Dredged Material Testing
A Work Flow Guide for Project Managers and Testing Laboratories

Dredging Summit & Expo '18
Norfolk, VA

Alpha Analytical & Key Environmental, Inc.

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Historic Maintenance Dredge Sediment Reuse in the New Jersey/New York City Metropolitan Area

- Dredge reuse is primarily used as fill materials
- Largely clayey and sandy silts, amended with 8% Portland Cement after dewatering in scow
  - Cement helps bind trace heavy metals contained in the sediments
  - Cement helps reduce moisture and increase strength
- Reused upland on impacted sites for fill or as part of surface cover
- >20 years: New Jersey was the primary placement location
  - Obtain an Acceptable Use Determination (AUD) from the NJDEP
  - Jersey Gardens Mall
  - Business Parks
  - Meadowlands
- Chemical characterization completed in advance of reuse requires agency review and approval
- Geotechnical testing often ignored due to the historic database of testing

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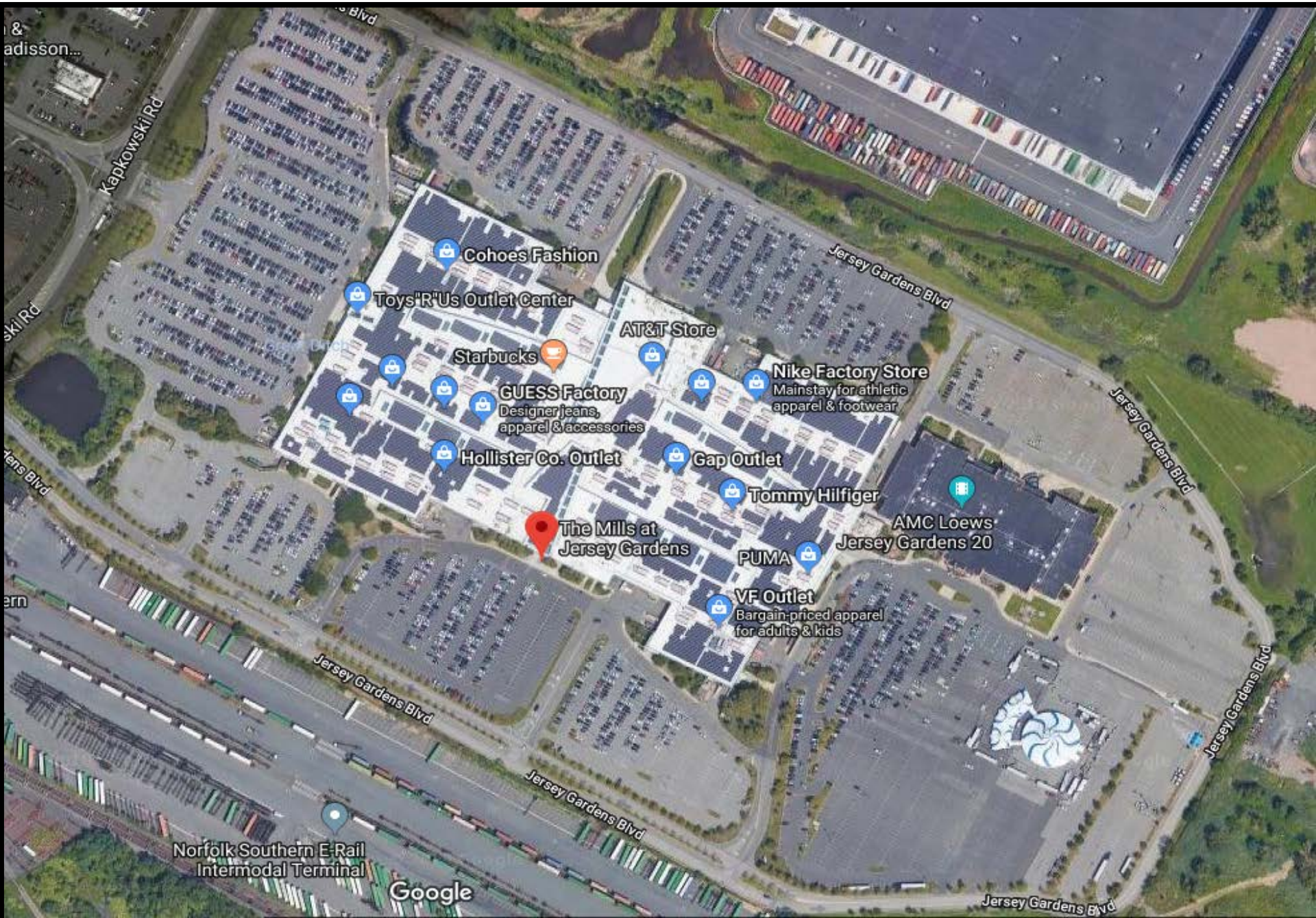
The Mills at Jersey Garden



