NAU Stormwater Runoff Quality & Quantity Mitigation

RainRoots Consulting

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CENE 476

12/05/25

Introduction

Purpose:

- Improve stormwater management
- Implement low impact developments (LID)
- Slowing, filtering, and infiltrating stormwater

Clients:

- **Adam Bringhurst:** NAU Civil & Environmental Engineering Department
- **Erin McAnally-Trejo:** NAU Sustainability Department

Background:

- Stormwater management often focuses on moving water as quickly as possible
- Negatively impacts groundwater and downstream ecosystems

Location: North Campus

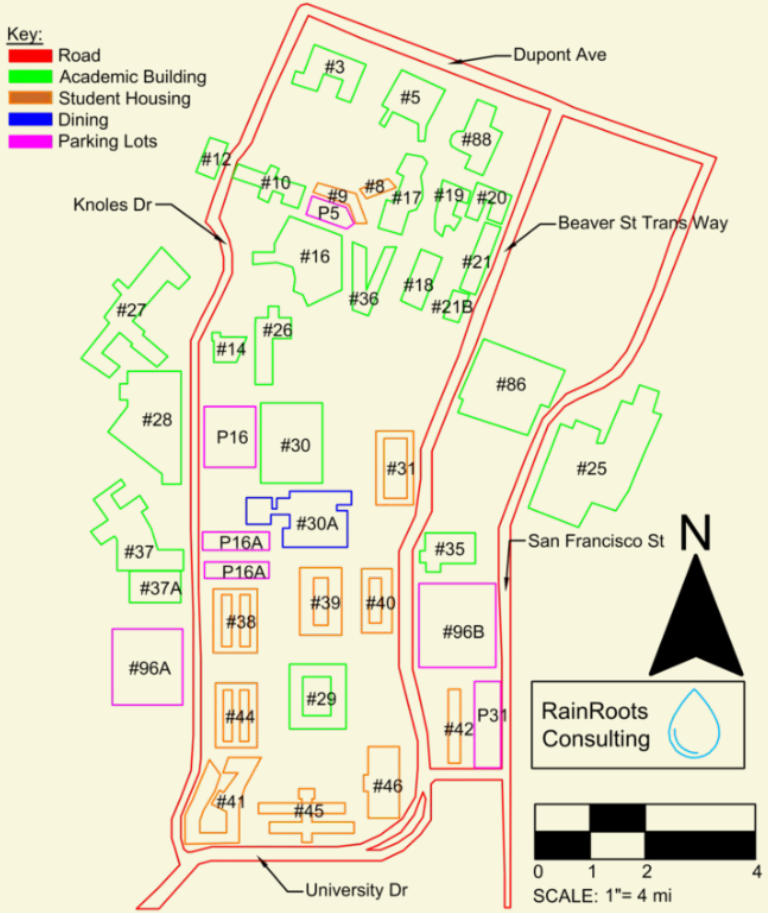


Figure 1 - North Campus Map

Location: Central Campus

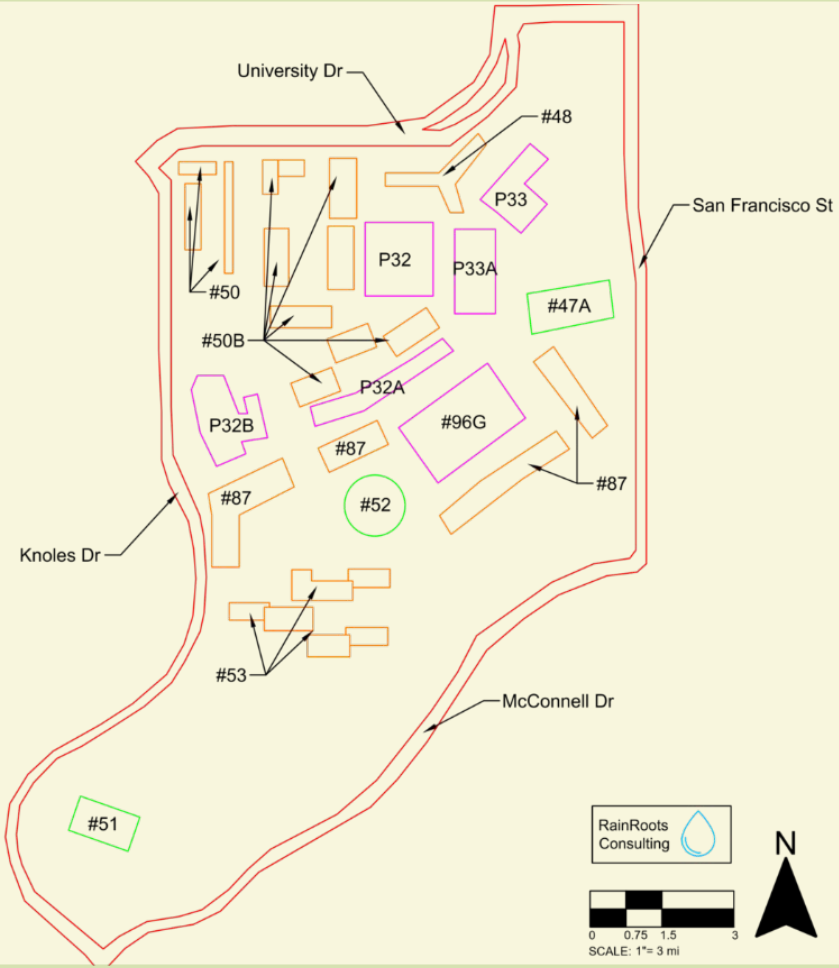


Figure 2 - Central Campus Map

Location: South Campus

Figure 3 - South Campus Map

Project Scope

Task 1: Preliminary Laboratory Research & Organization:

Task 1.1 : Laboratory Preparation
Task 1.2 : Laboratory Testing Organization

Task 2: Site Investigation Plan:

Task 2.1 : Create Field Assessment Form
Task 2.2 : Geolocate Areas of Interest

Figure 4 : MapItFast App [1]

Project Scope

Task 3: Creating the Location Inventory:

