:

2.1 WATERSHED DESCRIPTION

The project is located within the City of Mesa, Town of Gilbert, and unincorporated Maricopa County. The overall topography is flat, with the area generally draining from the northeast to the southwest

(See Figure 4, USGS Map, at Page 10). Most area adjacent to Power Road is developed and is served by on-site retention facilities. There are commercial sites at all corners of the intersection of Power Road and Baseline Road. A golf course and office condominium complex is located along a portion of the west edge of the Power Road right-of-way. Residential development abuts the east right-of-way. There is also one undeveloped parcel along the east right-of-way just north of Guadalupe Road. An existing undeveloped parcel at the southeast corner of Kiowa Avenue and Power Road is currently being developed and will be served by on-site retention

facilities. Refer to Figure 5.1, Aerial Photo, following page 7 for more detail. The project site watershed is formed by the following boundaries:

- **Guadalupe Road:** Surface water runoff from land outside the right-of-way south of Guadalupe Road will not drain to the project site.
- **Power Road:** Surface water runoff from land west of Power Road will flow into the East Maricopa Floodway (EMF), and will not impact the project site. On-site retention areas serve the majority of the parcels east of Power Road. However, an improved roadside ditch is necessary to convey runoff from an undeveloped area to the proposed Power Road storm drainage system. This ditch will remain in service until such time as the undeveloped area is developed and on-site retention facilities are constructed.
- **Baseline Road:** Surface water runoff from land north of Baseline Road will be retained on-site, and will not impact the project area.

3.2 PROPOSED DRAINAGE SYSTEMS

The following section is amended as follows:

1.1.4 Proposed Power Road Ditches

Surface water runoff from the undeveloped area along Power Road will be conveyed in a proposed roadside ditch that will drain to the proposed Power Road Drainage System. There will be no proposed roadside ditches south of Guadalupe, as new developments exist with on site retention.

The following section is amended as follows:

1.1.5 Proposed Retention Facilities

Runoff from Power Road south of Guadalupe Road will be collected in two proposed retention facilities west of Power Road and an existing retention facility on the Life School property, east

of Power Road. Runoff from the southern half of Guadalupe Road (west of Power Road) will be collected in three retention facilities located to the south of Guadalupe Road. Two of the retention facilities south of Guadalupe Road were constructed on site as part of the LDS Church site development. To the east of the development, a proposed retention facility will be constructed for flows from the southern half of Guadalupe Road that will not be retained by the LDS Church site. Scuppers have been designed to intercept gutter flow and direct it to the retention facilities along Guadalupe Road and Power Road, except for the existing retention basin located on the Life School Property. An existing catch basin constructed to handle offsite roadway frontage flows for the Life School property will be removed and replaced with a larger catch basin and larger storm drain pipe to handle the additional roadway runoff north of the Life School Property. The catch basin designs are included in Appendix S-D, Roadway Catch Basin Design. The retention facility on the property will not have to be modified. The original design according to the *Drainage Report for Life School*, proposes a maximum ponding depth of 2.8' with a freeboard of 2.9'. With the construction of the new curb & gutter along Power Road the additional runoff will increase the ponding limit from 2.8' to 3.5' (Acceptable ponding depth according to the City of Mesa Design Standards). Although the ponding depth of the retention basin will be increase the basin will still drain in under 36 hours and provide enough storage to retain the additional flows. Retention basin analyses are included in Appendix S-F, Retention Basin Design.

The following section is amended as follows:

1.1.6 Coordination With Existing Utilities

There are existing underground utilities along the project corridor that may require adjustment to clear the proposed drainage system. These utilities were potholed at potential points of conflict

during the 70 percent design phase that was completed by Sverdrup Civil. This information is now shown on the final engineering plans prepared by RBF Consulting.

3.3 HYDRAULIC ANALYSIS AND DESIGN

The following section is amended as follows:

3.3.3 Roadside Ditch Design

A roadside ditch is necessary to convey runoff from the undeveloped area east of Power Road into the proposed Power Road storm drain system. This ditch is required to convey the 10-year storm flow. The Rational Method was used to determine runoff from the undeveloped area. The ditch was analyzed as a triangular earth channel with grass (Manning's "n" of 0.03), 4:1 (horizontal: vertical) sideslopes, and a 0.4% longitudinal slope. Ditch designs are included in Appendix S-B, Roadside Ditch Design.

