Grand Canyon Unified School District Master Drainage Plan: Water Conveyance with Emphasis on Historical and Ecological Preservation

NORTHERN ARIZONA UNIVERSITY CENE 476C CAPSTONE PROJECT

Presented For: Industrial Advisory Board of Engineers

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SITE LOCATION – STATE AND REGIONAL

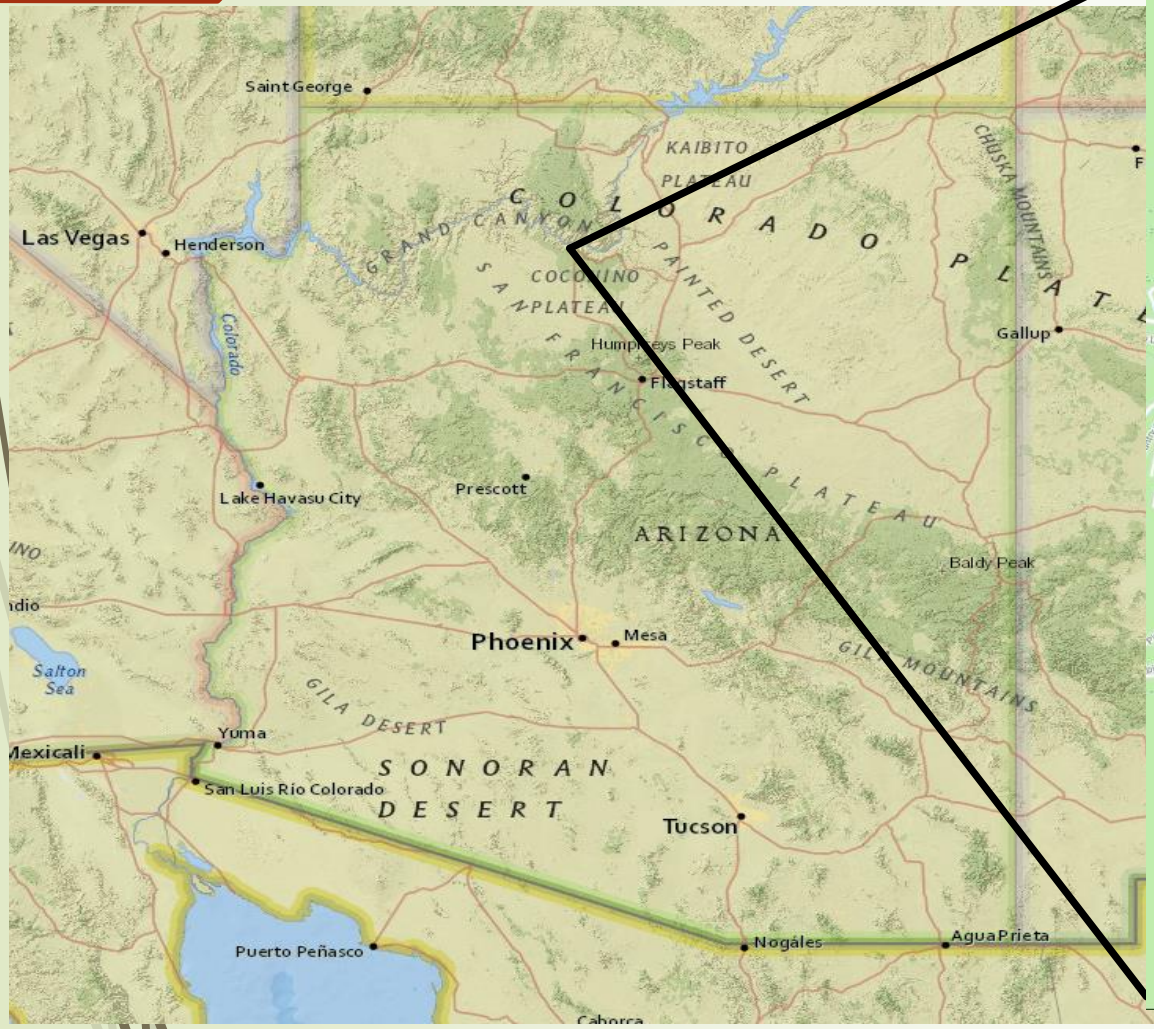

FIGURE 1: LOCATION IN ARIZONA [1]