Task 3.1 : Field Assessment
Task 3.2 : Field Results Analysis
Task 3.3 : Watershed Analysis
Task 3.2.1 : Delineate Watershed
Task 3.2.2 : Find Storm Event Flow

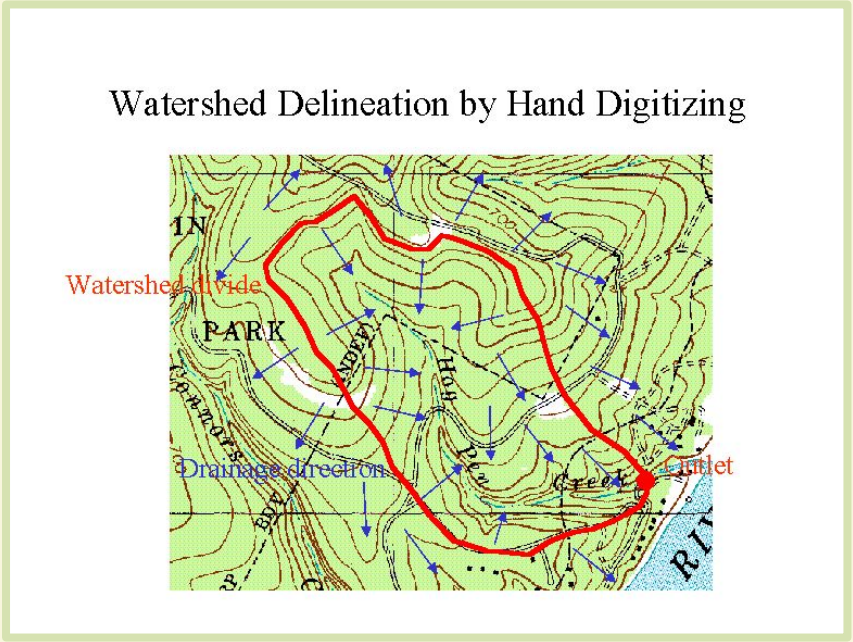


Figure 5: Example of Watershed Delineation [2]

Project Scope

Task 4: Stormwater Quality Analysis:

Task 4.1 : Sampling: *Roof, parking lot, field, and road runoff.*

Task 4.2 : Laboratory Work

- **Task 4.2.1** : Coliform: *HACH Method 8074*
- **Task 4.2.2** : Biochemical Oxygen Demand, BOD5: *USGS Method*
- **Task 4.2.3** : Chemical Oxygen Demand, COD: *Method 410.3 from the EPA*
- **Task 4.2.4** : pH: *ASTM D1293-12*
- **Task 4.2.5** : Fats, Oils, & Grease, FOG: *ASTM D7575*

Figure 6: Storm Water Sampling [3]

Project Scope

Task 5: Identify Locations for LID Implementation:

Task 6: Design:

- **Task 6.1** : Hydraulic Analysis
  - **Task 6.1.1** : Existing
  - **Task 6.1.2** : Proposed
- **Task 6.2** : Plan Set Design

Figure 7: Example Bioswale Design [4]

Project Scope

Task 7: Project Impacts:

- **Task 7.1:** Regulatory Impacts
- **Task 7.2:** Health & Environment Impacts
- **Task 7.3:** Economic Impacts
- **Task 7.4:** Societal Impacts

