

Rio de Flag Restoration

By: Artemis Designs

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CENE 476 Capstone Presentation

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Figure 1: Photo of Rio de
Flag Restoration Site [1]

Introduction

- Client: Edward Schenk, City of Flagstaff Stormwater management
- Improve the channel conditions
- Rio de Flag flowing from Herold Ranch Rd. to Foxglenn Park (Flagstaff, AZ)
- Currently: poor stream conveyance; excessive erosion; reduced the flow available to downstream portions of the reach

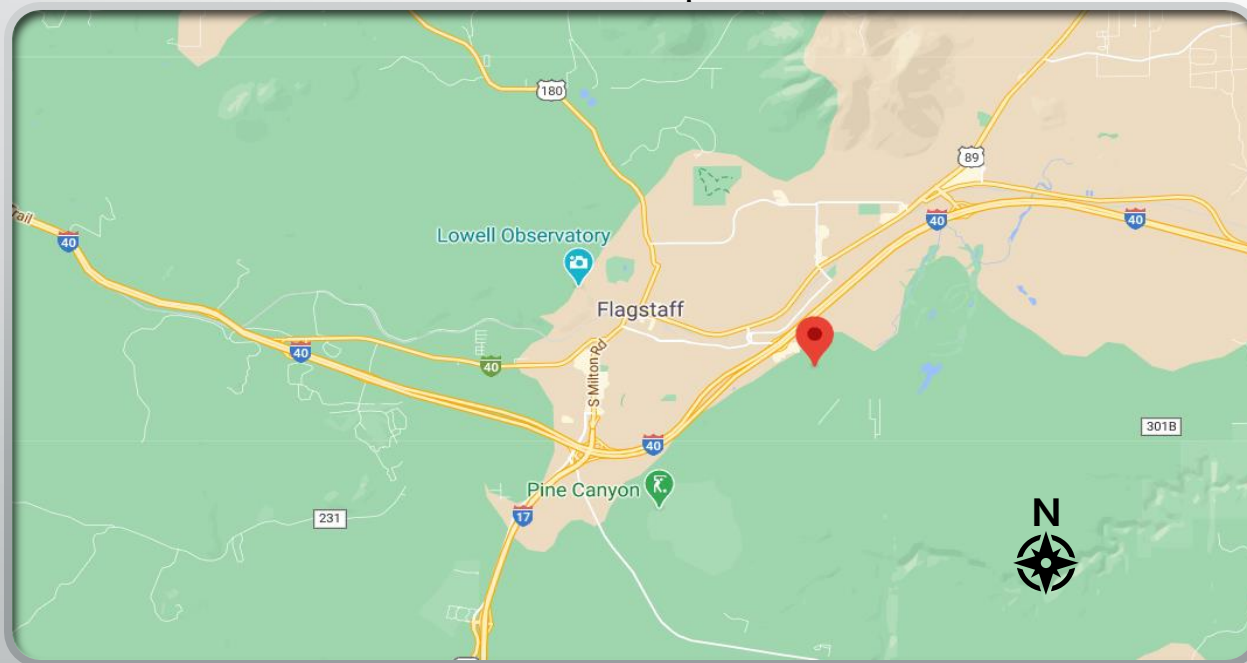


Figure 2: Site Location In Context of Flagstaff, Arizona [2]