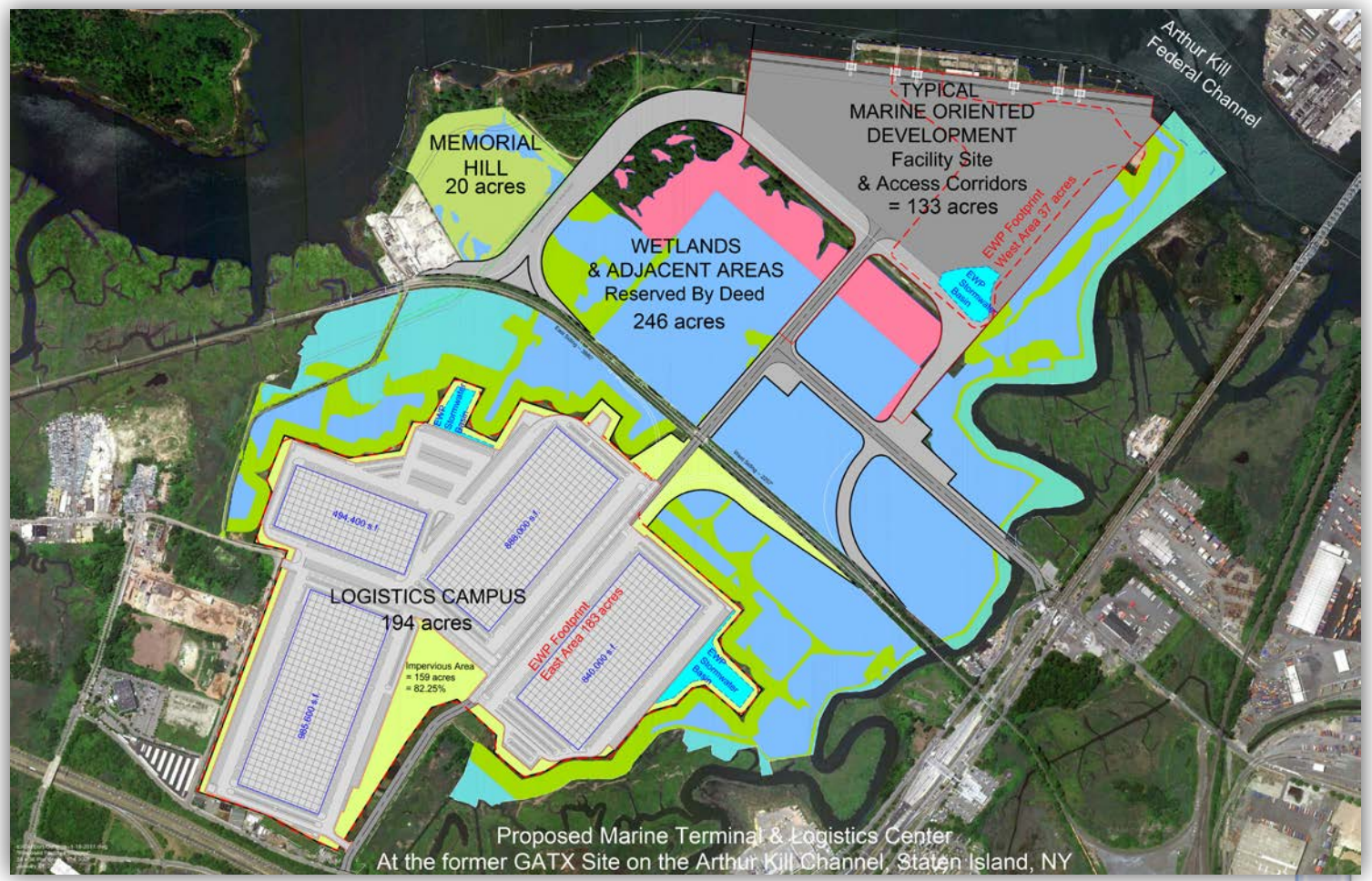
Benefits of Dredge Reuse

- Local renewable and recyclable resource for structural fill
- Reduces need for ocean disposal or CDF
- Environmentally protective (risk based)
- Savings of potential landfill space and cost
- Provides a solution for the Port Authority
- Benefits the placement site
- Reduced analytical testing complexity compared to ocean placement

Recent Developments

- Dredge reuse in NY was first permitted on a large scale project in NYC (380 Development)
  - >4,800,000 cubic yards
  - Beneficial Use Determinations (BUD) used for NYSDEC approval of each source or reach
  - Warehouse/Waterfront Development
- New York Port 360 Regulations were updated late in 2017 and address NDM
- MDE – Innovative Reuse and Beneficial Use of Dredged Material Guidance (August 2017)

