TINKER POND

DREDGE FEASIBILITY REPORT

Pennichuck Water Works

Nashua, NH

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Executive Summary

Tinker Pond is a detention pond located in Nashua, NH adjacent to Tinker Road and Everett Turnpike. The pond serves as a stormwater treatment system for runoff from nearby roadway, residential and commercial areas before it enters Harris Pond and the Pennichuck Brook drinking water system. Over the years, sediment and aquatic plant die-off has accumulated at the bottom of Tinker Pond and phosphorus loading has increased resulting in algal blooms, which could potentially lead to other water quality issues such as cyanobacteria.

As a result, CEI completed a dredge feasibility study to identify potential dredge options, dredge methods, disposal options and estimated costs to improve water quality and restore treatment capabilities of the pond in order to protect the drinking water supply.

CEI first completed a 2018 bathymetric analysis to compare to previous bathymetric studies of the pond that were completed in 2005. CEI used local datum to rectify mapping efforts completed in 2005 and 2018 and then compared the bathymetric maps to determine how much the pond had infilled over an approximate 13 year period. It was determined that approximately 6,800 cubic yards of sediment had accumulated in the pond over a 13 year period. This resulted in an annual loss of over 500 cubic yards per year or approximately 2% per year of the ponds original storage volume which was estimated at over 22,000 CY (4.5 million gallons).

This could mean that the ponds current estimated storage volume of 15,740 CY (3.2 million gallons) could be completely lost in another 30 years' time if infill rates remain the same. This information and bathymetric mapping was used to identify different potential dredge scenarios.

Based on the initial screening described in section 4, the material could either be re-used on-site or as daily cover at a landfill following approval by NHDES. The sample results did reveal some potential elevated levels, but nothing that exceeded NH Soil Remediation Standards.

For contingency purposes in this report, it is assumed that all dredge materials will be used as daily cover at a local landfill nearby to the pond, resulting in slightly higher disposal costs, but lower transportation costs.

This assumption should not preclude future evaluation of any potential onsite re-use options during future dredge planning process and coordination with NHDES. NHDES does provide flexibility in testing, sampling, segregating and treatment for any re-use or disposal options of contaminated or non-contaminated sediments.

Under any disposal scenario, the NHDES Waste Management Division will require preparation of a detailed dredge plan that would include additional sediment sampling and analysis. Upon review of results, NHDES will review any re-use or disposal options and before any material can be dredged, the dredge plan will need to be approved by the Waste Management Division.

CEI evaluated pros and cons of several different dredge methods to select the most cost effective method for sediment removal from the pond, handling and dewatering. This evaluation included assessment of construction feasibility for the site, environmental impacts, permitting feasibility and general costs. These were used to select the most cost effective methods that best fit the site and best met the overall project goals of improving water quality and treatment characteristics of the pond. CEI reviewed the following methods:

1. Hydraulic / Pneumatic Dredge
2. Mechanical Dry Dredge
3. Mechanical Wet Dredge

Based on the evaluation, a mechanical wet dredge with partial drawdown would be most feasible and cost effective option based on permitting limitations, proposed dredge quantities, dredge locations and dewatering requirements.

The following table summarizes the different scenarios that were evaluated, the resultant cost, pros and cons, and the resultant benefits for each scenario:

Scenario	Pros / Cons	Cost	Benefits
Scenario 1 – Full Volume Dredge (6,800 CY removed)	• Largest volume gain • Remove all plant species • Less favorable to permitting	$1.5 million	~43% gain +43 years to infill
Scenario 2 – Middle / Bench Dredge (5,200 CY removed)	• Large volume gain • Maintain some native plant species • More favorable to permitting	$1.2 million	~33% gain +40 years to infill
Scenario 3 – Full Organics Dredge (2,800 CY removed)	• Small volume gain • Remove all plant species • Less favorable to permitting	$700,000	~17% gain +35 years to infill
Scenario 4 – Inlet Dredge (1,000 CY removed)	• Very small volume gain • Maintain some native plant species • More favorable to permitting	$350,000	~5% gain +32 years to infill

In conclusion, this “forebay” fills in rapidly but is providing considerable protection to Harris Pond. CEI recommends that Pennichuck initiate dredging of the inlets only and it should be done within 10 years. Other options, such as aeration, could be considered to slow the infill rate but these were not reviewed here.

1.0 Introduction

Tinker Pond is a pond located in Nashua, NH adjacent to Tinker Road and Everett Turnpike. The pond serves as a stormwater treatment system for runoff from nearby roadway, residential and commercial areas before it enters Harris Pond and the Pennichuck Brook drinking water system. Over the years, sediment and aquatic plant die-off has accumulated at the bottom of Tinker Pond and phosphorus loading has increased resulting in algal blooms, which could potentially lead to other water quality issues such as cyanobacteria. CEI has been contracted by Pennichuck Water Works to perform a dredging feasibility study for Tinker Pond. The sediment and nutrient loading affect the pond's efficiency to treat stormwater before it enters the Pennichuck drinking water supply through Harris Pond. Therefore, dredging of the pond was evaluated as a way to increase the pond's treatment efficiency, and remove excessive sediment, vegetation and nutrient sources.

2.0 Project Background, Scope & Need

2.1 Project Background

Tinker Pond is a relatively small and shallow pond. It occupies approximately 2.01 acres (87,400 square feet) and has a volume of approximately 10,320 cubic yards (2,084,372 gallons) under its current conditions. Currently, the majority of the pond has an average depth of 3-4 feet, with the deepest point currently being 5-6 feet deep. Past bathymetry mapping, which was completed in 2005, showed that the average depth was 5-7 feet with the deepest section being close to 10 feet. The pond is part of the Pennichuck Brook watershed as it discharges to Harris Pond through a 36-inch diameter pipe under Tinker Road. The Harris Pond subwatershed comprises of approximately 150 acres, consisting of parts of Everett Turnpike, commercial parking lots and large residential areas. Tinker pond acts as a detention pond for stormwater runoff before discharging into a Harris Pond tributary and the Pennichuck water supply.

Between 2010 and 2011, Pennichuck completed several retrofits to Tinker Pond to improve storage and stormwater treatment. This work including the installation of an outlet control structure, which raised the water level that the pond would ultimately spill over and into the pre-existing discharge pipe to Harris Pond. The work also included modifications to existing inlets to the pond. One inlet was retrofitted with a large pre-treatment forebay to capture sediment from a large residential portion of the watershed. Two other inlets were retrofitted with diversion devices that forced water entering the pond to flow parallel to the shoreline rather than perpendicular. These retrofits were designed to improve settling time and create circulation in the pond that would cause flows to mimic water movement similar to round treatment settling tanks. This redirection was intended to allow sediment from highway runoff to settle at two easily accessible locations along the shoreline. During peak efficiency, Tinker Pond was estimated to remove approximately 70 pounds of phosphorus and approximately 140,000 pounds of sediment each year.

Historically, Tinker Pond has experienced a build-up of sediments and pollution due to stormwater runoff from Tinker Road and Everett Turnpike. The stormwater runoff transports both sediment and nutrients into the pond creating algal blooms and reducing the efficiency of the detention pond. Aerial imagery of Tinker Pond collected using sUAS Small Unmanned Aircraft Systems during the summer of 2017 showed that the pond was potentially experiencing a bloom of cyanobacteria and other algae and had a significant amount of aquatic vegetation, including the growth of water lilies. This observation of algae was made through visual observation of the aerial imagery, however, no testing was completed to confirm the type of algae bloom following the visual observation. The shallow depths of the pond, dense aquatic vegetative growth and the build-up of sediment and nutrients affects the ability of the pond to treat water before discharging into Harris Pond. If Tinker Pond's efficiency is adversely affected, there is a potential for contaminants in Tinker Pond to spill over into Harris Pond.

2.2 Project Scope

Initially, a scope of work was created to perform a feasibility study to address these issue. The scope of work included two tasks. The first task involved Pond bathymetry and sediment mapping, while the second task involved performing the dredging feasibility study. As part of the first task, fieldwork was performed in order to map sediment within Tinker Pond and detail the bathymetry of the Pond.

CEI collected and tested water samples for total phosphorus content, pH levels and total suspended solids (TSS) to determine the current water quality state of the pond and to develop of baseline for water quality in the pond going forward.

CEI also collected screening-level sediment samples to determine potential options and costs for dredged material disposal and/or reuse. The second task involved researching dredging options, logistics and estimated costs associated with dredging Tinker Pond under different volumes.

2.3 Project Need - Water Sample Results

Two water samples were collected and sent to ChemServe in Milford, NH for testing for total phosphorus, TSS and pH. The complete laboratory chemical analysis report produced by ChemServe Environmental Analytics for the 2018 water samples is included in **Appendix A**. At the time of sampling, there was no apparent algae bloom, however, sampling was completed during a time of the season where algae blooms are most likely and sampling results are highly representative of the worst water quality in the pond. There is no baseline standard comparison for these results that would impact dredge feasibility, rather, the results were used to indicate the severity of water pollution. The results from the water sample testing are summarized in **Table 1** below:

Table 1: Water Sample Results Summary

Parameter	Result
Total Phosphorus	0.353 mg/L
Total Suspended Solids (TSS)	785 mg/L
pH	6.25

The Trophic State Index (Carlson, 1977) or Trophic Class is a classification system designed to rate bodies of water based on the amount of biological activity they can sustain without having a negative impact or change in trophic state., The quantities of nitrogen, phosphorus, and other biologically useful nutrients are the primary determinants of a body of water's Trophic State Index (TSI). In fresh water, phosphorus tends to be the limiting resources in standing water bodies, so increased concentrations tend to result in increased plant growth, followed by increases in subsequent trophic levels and eventually potential harmful algal blooms. Although the term "trophic index" is commonly applied to lakes, any surface body of water may be indexed. Eutrophic waterbodies are typically defined as having phosphorus levels 24 and 96 ppb or micrograms per liter and a TSI between 50 and 70. Highly eutrophic or Hypereutrophic waterbodies are typically defined by having total phosphorus levels in excess of 100 or between 96 and up to 380 ppb or micrograms per liter. Based on this classification, the phosphorus levels in Tinker Pond are in excess of 350 ppb or micrograms per liter. At the time of sampling, the pond was likely in a Hypereutrophic state. Additionally, the level of TSS at 785,000 ppb is excessively high for a waterbody.

Based on these results, it is apparent that Tinker Pond has very poor water quality and it is highly likely that the pond has very low dissolved oxygen levels and very high potential for harmful algal or cyanobacteria blooms to occur during hot summer months. Due to Tinker Pond's close proximity to Harris Pond and the intake to the Pennichuck drinking water supply, options to improve treatment in Tinker Pond should be explored and ensure the Pond is working at peak efficiency.

3.0 Sediment Mapping & Infill Volume Estimates

3.1 Mapping

As part of the current sediment and bathymetry mapping effort (Task 1), CEI used a combination of GPS points and hand measurements taken during the summer of 2018. To obtain the water depths down to the top of sediment, CEI field personnel attached a Garmin Model GPSMAP 531S sonar unit to the side of a skiff and traversed the length of Tinker Pond. The Garmin has sonar capabilities that typically track the depth down to the pond bottom but with the dense aquatic vegetation, this function could not be readily calibrated. Instead, the Garmin was used to take a GPS point (latitude and longitude) as the boat traversed the length of the pond. At those

GPS points, physical hand measurements of the depth down to the top of sediment were taken. These hand measurements were compared to sonar data as part of a QA/QC data check. The GPS points and depths were then imported into AutoCAD software known as Civil 3D as X, Y and Z data points. In order to develop bathymetric contours within the pond, a known datum elevation was used based on benchmarks from a previously installed outlet structure.

The current bathymetry map details the various shallow depths around the pond. Bathymetry and sediment mapping of the pond was also completed in 2005 using similar methods (GPs and hand measurements) without the use of the sonar unit. The 2018 bathymetry of Tinker pond was compared to the original pond bathymetry from 2005 in order to interpolate how much sediment has accumulated over an approximate 13 year period, and to evaluate how quickly the remaining pond may fill in. The 2018 and 2005 bathymetric maps are provided in **Appendix B**.

3.2 Accumulation, Available Water Volumes and Infill

In order to estimate the amount of sediment accumulation between 2005 and 2018, various three dimensional surfaces and bathymetries were created in Autodesk Civil 3D software from the collected X, Y and Z depth data. The following 3 dimensional surfaces were created:

- Maximum water level surface based on installation of outlet control structure (elev. 171')
- Normal water level surface in 2018
- Bathymetry in 2018
- Normal water level surface in 2005 (prior to outlet structure installation)
- Bathymetry in 2005

Civil 3D software allows the user to calculate volumetric differences between two created three dimensional surfaces. These methods were used to calculate:

- Sediment accumulation over 13 year period (between 2005 and 2018)
- Water volume storage in 2018
- Water volume storage in 2005

The bathymetry created for the conditions of Tinker Pond in 2018 was compared to the original bathymetry of the pond. The lowest elevation of the pond in 2005 was approximately 160.0', while the lowest elevation of the pond was 163.5' in 2018. It was estimated that approximately 3.5 feet of sediment has accumulated over that 13 year period at the deepest spot. It appears that the normal water level in 2005 prior to 2011 retrofit was approximately 166-167' while in 2018 water levels were approximately 168' during the time of field measurements. These water levels were used to normalize depth measurements taken in both 2005 and 2018 to the spillway datum that was installed in 2011 and to confirm potential water volumes at different times. However, of the purposes and comparing water volumes and storage for this report, all analyzes was normalized to the maximum outlet structure water level of 171'.

Once the field measurements were normalized, the thickness of sediment was determined, the total volume of sediment accumulation was estimated and remaining volumes of water in the pond were calculated. This data was also used to determine the maximum potential amount of dredged material that could theoretically be removed under different dredge scenarios to re-establish 2005 pond depths..

Calculation were made assuming that the maximum surface water elevation was 171'. This was determined by creating a flat surface at 171' in Civil 3D software and comparing it to the 2005 and 2018 bathymetries. The surfaces from 2018 and 2005 depict how much volume of water the pond can store at those times up to this maximum 171' water level.

From these calculations, it appears that the pond, in its current state, has accumulated approximately 6,800 cubic yards of sediment and has lost 30% of its maximum storage volume based on this accumulation. Based on this 6,800 CY accumulation normalized over 13 years, it appears the pond seems to be infilling at an approximate rate of 523 cubic yards per year (2.3% per year of the pond's total volume in 2005). It is likely as the pond fills in more and excessive vegetation growth and die off rates increase, this infill rate could increase over time as well.

At this rate and if the pond were left untouched, it could potential fill in up to elevation 168' (normal pool) in 20 years (10,320 CY/523 CY) and completely fill in to its maximum level in approximately 30 years (15,750 CY / 523 CY).