The following section is amended as follows:

3.3.4 Retention Basin Design

Three retention basins are necessary to serve the southern half of Guadalupe Road located west of Power Road (two of the three retention basins required are existing, the other retention area will be constructed with the Power Road Project). Three more basins are necessary to serve Power Road south of Guadalupe Road (one of the three basins is existing, the other two basins will be constructed with the Power Road Project). The maximum depth of retention basins as measured from natural grade to the bottom of the basin shall be 1 meter. Excavation for a retention basin within public street right-of way is not permitted; therefore all but two of these basins have been located just outside the right-of-way. The retention facility serving

Guadalupe Road is located within the right-of-way and will require a drainage easement. Retention basins are required to contain the 100-year, 2-hour storm event runoff for City of Mesa, and 50-year, 2-hour storm event runoff for the Town of Gilbert. In addition, all retention basins are required to be designed to empty within 36 hours. Retention basin analyses are included in Appendix S-F, Retention Basin Design.

3.4 SUMMARY OF HYRDAULIC ANALYSES

The following section is amended as follows:

3.4.3 Roadway Ditch Summary

The roadway ditch proposed for this project serves an undeveloped area located east of Power Road. This ditch may not be needed in the future when the undeveloped property is improved and on-site retention basins are constructed and approved. At that point, the Power Road drainage network will no longer convey runoff from the undeveloped site. The proposed ditches will convey the 10-year design flow. Ditch designs are included in Appendix B, Roadside Ditch Design.

The following section is amended as follows:

3.4.4 Retention Basin Summary

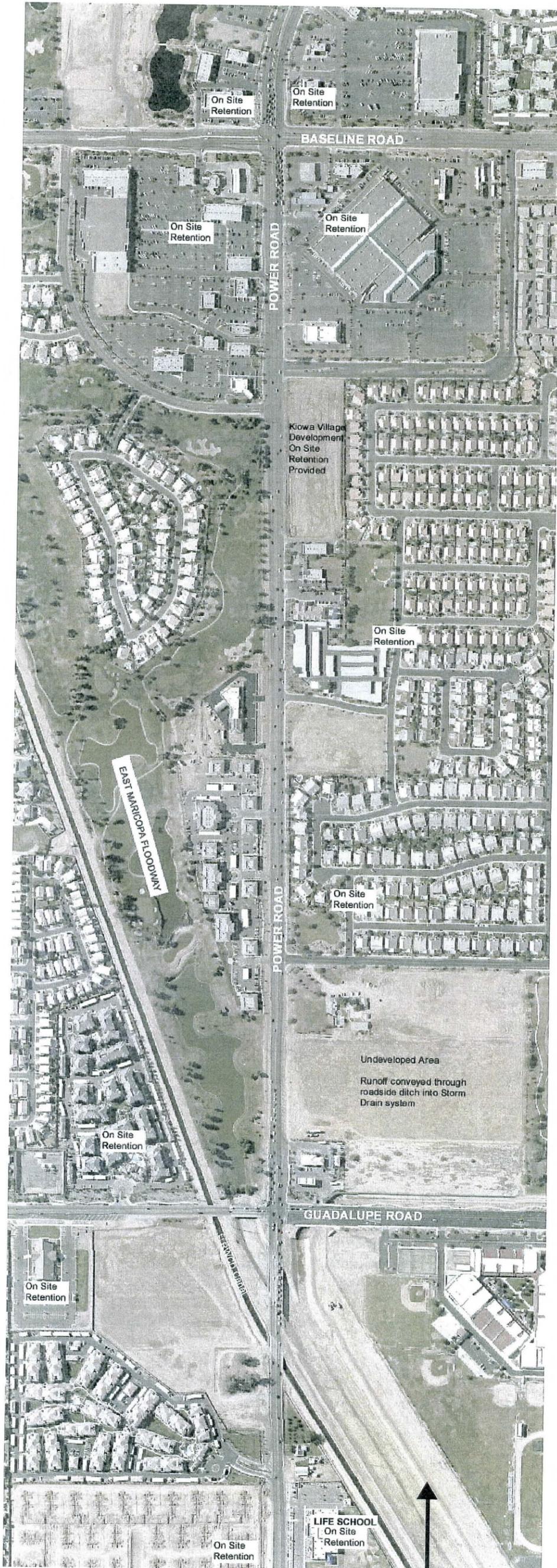
Three retention basins are proposed for this project. Two additional retention basins at the LDS Church site on Guadalupe Road were constructed and provide retention for runoff for the half street frontage along the property. One additional retention basin exists at the Life School property that is currently used to retain the runoff collected from the half street section of roadway that fronts the property. The storm drain catch basin, headwall, and pipe located on the Life School property will need to be removed and reconstructed to handle the additional flow from Power Road. All other existing retention basins and surrounding drainage structures are