Task 8: Deliverables:

- **Task 8.1** : 30% Submittal
- **Task 8.2** : 60% Submittal
- **Task 8.3** : 90% Submittal
- **Task 8.4** : Final Submittal

Figure 8: Triple Bottom Line [5]

Project Scope

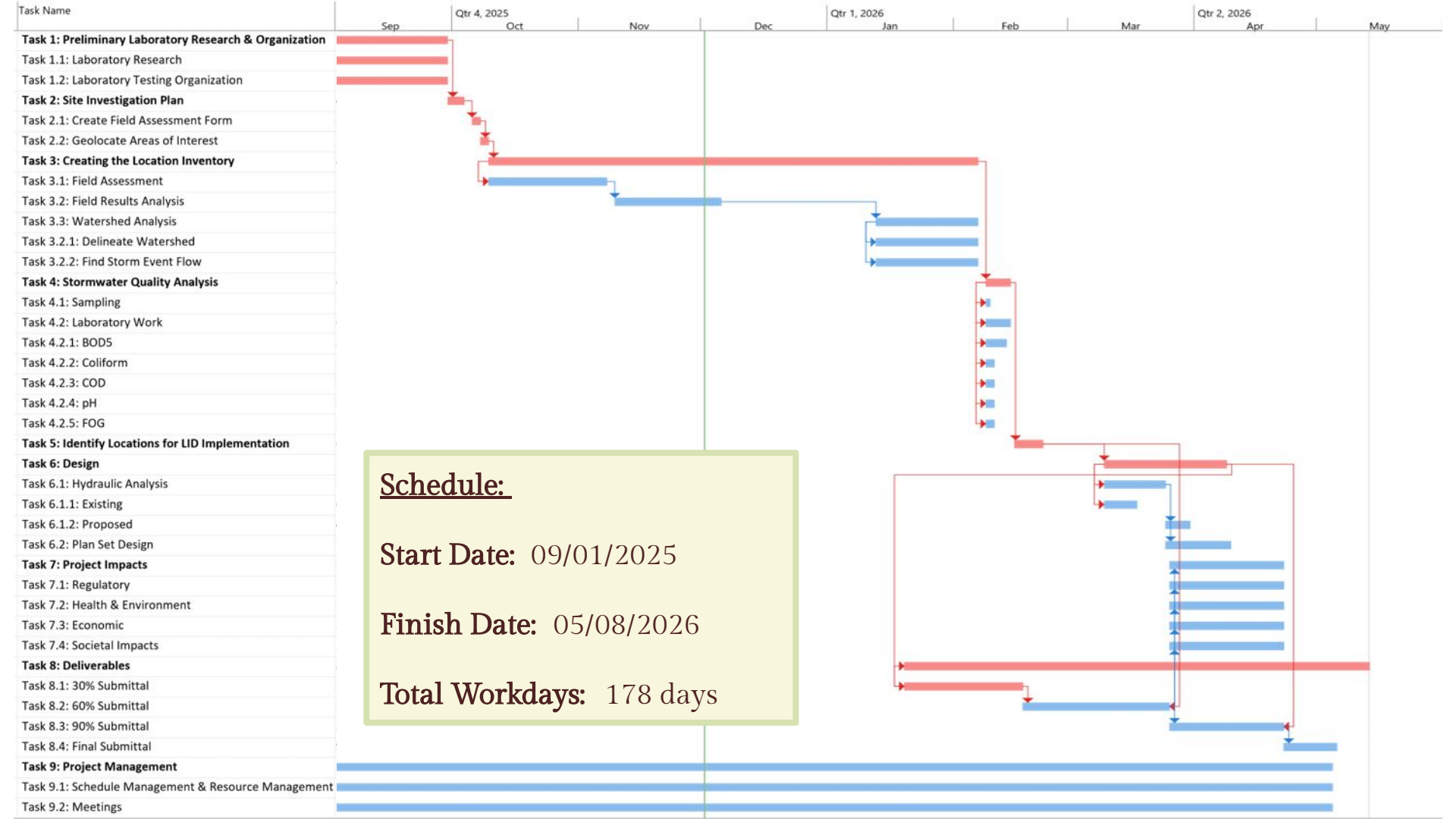
Task 9: Project Management:

- **Task 9.1** : Schedule Management & Resource Management
- **Task 9.2** : Meetings

Project Exclusions:

- Soil sampling
- Survey of Large Fields or Large Recreation Areas
- Analysis of Constructed LIDs
- Stormwater Quality Analysis to ADEQ Standards

Figure 9: Example of Large Recreation Area [6]