As noted, this infill and loss of water volume adversely affects Tinker Pond's efficiency at treating stormwater runoff and removing sediment and nutrients before it enters into Harris Pond. It also impacts the size storm that can be adequately stored or treated based on the water volume loss causing the pond to eventually spill more often into Harris Pond. Calculated accumulated sediment volumes and available water volumes are summarized in the **Table 2** below:

Table 2: Pond Volumes & Infill Estimates

Results	
13 year sediment accumulation	6,800 CY
2018 water volume from 2018 sediment bathymetry to mean water elevation (elevation 168')	10,320 CY
2018 maximum water volume storage (elevation 171')	15,740 CY
2005 maximum water storage volume (elevation 171')	22,540 CY (30% of original storage volume filled with sediment)

4.0 Sediment Sampling/Screening Results

Upon completion of the bathymetry and sediment mapping, CEI field personnel obtained sediment samples for evaluation of chemical constituents analyzed by a certified testing laboratory.

Several Screening-level sediment samples were taken at different points in Tinker Pond using a Russian Peat Core Sampler. The sampler was driven into the sediment at the bottom of the pond, and each core was extracted which was mixed and composited into one screening-level sediment sample that was placed in sample containers and sent to a certified laboratory for analysis. Sediment sample containers were sent to ChemServe in Milford, NH for testing. The sampled sediment was tested for metals, total phosphorus, volatile organic compounds (VOC), poly aromatic hydrocarbons (PAH) and triphenylformazan (TPF).

4.1 Dredged Sediment - Material Standards & Comparison Analysis

The composite sample was analyzed for several chemical constituents that were compared to the New Hampshire Department of Environmental Services (NHDES) Regulated Contaminants for Soil Remediation (Env-Or 606.19, Table 600-2 in the New Hampshire Code of Administrative Rules) and Environmental Protection Agency (EPA) Residential Soil Regional Screening Levels (RSL). The NH standards were used to compare options for composited dredged sediment handling and re-use versus lined landfill disposal The EPA RSLs were used to assess the level of risk for potential re-use on residential land if the sediment results were not in excess of any of the NH Soil Remediation Standards.

If levels from the composite samples were non-detect or below both the NH standard and any of the EPA RSLs, it is highly likely that the material could be re-used on-site in accordance with NHDES rules and regulations. In this case, NHDES would still need to review sample results and re-use on-site would be pending based on coordination and approval by NHDES during preparation of the dredge/sampling plans.

If levels exceed Federal Residential Soil RSL Standards, but fell below State Soil Remediation Standards, the material may be re-used on-site pending NHDES approval, however there may be a higher risk and chance that NHDES would not allow onsite re-use in a residential location which could potentially result in the material being sent to a landfill for daily cover. However, re-use options would be reviewed by the NHDES Waste Management Division and depending on the potential re-use location and type of proposed cover (e.g. lawn, pavement, concrete), sediment may still potentially be re-used onsite nearby. This could impact re-use versus daily cover in a landfill options as the costs associated with covering material with clean fill or pavement may out-weigh the hauling and tipping fees if used as daily cover at a landfill.

If any levels from any of the sampling exceeded State Soil Remediation Standards, the material may be considered “contaminated”, however, could still potentially be managed on-site if it meets site specific standards by Waste Management Division, or NHDES may allow contaminated soil to be isolated and treated/disposed of off-site potentially to a lined landfill (authorized treatment or disposal facility) separately and the rest of the non-contaminated soil

could be re-used on-site. Even if the on-site management option is allowed, the requirements would be more stringent and costly, however, would still be less expensive than the costs associated with disposal at a hazardous lined landfill.

Sample results and comparisons are summarized in Section 4.2 and in **Table 3**. Based on those comparisons, options are summarized in Section 5.

In addition to chemical make-up of dredged material, physical parameters were also evaluated to determine both disposal and dredge method feasibility. Even though there are no state or federal standard controlling the dredged material handling based on physical condition, the general consistency, organic content, gradation and moisture content can effect laboratory testing results and recommendations for dredge methods / handling.

Generally, sediment with higher organic content are more likely to absorb pollutants and chemicals and may result in higher relative concentrations of these chemicals compared to more granular, well drained material. Additionally, these higher organic materials hold more moisture and thereby have higher volumetric / density variability, which can also impact the overall concentration of chemical constituents. Materials with higher organic content may also reduce in volume so much when dried, that laboratory detection equipment may not be able to test down to a low enough level to compare to a given standard, even if a sample bottle is completely filled. In these cases, it is not certain how the material can be handled and additional testing may be required. For purposes of this report, if laboratory results are unknown based on low detection limits it would result in using the next worst case standard and resulting scenario for disposal. However, the potential for exceedances of any chemical compound based on a low detection limit should always be reviewed for the likeness based on the absence or presence of other similar compounds or materials from known feasible sources. This would be completed during the dredge plan and NHDES Waste Management Bureau would evaluate each case to determine the ultimate disposal and re-use location.

The physical properties of the encountered dredge material are described in Section 4.3 below. The impacts of these physical properties are provided in Section 6 and 7.

4.2 Sediment Samples – Chemical Screening Results

Table 3 below provides the sediment sample results in the far right column and these are to be compared to both the NH Remediation Standard in the far left column and the EPA RSLs listed in the two middle columns. As shown in the table below, the sediment results within Tinker Pond did not exceed any of the soil NH Soil Remediation Standards. However, some of the sediment parameter results did exceed the EPA residential soil RSLs. In these cases, the result in the right hand column has an asterisk "*" next to it. Concentrations with a "<" symbol represent the laboratory detection limit for a particular constituent. Bold numbers represent concentrations that were above laboratory detection limits, however did not exceed any standards or RSLs. Numbers highlighted in yellow represent concentrations in which the laboratory detection limit itself is higher than the soil remediation standard, residential soil RSL, or both. In these cases, the detection limit is not low enough to determine whether a concentration level above the soil remediation

standard or residential soil RSL has occurred and if similar results take place during the actual dredge/sampling process, additional evaluation and or testing would be required.

Table 3: Sediment Sample Results Summary

Sample ID:	**Soil Remediation Standard (Env-Or 606.19)**	**EPA Residential Soil RSL**		**Tinker Pond Sediment**
Lab Sample ID:		**Carcinogenic SL TR = 1*10-6**	**Non-carcinogenic SL Child THQ = 1**	**19020214**
Sample Date:				**2/20/2019**
Metals (mg/kg)				
Cadmium	33	2100	71	<0.411
Chromium (III)	1000	---	120000	**10.2**
Chromium (VI)	130	0.3	230	10.2*
Lead	400	---	400	**24.5**
Mercury	7	---	11	<0.02
Nickel	400	15000	1500	**24.5**
Selenium	180	---	390	<4.11
Silver	89	---	390	<0.411
Zinc	1000	---	23000	**173**
Total Petroleum Hydrocarbons (TPH) (mg/kg)				
Total Petroleum Hydrocarbons	10000	---	---	< 50
TPH as Diesel	10000	---	---	< 50
TPH as Lube Oil	10000	---	---	**84**
Semi-Volatile Organic Compounds (mg/kg)				
Acenaphthene	340	---	3600	<0.160
Acenaphthylene	490	---	---	<0.160
Anthracene	1000	---	18000	<0.160
Benzo(a)anthracene	1	1.1	---	<0.160
Benzo(a)pyrene	0.7	0.11	18	<0.160
Benzo(b)fluoranthene	1	1.1	---	**0.230**
Benzo(k)fluoranthene	12	11	---	<0.160
Chrysene	120	110	---	**0.200**
Dibenzo(a,h)anthracene	0.7	0.11	---	<0.160
Fluoranthene	960	---	2400	**0.420**
Fluorene	77	---	2400	<0.160
Indeno(1,2,3-cd)pyrene	1	1.1	---	<0.160
Methylnaphthalene, 2-	96	---	240	<0.160
Naphthalene	5	3.8	130	<0.039
Pyrene	720	---	1800	**0.37**
Volatile Organic Compounds (mg/kg)				
Acetone	75	---	61000	<0.490
Acrylonitrile	0.5	0.25	16	<0.190
Benzene	0.3	1.2	82	<0.039
Bromodichloromethane	0.1	0.29	1600	<0.023
Bromoform	0.1	19	1600	<0.039
Bromomethane	0.3	---	6.8	<0.078
Butylbenzene, n-	110	---	3900	<0.039
Butylbenzene, sec-	130	---	7800	<0.039
Butylbenzene, tert-	100	---	7800	<0.039

Carbon disulfide	460	---	770	<0.039
Carbon tetrachloride	12	0.65	100	<0.039
Chloromethane	3	---	110	<0.120
Chlorotoluene, 2 (o)	15	---	1600	<0.039
Chlorotoluene, 4 (p)	680	---	1600	<0.039
Volatile Organic Compounds (mg/kg)				
Dibromochloromethane	1	8.3	1600	<0.039
Dibromochloropropane	0.1	0.01	4.7	<0.039
Dichlorobenzene, 1,2- (o-DCB)	88	---	1800	<0.039
Dichlorobenzene, 1,3- (m-DCB)	150	---	---	<0.039
Dichlorobenzene, 1,4- (p-DCB)	7	2.6	3400	<0.039
Dichlorodifluoromethane	1000	---	87	<0.039
Dichloroethane, 1,1-	3	3.6	16000	<0.039
Dichloroethane, 1,2-	0.1	0.46	31	<0.039
Dichloroethylene, 1,1-	14	---	230	<0.039
Dichloroethylene, trans-1,2-	9	---	1600	<0.039
Dichloromethane (Methylene chloride)	0.1	57	350	<0.190
Dichloropropane, 1,2-	0.1	2.5	16	<0.039
Dichloropropene, 1,3-	0.1	1.8	72	<0.039
Diethyl ether	3900	---	16000	<0.039
Diisopropyl ether (DIPE)	10	---	2200	<0.039
Ethyl tert butyl ether (ETBE)	0.7	---	---	<0.039
Ethylbenzene	120	5.8	3400	<0.039
Ethylene dibromide	0.1	0.04	73	<0.039
Hexachlorobutadiene	17	1.2	78	<0.078
Isopropyl benzene	330	---	1900	<0.039
Methyl ethyl ketone (MEK)	51	---	27000	<0.039
Methyl isobutyl ketone (MIBK)	29	---	33000	<0.039
Methyl tert butyl ether (MTBE)	0.2	47	15000	<0.039
Monochlorobenzene	6	---	280	<0.039
Naphthalene	5	3.8	130	<0.039
Propyl benzene, n-	85	---	3800	<0.039
Styrene	17	---	6000	<0.039
Tertiary amyl methyl ether (TAME)	3	---	---	<0.039
Tertiary butyl alcohol (TBA)	2	---	---	<0.039
Tetrachloroethane, 1,1,1,2-	0.8	2	2300	<0.039
Tetrachloroethane, 1,1,2,2,-	4	0.6	1600	<0.019
Tetrachloroethylene (PCE)	2	24	81	<0.039
Toluene	100	---	4900	<0.039
Trichlorobenzene, 1,2,4-	19	24	58	<0.039
Trichloroethane, 1,1,1-	78	---	8100	<0.039
Trichloroethane, 1,1,2-	0.1	1.1	1.5	<0.039
Trichloroethylene (TCE)	0.8	0.94	4.1	<0.039
Trichlorofluoromethane	1000	---	23000	<0.039
Trichloromethane (Chloroform)	3	0.32	200	<0.039
Trichloropropane, 1,2,3-	0.1	0.01	4.8	<0.039
Trimethylbenzene, 1,2,4	130	---	300	<0.039
Trimethylbenzene, 1,3,5	96	---	270	<0.039
Vinyl chloride	1	0.06	70	<0.039
Xylenes (mixed isomers)	500	---	580	<0.039

These results are used to determine reuse or disposal options based on rules and regulations listed in section 5. These are screening level samples only and additional samples taken throughout the pond will be warranted based on what dredge scenario is selected as a viable option in the future. The complete laboratory chemical analysis report produced by ChemServe Environmental Analytics for the 2018 samples and the Env-Or 606.19, Table 600-2 is included in **Appendix C**.

4.3 Sediment Samples - Physical Condition

The encountered sediment consisted of a sludge-like top layer of organic material that was approximately 18" thick. This layer was compact and very hard to penetrate with the core samplers. The material was highly organic with high moisture content and was indicative of excessive plant die-off associated with highly eutrophic waterbodies. Underneath this 18" thick layer of sludge-like organic material was coarse fine sand. The core samples extended approximately 12-inches into this underlying sand layer, however it is unknown how thick this layer is. Similar material has been observed in the sediment forebay that was installed as part of the 2010/2011 retrofits. This material is indicative of sediment accumulations associated with stormwater runoff and winter sanding activities contributed from both the adjacent highway and commercial / residential land uses.

The physical properties of these different materials can impact dredge methods, handling, disposal and duration of the dredging effort. The organic material can more easily removed using pneumatic methods as the material will be more liquid. The sandy material could be removed pneumatically, but mechanical methods may be more cost effective. This material may take a longer time to dewater and may need additional dewatering equipment to allow for transport. The sandy material will be self-draining and would drain much quicker and less costly to dewater. As noted above, the organic soil would have higher volumetric and density fluctuations and once dewatered would be very lightweight, reducing overall transport and disposal costs. Sandy material will not hold as much water and will not reduce in volume or density once dried for transport or re-use resulting in higher costs. The impacts of these physical factors are described in more detail in Section 6 and were used to select the recommended dredging methods and plan.

5.0 Disposal Rules, Regulations and Options

5.1 Rules and Regulations

According to Env-Or 611 in the New Hampshire Code of Administrative Rules, there are two types of contaminated soil as defined by the following:

- Non-hazardous oil-contaminated soil (NCOS) – soil that is contaminated with oil; soil that is not a hazardous waste as defined by RSA 147-B: 2, VII; and, soil that is certified as NCOS in accordance to Env-Or 611.03.

- Non-hazardous contaminated soil (NCS) – soil that contains a regulated contaminant; soil that is not a hazardous waste as defined by RSA 147-B: 2, VII; and, soil that cannot be certified as an NCOS in accordance to Env-Or 611.03.

According to the data (**Table 3**), the Tinker Pond dredge material is not contaminated with oil since TPH was detected as lube Oil but well below standards. The soil does contain regulated contaminants over laboratory detection limits including chromium (III), lead, nickel, zinc, TPH as Lube Oil, Benzo(b)fluoranthene, Chrysene, Fluoranthene and Pyrene. However, metals are commonly found in natural soils and not necessarily indicative of a release of hazardous material. The concentrations also do not exceed the NH soil remediation standards or EPA residential soil RSLs. Chromium (VI) levels were below the NH Soil Remediation Standard, but above EPA RSL (carcinogenic) and this level could potentially impact where material is re-used and what type of cover may be required. This would depend on a risk assessment by NHDES, in particular if the re-use location was identified in any residentially zoned properties. This would be something to discuss when coordinating with NHDES about the dredge/sampling plan.