adequately sized and will not be reconstructed. The proposed retention facilities can be removed once the undeveloped properties adjacent to the roadway served by them are improved and on-site retention basins are constructed and approved. At that time, runoff from the project roadways generally fronting the properties could be collected in the on-site retention basins. Retention volume is provided to contain the 100-year, 2-hour storm event runoff for City of Mesa, and 50-year, 2-hour storm event runoff for the Town of Gilbert. In addition, all retention basins are designed to empty within 36 hours. Retention basin designs are included in Appendix S-F, Retention Basin Design.

Figure 5.1

Aerial Photo

Refer to Next Page



AERIAL PHOTO
NOT TO SCALE

N

Figure 6.1

Drainage Map

Refer to Next Page

Appendix S-B

Roadside Ditch Design

Appendix B contains information related to Section 3.3.3. "Roadside Ditch Design" and as part of the Sverdrup Civil Final Drainage report should be modified to remove any calculations and/or analyses associated with 'Undeveloped Area One'. 'Undeveloped Area One' has since been developed.

Appendix S-C

Roadside Spread Width Calculation

This supplemental appendix contains information related to Section 3.3.2 "Roadway Spread Width Calculation". Appendix C as part of the Final Drainage Report shall be amended to include the calculations and tables that follow:

2. Life School Gutter Section Analysis

Table S-A Rational For Windows Hydrological Summary Table

Life School Gutter Section Analysis

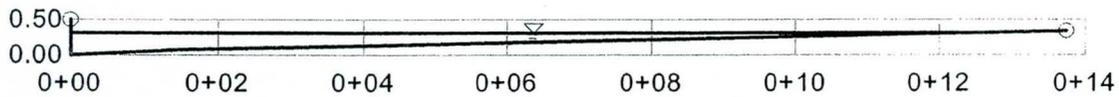
Cross Section for Gutter Section

Project Description

Worksheet	Life School Gutter Section Analysis
Type	Gutter Section
Solve For	Spread

Section Data

Slope	0.007200 ft/ft
Discharge	5.00 cfs
Gutter Width	1.50 ft
Gutter Cross Slope	0.055000 ft/ft
Road Cross Slope	0.020000 ft/ft
Spread	12.73 ft
Mannings Coefficient	0.013



V:1
H:1
NTS

12.73' < 17'

Therefore, more than one lane open @ 10-yr event.

Appendix S-D

Rational Method and Catch Basin Location

This supplemental appendix contains information related to Section 3.2 "Proposed Drainage Systems". Appendix D as part of the Final Drainage Report shall be amended to include the calculations and tables that follow:

- Power Road
 - Sizing Life School Catch Basin
 - Maximum Capacity of new Storm Drain Outlet Pipe

Sizing Life School Catch Basin Design

Design for an **At Grade** catch basin along Power Road at station 0+450.000 to remove the 100-year flows.

Solving for flow ratio:

$$w = 1' 6" \quad T = 18.14' \quad n = .015 \quad S_x = 2.0 \% \quad S_w = 14.71 \%$$

$$E_o = 1 - (1 - W/T)^{2.67} = 1 - (1 - 1.5/18.14)^{2.67} = \mathbf{0.21}$$

Solving for equivalent cross slope:

$$S_e = S_x + S_w * E_o = 2 + 14.71 * 0.21 = \mathbf{5.09\%}$$

$$L_T = K_C * Q^{0.42} * S_L^{0.3} (1/n * S_e)^{0.6} \quad (\text{HEC-22 Eqn. 4-22})$$

$$Q_{100} = 10 \text{ cfs (PER TABLE S-A)}$$

$$\text{Use 20\% clog factor} = 10 / (1 - 0.20) = 12.5 \text{ cfs}$$

$$L_t = .6 * 12.5^{.42} * .0072^{-.3} * (1/ (.015 * .0509))^{.6} = \mathbf{29.26'}$$

Result:

Existing MAG 503-1 catch basin will need to be removed and replaced. A City of Phoenix (COP) Standard **1569-1 Type 'M-2'** Catch Basin with a 17' wing and a 10' wing will be needed. The larger 17' wing shall be placed upstream of the at grade catch basin.