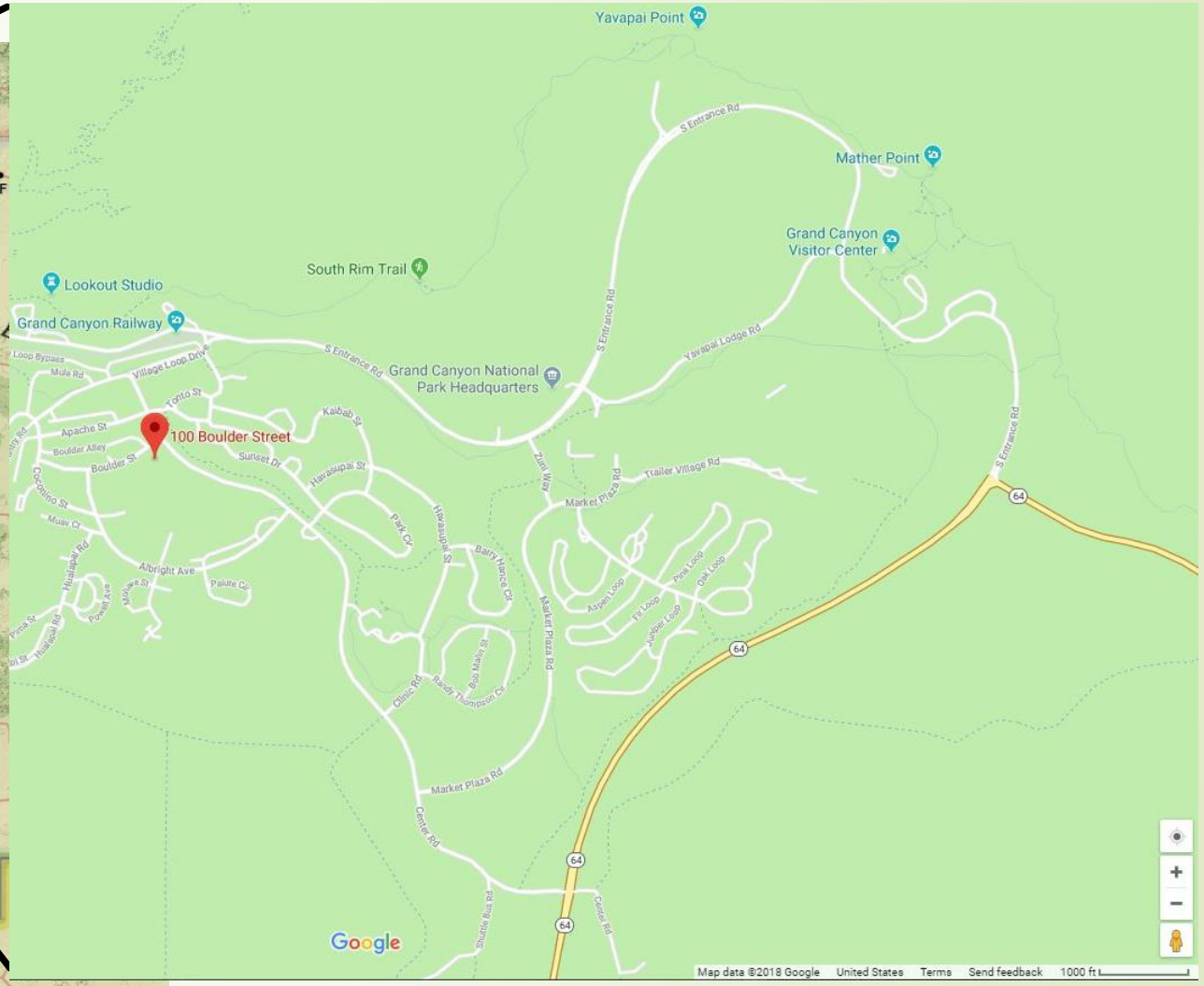

FIGURE 2: LOCATION IN REGION [2]

AERIAL MAP – GCUSD PROPERTY

FIGURE 3: AERIAL VIEW OF GRAND CANYON UNIFIED SCHOOL DISTRICT [2]