Additionally, the laboratory detection limit for two compounds, including Dibromochloropropane and Trichloropropane, 1,2,3-, were higher than the associated NH Soil remediation standard and the EPA residential soil RSLs. In this case, the potential presence was evaluated based on the presence of other similar compounds and it is not likely that these constituents would exist in large quantities above the standards that would impact re-use or disposal options for all of the sediment. In the worst case, the material would be separated and re-evaluated for disposal options at a lined land-fill. These results would most likely require re-sampling during the dredge planning process and the NHDES Waste Management Division would need to identify potential risks associated with any on-site reuse or landfill disposal.

Based on the above result and for the purposes of budget planning, it is assumed that the sediment could very likely be used as daily cover at a landfill and costs / contingencies are carried for that option. This assumption should not preclude future evaluation of re-use options during dredge planning process and coordination with NHDES.

As part of dredge feasibility evaluation, NHDES Waste Management Division was also contacted about general rules for dredging and disposal. Prior to completion of any dredge project, NHDES should be coordinated with to develop a dredge plan. As part of this plan, NHDES would review dredge methods, sampling/testing frequency and disposal requirements. Sampling and testing will be required in addition to this initial sediment screening effort. Sampling frequency and testing parameters are often based on the receiving facilities pre-characterization and confirmatory sampling requirements and the plan would be based on these. However, in any case of re-use there may not be specific requirements, and sampling procedures would have to be planned and coordinated with NHDES prior to acceptance of the dredge plan. NHDES requires that if re-use is proposed and the material could not be permanently stored at the site, the dredge plan would also include pre-approval of the re-use site to confirm property owner agreement, future use of the site and potential stabilization methods.

As part of this effort, NHDES noted there was flexibility in the plan to grid, sample, test and verify dredge material locations during the dredge operations. This could be completed if material is encountered that was initially screened as viable for re-use, however, additional testing shows that it does not meet re-use standards and needs to be disposed of. This subject material could be mapped, segregated and handled separately for ultimate disposal at a specific landfill, while the remaining "clean" material could be handled for re-use.

5.2 Disposal Options

Based on the screening-level sample, the dredge material can be classified as NCS that does not exceed any of the soil remediation standards in Env-Or 606.19, Table 600-2. According to Env-Or 611.06 (d), NOCS or NCS that does not exceed soil remediation standards may be left in place, reused on-site, or removed from the site to an authorized treatment or disposal facility.

For planning purposes, options and costs for disposal should include:

1) Storing / re-use of material onsite with approval by NHDES Waste Management Division;
2) Re-use in a landfill as daily cover;
3) Disposing in a lined landfill as contaminated or hazardous material.

Costs associated with these options are approximately $15 per ton for onsite re-use and approximately $45 per ton for landfill disposal as daily cover. Disposal at a lined landfill would be the most expensive option at approximately $95 per ton. The material would be deemed contaminated or hazardous and placarded, transported and disposed of at a pre-approved accepting facility based on the specific requirements.

Based on the initial screening, the material could either be re-used on-site or as daily cover at a landfill depending on NHDES approval. For costing purposes in this report, it is assumed that all dredge materials will be used as daily cover at a landfill nearby to the pond, resulting in lower transportation costs. This option assumes the material will have relatively low volume changes once dry and will be transported to a local accepting facility. Costs and options for re-use at an upland location nearby that requires fill and which is owned by Pennichuck were also provided in **Appendix D**. However, for budget planning and contingency purposes, the landfill daily cover costs are highlighted in Section 7 below. Any re-use material would need to be covered with additional loam and seeded to stabilize the fill area. It is also recommended that any material to be re-used in an upland area should be pre-approved by NHDES and local permitting regulators.

During the dredge operation, further sampling will be required by the NHDES Waste Management Bureau. If future sampling efforts were to reveal that the dredge material did contain contaminants above the NH soil remediation standards, the following storage, re-use, and disposal guidance would apply: According to guidance for contaminated soil storage (Env-Or 611.05), Non-hazardous Oil Contaminated Soil (NOCS) or Non-hazardous Contaminated Soil (NCS) that exceeds any of the soil remediation standards in Env-Or 606.19, Table 600-2, may be temporarily stored on-site awaiting off-site disposal for a period of no longer than 4 months. The stored NOCS or NCS must be stored in a manner that prevents contact with the ground, precipitation, storm water run-off. Therefore, the temporary stockpile must be placed on top of

and covered by impermeable material, which is chemically compatible with the contamination. The temporary stockpile must only be uncovered when NCS is being added or removed for off-site disposal.

According to guidance for contaminated soil disposal and reuse (Env-Or 611.06), NOCS or NCS that exceeds any of the soil remediation standards in Env-Or 606.19, Table 600-2, shall be managed on-site if approved remedial action by the department, meets site-specific standards, or in accordance with a department-approved AUR. The NOCS or NCS must otherwise be removed from the site to an authorized treatment or disposal facility. If material is not allowed to be re-used on site and must be disposed off-site, isolated pockets of contaminated material, if approved by Waste Management Division in the dredge plan, may be handled and treated separately from material with results below soil remediation standards.

Disposal and treatment costs will ultimately vary depending on the facility and transportation logistics.

6.0 Dredge Methods, Dewatering & Handling

CEI evaluated pros and cons of several different dredge methods to select the most cost effective method for sediment removal, handling and dewatering. This evaluation included assessment of construction feasibility for the site, environmental impacts, permitting feasibility and general costs. These were used to select the most cost effective methods that best fit the site and best met the overall project goals of improving water quality and treatment characteristics of the pond. CEI reviewed the following methods:

1. Hydraulic / Pneumatic Dredge
2. Mechanical Dry Dredge
3. Mechanical Wet Dredge

A description of methods with different feasibility concerns and potential pros and cons for each method are provided in Sections 6.1 through 6.3. A description of potential permitting considerations and efforts required for each of the associated dredge methods is provided in Section 6.4. Dredge method recommendations are provided in Section 6.5.

6.1 Hydraulic / Pneumatic Dredge

Description

Hydraulic or pneumatic dredging utilizes machinery to excavate sediment and plant material from areas under water. It is a more advanced form of wet dredging where the sediment debris is agitated and then vacuumed out through a pipeline to the collection area from a floating structure or a barge. Hydraulic dredging is performed by a suction dredge that has a cutter head. Pneumatic dredging is used for sediments with higher solid contents where air pressure is used to pump the sediments out of the lake. A barge with a suction line is used to suck out the plants and sediment to a specific depth. The pond does not need to be dewatered before employing either method but should be performed during the summer months to avoid any freezing of the pump systems. The dredged

material is collected and deposited on shore, where it is staged, fully dewatered, and stored for reuse or disposal. An intermediate holding area may also be required for the dredged material because of its water content before transporting the material to be processed. Water produced from dewatering may be returned to the pond. The plant species removal is non-selective and can be performed in any season. The purpose of hydraulic or pneumatic dredging is to complete careful removal of sediment from specific dredge locations or increase accessible pond storage at specific depths for additional water supply under no drawdown. This method is usually more feasible or favorable to larger deeper waterbodies that require more careful dredge methods. Other benefits to pneumatic dredging can include careful removal of specific aquatic plant and algae growth within the pond at specific depths.

Feasibility/ Strengths/ Weaknesses

Hydraulic or pneumatic dredging is the most effective dredging method in reducing sediment levels and plant growth in deep areas or specific dredge locations to increase storage in a careful controlled method. This method is not effective when the dredge material contains large obstructions. Unlike mechanical dry or wet dredging, hydraulic or pneumatic dredging does not require a pond drawdown, which reduces turbidity and impacts on shallow organic habitats. This approach, however, requires more sophisticated, expensive equipment. The floating equipment is harder to mobilize and set up and may not be cost effective for small areas with more challenging access. Mobility of the equipment and piping can be a challenge on smaller, shallower surface waterbodies, making this a more expensive, less feasible option for this site.

Environmental Impacts

Benefits:

- No drawdown necessary;
- Better control of turbidity in smaller locations;
- Careful control of dredge locations and rooted plant protection;
- Larger access to varied depth gradients and opportunities to maintain habitat diversity without disruption during operations;
- Less impacts to wetland areas due to floating equipment and material movement methods;
- Less impacts to native terrestrial shoreline and aquatic habitats based on no drawdown and the use of floating equipment.

Detriments:

- More of a challenge when dealing with potential obstructions and unwanted material in dredged sediment which can result in higher impacts;
- Much larger temporary upland alteration of terrain associated with staging, dewatering, storage, and truck routes;
- More upland area impacts for mobilization and set up of large floating equipment into the pond.

Permitting Feasibility

- Shoreland permitting could be more stringent based on much higher upland impacts associated with dewatering and equipment;
- Wetland permitting may be more feasible due to no drawdown needed and less impacts within the waterbody associated with floating equipment and easier movement of dredged sediment;
- This methods is also favorable to wetland permitting based on the more control over dredge depths and locations compared to other non-drawdown methods such as mechanical wet dredging;
- May be more favorable for permitting in larger waterbodies or waterbodies that have higher environmental or natural habitat benefits or waterbodies that require higher levels of turbidity controls such as drinking waterbody supplies.

Time to Completion

- Permitting – one to two years depending on agency review times.
- Dredging time will vary based on the amount to be dredged, time to dewater, and reuse/disposal options as noted:
    - Pond Dewatering: 0 months;
    - Dredge & Dewatering Equipment Set-up: 1 month;
    - Dredge – 4 – 8 weeks to dredge the entire pond (approximately 6,800 CY). It is estimated that 200 - 400 CY can be dredged in a day.
    - Sediment Dewatering: 1 – 2 months. Dewatering time and temporary storage will be the limiting factor impacting duration and costs for this option;

Estimated Dredge Cost

Dredge costs will vary depending on the amount of dredge material removed and disposal/reuse option implemented. More detailed costs are provided in Section 7 under the different scenarios. Typically, for hydraulic or pneumatic dredging, and associated material processing, costs range from $10 to $40 per CY of dredged material removed. Based on the limited space, small pond surface area and challenging access, the costs for pneumatic dredging would be closer to the $30 or more per CY for this site.

6.2 Mechanical Dry Dredge

Description

Mechanical dry dredging involves the removal of sediment and plant material using standard construction equipment working in the dry once the waterbody has been drained to a specific water level. The pond is usually fully drained prior to dredging to limit the flow or turbid water downstream. Dewatering of the sediment is normally completed by allowing the material to drain first prior to removal, this often limits the amount of sediment dewatering time needed once dredging activities begin. It is usually performed by building temporary access roads to the dredge

locations and using excavators to fill haul trucks with dredged material that can be temporarily stockpiled in designated upland areas if additional dewatering is necessary. The dredged material is collected and deposited on shore, where it is staged, fully dewatered, and stored for reuse or disposal. An intermediate or temporary holding area may also be required for the dredged material because of its water content before transporting the material to be processed. Water produced from dewatering may often be filtered and returned to the pond, however, the water content would likely be much lower if the pond was drained ahead of time and dewatering time and costs would be greatly reduced. The plant species removal is non-selective and can be performed in any season. The purpose of dry dredging is to complete careful removal of sediment from specific dredge locations, to completely return a pond to its pre-sedimentation conditions or increase accessible pond storage for additional water supply at a cheaper cost under a complete drawdown condition. This method is usually more feasible or favorable to smaller, shallower waterbodies, however, can be cost effectively completed on larger waterbodies depending on the permitting and drawdown duration limitations. Other benefits to mechanical dry dredging includes careful removal of aquatic plants at specific depths and control of algae growth within the pond by dewatering, drying and skimming of top layers of sediment.

Feasibility/ Strengths/ Weaknesses

Mechanical dry dredging is an effective dredging method in reducing sediment levels and plant growth in specific shallow areas or to increase active storage for small waterbodies in a more controlled method. This method is effective when the dredge material contains large obstructions and it is easier to avoid obstacles. It can be a challenge and may not be as feasible in deeper or larger waterbodies that cannot be adequately drained of water in a reasonable timeframe. This dredging approach also typically requires the least amount of preparation and is typically the cheapest dredging approach, however, this method would may allow for proper dredging in deeper areas or areas that do not drain due to groundwater levels. Typically this method is completed during dry times, but additional stormwater management, erosion controls, flood controls and special water handling methods maybe needed to maintain the drawdown levels and to protect construction equipment and labor. This option typically requires less downstream controls and turbidity curtains thus has less potential environmental impacts associated with turbidity and potential releases to downstream receiving waterbodies. However, this methods can have a higher environmental impact on aquatic plant and animal life that may rely on higher water levels.

Environmental Impacts

<u>Benefits</u>:

- Full drawdown necessary;
- Better control of turbidity in smaller locations;
- Better control of dredge locations and rooted plant protection;
- Easier avoidance of obstructions and removal of unwanted material in dredged sediment, resulting in less potential impacts;
- Larger access to varied depth gradients and opportunities to maintain habitat diversity without disruption during operations;

- Smaller temporary upland alteration of terrain from staging, dewatering, storage, and truck routes compared to hydraulic methods;
- Less upland impacts associated with dewatering activities, sometimes no additional dewatering or temporary storage is needed.

Detriments:

- More wetland impact based on drawdown and equipment access into waterbody;
- Higher stormwater management requirements, flood control and special water handling needed during dredge operations;
- Higher impact on aquatic species and habitats during drawdown;

Permitting Feasibility

- Shoreland permitting could be less stringent based on less upland impacts;
- Wetland permitting could be a challenge due to drawdown and increased impacts within the waterbody based on equipment access. These impacts could be balanced with better control of dredge locations and easier protection of un-touched areas.
- May be more feasible for permitting in smaller waterbodies or waterbodies with less environmental or natural habitat benefits.

Time to Completion

- Permitting – one to two years depending on agency review times.
- Dredging time will vary based on the amount to be dredged, time to dewater, and reuse/disposal options as noted:
    - Pond Dewatering: 1-2 months;
    - Dredge & Dewatering Equipment Set-up: 1 week or less;
    - Dredge – 2 to 4 weeks to dredge the entire pond (approximately 6,800 CY). It is estimated that 500 – 800 CY can be dredged in a day depending on the size of excavation equipment and number of haul trucks;
    - Sediment Dewatering: 0 to 2 weeks. Dewatering time and temporary storage may not be necessary and would be minimal to not impact duration and costs for this option.