The existing 24" H.D.P.E. pipe will also be replaced with a 30" RGRCP pipe. See **Proposed Capacity of Storm Drain Outlet Pipe** as part of this appendix.

Scenario: Life School Storm Drain Outlet Pipe

Combined Pipe\Node Report

Label	Length (ft)	Section Size	Full Capacity (cfs)	Average Velocity (ft/s)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Constructed Slope (ft/ft)
P-1	110.00	30 inch	18.34	N/A	1,324.40	1,324.62	0.002000

Appendix S-F

Retention Basin Design

This supplemental appendix contains information related to Section 3.3.4 "Retention Basin Design". Appendix F as part of the Final Drainage Report shall be modified as follows:

1. Power Road Retention Basin Design

Table F-1.1 Retention Volume Calculation, Power Road, South of Guadalupe Road

Figure F-1.1 Contributing Area to Power Road, South of Guadalupe Road

Table F-1.2 Life School Retention Volume Provided, Power Road

2. Guadalupe Road Retention Basin Design

Table F-2.1 Retention Volume Calculation, Guadalupe Road, West of Power Road

Figure F-2.1 Contributing Area to Guadalupe Road, West of Power Road

Table F-2.2 Proposed Retention Volume Provided, Guadalupe Road

All calculations and tables that follow are supplemental to Appendix F and is organized as follows:

TABLE F-1.1 Retention Volume Calculation, Power Road, South of Guadalupe

Location: west of Power Road				
area id	area (m ²)	C	rainfall (mm)	volume (m ³)
1	2127	0.95	65.8	133
Required Retention Volume:				133
Proposed Retention Provided:				300
Location: east of Power Road				
area id	area (m ²)	C	rainfall (mm)	volume (m ³)
2+3	10703	0.95	65.8	669
Required Retention Volume*:				669
Proposed Retention Provided:				710

* Included onsite retention from Life School

- Notes:
- 1) See next page for areas map
 - 2) 100-year 2-hour rainfall (Table in Appendix F)
 - 3) Areas different from Appendix F because of new developments.
 - 4) See Drainage Map, Page S-8 for schematic of Power Road basins