Proposed Marine Terminal & Logistics Center

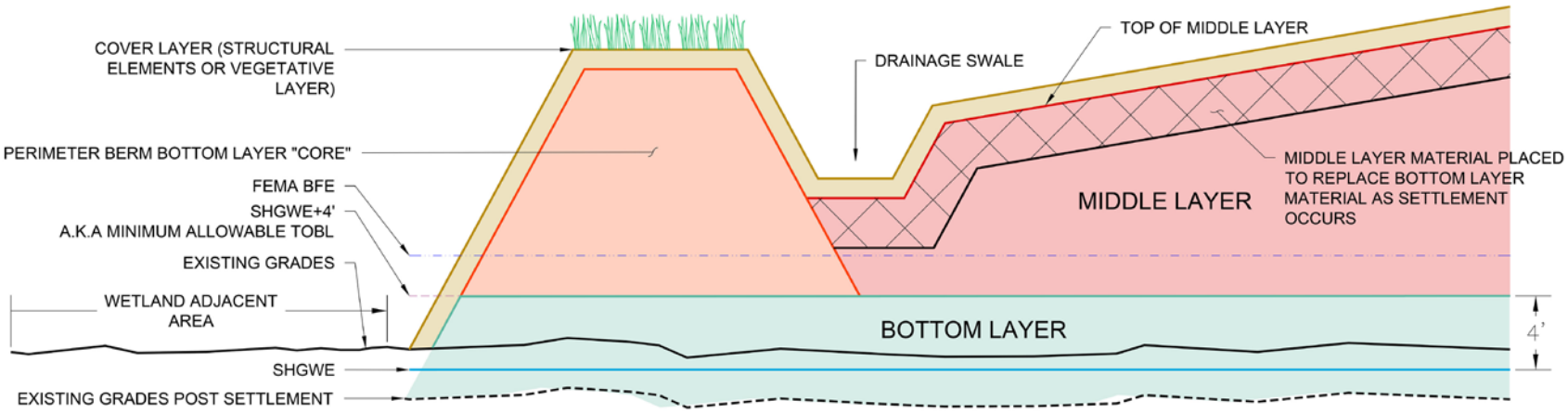


380 Warehouse Construction

380 Development Site Information

- 675-acre Brownfield Waterfront Redevelopment Site (NYSDEC Region 2)
- Past Use - Major Oil Terminal and LNG Plant
- Future Use - Logistics Center with warehousing and/or Marine Terminal
- Remediate per Modified Order on Consent
- Surface Cover Design Considerations
  - Account for Perimeter dike, existing stormwater system and wetlands
  - Provided Stormwater Drainage and Treatment
  - Developable Ground Surface above the Flood Plain **and Seasonal High Groundwater**
  - Stable Earth Placement (Supports Development)
  - Three Layer Surface Cover Approach
- Chemical Requirements/Geotechnical requirements
- Middle Layer – Amended or Raw Dredge meets the Commercial and Protection of Groundwater (PGW) SCOs, if > PGW SCOs, allows for SPLP Leachate< Groundwater Standards (Class GA)

Completed Construction Post-Settlement



COMPLETED CONSTRUCTION POST-SETTLEMENT

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Laboratory Characterization

Jim Occhialini
Liz Porta
Alpha Analytical

Sediments are *Different…*