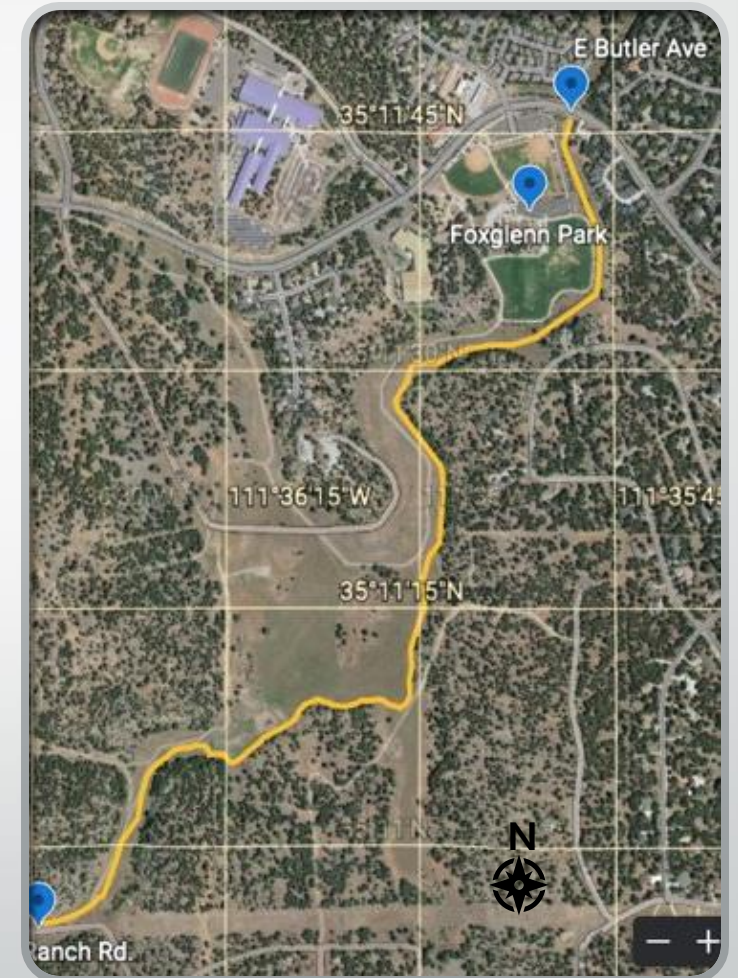


Figure 3: Closeup View of Reach Location [2]

Project Scope

- Task 1.0 Project Due Diligence
 - Task 1.1 Site Investigation
 - 1.1.1 Soil Survey
 - 1.1.2 Plant Survey
 - 1.1.3 Topographic Survey
 - Task 1.2 Previous Studies
 - 1.2.1. Federal Emergency Management Agency (FEMA) Floodway and Flood Insurance Study (FIS)
 - 1.2.2 City of Flagstaff Stormwater Management Design Manual (SWMDM)
 - Task 1.3 Representative Site Determination

Project Scope

- Task 2.0 Hydrologic Data
 - Task 2.1 Sub-basin Delineation
 - Task 2.2 Sub-basin Properties
 - Task 2.3 FEMA/ City of Flagstaff
- Task 3.0 Hydraulics
 - Task 3.1 Input Data Development
 - Task 3.2 NRCS Analyzer
 - Task 3.3 HEC-RAS Analysis
- Task 4.0 Design
 - Task 4.1 CAD Drafting
 - Task 4.2 Hydraulic Software

Project Scope

- Task 5.0 Deliverables
 - Task 5.1 30% Submittal
 - Task 5.2 60% Submittal
 - Task 5.3 90% Submittal
 - Task 5.4 Final Report
 - Task 5.5 Final Presentation
 - Task 5.6 Website
- Task 6.0 Project Management
 - Task 6.1 Team Meetings
 - Task 6.2 Tech Advisor Meetings
 - Task 6.3 Client Meetings
 - Task 6.4 Schedule Management
 - Task 6.5 Resource Management
 - Task 6.6 Impacts