CURRENT INFRASTRUCTURE

FIGURE 4: SEDIMENT IN CULVERT A [3]

FIGURE 5: SEDIMENT IN CULVERT B [3]

FIGURE 6: AREA OF SURFACE FLOW WITH STRUCTURE FOUNDATION IN PATH [3]

SCOPE OF SERVICES

TASK #1: FIELD WORK

1.1 COMPLETE NAU SAFETY FORMS

1.2 FIELD INVESTIGATION

TASK #2: SURVEY WITH GPS

2.1 INVENTORY OF EXISTING INFRASTRUCTURE

2.2 CREATE TOPOGRAPHIC MAP WITH AUTOCAD® CIVIL 3D [4]

FIGURE 7: GCUSD CAMPUS [3]

SCOPE OF SERVICES CONT.

TASK #3: CALCULATE DISCHARGE FROM HYDROLOGICAL DATA

- USING MODIFIED RATIONAL METHOD [5]

3.1 WATERSHED DELINEATION [6]

3.2 RUNOFF COEFFICIENT DETERMINATION

3.3 CALCULATE DISCHARGE

TABLE 1: EQUATION FOR MODIFIED RATIONAL METHOD [5]

Peak Flow	$Q_p = C_f CiA$
Antecedent Precipitation Factor	C_f
Runoff Coefficient	C
Rainfall Intensity	i
Drainage Area	A

SCOPE OF SERVICES CONT.

TASK #4: EVALUATE HYDRAULICS

4.1 EXISTING CULVERT ANALYSIS

- WITH BENTLEY® CULVERTMASTER

4.2 DEVELOP ALTERNATIVE CULVERT DESIGNS

4.3 EXISTING CHANNEL ANALYSIS

- WITH BENTLEY® FLOWMASTER

4.4 DEVELOP ALTERNATIVE CHANNEL DESIGNS

FIGURE 8: BENTLEY SYSTEMS LOGO [7]

[7]

SCOPE OF SERVICES CONT.

TASK #5: GENERATE CONCEPTUAL DESIGN PLANS

5.1 OVERLAY EXISTING MAPS

5.2 DRAFT ALTERNATIVES

- INCLUDING DESIGN NOTES AND DETAILS

5.3 DETERMINE MATERIAL QUANTITIES

TASK #6: PROVIDE DOCUMENTATION

6.1 INSTRUCTIONS ON USE OF DESIGN

6.2 INSTRUCTIONS FOR MAINTENANCE

SCOPE OF SERVICES CONT.

TASK #7: PROJECT MANAGEMENT

7.1 MEETINGS

- GROUP
- COORDINATOR
- TECHNICAL ADVISOR
- CLIENT

7.2 MINUTES AND NOTES

7.3 TASK ASSIGNMENT AND FEEDBACK

7.4 DELIVERABLE ITEMS

- STATUS UPDATES
- 30% DESIGN
- 60% DESIGN
- TRIPLE BOTTOM LINE- COST BENEFIT ANALYSIS
- FINAL PRESENTATION
- FINAL REPORT/PLANS
- WEB PAGE