Estimated Dredge Cost

Dredge costs will vary depending on the amount of dredge material removed and disposal/reuse option implemented. More detailed costs are provided in Section 7 under the different scenarios. Typically, for dry mechanical dredging, and associated material handling, costs range from $5 to $20 per CY of dredged material removed depending on the size and number of equipment and if additional dewatering is needed. The less times that the material needs to be handled, the cheaper the cost. Based on the smaller footprint and relatively coarse / well drained material type associated with the bottom dredge material, the costs for mechanical dry dredging would be closer to the $10

or more per CY for this site and this would likely be the cheapest dredging method option of the alternatives evaluated.

6.3 Mechanical Wet Dredge

Description

Mechanical wet dredging involves the removal of sediment and plant material using larger non-standard construction that works from the shoreline during no or partial drawdown of water levels. It is usually performed by scraping and removing sediment and plant material with a clamshell, long-reach excavator, bucket dredge, or dragline. The water levels are usually maintained at or near normal levels or the waterbody is partially drained to a predetermined level prior to dredging to limit the flow or turbid water downstream. The dredged material is collected and deposited on shore, where it is staged, fully dewatered, and stored for reuse or disposal. A more permanent holding area is usually required for the dredged material because of its water content before transporting the material to be processed. This can be done on any size waterbody, however, is usually most cost effective on smaller, shallower waterbodies where equipment can reach and gain access to dredge areas from the shoreline.

Mechanical wet dredging can also be completed on floating equipment to gain access. This option can become more costly and slower compared to other options based on the size of the barge needed and temporary storage or handling of sediment on the barge, Often times, the material will need additional more long-term dewatering before ultimate transport of disposal and this can be sped up with the use of dewatering equipment. Water produced from dewatering may be returned to the waterbody following filtration and treatment.

There is usually less control of dredged locations and depths and plant species removal is non-selective and can be performed in any season. The most common purpose of mechanical wet dredging is to completely return a pond to its pre-sedimentation conditions or increase accessible pond storage for additional water supply at a cheaper cost with no concern for controlled removal of sediment and without the need to drawdown or control water levels. Other benefits to mechanical wet dredging includes quick removal of excessive aquatic plant material similar to aquatic plant harvesting methods and control of algae growth within the pond by complete removal of all sediment and plant material.

Feasibility/ Strengths/ Weaknesses

Mechanical wet dredging is an effective dredging method in reducing sediment levels and plant growth in large areas to increase active storage on a larger scale without the need for controlled removal. This method is somewhat cost effective when the dredge material contains large obstructions, but it can be a challenge to locate or avoid obstacles while dredging. It can be a challenge and may not be as feasible in deeper or larger waterbodies where material cannot be reached with dredge equipment. This dredging approach requires considerable set up and impacts

to shoreline areas depending on the size of dredge equipment. This method can be completed at any time of year, but is most effective during dry times. It may require a partial drawdown to access more challenging or deeper areas of dredge. This option typically requires more erosion and turbidity controls because it is done under no drawdown conditions with larger, less maneuverable equipment and could result in a higher potential for environmental impacts associated with turbidity issues and potential releases to downstream receiving waterbodies.

Environmental Impacts

Benefits:

- No or only partial drawdown necessary;
- Less overall wetland impacts based on need for drawdown and minimal equipment access into waterbody;
- Less stormwater management requirements, flood control and special water handling needed during dredge operations;
- Less impact on aquatic species and habitats based on no drawdown;

Detriments:

- More upland alteration of terrain from staging, dewatering, storage, and usage of large equipment along the shoreline;
- Higher potential upland impacts associated with sediment storage and dewatering activities;
- Impacts large areas of wetland and is less effective on selective dredging with less control of dredge locations and rooted plant protection;
- Less access to varied depth gradients and opportunities to maintain habitat diversity or habitat impacts without disruption during operations;
- Less control of turbidity and higher potential for releases;
- Smaller temporary upland alteration of terrain from staging, dewatering, storage, and truck routes compared to hydraulic methods;
- More challenging to identify or avoid obstructions and removal of unwanted material in dredged sediment, resulting in higher potential impacts;

Permitting Feasibility

- Shoreland permitting will be more stringent based on more upland impacts associated with equipment set up and dewatering;
- Wetland permitting will be less stringent due to no need for a drawdown. However, increased impacts within the waterbody would be anticipated compared to pneumatic dredge methods based on equipment type and less control over dredge locations and depths.
- This option would be more favorable for permitting in smaller waterbodies or waterbodies with less environmental or natural habitat benefits.

Time to Completion

- Permitting – one to two years depending on agency review times.
- Dredging time will vary based on the amount to be dredged, time to dewater, and reuse/disposal options as noted:
    - Pond Dewatering: 0 - 1 month depending on partial drawdown and time of year;
    - Dredge & Dewatering Equipment Set-up: 2 weeks or more;
    - Dredge – 3 to 6 weeks to dredge the entire pond (approximately 6,800 CY). It is estimated that 300 – 500 CY can be dredged in a day depending on the size of excavation equipment;
    - Sediment Dewatering: 1 month. Dewatering time and temporary storage will be the limiting factor impacting duration and costs for this option. Dewatering time should be less than pneumatic or other hydraulic methods.

Estimated Dredge Cost

Dredge costs will vary depending on the amount of dredge material removed and disposal/reuse option implemented. More detailed costs are provided in Section 7 under the different scenarios. Typically, for wet mechanical dredging, and associated material handling / dewatering, costs range from $10 to $30 per CY of dredged material removed depending on the size of equipment and size of dewatering area needed. Based on the smaller footprint and relatively coarse / well drained material type associated with the bottom dredge material, the costs for mechanical wet dredging would be closer to the $20 or more per CY for this site and would likely be the most cost effective hydraulic method for this site if a drawdown is not permissible or feasible.

6.4 Dredge Method Permit Considerations

No matter what dredge option is utilized, the permitting process for dredging will be the longest duration for planning and dredge completion. A detailed dredge and sampling plan will be required and this will be reviewed by the state and local agencies. Permitting will also likely impact recommendations for dredge locations, methods and any upland re-use options. At a minimum the following permits and reviews have been identified for this work:

- Local Conservation Commission Approval:
- U.S. Army Corp of Engineers Individual Permit
- NHDES Alteration of Terrain Permit Application (*RSA 485-A:17, Env-Wq 1500*)
- NHDES Shoreland Permit Application (*RSA 483-9, Env-Wq 1400*)
- NHDES Wetland Permit Application (*RSA 482-A, Env-Wq 100-900*)
    - U.S. Army Corps of Engineers New Hampshire Programmatic General Permit (NH PGP)
    - NH Natural Heritage Bureau (NHB) Review
    - NH Division of Historical Resources (DHR) Review
    - NH Fish and Game (FG) Review
    - Designated River Check and National Wetland Inventory Check

Associated permitting costs are approximately **$35,000 - 50,000** for this effort.

6.5 Dredge Method, Drawdown & Dewatering Recommendations

CEI recommends a mechanical wet or partial dry dredge based on the shallow depths of the pond and relatively small footprint. Drawdown requirements would determine whether a dry or wet mechanical dredge method is selected and this will likely be determined through the permitting process. Even though Tinker Pond is heavily influenced by stormwater and has become more a treatment system, there are still many natural habitats and aquatic species that would be impacted by a complete drawdown. Even though the drawdown is feasible for the relatively small footprint and infrastructure is currently in place to complete a drawdown, this option would face more permitting challenges compared to options that do not require a drawdown. A partial drawdown would balance the protection of sensitive habitats and species and allow for a more complete and accurate dry dredge. However, if permitting determines that a drawdown is not feasible,, most of the proposed dredge locations can easily be reached with larger equipment working from the shorelines.

The use of floating equipment for this site would be problematic for a hydraulic dredge and for mechanical wet dredge based on shallow depths, plant growth and limited access. Hydraulic dredging would be cost prohibitive because of the cost to maneuver large barges and dewater on a small water body. The relatively small volume of sediment would outweigh the cost effectiveness of setting up a dewatering system and mobilizing complicated floating dredge equipment.

In the case of Tinker Pond, meeting specific dredge locations and depths is not as critical to re-establish treatment volume and improve overall water column conditions. Removal of specific plant communities or dredge depths is not a critical goal for this project either, so wet dredging could better meet project intent compared to mechanical dry dredging as the need for more accurate dredge removal is not necessary.

Depending on the final selected dredge locations and depths, a partial drawdown would make the mechanical wet dredge even more feasible and help minimize turbidity issues and challenges with access. The dredge machinery could be smaller with a partial drawdown and equipment would be able to reach most locations from the shoreline or partially into the normal water line. A mechanical dredge with partial drawdown would also be beneficial due to the pond's small volume and the time required to dewater the sediment. There is minimal space to stock pile dredged materials nearby. Based on the underlying materials, most of this material would drain quickly, resulting in a shorter anticipated dewatering duration, smaller dewatering footprint, less need for additional dewatering equipment and thus, would make the mechanical wet dredge even more feasible.

A mechanical wet dredge with partial drawdown would be most feasible and cost effective option based on permitting limitations, proposed dredge quantities, dredge locations and dewatering requirements. This method would best balance dredge procedures with permitting requirements,

ecological benefits and pond conditions. This would meet the project goals of improving overall water quality and potential stormwater treatment capabilities in the pond without incurring very high costs or creating undue impacts. Dewatering equipment would not be necessary and sediment could be stockpiled in the small area between Tinker Road and the northern bank of the pond for a short duration before ultimate disposal or upland reuse.

7.0 Dredge Location / Depth Scenarios, Costs & Benefits

CEI evaluated four different dredging scenarios based on costs and benefits. The scenarios involve dredging different pond depths at different locations which result in different dredge volumes and associated costs. As noted in Section 6.4 above, all of the cost options described below assume using a minor partial drawdown and a mechanical wet dredge using equipment operating from the shoreline. Even though the highlighted costs below assumed a mechanical wet dredge, **Appendix D** also includes cost options associated with mechanical dry dredge and pneumatic dredging even though those options may not be deemed as feasible for this site. All cost scenarios listed below also assume transport and disposal of sediment to a nearby landfill location for placement as daily cover.

Offsetting scenario costs may include on-site re-use of dredged material as loam or compost, or internal hauling services, in which case a disposal or storage area would need to be identified. **Appendix D** also includes costs for an on-site upland re-use option even though this will be dependent of the final dredge plan review and approval by NHDES.

Each of the four scenarios were evaluated for costs, pros and cons. The following are the four scenarios that were evaluated with associated descriptions, costs and benefits listed below:

1. Dredge entire pond footprint down to the pond elevations measured in 2005;
2. Dredge the middle of the pond down to elevations measured in 2005 and maintain an un-touched 50-100-foot wide bench on all sides of the pond;
3. Dredge the entire pond footprint but only the top 12 to 18-inches of organic material is removed;
4. Dredge at three specific inlet locations adjacent to the shoreline down to desired water levels of approx. 24-inches to maintain adequate future storage and treatment.

Estimated costs of dredging scenarios are provided in the attached cost breakdown backup in **Appendix D** and generally include the following:

- Design, bidding and permitting;
- Mobilization, equipment, and labor;
- Construction of staging areas and access/truck routes;
- Implementation of sediment/erosion controls;
- Mechanical wet dredging procedures;
- Material processing (storage, dewatering, hauling);

- Dredged material disposal or re-use;
- Final loaming, grading, seeding.
- Sediment sampling & analysis
- Dredging management and oversight

7.1 Scenario 1 - Dredge entire pond down to 2005 elevations

In this scenario, the full pond depth would be dredged back down to the conditions seen in 2005. This would result in dredging an approximate total of 6,800 CY of material. The 2018 contours were compared to the 2005 contours to see how much volume of storage was lost over the 13 year period. The volume of storage that was lost was interpolated to be the volume of sediment that had accumulated. This was calculated through the use of surfaces in AutoCAD Civil 3D.

By dredging the full depth of sediment accumulated, the pond would have approximately 43 years of storage before it would fill up to its maximum level based on the infill rate of 523 CY/year. This would gain approximately 13 years of storage assuming the current sediment loading and infill rates remain the same. The total maximum storage of the pond would increase from approximately 15,740 CY to approximately 22,540 CY.

Based on the use of a mechanical wet dredge method under a partial drawdown and onsite re-use for dredge spoils, the total cost in this scenario could be up to $1,500,000

This scenario would be beneficial because it would gain the most amount of storage (a 43% increase from current conditions) and wouldn't require additional follow-up maintenance for an extended period of time. It also would remove the most critical section of sediment, but would also strip most of the native vegetation making the pond more susceptible to undesirable plant growth and potential poor water quality conditions. Although storage would increase greatly, this is the most costly of all of the scenarios that were evaluated. This scenario has the largest dredge depth and would require the most amount of time to complete.

7.2 Scenario 2 – Dredge middle of pond and bench down to 2005 elevations

In this scenario, a 50 to 100-foot wide bench on all sides of the pond would be maintained and a 5H:1V slope from this bench would be carried down to the deepest levels in the middle of the pond down to and near the previous 2005 deepest water depths. The bench would be intended to remain untouched at the 2018 bathymetric grades and would allow for desirable native plan growth and habitats along the shoreline. This would minimize the amount of native plant species removal during dredge and would allow the pond to recover quickly after dredging and minimize the potential for invasives or other undesirable plant growth to take over once sediments have been removed.

This would result in a dredged volume of approximately 5,100 – 5,200 CY. This volume was determined using AutoCAD profiles for 2005, 2018 and a new CAD surface based on the

proposed bench following the shoreline perimeter and the 5H:1V slope down to an approximate elevation 160.00-feet.

Dredging 5,200 CY would give the pond approximately 40 years of storage before it would fill up to its maximum level based on the infill rate of 523 CY/year. This would gain approximately 10 years of storage assuming the current sediment loading and infill rates remain the same. The total storage of the pond would increase from approximately 15,740 CY to 20,940 CY.

Based on the use of a mechanical wet dredge method under a partial drawdown and onsite re-use for dredge spoils, the total cost in this scenario could be up to $1,200,000

This scenario would still provide a 32.5% increase in storage and would provide gained storage of 10 years which is only three years less than the full depth dredge scenario. This option would be a more resilient and sustainable solution that would provide better ecological benefits that would assist in water quality improvements. It would also be more favorable to permitting due to reduced impacts and less removal of native plant material. This scenario would still be costly due to the large dredging volume and the time it would take to complete the dredging operation.

7.3 Scenario 3 - Dredge entire top organic layer over the pond footprint

In this scenario, the top 12 to 18-inches of organic material would be dredged around the entirety of the pond, resulting in a total dredged volume of approximately 2,800 CY. In order to determine the volume, the 2018 profile of Tinker Pond was used. 12-inch and an 18-inch offsets of the profile were created and the areas in between the profiles were multiplied by the total length of the pond to determine the volume of material to be dredged. The volumes for the 12-inch and 18-inch depth offsets were averaged to represent the average organic material dredged over the pond.