Exclusions

- USACE 404 Jurisdiction

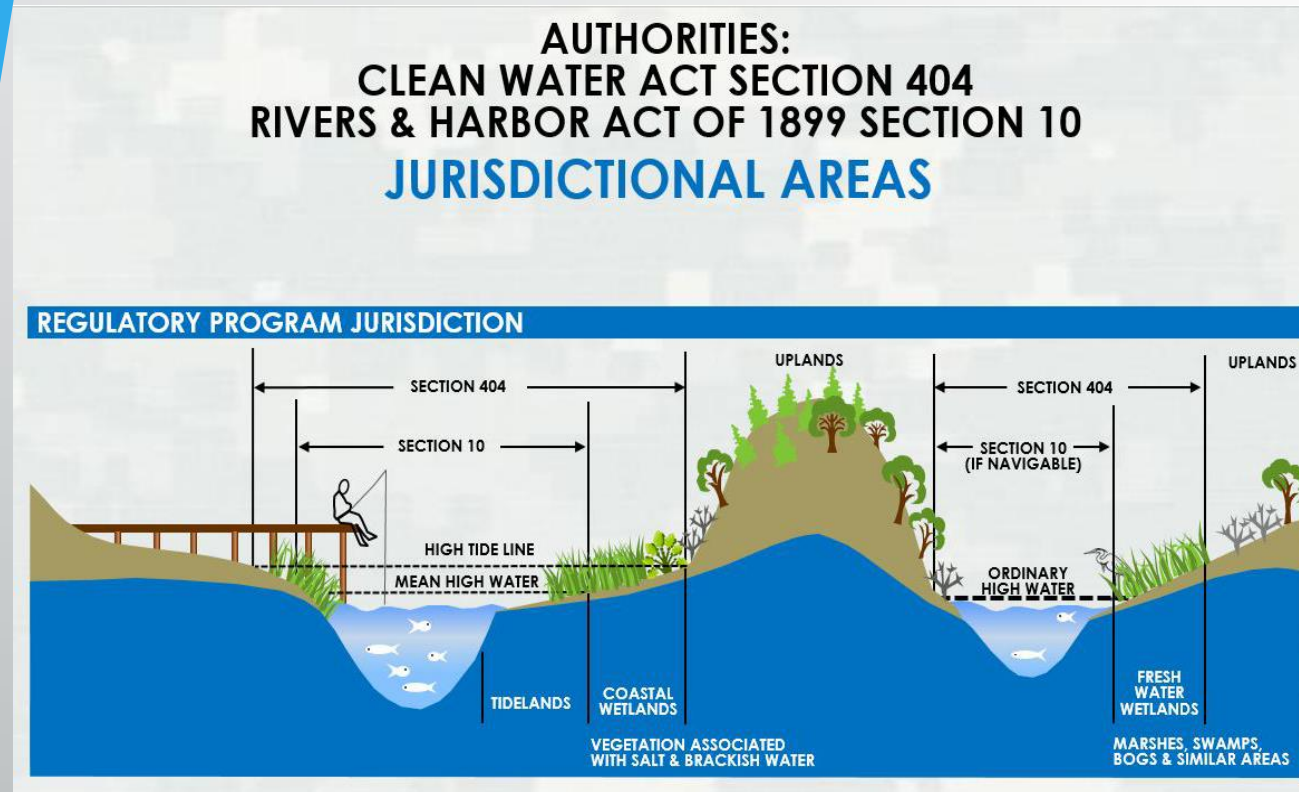


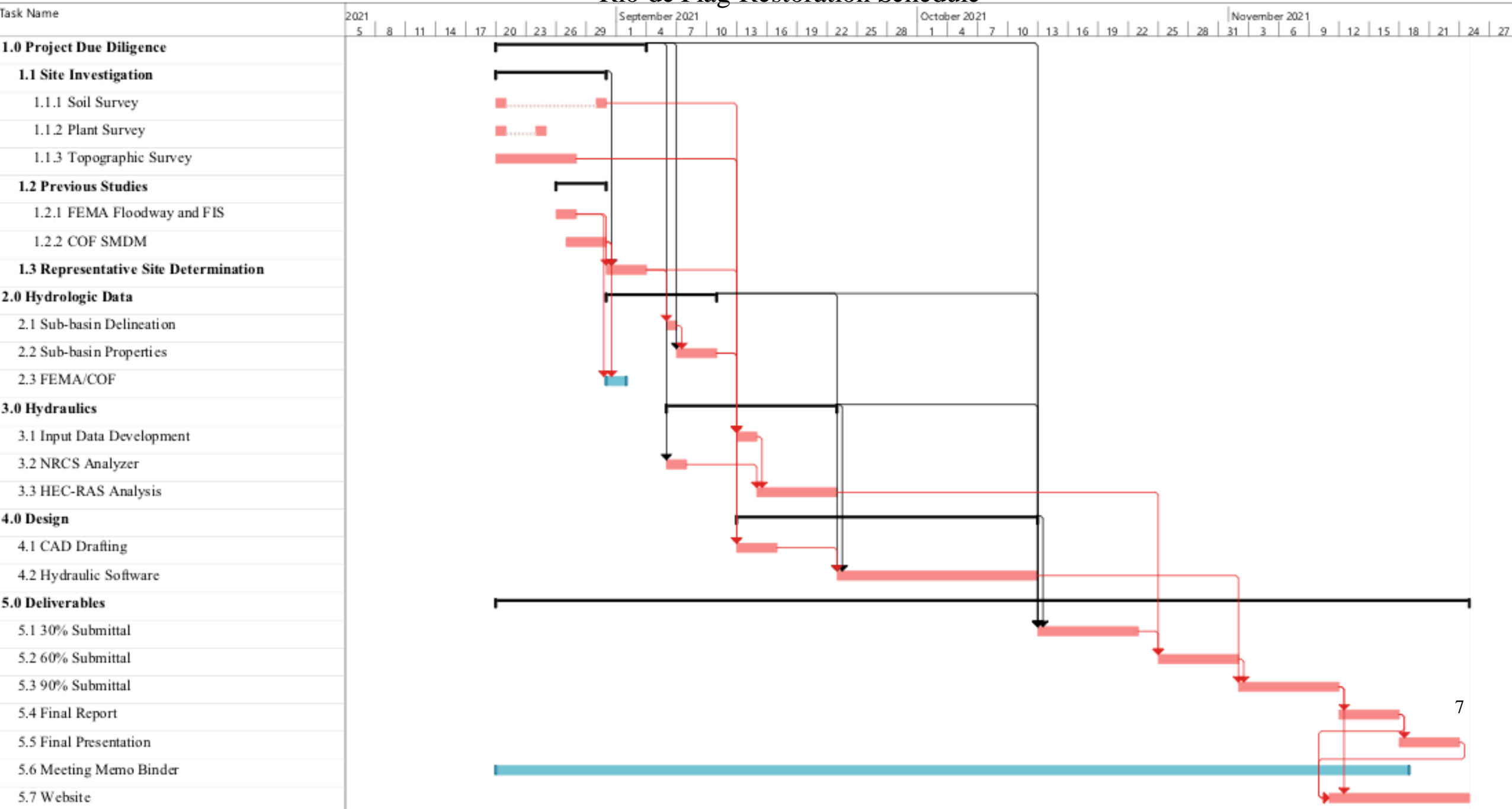
Figure 4: USACE 404 Jurisdiction Diagram of Provenance [6]