Task Name
Qtr 4, 2025
Qtr 1, 2026
Qtr 2, 2026
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Task 1: Preliminary Laboratory Research & Organization
Task 1.1: Laboratory Research
Task 1.2: Laboratory Testing Organization
Task 2: Site Investigation Plan
Task 2.1: Create Field Assessment Form
Task 2.2: Geolocate Areas of Interest
Task 3: Creating the Location Inventory
Task 3.1: Field Assessment
Task 3.2: Field Results Analysis
Task 3.3: Watershed Analysis
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Task 4: Stormwater Quality Analysis
Task 4.1: Sampling
Task 4.2: Laboratory Work
Task 4.2.1: BOD5
Task 4.2.2: Coliform
Task 4.2.3: COD
Task 4.2.4: pH
Task 4.2.5: FOG
Task 5: Identify Locations for LID Implementation
Task 6: Design
Task 6.1: Hydraulic Analysis
Task 6.1.1: Existing
Task 6.1.2: Proposed
Task 6.2: Plan Set Design
Task 7: Project Impacts
Task 7.1: Regulatory
Task 7.2: Health & Environment
Task 7.3: Economic
Task 7.4: Societal Impacts
Task 8: Deliverables
Task 8.1: 30% Submittal
Task 8.2: 60% Submittal
Task 8.3: 90% Submittal
Task 8.4: Final Submittal
Task 9: Project Management
Task 9.1: Schedule Management & Resource Management
Task 9.2: Meetings
Schedule:
Start Date: 09/01/2025
Finish Date: 05/08/2026
Total Workdays: 178 days

Project Staffing and Billing Rate

Project Positions :

Senior Engineer (SENG):
- Civil Professional Engineer (PE)
- 5-10 years experience

Engineer in Training (EIT):
- Bachelor's degree in civil/environmental engineering
- Passed Fundamentals of Engineering (FE)

Lab Technician (LT):
- 1-2 years of laboratory experience

Stormwater Technician (SWT):
- Prior experience in stormwater data collection & analysis

Employee	Billing Rate
SENG	**$136/hr**
EIT	**$84/hr**
LT	**$69/hr**
SWT	**$69/hr**

Table 1: Staff Billing Rates

Project Staffing Hours

Tasks	Senior Engineer	Lab Technician	Stormwater Technician	EIT
Task 1: Preliminary Labortory Reseach & Organization	4	24	10	8
Task 2: Site Investigation Plan	4	0	8	4
Task 3: Creating the Location Inventory	6	0	92	70
Task 4: Stormwater Quality Analysis	10	51	14	4
Task 5: Identify Locations for LID Implementation	8	4	8	4
Task 6: Design	24	14	4	25
Task 7: Project Impacts	6	4	0	8
Task 8: Deliverables	38	23	8	54
Task 9: Project Management	50	33	30	25
Total Hours	150	153	174	202
	679			

Table 2: Staffing

Total Cost for Engineering Services

Subsection	Classification	Quantity	Rate	Unit	Cost
1.0 Personnel	SENG	150 hours	$136	$/hr	$20,460
	EIT	202 hours	$84	$/hr	$16,887
	LT	153 hours	$69	$/hr	$10,569
	SWT	174 hours	$69	$/hr	$12,020
Subtotal					**$59,936**
2.0 Resources	Software	10 days	$100	$/day	$1,000
	Lab Work	5 days	$100	$/day	$500
	Lab Supplies	1	$500/LS	LS	$500
Subtotal					**$2,000**
Total					**$61,936**

Table 3: Engineering Cost of Services

References

[1] AgTerra Technologies, Inc., “MapItFast — Field-based Mapping,” Aptoide. [Online]. Available: https://mapitfast.en.aptoide.com/app. [Accessed: Dec. 2, 2025].
[2] D. Maidment, “Dallas hydrology lecture slide 30.” University of Texas at Austin, Dept. of Civil, Architectural and Environmental Engineering. [Online]. [Accessed: Dec. 2, 2025]. Available: https://www.caee.utexas.edu/prof/maidment/visual/dallas/david1/sld030.htm. [Accessed: Dec. 2, 2025].
[3] “Water Testing and Leakage,” Sandberg LLP. [Online]. Available: https://www.sandberg.co.uk/laboratories/chemistry/water-testing-and-leakage/. [Accessed: Dec. 2, 2025].
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[5] “Triple Bottom Line: Achieving Success With Purpose,” Charity Miles. [Online]. Available: https://charitymiles.org/triple-bottom-line/. [Accessed: Dec. 2, 2025].
[6] “South Campus Recreation Complex,” Northern Arizona University, Facility Services. [Online]. Available: https://in.nau.edu/facility-services/pdc/building-green/south-campus-recreation-complex/. [Accessed: Dec. 2, 2025].

Questions?