Dredging 2,800 CY would give the pond approximately 35 years of storage before it would fill up to its maximum level based on the infill rate of 523 CY/year. This would gain approximately 5 years of storage assuming the current sediment loading and infill rates remain the same. The total storage of the pond would increase from approximately 15,740 CY to 18,540 CY.

Based on the use of a mechanical wet dredge method under a partial drawdown and onsite re-use for dredge spoils, the total cost in this scenario could be up to $700,000

This scenario would provide a 17% increase in storage and would be the less costly compared to Scenarios 1 and 2. This scenario would require maintenance much sooner than the other scenarios because the pond's storage would only last for approximately 35 years instead of 40 or 43 years. This scenario would only remove the highly organic sediments and maintain the sandy material below which would assist in removal of phosphorus loading associated with decaying plant material which could help to improve water quality in the pond. This option may be less

favorable to the mechanical wet dredge methods since the control over dredge depths is more challenging. Similar to Scenario 1, this option would also strip most of the native vegetation making the pond more susceptible to undesirable plant growth and potential poor water quality conditions in the future. It is not clear whether an increase in depth of 18-inches over the pond area would improve conditions in the water column with the loss of most of the native plant growth and filtering abilities.

7.4 Scenario 4 - Dredge at three inlets down to 24-inches

As noted above, several of the inlets to Tinker Pond were retrofitted to improve stormwater treatment capabilities. In this scenario, very specific areas located adjacent to the shoreline and at the discharge of two of the inlet pipes would be dredged down approximately 24-inches to provide a large bowl for sediment capture. Additionally, a third bowl would be dredged at the end of the forebay and level spreader at the third inlet retrofit. This would also be completed down approximately 24-inches from the current bathymetric grade in the area. These bowls were assumed to be approximately 50 feet long by 100 feet long and this dredging effort would leave the remaining portions of the pond un-touched to minimize impacts and limit disruption of the pond.

This scenario would result in a total dredged volume of approximately 900 – 1,000 CY. In order to determine the volume, the 2018 profile of Tinker Pond was used. Specific 50 foot wide portions of the pond were selected and a 24-inch offset of the profile was created and the area in between the two profiles was multiplied by the total length of the proposed bowl to determine the volume of material to be dredged.

Dredging 900-1,000 CY would give the pond approximately 32 years of storage before it would fill up to its maximum level based on the infill rate of 523 CY/year. This would gain approximately 1 - 2 years of storage assuming the current sediment loading and infill rates remain the same. The total storage of the pond would increase from approximately 15,740 CY to 16,740 CY.

Based on the use of a mechanical wet dredge method under a partial drawdown and onsite re-use for dredge spoils, the total cost in this scenario could be up to $350,000

This scenario would provide a 5% – 6% increase in storage and would be the least costly option of the three previous scenarios. This scenario would require maintenance much sooner than the other scenarios because the pond's storage would only last for approximately 32 years instead of 40 or 43 years. It is possible that this effort may have to be repeated every 5-10 years to continually keep up with the ever increasing infill rates. Similar to Scenario 2, this option may be more favorable to permitting due to reduced impacts and could provide additional ecological and water quality benefits based on less removal of native plant material and habitats.

Table 4 below provides a summary of the four evaluated dredge location and depth scenarios with along with associated pro/cons, benefits and estimated costs. A cost breakdown for each scenario is provided in **Appendix D**.

Table 4: Dredge Volume Scenarios

Scenario	Pros / Cons	Cost	Benefits
Scenario 1 – Full Volume Dredge (6,800 CY removed)	• Largest volume gain • Remove all plant species • Less favorable to permitting	$1.5 million	~43% gain +43 years to infill
Scenario 2 – Middle / Bench Dredge (5,200 CY removed)	• Large volume gain • Maintain some native plant species • More favorable to permitting	$1.2 million	~33% gain +40 years to infill
Scenario 3 – Full Organics Dredge (2,800 CY removed)	• Small volume gain • Remove all plant species • Less favorable to permitting	$700,000	~17% gain +35 years to infill
Scenario 4 – Inlet Dredge (1,000 CY removed)	• Very small volume gain • Maintain some native plant species • More favorable to permitting	$350,000	~5% gain +32 years to infill

Appendix A
Water Sampling Laboratory Report

317 Elm Street
Milford, NH 03055

(603) 673-5440
Fax (603) 673-0366
Sales@chemservelab.com

Tuesday, September 11, 2018

Ben Lundsted
Comprehensive Environmental Inc.
21 Depot St
Merrimack NH 03054

Project Name: Tinker Pond Dredging
Project #: 131-59
Project Location: Tinker Pond, Nashua NH
Control #: 111795

Lab ID: 18080533
Date Received: 8/30/2018

Dear Ben Lundsted

Enclosed please find the laboratory results for the above referenced samples that were received by the ChemServe sample custodian on the above referenced date. Any abnormalities to the samples upon receipt would be noted on the enclosed chain of custody document. This report is not valid without a completed chain of custody with the corresponding control number, attached.

All samples analyzed by ChemServe are subject to quality standards. These standards are as stringent or more stringent than those established under NELAC, 40 CFR Part 136, state certification programs, and corresponding methodologies. ChemServe has a written QA/QC Procedures Manual that outlines these standards, and is available for your reference, upon request. Unless otherwise stated on the Chain of Custody or within the report, all holding times, preservation techniques, container types, and analytical methods are analogous with those outlined by NELAC. All units are based on “as received” weight unless denoted “dry”.

Residual chlorine, sulfite and pH are intended to be performed as an immediate field analysis. Should any of these analyses be performed in the lab instead of in the field it will result in those analyses being performed out of holding time.

I certify that I have reviewed the above referenced analytical data and state forms, and I have found this report within compliance with the procedures outlined within NELAC. ChemServe’s certified parameter list can be found at http://www.chemservelab.com/Laboratory-Information-and-Documentation.aspx

Jay Chrystal - President/Laboratory Director

Certificate Number 1008

317 Elm Street
Milford, NH 03055
(603) 673-5440
Sales@chemservelab.com

Comprehensive Environmental Inc.
Ben Lundsted
21 Depot St
Merrimack NH 03054

Control #: 111795
Project Number: 131-59
Project Name: Tinker Pond Dredging
Project Location: Tinker Pond, Nashua NH

Lab ID: 18080533
Date: 9/11/2018

Lab ID: 18080533

Sample Receiving and Comment Summary

Were samples submitted with a chain of custody?	Yes
Do all samples received match the chain of custody?	Yes
Were all samples received within applicable holding times?	No
Were all containers intact when received?	Yes
Were samples for volatile organic analysis free of headspace (per method)?	N/A
Was there evidence of cooling or were samples received on the same day as collection?	Yes
If the sample pH was not correct was it adjusted where applicable?	Yes
Were samples for dissolved metals already filtered by the client or field sampling?	N/A
Were Samples for O-phos filtered in the field?	N/A
Were samples received in the appropriate containers?	Yes
Were samples received in the appropriate containers?	Yes

Sample	Method	Client Identity	Matrix	Analyst
18080533-001	SW 8270D	Tinker Pond Sediment	Solid	PaulF

Comment: 2 fluorobiphenyl surrogate low due to matrix

Sample	Method	Client Identity	Matrix	Analyst
18080533-001	SW 8260C	Tinker Pond Sediment	Solid	LauraB

Comment: Sample diluted due to matrix.

Sample	Method	Client Identity	Matrix	Analyst
18080533-002	SM 4500-H-B	Tinker Pond Water	Wastewater	HeatherS

Comment: pH analysis performed in lab

Sample	Method	Client Identity	Matrix	Analyst
18080533-002	SM 2540D	Tinker Pond Water	Wastewater	JesseP

Comment: TSS sample contains insoluble floating algae on surface.

**** Blank comment sections denote "No Comment"***

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Comprehensive Environmental Inc.
Ben Lundsted
21 Depot St
Merrimack NH 03054

Control #: 111795
Project Number: 131-59
Project Name: Tinker Pond Dredging
Project Location: Tinker Pond, Nashua NH

Analytical Results

Lab ID: 18080533
Date: 9/11/2018

Sample	Client Sample Identity	Start Date/Time Sampled:	Matrix
18080533-002	Tinker Pond Water	8/24/2018 10:00:00 AM	Wastewater

Composite Start Date and Time 8/24/2018 10:00:00 AM **Composite End Date and Time**

Parameter	Method	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Hot Plate Digestion	EPA 200.7			8/31/2018	1	0
Phosphorous-P Total	EPA 200.7	0.535 mg/L		9/5/2018	1	0.01
Total Suspended Solids	SM 2540D	785 mg/L		8/31/2018	1	4
pH	SM 4500-H-B	6.25 units		9/4/2018	1	0

Qualifier:	Description:
B-	Method blank contaminated with target analyte.
B1-	BOD had total oxygen loss. Result reported as ">"the highest dilution.
B2-	BOD had no oxygen loss. Result reported as "<" the lowest dilution.
G-	Reporting limit elevated due to matrix interference.
H-	Method prescribed holding time exceeded.
J-	Indicates an estimated value. Value is less than the quantitation limit.
IL-	Internal Standard(s) recovery was low due to matrix. Result may be biased high.
IH-	Internal Standard(s) recovery was high due to matrix. Result may be biased low.
LH-	Laboratory control spike(s) was high. Results may be biased high.
LL-	Laboratory control spike(s) was low. Results may be biased low.
MH-	Matrix spike recovery high due to matrix. Results may be biased high.
ML-	Matrix spike recovery low due to matrix. Results may be biased low.
N-	Non-target compound. Reported as a TIC.
NC-	Spike recovery was not calculated due to the concentration of the analyte being >4 times the concentration of the spike added.
R-	RPD outside acceptable recovery limits.
RO-	Sample received out of holding time.
SH-	Surrogate recovery high due to matrix
SL-	Surrogate recovery low due to matrix
U-	BOD/CBOD blank had an oxygen depletion greater than the suggested amount of 0.200.
V-	Sample pH for analysis was not within the required range when checked at time of analysis.
Z	Too numerous to count (TNTC)

An "A" in the result column on the report indicates absent for presence/absent bacteria and a "P" indicates present for presence/absent bacteria.

Chain of Custody No. 111795
Multiple COC's Yes (No)

ChemServe ENVIRONMENTAL ANALYSTS

CHAIN OF CUSTODY

317 Elm Street Milford, NH 03055
(603) 673-5440/ Fax (603) 673-0366

A CUSTOMER INFORMATION

CUSTOMER: COMPREHENSIVE ENVIRONMENTAL INC.
ADDRESS: 21 DEPOT STREET
CITY/STATE/ZIP MERRIMACK, NH 03054
TELEPHONE: (603) 429-3584
REPORT TO: Ben Lundsted
EMAIL TO: blundsted@ceiengineers.com

B PROJECT INFORMATION

JOB NAME: TINKER POND DREDGING
JOB NUMBER: 131-59
LOCATION: TINKER POND, NASHUA, NH
INVOICE EMAIL: MKneeland@ceiengineers.com
INVOICE TO: Ben Lundsted
P.O. NUMBER:

C SAMPLE INFORMATION

TURNAROUND TIME: (CIRCLE ONE:)

(10 DAY STANDARD) RUSH (MUST BE PRE-APPROVED)

7day 5 day 4 day 3 day 2 day 1 day Same Day

MCP ☐ YES ☐ NO ☐ GWI ☐ GW2 ☐ GW3

STATION # Ⓓ	SAMPLE IDENTIFICATION & LOCATION Ⓔ	COLLECTED Ⓕ DATE	COLLECTED Ⓖ TIME	SAMPLE TYPE Ⓗ GRAB	SAMPLE TYPE Ⓗ COMP	Ⓘ MATRIX SOLID (S) GROUND WATER (G) DRINKING WATER (D) WASTE WATER (W)	Ⓙ # OF CONTAINERS	Ⓚ CONTAINER AND PRESERVATIVE Jar/None	8186A Vile	Bottle/None	Bottle/HNO3	Ⓛ ANALYSIS
	TINKER POND SEDIMENT	8/24/18	9:00am		X	S	2	1	1			PAH, TPH, Metals Tot. Phos, VOC
	TINKER POND WATER	8/24/18	10:00am	X		W	2			1	1	Tot. Phos, PH, TSS

Page 8 of 9

Ⓜ CUSTODY SAMPLER: Jeff Koloski (print name)
SIGNATURE:

	DATE	MILITARY TIME
RELINQUISHED:	8/30	10:33
RECEIVED:	8/30	10:33
RELINQUISHED:	8/30	11:20
RECEIVED FOR LAB:	8/30/18	11:20

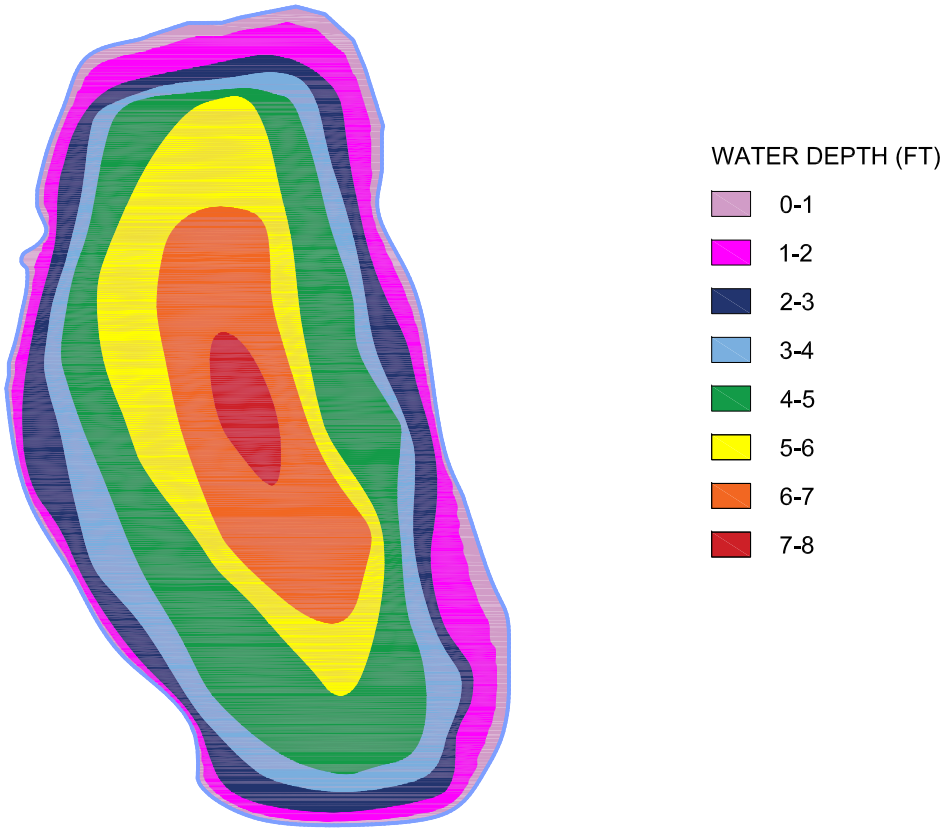
SAMPLE CHECK LIST:
RECEIVED WITHIN HOLD TIME YES OR NO
RECEIVED IN GOOD CONDITION YES OR NO
TEMP BLANK 3 °C
SHIPPED OR (HAND DELIVERED)
SAMPLES WERE PROPERLY PRESERVED (YES) NO N/A
SAMPLES WERE FILTERED IN FIELD LAB (N/A)
IF NO EXPLAIN:

GROUP # 18080533 9/7

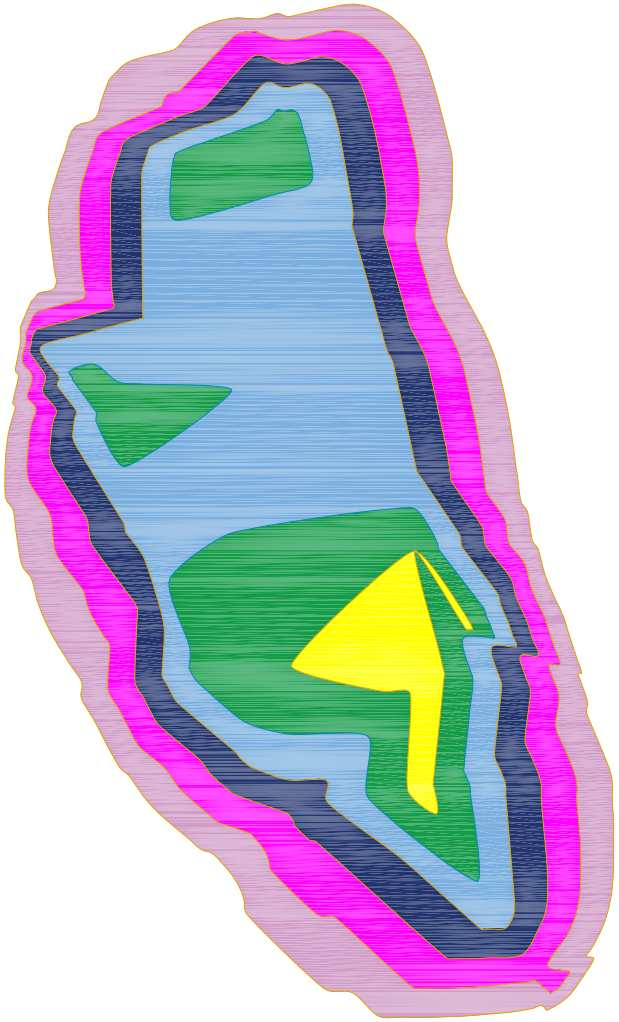
FIELD READING(S) & COMMENTS:

Appendix B
2005 & 2018 Bathymetric Maps

Tinker Pond Bathymetry 2005



Tinker Pond Bathymetry 2018



WATER DEPTH (FT)

- 0-1
- 1-2
- 2-3
- 3-4
- 4-5
- 5-6

Appendix C
Sediment Sampling Laboratory Report

317 Elm Street
Milford, NH 03055

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Fax (603) 673-0366
Sales@chemservelab.com

Friday, March 01, 2019

Ben Lundsted
Comprehensive Environmental Inc.
21 Depot St
Merrimack NH 03054

Project Name: Tinker Pond Dredging
Project #: 131-59
Project Location: Tinker Pond, Nashua NH
Control #: 115726

Lab ID: 19020214
Date Received: 2/20/2019

Dear Ben Lundsted

Enclosed please find the laboratory results for the above referenced samples that were received by the ChemServe sample custodian on the above referenced date. Any abnormalities to the samples upon receipt would be noted on the enclosed chain of custody document. This report is not valid without a completed chain of custody with the corresponding control number, attached.

All samples analyzed by ChemServe are subject to quality standards. These standards are as stringent or more stringent than those established under NELAC, 40 CFR Part 136, state certification programs, and corresponding methodologies. ChemServe has a written QA/QC Procedures Manual that outlines these standards, and is available for your reference, upon request. Unless otherwise stated on the Chain of Custody or within the report, all holding times, preservation techniques, container types, and analytical methods are analogous with those outlined by NELAC. All units are based on “as received” weight unless denoted “dry”.

Residual chlorine, sulfite and pH are intended to be performed as an immediate field analysis. Should any of these analyses be performed in the lab instead of in the field it will result in those analyses being performed out of holding time.

I certify that I have reviewed the above referenced analytical data and state forms, and I have found this report within compliance with the procedures outlined within NELAC. ChemServe’s certified parameter list can be found at http://www.chemservelab.com/Laboratory-Information-and-Documentation.aspx

Jay Chrystal - President/Laboratory Director

Certificate Number 1008

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Comprehensive Environmental Inc.
Ben Lundsted
21 Depot St
Merrimack NH 03054

Control #: 115726
Project Number: 131-59
Project Name: Tinker Pond Dredging
Project Location: Tinker Pond, Nashua NH

Lab ID: 19020214
Date: 3/1/2019

Lab ID: 19020214

Sample Receiving and Comment Summary

Were samples submitted with a chain of custody?	Yes
Do all samples received match the chain of custody?	Yes
Were all samples received within applicable holding times?	Yes
Were all containers intact when received?	Yes
Were samples for volatile organic analysis free of headspace (per method)?	N/A
Was there evidence of cooling if not submitted the same day as sampling?	Yes
If the sample pH was not correct was it adjusted where applicable?	Yes
Were samples for dissolved metals already filtered by the client or field sampling?	N/A
Were Samples for O-phos filtered in the field?	N/A
Were samples received in the appropriate containers?	Yes
Where applicable; were chemical and micro samples received at correct temps.	N/A

Sample	Method	Client Identity	Matrix	Analyst
19020214-001	SW 8260C	Tinker Pond Sediment	Solid	LauraB

Comment: Received two jars of sample for percent solid that were not consistant. Percent solid for the jar with more water content was applied; as that jar was used in the rest of the lab for analysis.

**** Blank comment sections denote "No Comment"***

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Comprehensive Environmental Inc.
Ben Lundsted
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Merrimack NH 03054

Control #: 115726
Project Number: 131-59
Project Name: Tinker Pond Dredging
Project Location: Tinker Pond, Nashua NH

Analytical Results

Lab ID: 19020214
Date: 3/1/2019

Sample	Client Sample Identity	Start Date/Time Sampled:	Matrix
19020214-001	Tinker Pond Sediment	2/20/2019 9:00:00 AM	Solid

Composite Start Date and Time 2/20/2019 9:00:00 AM **Composite End Date and Time**

Parameter	Method	Result	Qualifier	Date/Time Analyzed	RDL	Analyst
Total Solids	In House	61 %		2/21/2019	0.1	EmilyM
Hot Plate Digestion	SW 3050B			2/22/2019	0	CharleneF
Extraction 8270C	SW 3546			2/21/2019	0	EmilyM
Extraction SW 3546	SW 3546			2/21/2019	0	EmilyM
Antimony	SW 6010B	< 4.11 mg/kg dry Wt.		2/25/2019	4.11	BenN
Arsenic	SW 6010B	6.86 mg/kg dry Wt.		2/25/2019	4.11	BenN
Beryllium	SW 6010B	< 0.411 mg/kg dry Wt.		2/25/2019	0.411	BenN
Cadmium	SW 6010B	< 0.411 mg/kg dry Wt.		2/25/2019	0.411	BenN
Chromium	SW 6010B	10.2 mg/kg dry Wt.		2/25/2019	0.411	BenN
Copper	SW 6010B	13.4 mg/kg dry Wt.		2/25/2019	0.411	BenN
Lead	SW 6010B	24.5 mg/kg dry Wt.		2/25/2019	4.11	BenN
Nickel	SW 6010B	17.8 mg/kg dry Wt.		2/25/2019	0.411	BenN
Selenium	SW 6010B	< 4.11 mg/kg dry Wt.		2/25/2019	4.11	BenN
Silver	SW 6010B	< 0.411 mg/kg dry Wt.		2/25/2019	0.411	BenN
Thallium	SW 6010B	< 4.11 mg/kg dry Wt.		2/25/2019	4.11	BenN
Zinc	SW 6010B	173 mg/kg dry Wt.		2/25/2019	0.411	BenN
Phosphorous-P Total	SW 6010C	280 mg/kg dry Wt.		2/25/2019	0.821	BenN
Mercury	SW 7471A	< 0.02 mg/L		2/22/2019	0.02	BenN
Total Other Petroleum Hydrocarbons	SW 8015	< 50000 ug/kg dry Wt.		2/22/2019	50000	PaulF
TPH as Diesel	SW 8015	< 50000 ug/kg dry Wt.		2/22/2019	50000	PaulF
TPH as Lube Oil	SW 8015	84000 ug/kg dry Wt.		2/22/2019	50000	PaulF
1,1,1,2-Tetrachloroethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,1,1-Trichloroethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,1,2,2-Tetrachloroethane	SW 8260C	< 19 ug/kg dry Wt.		2/27/2019	19	LauraB
1,1,2-Trichloroethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,1-Dichloroethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,1-Dichloroethene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,1-Dichloropropene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2,3-Trichlorobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2,3-Trichloropropane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2,4-Trichlorobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2,4-Trimethylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2-Dibromo-3-Chloropropane	SW 8260C	< 78 ug/kg dry Wt.		2/27/2019	78	LauraB
1,2-Dibromoethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2-Dichlorobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2-Dichloroethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,2-Dichloropropane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,3,5-Trichlorobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB

317 Elm Street
Milford, NH 03055
(603) 673-5440
Sales@chemservelab.com

Sample	Client Sample Identity	Start Date/Time Sampled:	Matrix
19020214-001	Tinker Pond Sediment	2/20/2019 9:00:00 AM	Solid

Composite Start Date and Time 2/20/2019 9:00:00 AM **Composite End Date and Time**

Parameter	Method	Result	Qualifier	Date/Time Analyzed	RDL	Analyst
1,3,5-Trimethylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,3-Dichlorobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,3-Dichloropropane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
1,4-Dichlorobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
2,2-Dichloropropane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
2-Butanone	SW 8260C	< 490 ug/kg dry Wt.		2/27/2019	490	LauraB
2-Chlorotoluene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
2-Ethoxy-2-Methyl Propane (ETBE)	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
2-Hexanone	SW 8260C	< 490 ug/kg dry Wt.		2/27/2019	490	LauraB
2-Methoxy-2-Methyl Butane (TAME)	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
2-Methoxy-2-Methyl Propane (MTBE)	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
2-Methyl-2-Propanol (TBA)	SW 8260C	< 780 ug/kg dry Wt.		2/27/2019	780	LauraB
4-Chlorotoluene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
4-Isopropyltoluene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
4-Methyl-2-Pentanone	SW 8260C	< 390 ug/kg dry Wt.		2/27/2019	390	LauraB
Acetone	SW 8260C	< 490 ug/kg dry Wt.		2/27/2019	490	LauraB
Acrolein	SW 8260C	< 190 ug/kg dry Wt.		2/27/2019	190	LauraB
Acrylonitrile	SW 8260C	< 190 ug/kg dry Wt.		2/27/2019	190	LauraB
Benzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Bromobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Bromochloromethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Bromodichloromethane	SW 8260C	< 23 ug/kg dry Wt.		2/27/2019	23	LauraB
Bromoform	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Bromomethane	SW 8260C	< 78 ug/kg dry Wt.		2/27/2019	78	LauraB
Carbon Disulfide	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Carbon Tetrachloride	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Chlorobenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Chloroethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Chloroform	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Chloromethane	SW 8260C	< 120 ug/kg dry Wt.		2/27/2019	120	LauraB
Cis-1,2-Dichloroethene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Cis-1,3-Dichloropropene	SW 8260C	< 16 ug/kg dry Wt.		2/27/2019	16	LauraB
Dibromochloromethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Dibromomethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Dichlorodifluoromethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Diethyl Ether	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Di-Isopropyl Ether	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Ethylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Hexachlorobutadiene	SW 8260C	< 78 ug/kg dry Wt.		2/27/2019	78	LauraB
Isopropylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
M/P-Xylene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Methylene Chloride	SW 8260C	< 190 ug/kg dry Wt.		2/27/2019	190	LauraB
Naphthalene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
N-Butylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
N-Propylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB

317 Elm Street
Milford, NH 03055
(603) 673-5440
Sales@chemservelab.com

Sample	Client Sample Identity	Start Date/Time Sampled:	Matrix
19020214-001	Tinker Pond Sediment	2/20/2019 9:00:00 AM	Solid

Composite Start Date and Time 2/20/2019 9:00:00 AM **Composite End Date and Time**

Parameter	Method	Result	Qualifier	Date/Time Analyzed	RDL	Analyst
O-Xylene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Sec-Butylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Styrene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Tert-Butylbenzene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Tetrachloroethene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Tetrahydrofuran	SW 8260C	< 490 ug/kg dry Wt.		2/27/2019	490	LauraB
Toluene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Trans-1,2-Dichloroethene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Trans-1,3-Dichloropropene	SW 8260C	< 16 ug/kg dry Wt.		2/27/2019	16	LauraB
Trichloroethene	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Trichlorofluoromethane	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
Vinyl Chloride	SW 8260C	< 39 ug/kg dry Wt.		2/27/2019	39	LauraB
2-Methylnaphthalene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Acenaphthene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Acenaphthylene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Anthracene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Benzo[A]Anthracene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Benzo[A]Pyrene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Benzo[B]Fluoranthene	SW 8270D	230 ug/kg dry Wt.		2/22/2019	160	PaulF
Benzo[G,H,I]Perylene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Benzo[K]Fluoranthene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Chrysene	SW 8270D	200 ug/kg dry Wt.		2/22/2019	160	PaulF
Dibenz[A,H]Anthracene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Fluoranthene	SW 8270D	420 ug/kg dry Wt.		2/22/2019	160	PaulF
Fluorene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Indeno[1,2,3-Cd]Pyrene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Naphthalene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Phenanthrene	SW 8270D	< 160 ug/kg dry Wt.		2/22/2019	160	PaulF
Pyrene	SW 8270D	370 ug/kg dry Wt.		2/22/2019	160	PaulF

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Qualifier:	Description:
B-	Method blank contaminated with target analyte.
B1-	BOD had total oxygen loss. Result reported as ">"the highest dilution.
B2-	BOD had no oxygen loss. Result reported as "<" the lowest dilution.
G-	Reporting limit elevated due to matrix interference.
H-	Method prescribed holding time exceeded.
J-	Indicates an estimated value. Value is less than the quantitation limit.
IL-	Internal Standard(s) recovery was low due to matrix. Result may be biased high.
IH-	Internal Standard(s) recovery was high due to matrix. Result may be biased low.
LH-	Laboratory control spike(s) was high. Results may be biased high.
LL-	Laboratory control spike(s) was low. Results may be biased low.
MH-	Matrix spike recovery high due to matrix. Results may be biased high.
ML-	Matrix spike recovery low due to matrix. Results may be biased low.
N-	Non-target compound. Reported as a TIC.
NC-	Spike recovery was not calculated due to the concentration of the analyte being >4 times the concentration of the spike added.
R-	RPD outside acceptable recovery limits.
RO-	Sample received out of holding time.
SH-	Surrogate recovery high due to matrix
SL-	Surrogate recovery low due to matrix
U-	BOD/CBOD blank had an oxygen depletion greater than the suggested amount of 0.200.
V-	Sample pH for analysis was not within the required range when checked at time of analysis.
Z	Too numerous to count (TNTC)

An "A" in the result column on the report indicates absent for presence/absent bacteria and a "P" indicates present for presence/absent bacteria.