General Project Planning

- Project schedule, logistics, required turnaround time
  - Sample holding time
- Simultaneous Vs. tiered approach analytical scheme
- Sampling & analysis plan
  - Project specific QC requirements
  - Field QC samples
  - Laboratory certifications
- Regulatory criteria for disposal
  - Upland disposal, beneficial re-use, open ocean, etc.
    - Detection limits

Field Logistics

- Compositing instructions
  - Tracking of composite intervals
- Sediment amendments?
  - Amending ratio?
- Sample volume requirements
- Long term storage of sediment samples?
  - Sample disposal timeframe

Testing Required to Support Beneficial Reuse NY / NJ Upland Disposal

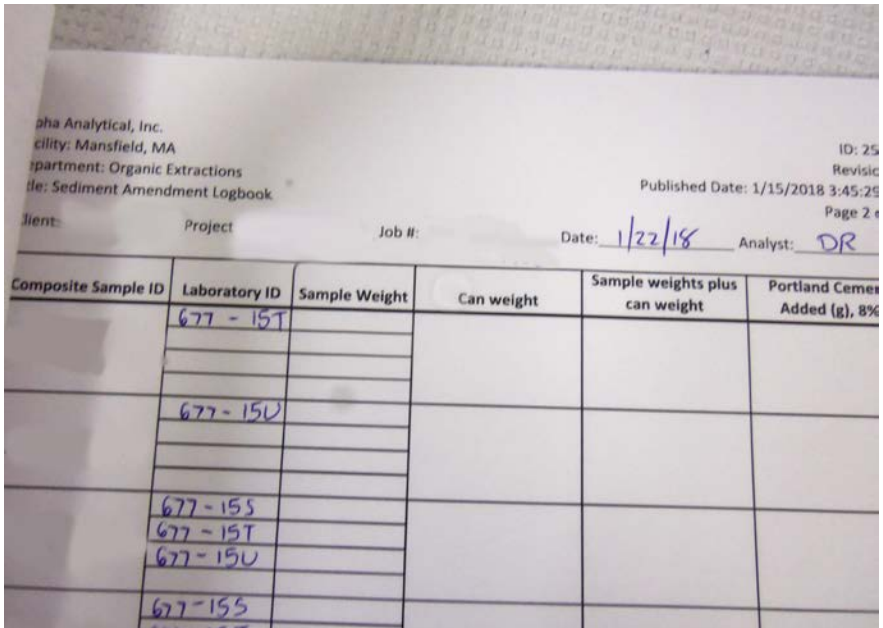
- Grain size (< 90% sand)? TOC (> 0.5%)?
- Analytical testing
  - VOCs, SVOCs, PCBs, pesticides, metals, hex Cr, CN, pesticides / herbicides & TCDD / TCDF
- Sample generation
  - Composite / homogenize as needed, preparation of:
    - Raw bulk sediment chemistry
    - Processed amended sediment (e.g 8% Portland cement)
    - SPLP analysis of the processed amended chemistry
  - 3 sets of results per sample (raw, amended & SPLP)