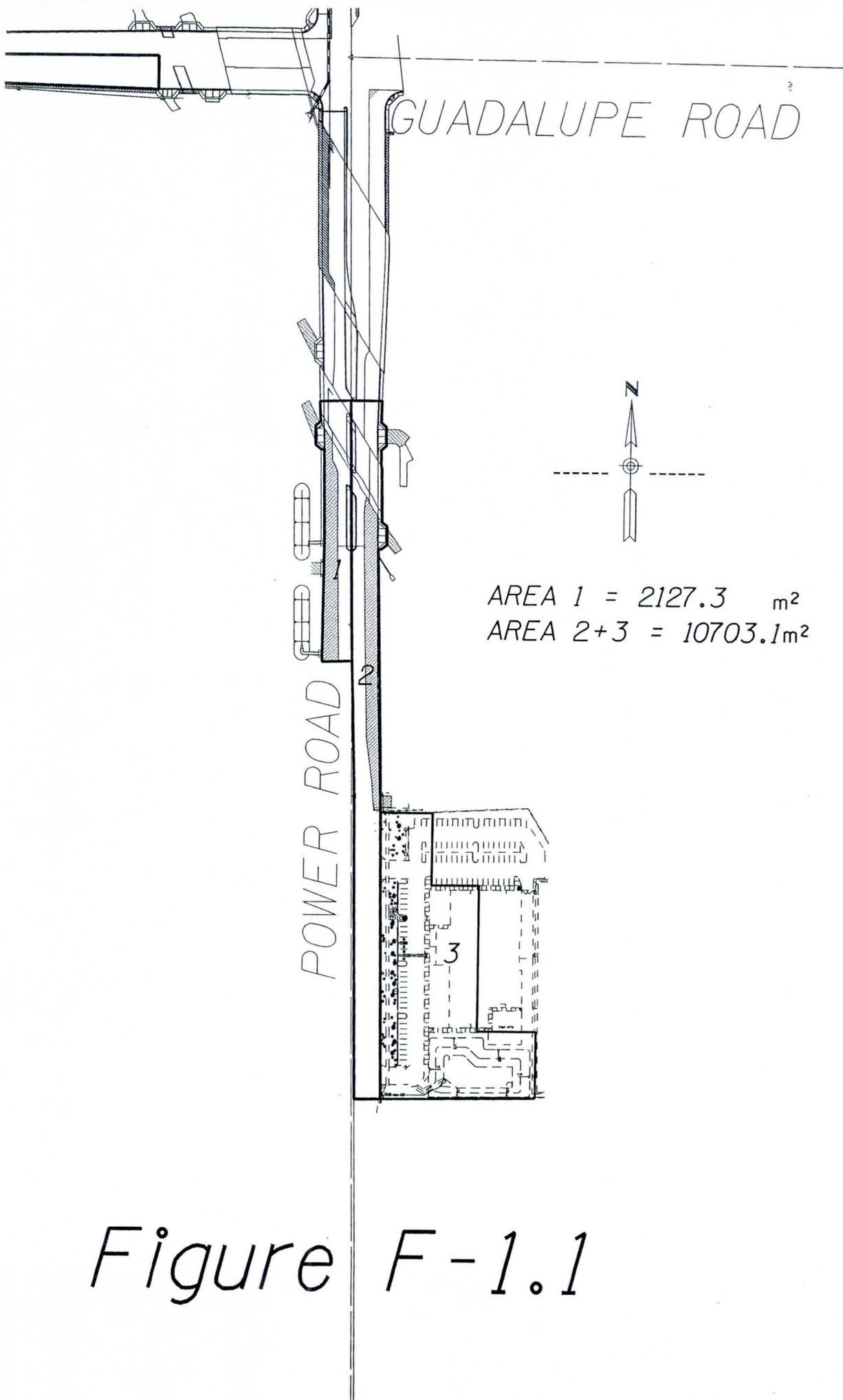


Figure F-1.1

TABLE F-1.2 Life School Retention Volume Provided, Power Road
 East of Power Road, South of Guadalupe Road

Elevation (ft)	Area (ft ²)	Avg Area (ft ²)	Elev Change (ft)	Volume Change (ft ³)
24.4	0			
		2750	0.7	1925
25.1	5500			
		8264	2.8	23139.2
27.9	11028			
			Total Volume=	25064.2

METRIC CONVERSION 25064.2 ft³ = 709.74 m³

Notes:

1) See Life School Drainage Report of Grading and Drainage Plans
 produced by A-N West, Inc. Consulting Engineers

Report Completed 3-21-03
City of Mesa Approved 4-4-02

A-N West, Inc
 7600 N. 15th St
 Ste 200
 Phoenix, AZ 85020
 602-861-2200

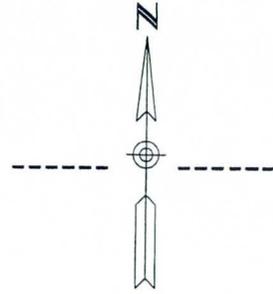
TABLE F-2.1 Retention Volume Calculation, Guadalupe Road, West of Power Road

Location: west of Power Road				
area id	area (m ²)	C	rainfall (mm)	volume (m ³)
1	2509	0.95	58.5	140
Required Retention Volume:				140
Proposed Retention Provided:				161

- Notes:
- 1) See next page for areas map
 - 2) 50-year 2-hour rainfall (Table in Appendix F)
 - 3) Areas different from Appendix F because of new developments.
 - 4) See Drainage Map, Page S-8 for schematic of Guadalupe Road basins