Surrogate Report

Client: Comprehensive Environmental Inc. **Order #:** 19020214

Matrix: **Solid**

Units: ug/L			Percent	Control	Surrogate	Surrogate
Sample Number	**Surrogate**	**Method**	**Recovery**	**Limits**	**Amount**	**Result**
19020214-001	4-Bromofluorobenzene	SW 8260C	91.8	70-130	20	18.36
19020214-001	Dibromofluoromethane	SW 8260C	101.55	70-130	20	20.31
19020214-001	Toluene-d8	SW 8260C	97.3	70-130	20	19.46

Units: ug/L			Percent	Control	Surrogate	Surrogate
Sample Number	**Surrogate**	**Method**	**Recovery**	**Limits**	**Amount**	**Result**
19020214-001	2-Fluorobiphenyl	SW 8270D	58.48	30-130	25	14.62
19020214-001	Nitrobenzene-d5	SW 8270D	49.08	30-130	25	12.27
19020214-001	Terphenyl-d14	SW 8270D	88.68	30-130	25	22.17

Chain of Custody No. 115726

Multiple COC's Yes (No)

ChemServe ENVIRONMENTAL ANALYSTS

CHAIN OF CUSTODY

317 Elm Street Milford, NH 03055
(603) 673-5440/ Fax (603) 673-0366

A CUSTOMER INFORMATION

CUSTOMER: Comprehensive Environmental Inc.
ADDRESS: 21 Depot Street
CITY/STATE/ZIP Merrimack, NH 03054
TELEPHONE: (603) 429-3584
REPORT TO: Ben Lundsted
EMAIL TO: blundsted@ceiengineers.com

B PROJECT INFORMATION

JOB NAME: Tinker Pond
JOB NUMBER: 131-59
LOCATION: Tinker Pond, Nashua, NH
INVOICE EMAIL: mkreeland@ceiengineers.com
INVOICE TO: Ben Lundsted
P.O. NUMBER:

C SAMPLE INFORMATION

TURNAROUND TIME: (CIRCLE ONE:)

(10 DAY STANDARD) RUSH (MUST BE PRE-APPROVED)

7day 5 day 4 day 3 day 2 day 1 day Same Day

MCP ☐ YES ☐ NO ☐ GWI ☐ GW2 ☐ GW3

STATION # (D)	SAMPLE IDENTIFICATION & LOCATION (E)	COLLECTED DATE (F)	COLLECTED TIME (G)	SAMPLE TYPE GRAB (H)	SAMPLE TYPE COMP (H)	MATRIX (I) SOLID (S) GROUND WATER (G) DRINKING WATER (D) WASTE WATER (W)	# OF CONTAINERS (J)	CONTAINER AND PRESERVATIVE (K) Jar / None	60ml VOA Vile	ANALYSIS (L)
	Tinker Pond Sediment	2/20/19	9:00AM		X	S	6	4	2	PAH, TPH, Metals, Tot. Phos, VOC (Multiple jars to make sure there is enough material Run one test for each)
		DATE	TIME							
		DATE	TIME							
		DATE	TIME							
		DATE	TIME							
		DATE	TIME							
		DATE	TIME							
		DATE	TIME							
		DATE	TIME							

M CUSTODY

SAMPLER: (print name) Nick Shaw
SIGNATURE: Nick Shaw

	DATE	MILITARY TIME
RELINQUISHED: Nick Shaw	2-20-19	1705
RECEIVED:	DATE	TIME
RELINQUISHED:	DATE	TIME
RECEIVED FOR LAB: Mel Ce	2/20/19	1050

SAMPLE CHECK LIST:

RECEIVED WITHIN HOLD TIME (YES) OR NO
RECEIVED IN GOOD CONDITION (YES) OR NO
TEMP BLANK 7.5 °C
SHIPPED OR HAND DELIVERED
SAMPLES WERE PROPERLY PRESERVED (YES) NO N/A
SAMPLES WERE FILTERED IN FIELD LAB (N/A)
IF NO EXPLAIN:

GROUP # 1902014 2-27-19

FIELD READING(S) & COMMENTS:

Appendix D
Cost Estimate Details

Scenario #1 - 6,800 cy	Amount	Unit
Volume to be Removed (**Enter Value**)	6,800.00	CY

TOWN :	Nashua, NH	
PROJECT:	Tinker Pond Dredge Study	
FILE:	131-59	5/29/2019

Tinker Dredge Cost Summary - Scenario #1 - 6,800 cy		
Mechanical Wet Dredge (Upland Re-Use)	$	1,308,000.00
Mechanical Wet Dredge (Landfill Disposal)	**$**	**1,523,000.00**
Mechanical Dry Dredge (Upland Re-Use)	$	1,146,000.00
Mechanical Dry Dredge (Landfill Disposal)	$	1,361,000.00
Hydraulic Dredge (Upland Re-Use)	$	1,469,000.00
Hydraulic Dredge (Landfill Disposal)	$	1,684,000.00

Min.	$	1,146,000.00
Max.	$	1,684,000.00
Avg.	$	1,415,166.67

ESTIMATE (Mechanical Wet Dredge - Upland Re-Use) - Scenario #1 - 6,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$154,320.78	$154,320.78	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	6800	CY	$20.00	$136,000.00	
4	CLEARING & PREP	0.52	ACRE	$8,000.00	$4,171.90	
5	DE-WATERING SEDIMENT	6800	CY	$15.00	$102,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$91,800.00	$91,800.00	
7	UPLAND REUSE TRANSPORT	9180	TON	$5.00	$45,900.00	
8	UPLAND REUSE	9180	TON	$15.00	$137,700.00	
9	STABILIZE, LOAM & SEED PILE	36720	SF	$5.00	$183,600.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	22716	SF	$2.00	$45,432.00	$771,603.90
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	
25					$0.00	
26					$0.00	

PARTICIPATING TOTAL= $1,005,924.68

SUBTOTAL= $1,005,924.68

30% CONTINGENCY= $301,777.40

TOTAL= $1,307,702.09

SAY $1,308,000.00

ESTIMATE (Mechanical Wet Dredge - Landfill Disposal) - Scenario #1 - 6,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$181,860.78	$181,860.78	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	6800	CY	$20.00	$136,000.00	
4	CLEARING & PREP	0.52	ACRE	$8,000.00	$4,171.90	
5	DE-WATERING SEDIMENT	6800	CY	$15.00	$102,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$91,800.00	$91,800.00	
7	LANDFILL TRANSPORT	9180	TON	$10.00	$91,800.00	
8	LANDFILL DISPOSAL	9180	TON	$45.00	$413,100.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	22716	SF	$2.00	$45,432.00	$909,303.90
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL= $1,171,164.68

SUBTOTAL= $1,171,164.68

30% CONTINGENCY= $351,349.40

TOTAL= $1,522,514.09

SAY $1,523,000.00

ESTIMATE (Mechanical Dry Dredge - Upland Re-Use) - Scenario #1 - 6,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$131,911.59	$131,911.59	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	6800	CY	$15.00	$102,000.00	
4	CLEARING & PREP	0.31	ACRE	$8,000.00	$2,485.95	
5	DE-WATERING SEDIMENT	6800	CY	$5.00	$34,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$91,800.00	$91,800.00	
7	UPLAND REUSE TRANSPORT	9180	TON	$5.00	$45,900.00	
8	UPLAND REUSE	9180	TON	$15.00	$137,700.00	
9	STABILIZE, LOAM & SEED PILE	36720	SF	$5.00	$183,600.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	13536	SF	$2.00	$27,072.00	$659,557.95
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$881,469.54
SUBTOTAL=	$881,469.54
30% CONTINGENCY=	$264,440.86
TOTAL=	$1,145,910.40
SAY	$1,146,000.00

ESTIMATE (Mechanical Dry Dredge - Landfill Disposal) - Scenario #1 - 6,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$159,451.59	$159,451.59	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	6800	CY	$15.00	$102,000.00	
4	CLEARING & PREP	0.31	ACRE	$8,000.00	$2,485.95	
5	DE-WATERING SEDIMENT	6800	CY	$5.00	$34,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$91,800.00	$91,800.00	
7	LANDFILL TRANSPORT	9180	TON	$10.00	$91,800.00	
8	LANDFILL DISPOSAL	9180	TON	$45.00	$413,100.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	13536	SF	$2.00	$27,072.00	$797,257.95
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$1,046,709.54
SUBTOTAL=	$1,046,709.54
30% CONTINGENCY=	$314,012.86
TOTAL=	$1,360,722.40
SAY	$1,361,000.00

ESTIMATE (Hydraulic Dredge - Upland Re-Use) - Scenario #1 - 6,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$176,623.18	$176,623.18	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	6800	CY	$30.00	$204,000.00	
4	CLEARING & PREP	0.62	ACRE	$8,000.00	$4,971.90	
5	DE-WATERING SEDIMENT	6800	CY	$20.00	$136,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$91,800.00	$91,800.00	
7	UPLAND REUSE TRANSPORT	9180	TON	$5.00	$45,900.00	
8	UPLAND REUSE	9180	TON	$15.00	$137,700.00	
9	STABILIZE, LOAM & SEED PILE	36720	SF	$5.00	$183,600.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	27072	SF	$2.00	$54,144.00	$883,115.90
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL= $1,129,739.08

SUBTOTAL= $1,129,739.08

30% CONTINGENCY= $338,921.72

TOTAL= $1,468,660.81

SAY $1,469,000.00

ESTIMATE (Hydraulic Dredge - Landfill Disposal) - Scenario #1 - 6,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$204,163.18	$204,163.18	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	6800	CY	$30.00	$204,000.00	
4	CLEARING & PREP	0.62	ACRE	$8,000.00	$4,971.90	
5	DE-WATERING SEDIMENT	6800	CY	$20.00	$136,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$91,800.00	$91,800.00	
7	LANDFILL TRANSPORT	9180	TON	$10.00	$91,800.00	
8	LANDFILL DISPOSAL	9180	TON	$45.00	$413,100.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	27072	SF	$2.00	$54,144.00	$1,020,815.90
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL= $1,294,979.08

SUBTOTAL= $1,294,979.08

30% CONTINGENCY= $388,493.72

TOTAL= $1,683,472.81

SAY $1,684,000.00

Scenario #2 - 5,200 cy	Amount	Unit
Volume to be Removed (**Enter Value**)	5,200.00	CY

TOWN :	Nashua, NH	
PROJECT:	Tinker Pond Dredge Study	
FILE:	131-59	5/29/2019

Tinker Dredge Cost Summary - Scenario #2 - 5,200 cy		
Mechanical Wet Dredge (Upland Re-Use)	$	1,038,000.00
Mechanical Wet Dredge (Landfill Disposal)	**$**	**1,202,000.00**
Mechanical Dry Dredge (Upland Re-Use)	$	921,000.00
Mechanical Dry Dredge (Landfill Disposal)	$	1,085,000.00
Hydraulic Dredge (Upland Re-Use)	$	1,161,000.00
Hydraulic Dredge (Landfill Disposal)	$	1,325,000.00

Min.	$	921,000.00
Max.	$	1,325,000.00
Avg.	$	1,122,000.00

ESTIMATE (Mechanical Wet Dredge - Upland Re-Use) - Scenario #2 - 5,200 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$119,634.10	$119,634.10	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	5200	CY	$20.00	$104,000.00	
4	CLEARING & PREP	0.42	ACRE	$8,000.00	$3,378.51	
5	DE-WATERING SEDIMENT	5200	CY	$15.00	$78,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$70,200.00	$70,200.00	
7	UPLAND REUSE TRANSPORT	7020	TON	$5.00	$35,100.00	
8	UPLAND REUSE	7020	TON	$15.00	$105,300.00	
9	STABILIZE, LOAM & SEED PILE	28080	SF	$5.00	$140,400.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	18396	SF	$2.00	$36,792.00	$598,170.51
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	
25					$0.00	
26					$0.00	

PARTICIPATING TOTAL=	$797,804.61
SUBTOTAL=	$797,804.61
30% CONTINGENCY=	$239,341.38
TOTAL=	$1,037,146.00
SAY	$1,038,000.00

ESTIMATE (Mechanical Wet Dredge - Landfill Disposal) - Scenario #2 - 5,200 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$140,694.10	$140,694.10	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	5200	CY	$20.00	$104,000.00	
4	CLEARING & PREP	0.42	ACRE	$8,000.00	$3,378.51	
5	DE-WATERING SEDIMENT	5200	CY	$15.00	$78,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$70,200.00	$70,200.00	
7	LANDFILL TRANSPORT	7020	TON	$10.00	$70,200.00	
8	LANDFILL DISPOSAL	7020	TON	$45.00	$315,900.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	18396	SF	$2.00	$36,792.00	$703,470.51
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL= $924,164.61

SUBTOTAL= $924,164.61

30% CONTINGENCY= $277,249.38

TOTAL= $1,201,414.00

SAY $1,202,000.00

ESTIMATE (Mechanical Dry Dredge - Upland Re-Use) - Scenario #2 - 5,200 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$102,968.25	$102,968.25	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	5200	CY	$15.00	$78,000.00	
4	CLEARING & PREP	0.26	ACRE	$8,000.00	$2,089.26	
5	DE-WATERING SEDIMENT	5200	CY	$5.00	$26,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$70,200.00	$70,200.00	
7	UPLAND REUSE TRANSPORT	7020	TON	$5.00	$35,100.00	
8	UPLAND REUSE	7020	TON	$15.00	$105,300.00	
9	STABILIZE, LOAM & SEED PILE	28080	SF	$5.00	$140,400.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	11376	SF	$2.00	$22,752.00	$514,841.26
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$707,809.51
SUBTOTAL=	$707,809.51
30% CONTINGENCY=	$212,342.85
TOTAL=	$920,152.36
SAY	$921,000.00