Dredging
1/17/18
1-C
10:58
Dredging
1-B
1/17/18


271.4 g

Sample Amendment

- ~ 2000g raw bulk sediment
  - Standard protocol
    - e.g 8% ratio Portland Cement to sediment
- Amended sediment subsampled for chemistry analysis


aha Analytical, Inc.
cility: Mansfield, MA
partment: Organic Extractions
de: Sediment Amendment Logbook
ID: 25
Revisic
Published Date: 1/15/2018 3:45:29
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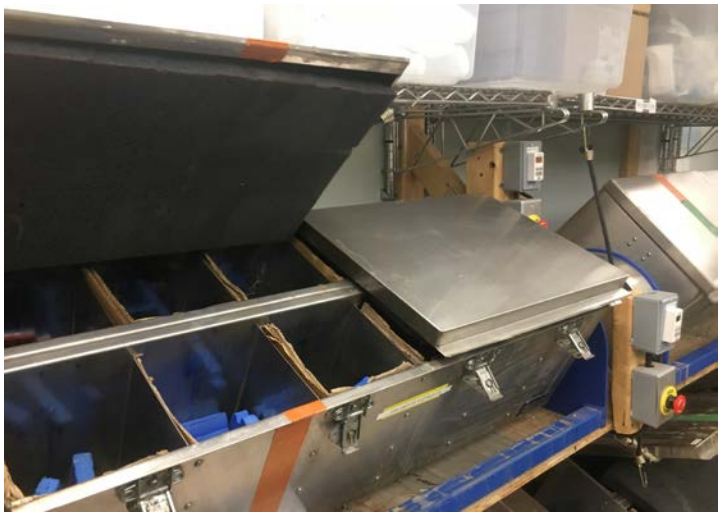
lient: Project Job #: Date: 1/22/18 Analyst: DR