- Construction



Figure 5: Construction Near Rio de Flag [7]

Rio de Flag Restoration Schedule



Staffing Plan

Task	PM	ENG	EIT	TECH	Hours
1.0 Site Investigation	7	34	96	10	146
1.1 Surveying Data	2	29	80	10	
1.2 Previous Studies	1	1	12	0	
1.3 Representative Site Determination	4	4	4	0	
2.0 Hydrologic Data	4	6	22	4	25
2.1 Sub-Basin Delineation	0.5	1	4	0	
2.2 Sub-Basin Properties	0.5	0.5	4	4	
2.3 FEMA/City of Flagstaff	2	4	4	0	
3.0 Hydraulic Data	2	4	28	0	40
3.1 Input Data Development	1	2	14	0	
3.2 NRCS Analyzer	0.5	2	20	0	
3.3 HEC-RAS Analysis	0.5	0.5	30	0	
4.0 Design	8	50	160	4	222
4.1 CAD Drafting	4	20	80	0	
4.2 Hydraulic Software	4	30	80	4	
5.0 Deliverables	23	51	77	21	172
5.1 30% Submittal	2	10	16	4	
5.2 60% Submittal	4	10	8	4	
5.3 90% Submittal	4	10	16	4	
5.4 Final Report	4	8	10	2	
5.5 Final Presentation	6	8	8	4	
5.6 Meeting Memo Binder	1	1	1	1	
5.7 Website	2	4	18	2	
6.0 Project Management	51	42	37	28	158
Total Hours:	95	186	416	67	764

Cost of Services

Category	Classification	Hours	Rate, \$/hr	Cost
Personnel	PM	94.5	200	\$18,900
	ENG	186	140	\$26,040
	EIT	416	90	\$37,440
	TECH	67	60	\$4,020
Lab Fees		4	25	\$100
Software Fees		Yearly	1300	\$1,300
TOTAL		764		\$86,500

References

- [1] *Rio de Flag reach*. 2021.
- [2] *Google Earth*. [Online]. Available: <https://earth.google.com/web/@35.18457654,-111.60653655,2077.3789976a,9446.49157517d,30y,0h,0t,0r/data=MicKJQojCiExWktGdEFQUk1QV1ctb1RJaUktaktpRTIWSldWcjNmOXQ>. [Accessed: 06-Feb-2021].
- [3] “Home,” *Portland District, US Army Corps of Engineers*. [Online]. Available: <https://www.nwp.usace.army.mil/Missions/Regulatory/Jurisdiction.aspx>. [Accessed: 06-Feb-2021].
- [4] Cella Barr Associates, “Canyon De Rio Development Plan,” *City of Flagstaff Official Website*, May-1984. [Online]. Available: <https://www.flagstaff.az.gov/DocumentCenter>. [Accessed: 08-Feb-2021].
- [5] 2009. COF Low Impact Development. 1st ed. [eBook] Flagstaff: City of Flagstaff. Available at: [<https://www.flagstaff.az.gov/DocumentCenter/View/8401/COF-LID-Manual-1-09?bidId=>>] [Accessed 15 February 2021].
- [6] “Home,” *Alaska District, U.S. Army Corps of Engineers*. [Online]. Available: <https://www.poa.usace.army.mil/Missions/Regulatory/Jurisdictional-Determinations/Limits-of-Jurisdiction/>. [Accessed: 12-Apr-2021].
- [7] “Home,” *Oxbow Ecological Engineering, LLC*. [Online]. Available: <http://oxbow-eco-eng.com/>. [Accessed: 12-Apr-2021].



Questions?