PROJECT LIMITATIONS

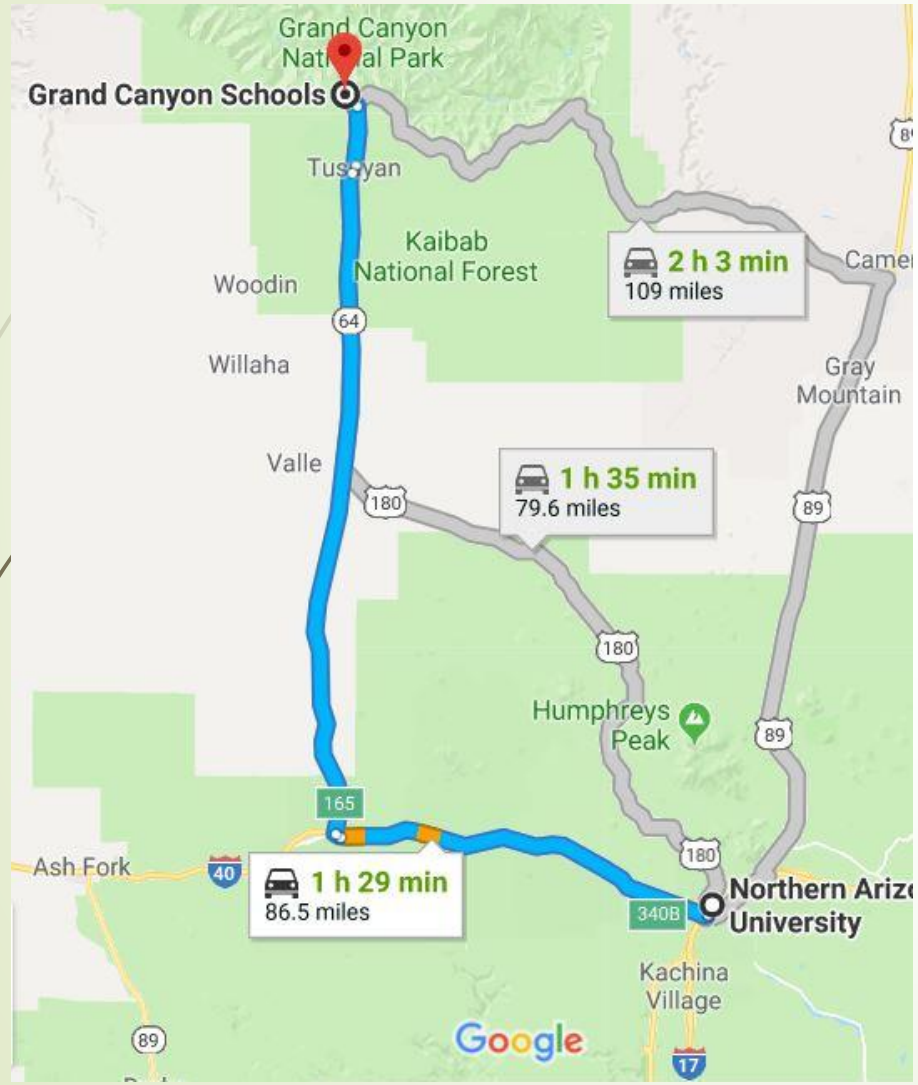

FIGURE 9: TRAVEL MAP FOR NAU TO GCS [2]

- **CHALLENGES**
  - SCHEDULE
  - TRAVEL
- **EXCLUSIONS**
  - FLOOD PLAIN DELINEATION
  - STRUCTURAL ANALYSIS
  - CONSTRUCTION AND IMPLEMENTATION
  - WATER QUALITY TESTING