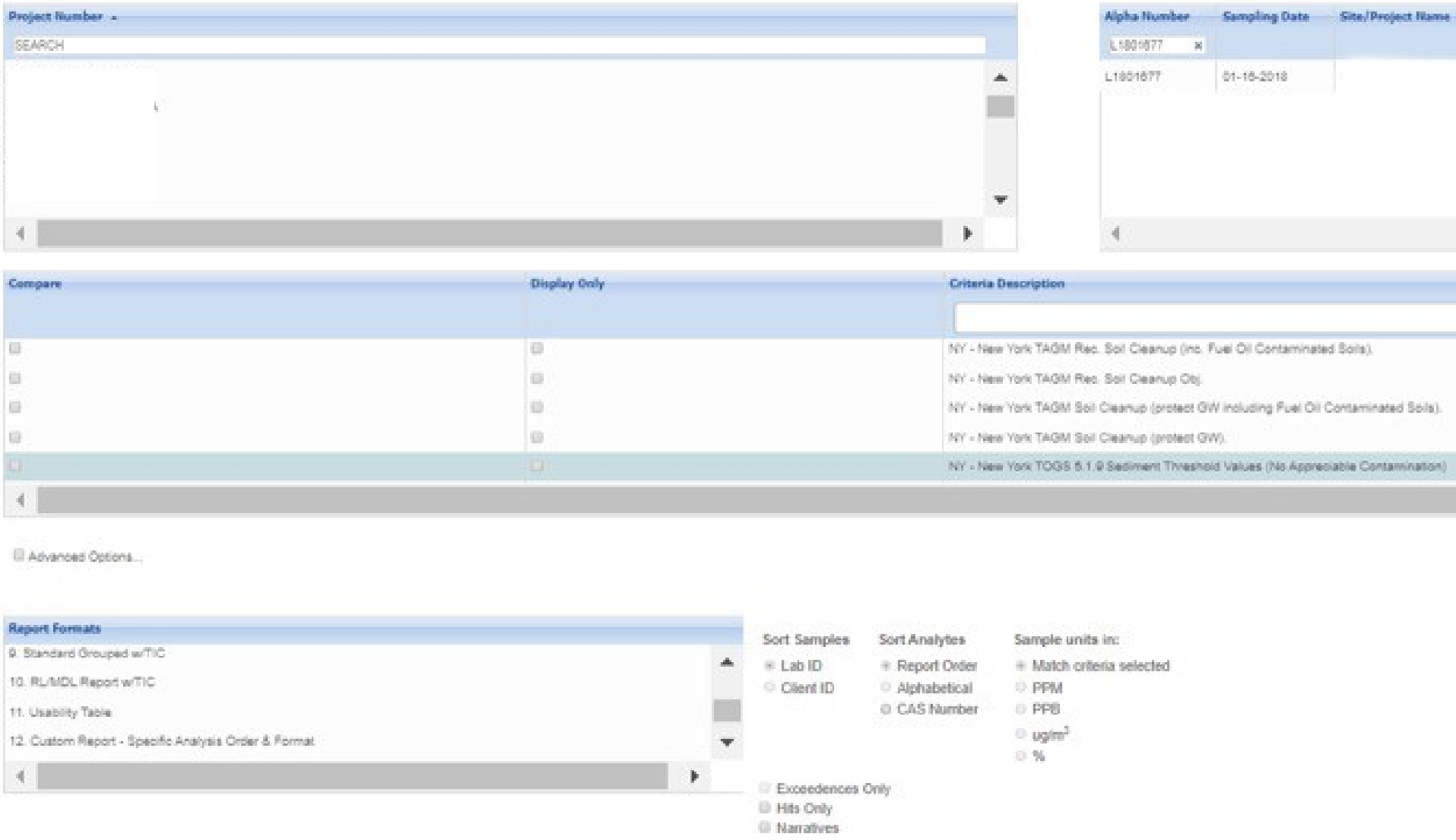
Composite Sample ID	Laboratory ID	Sample Weight	Can weight	Sample weights plus can weight	Portland Cemer Added (g), 8%
	677 - 15T				
	677 - 15U				
	677 - 15S				
	677 - 15T				
	677 - 15U				
	677 - 15S				

SPLP Analysis

- Amended sediment sub sample
  - Aliquot prepared for SPLP extraction
    - 20X ratio solid to extraction fluid
    - 18 hour extraction
  - Generation of aqueous leachate sample
- Aqueous sample analyzed for same chemistry parameters