AREA 1 = 2508.6 m²

GUADALUPE ROAD



POWER ROAD

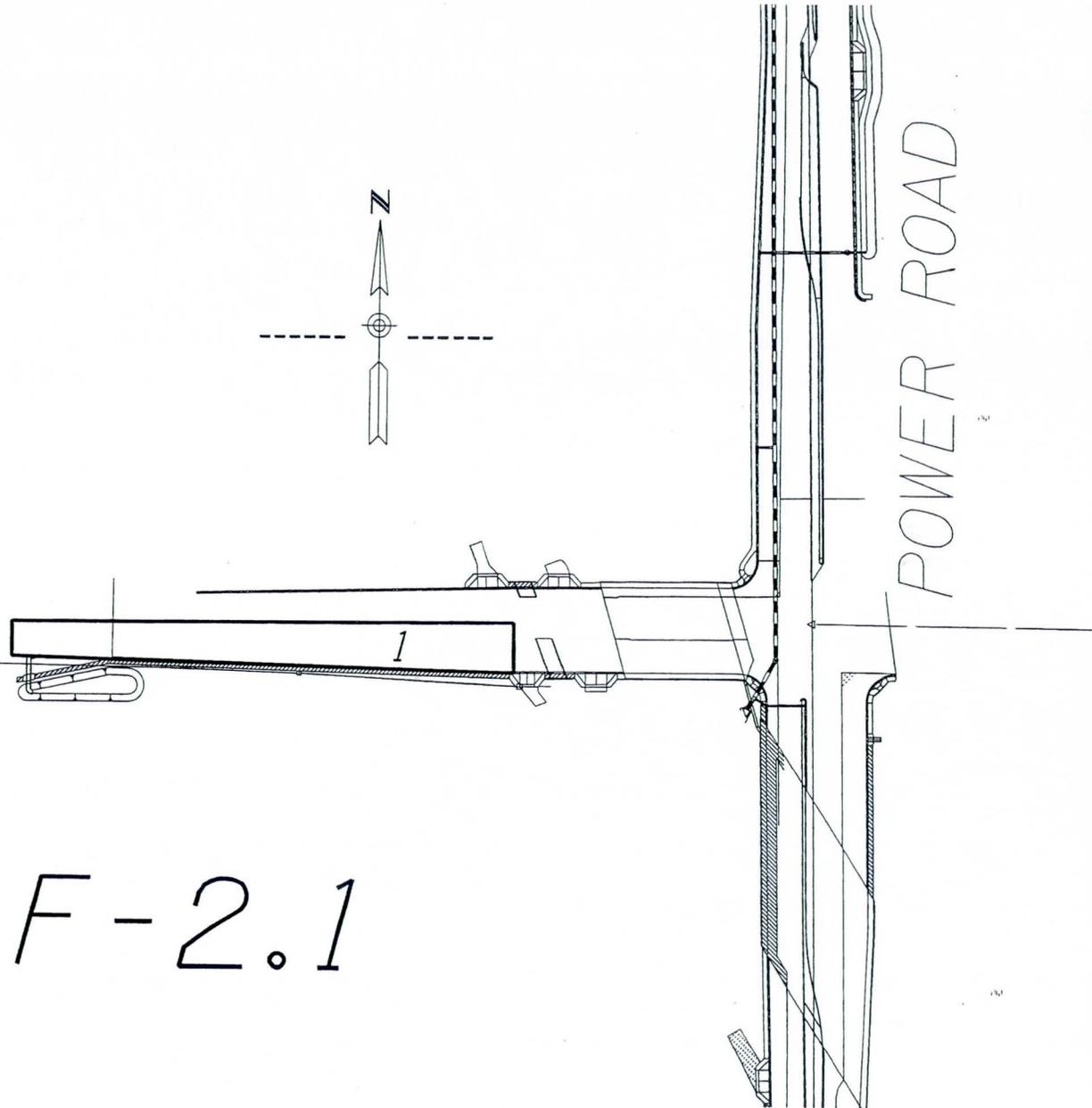


Figure F-2.1

TABLE F-2.2 Proposed Retention Volume Provided, Guadalupe Road
 West of Power Road, South of Guadalupe Road

Elevation (ft)	Area (ft ²)	Avg Area (ft ²)	Elev Change (ft)	Volume Change (ft ³)
0	1682.93			
2	4024.809	2853.8695	2	5707.739
Total Volume=				5707.739

METRIC CONVERSION 5707.739 ft³ = 161 m³

Notes:

1) See Life School Drainage Report of Grading and Drainage Plans