GANTT CHART

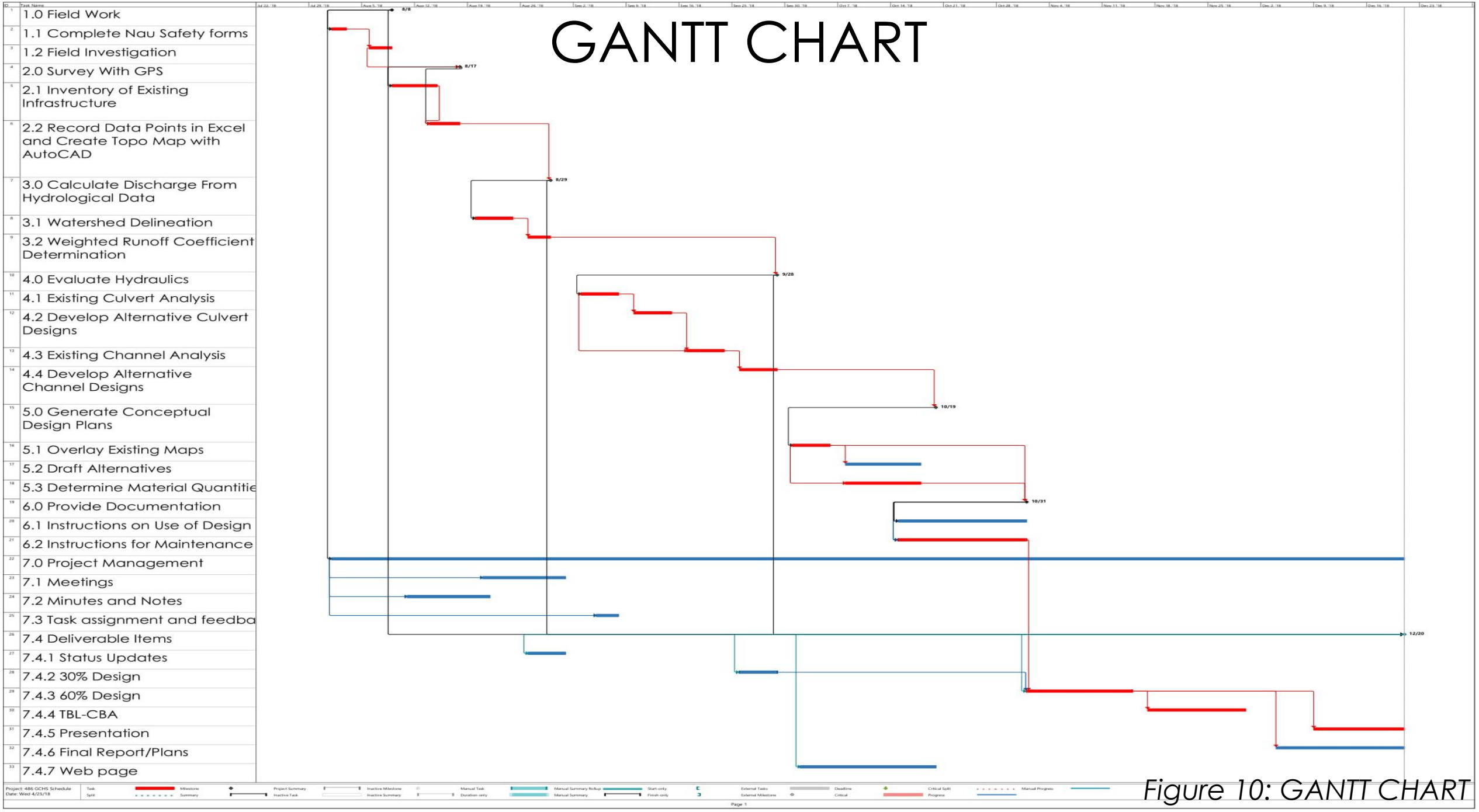

Figure 10: GANTT CHART

TABLE 2: STAFFING HOURS FOR MAJOR TASKS

Major Tasks and Staff (hrs)								
#	Task Description	Principle	Manager	PE	EIT	Tech	Admin	Task Total (Hr)
1.0	Field Work	1	1	3	12	13	2	32
2.0	Surveying with GPS	0	0	4	24	24	1	53
3.0	Hydrology	0	0	6	12	12	0	30
4.0	Evaluate Hydraulics	15	17	24	24	30	10	120
5.0	Generate Conceptual Design Plans	2	0	8	16	16	12	54
6.0	Provide Documentation	0	0	2	4	4	4	14
7.0	Project Management	39	27	49	109	109	67	400
Total Staff Hours		57	45	96	201	208	96	703

STAFFING EXPENSES

TABLE 3: STAFF AND RATES FOR GCUSD MASTER DRAINAGE PROJECT

Staff Member Rates and Hours		
Position	Rate ($/hr)	Total Hours
Principal Engineer	200	57
Manager	125	45
Project Engineer	142	96
EIT	105	201
Tech	80	208
Administration	50	96
TOTAL HOURS		703

[8]

TABLE 4: BREAKDOWN OF SERVICE EXPENSES

COST OF ENGINEERING SERVICES	
Cost of Travel	
Mileage Cost	$120
Car Rental ($/day)	$55
Total Travel Cost for 2 days	$230
Cost of Equipment	
Surveying Equipment ($/day)	$250
Total Equipment Rental for 2 days	$500

TABLE 5: SUMMARY OF EXPENSES FOR GCUSD MASTER DRAINAGE PROJECT

Summary of Expenses	
Total Cost of Engineering Services	$730
Total Staffing Cost	$71,842
Total Cost of Project	$72,572

REFERENCES

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[4] "Civil 3D | Civil Engineering Software | Autodesk", *Autodesk.com*, 2018. [Online]. Available: https://www.autodesk.com/products/civil-3d/overview. [Accessed: 24- Apr- 2018].

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QUESTIONS OR CONCERNS