Data Delivery / Data Management



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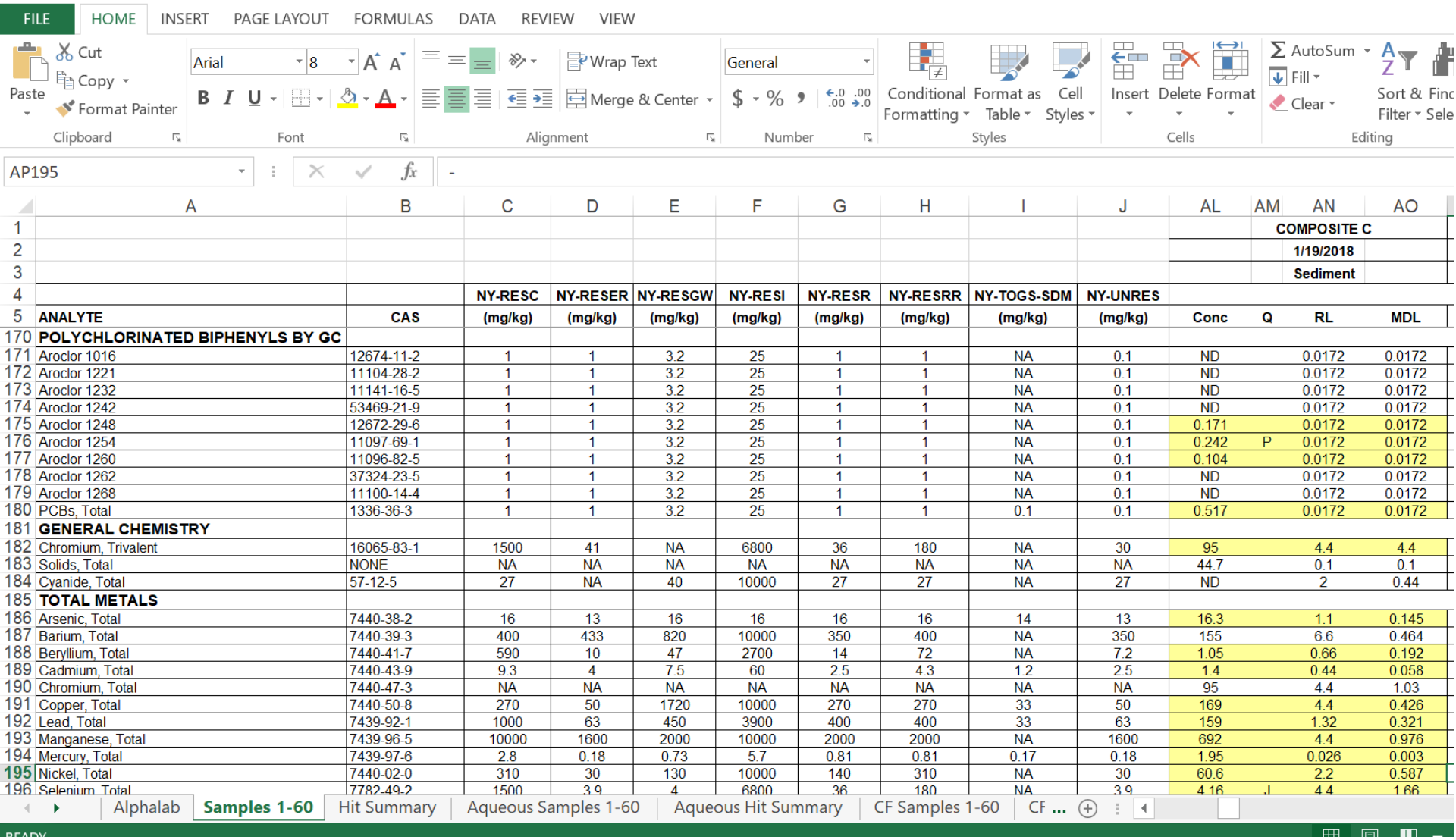

	A	B	C	D	E	F	G	H	I	J	AL	AM	AN	AO
1													COMPOSITE C	
2													1/19/2018	
3													Sediment	
4			NY-RESC	NY-RESER	NY-RESGW	NY-RESI	NY-RESR	NY-RESRR	NY-TOGS-SDM	NY-UNRES				
5	ANALYTE	CAS	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	Conc	Q	RL	MDL
170	**POLYCHLORINATED BIPHENYLS BY GC**													
171	Aroclor 1016	12674-11-2	1	1	3.2	25	1	1	NA	0.1	ND		0.0172	0.0172
172	Aroclor 1221	11104-28-2	1	1	3.2	25	1	1	NA	0.1	ND		0.0172	0.0172
173	Aroclor 1232	11141-16-5	1	1	3.2	25	1	1	NA	0.1	ND		0.0172	0.0172
174	Aroclor 1242	53469-21-9	1	1	3.2	25	1	1	NA	0.1	ND		0.0172	0.0172
175	Aroclor 1248	12672-29-6	1	1	3.2	25	1	1	NA	0.1	0.171		0.0172	0.0172
176	Aroclor 1254	11097-69-1	1	1	3.2	25	1	1	NA	0.1	0.242	P	0.0172	0.0172
177	Aroclor 1260	11096-82-5	1	1	3.2	25	1	1	NA	0.1	0.104		0.0172	0.0172
178	Aroclor 1262	37324-23-5	1	1	3.2	25	1	1	NA	0.1	ND		0.0172	0.0172
179	Aroclor 1268	11100-14-4	1	1	3.2	25	1	1	NA	0.1	ND		0.0172	0.0172
180	PCBs, Total	1336-36-3	1	1	3.2	25	1	1	0.1	0.1	0.517		0.0172	0.0172
181	**GENERAL CHEMISTRY**													
182	Chromium, Trivalent	16065-83-1	1500	41	NA	6800	36	180	NA	30	95		4.4	4.4
183	Solids, Total	NONE	NA	NA	NA	NA	NA	NA	NA	NA	44.7		0.1	0.1
184	Cyanide, Total	57-12-5	27	NA	40	10000	27	27	NA	27	ND		2	0.44
185	**TOTAL METALS**													
186	Arsenic, Total	7440-38-2	16	13	16	16	16	16	14	13	16.3		1.1	0.145
187	Barium, Total	7440-39-3	400	433	820	10000	350	400	NA	350	155		6.6	0.464
188	Beryllium, Total	7440-41-7	590	10	47	2700	14	72	NA	7.2	1.05		0.66	0.192
189	Cadmium, Total	7440-43-9	9.3	4	7.5	60	2.5	4.3	1.2	2.5	1.4		0.44	0.058
190	Chromium, Total	7440-47-3	NA	NA	NA	NA	NA	NA	NA	NA	95		4.4	1.03
191	Copper, Total	7440-50-8	270	50	1720	10000	270	270	33	50	169		4.4	0.426
192	Lead, Total	7439-92-1	1000	63	450	3900	400	400	33	63	159		1.32	0.321
193	Manganese, Total	7439-96-5	10000	1600	2000	10000	2000	2000	NA	1600	692		4.4	0.976
194	Mercury, Total	7439-97-6	2.8	0.18	0.73	5.7	0.81	0.81	0.17	0.18	1.95		0.026	0.003
195	Nickel, Total	7440-02-0	310	30	130	10000	140	310	NA	30	60.6		2.2	0.587
196	Selenium, Total	7782-49-2	1500	3.9	4	6800	36	180	NA	3.9	4.16	J	4.4	1.66

Data Review

- Compare to placement site-specific requirements
- Run contingent samples, if necessary
- Compare Results/RLs/MDLs to requirements
- Material inspection and confirmation upon delivery
- Is confirmatory sampling required or contingent sampling?

Preparing for Upland Reuse

- Development of Project details and needs
  - Locations, volume, expected types of sediments
- Identify potential placement location(s) and site-specific criteria
  - Number of borings
  - Specific zones (silts, sands, clay, till)
  - Number of samples
  - Chemical criteria and reporting limits (e.g., commercial use or direct contact, groundwater protection, Ecological protection?)
  - Other
- Prepare Site-Specific Sampling and Analyses Plan (SSAP)
- Obtain agency approval of plan
- Implement SSAP and compare results to site-specific or regulatory criteria (NJSRS, like-on-like, 75th Percentile, NYSDEC Part 360, PA Fill Guidance)
- Permits

Typical Means for Approval

- Development/Dredge Permit
- NY BUD – Site-specific Beneficial Reuse Determination (BUD)
- NY Part 360 Regulations for use of amended or raw dredge as fill
- NJ Dredge permits with NJ AUD
- PA Fill Regulations, ACT 2, and Development Permits
- MD Beneficial Reuse Guidance

Lessons Learned

- Identify acceptance locations and site-specific requirements early
- Incorporate the requirements into the SSAP, and start conversations with the lab on details in advance of characterization
- Agency Flexibility (volume, criteria, number of borings, etc.,)? What about the reuse site?
- Use lab generated tables for quick criteria comparisons
- Plan for alternatives and potential worst case (What if 8 out of 10 samples pass site-specific criteria?)
- Verify the lab is certified in the state of reuse for the analytical parameters
- Work with an experienced lab to reduce time spent up-front
- Work with an experienced driller
- Optimize dredge/core volumes needed for testing and amendment at the lab and discuss with driller