ESTIMATE (Mechanical Dry Dredge - Landfill Disposal) - Scenario #2 - 5,200 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$124,028.25	$124,028.25	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	5200	CY	$15.00	$78,000.00	
4	CLEARING & PREP	0.26	ACRE	$8,000.00	$2,089.26	
5	DE-WATERING SEDIMENT	5200	CY	$5.00	$26,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$70,200.00	$70,200.00	
7	LANDFILL TRANSPORT	7020	TON	$10.00	$70,200.00	
8	LANDFILL DISPOSAL	7020	TON	$45.00	$315,900.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	11376	SF	$2.00	$22,752.00	$620,141.26
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL= $834,169.51

SUBTOTAL= $834,169.51

30% CONTINGENCY= $250,250.85

TOTAL= $1,084,420.36

SAY $1,085,000.00

ESTIMATE (Hydraulic Dredge - Upland Re-Use) - Scenario #2 - 5,200 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$137,136.50	$137,136.50	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	5200	CY	$30.00	$156,000.00	
4	CLEARING & PREP	0.52	ACRE	$8,000.00	$4,178.51	
5	DE-WATERING SEDIMENT	5200	CY	$20.00	$104,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$70,200.00	$70,200.00	
7	UPLAND REUSE TRANSPORT	7020	TON	$5.00	$35,100.00	
8	UPLAND REUSE	7020	TON	$15.00	$105,300.00	
9	STABILIZE, LOAM & SEED PILE	28080	SF	$5.00	$140,400.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	22752	SF	$2.00	$45,504.00	$685,682.51
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL= $892,819.01

SUBTOTAL= $892,819.01

30% CONTINGENCY= $267,845.70

TOTAL= $1,160,664.72

SAY $1,161,000.00

ESTIMATE (Hydraulic Dredge - Landfill Disposal) - Scenario #2 - 5,200 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$158,196.50	$158,196.50	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	5200	CY	$30.00	$156,000.00	
4	CLEARING & PREP	0.52	ACRE	$8,000.00	$4,178.51	
5	DE-WATERING SEDIMENT	5200	CY	$20.00	$104,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$70,200.00	$70,200.00	
7	LANDFILL TRANSPORT	7020	TON	$10.00	$70,200.00	
8	LANDFILL DISPOSAL	7020	TON	$45.00	$315,900.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	22752	SF	$2.00	$45,504.00	$790,982.51
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL= $1,019,179.01

SUBTOTAL= $1,019,179.01

30% CONTINGENCY= $305,753.70

TOTAL= $1,324,932.72

SAY $1,325,000.00

Scenario #3 - 2,800 cy	Amount	Unit
Volume to be Removed (**Enter Value**)	2,800.00	CY

TOWN :	Nashua, NH	
PROJECT:	Tinker Pond Dredge Study	
FILE:	131-59	5/29/2019

Tinker Dredge Cost Summary - Scenario #3 - 2,800 cy		
Mechanical Wet Dredge (Upland Re-Use)	$	632,000.00
Mechanical Wet Dredge (Landfill Disposal)	**$**	**720,000.00**
Mechanical Dry Dredge (Upland Re-Use)	$	582,000.00
Mechanical Dry Dredge (Landfill Disposal)	$	670,000.00
Hydraulic Dredge (Upland Re-Use)	$	699,000.00
Hydraulic Dredge (Landfill Disposal)	$	788,000.00

Min.	$	582,000.00
Max.	$	788,000.00
Avg.	$	681,833.33

ESTIMATE (Mechanical Wet Dredge - Upland Re-Use) - Scenario #3 - 2,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$67,604.09	$67,604.09	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	2800	CY	$20.00	$56,000.00	
4	CLEARING & PREP	0.27	ACRE	$8,000.00	$2,188.43	
5	DE-WATERING SEDIMENT	2800	CY	$15.00	$42,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$37,800.00	$37,800.00	
7	UPLAND REUSE TRANSPORT	3780	TON	$5.00	$18,900.00	
8	UPLAND REUSE	3780	TON	$15.00	$56,700.00	
9	STABILIZE, LOAM & SEED PILE	15120	SF	$5.00	$75,600.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	11916	SF	$2.00	$23,832.00	$338,020.43
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	
25					$0.00	
26					$0.00	

PARTICIPATING TOTAL= $485,624.52

SUBTOTAL= $485,624.52

30% CONTINGENCY= $145,687.35

TOTAL= $631,311.87

SAY $632,000.00

ESTIMATE (Mechanical Wet Dredge - Landfill Disposal) - Scenario #3 - 2,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$78,944.09	$78,944.09	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	2800	CY	$20.00	$56,000.00	
4	CLEARING & PREP	0.27	ACRE	$8,000.00	$2,188.43	
5	DE-WATERING SEDIMENT	2800	CY	$15.00	$42,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$37,800.00	$37,800.00	
7	LANDFILL TRANSPORT	3780	TON	$10.00	$37,800.00	
8	LANDFILL DISPOSAL	3780	TON	$45.00	$170,100.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	11916	SF	$2.00	$23,832.00	$394,720.43
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$553,664.52
SUBTOTAL=	$553,664.52
30% CONTINGENCY=	$166,099.35
TOTAL=	$719,763.87
SAY	$720,000.00

ESTIMATE (Mechanical Dry Dredge - Upland Re-Use) - Scenario #3 - 2,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$59,553.24	$59,553.24	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	2800	CY	$15.00	$42,000.00	
4	CLEARING & PREP	0.19	ACRE	$8,000.00	$1,494.21	
5	DE-WATERING SEDIMENT	2800	CY	$5.00	$14,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$37,800.00	$37,800.00	
7	UPLAND REUSE TRANSPORT	3780	TON	$5.00	$18,900.00	
8	UPLAND REUSE	3780	TON	$15.00	$56,700.00	
9	STABILIZE, LOAM & SEED PILE	15120	SF	$5.00	$75,600.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	8136	SF	$2.00	$16,272.00	$297,766.21
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$447,319.46
SUBTOTAL=	$447,319.46
30% CONTINGENCY=	$134,195.84
TOTAL=	$581,515.30
SAY	$582,000.00

ESTIMATE (Mechanical Dry Dredge - Landfill Disposal) - Scenario #3 - 2,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$70,893.24	$70,893.24	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	2800	CY	$15.00	$42,000.00	
4	CLEARING & PREP	0.19	ACRE	$8,000.00	$1,494.21	
5	DE-WATERING SEDIMENT	2800	CY	$5.00	$14,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$37,800.00	$37,800.00	
7	LANDFILL TRANSPORT	3780	TON	$10.00	$37,800.00	
8	LANDFILL DISPOSAL	3780	TON	$45.00	$170,100.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	8136	SF	$2.00	$16,272.00	$354,466.21
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL= $515,359.46

SUBTOTAL= $515,359.46

30% CONTINGENCY= $154,607.84

TOTAL= $669,967.30

SAY $670,000.00

ESTIMATE (Hydraulic Dredge - Upland Re-Use) - Scenario #3 - 2,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$77,906.49	$77,906.49	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	2800	CY	$30.00	$84,000.00	
4	CLEARING & PREP	0.37	ACRE	$8,000.00	$2,988.43	
5	DE-WATERING SEDIMENT	2800	CY	$20.00	$56,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$37,800.00	$37,800.00	
7	UPLAND REUSE TRANSPORT	3780	TON	$5.00	$18,900.00	
8	UPLAND REUSE	3780	TON	$15.00	$56,700.00	
9	STABILIZE, LOAM & SEED PILE	15120	SF	$5.00	$75,600.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	16272	SF	$2.00	$32,544.00	$389,532.43
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL= $537,438.92

SUBTOTAL= $537,438.92

30% CONTINGENCY= $161,231.67

TOTAL= $698,670.59

SAY $699,000.00

ESTIMATE (Hydraulic Dredge - Landfill Disposal) - Scenario #3 - 2,800 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$89,246.49	$89,246.49	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	2800	CY	$30.00	$84,000.00	
4	CLEARING & PREP	0.37	ACRE	$8,000.00	$2,988.43	
5	DE-WATERING SEDIMENT	2800	CY	$20.00	$56,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$37,800.00	$37,800.00	
7	LANDFILL TRANSPORT	3780	TON	$10.00	$37,800.00	
8	LANDFILL DISPOSAL	3780	TON	$45.00	$170,100.00	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	16272	SF	$2.00	$32,544.00	$446,232.43
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL= $605,478.92

SUBTOTAL= $605,478.92

30% CONTINGENCY= $181,643.67

TOTAL= $787,122.59

SAY $788,000.00

Scenario #4 - 950 cy	Amount	Unit
Volume to be Removed (**Enter Value**)	950.00	CY

TOWN :	Nashua, NH	
PROJECT:	Tinker Pond Dredge Study	
FILE:	131-59	5/29/2019

Tinker Dredge Cost Summary - Scenario #4 - 950 cy		
Mechanical Wet Dredge (Upland Re-Use)	$	319,000.00
Mechanical Wet Dredge (Landfill Disposal)	**$**	**349,000.00**
Mechanical Dry Dredge (Upland Re-Use)	$	321,000.00
Mechanical Dry Dredge (Landfill Disposal)	$	351,000.00
Hydraulic Dredge (Upland Re-Use)	$	343,000.00
Hydraulic Dredge (Landfill Disposal)	$	373,000.00

Min.	$	319,000.00
Max.	$	373,000.00
Avg.	$	342,666.67

ESTIMATE (Mechanical Wet Dredge - Upland Re-Use) - Scenario #4 - 950 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$27,497.61	$27,497.61	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	950	CY	$20.00	$19,000.00	
4	CLEARING & PREP	0.16	ACRE	$8,000.00	$1,271.07	
5	DE-WATERING SEDIMENT	950	CY	$15.00	$14,250.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$12,825.00	$12,825.00	
7	UPLAND REUSE TRANSPORT	1283	TON	$5.00	$6,412.50	
8	UPLAND REUSE	1283	TON	$15.00	$19,237.50	
9	STABILIZE, LOAM & SEED PILE	5130	SF	$5.00	$25,650.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	6921	SF	$2.00	$13,842.00	$137,488.07
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	
25					$0.00	
26					$0.00	

PARTICIPATING TOTAL= $244,985.69

SUBTOTAL= $244,985.69

30% CONTINGENCY= $73,495.71

TOTAL= $318,481.40

SAY $319,000.00

ESTIMATE (Mechanical Wet Dredge - Landfill Disposal) - Scenario #4 - 950 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$31,345.11	$31,345.11	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$10,000.00	$10,000.00	
3	DREDGING	950	CY	$20.00	$19,000.00	
4	CLEARING & PREP	0.16	ACRE	$8,000.00	$1,271.07	
5	DE-WATERING SEDIMENT	950	CY	$15.00	$14,250.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$12,825.00	$12,825.00	
7	LANDFILL TRANSPORT	1283	TON	$10.00	$12,825.00	
8	LANDFILL DISPOSAL	1283	TON	$45.00	$57,712.50	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$15,000.00	$15,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	6921	SF	$2.00	$13,842.00	$156,725.57
12	PERMITTING	1	LS	$40,000.00	$40,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$268,070.69
SUBTOTAL=	$268,070.69
30% CONTINGENCY=	$80,421.21
TOTAL=	$348,491.90
SAY	$349,000.00

ESTIMATE (Mechanical Dry Dredge - Upland Re-Use) - Scenario #4 - 950 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$26,087.51	$26,087.51	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	950	CY	$15.00	$14,250.00	
4	CLEARING & PREP	0.13	ACRE	$8,000.00	$1,035.54	
5	DE-WATERING SEDIMENT	950	CY	$5.00	$4,750.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$12,825.00	$12,825.00	
7	UPLAND REUSE TRANSPORT	1283	TON	$5.00	$6,412.50	
8	UPLAND REUSE	1283	TON	$15.00	$19,237.50	
9	STABILIZE, LOAM & SEED PILE	5130	SF	$5.00	$25,650.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	5639	SF	$2.00	$11,277.00	$130,437.54
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$246,525.04
SUBTOTAL=	$246,525.04
30% CONTINGENCY=	$73,957.51
TOTAL=	$320,482.56
SAY	$321,000.00

ESTIMATE (Mechanical Dry Dredge - Landfill Disposal) - Scenario #4 - 950 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$29,935.01	$29,935.01	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$25,000.00	$25,000.00	
3	DREDGING	950	CY	$15.00	$14,250.00	
4	CLEARING & PREP	0.13	ACRE	$8,000.00	$1,035.54	
5	DE-WATERING SEDIMENT	950	CY	$5.00	$4,750.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$12,825.00	$12,825.00	
7	LANDFILL TRANSPORT	1283	TON	$10.00	$12,825.00	
8	LANDFILL DISPOSAL	1283	TON	$45.00	$57,712.50	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$10,000.00	$10,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	5639	SF	$2.00	$11,277.00	$149,675.04
12	PERMITTING	1	LS	$50,000.00	$50,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	

PARTICIPATING TOTAL=	$269,610.04
SUBTOTAL=	$269,610.04
30% CONTINGENCY=	$80,883.01
TOTAL=	$350,493.06
SAY	$351,000.00

ESTIMATE (Hydraulic Dredge - Upland Re-Use) - Scenario #4 - 950 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$32,250.01	$32,250.01	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	950	CY	$30.00	$28,500.00	
4	CLEARING & PREP	0.26	ACRE	$8,000.00	$2,071.07	
5	DE-WATERING SEDIMENT	950	CY	$20.00	$19,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$12,825.00	$12,825.00	
7	UPLAND REUSE TRANSPORT	1283	TON	$5.00	$6,412.50	
8	UPLAND REUSE	1283	TON	$15.00	$19,237.50	
9	STABILIZE, LOAM & SEED PILE	5130	SF	$5.00	$25,650.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	11277	SF	$2.00	$22,554.00	$161,250.07
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL=	$263,500.09
SUBTOTAL=	$263,500.09
30% CONTINGENCY=	$79,050.03
TOTAL=	$342,550.12
SAY	$343,000.00

ESTIMATE (Hydraulic Dredge - Landfill Disposal) - Scenario #4 - 950 cy

TOWN : Nashua, NH

PROJECT: Tinker Pond Dredge Study

FILE: 131-59 5/29/2019

ITEM #	DESCRIPTION	QUANTITIES PART.	UNIT	UNIT $ PRICE	TOTAL $ VALUE	
1	MOBILIZATION/DEMOBILIZATION/STAGING/SET UP/MANAGEMENT	1	LS	$36,097.51	$36,097.51	
2	DEWATERING POND & EMERGENCY WATER HANDLING	1	LS	$5,000.00	$5,000.00	
3	DREDGING	950	CY	$30.00	$28,500.00	
4	CLEARING & PREP	0.26	ACRE	$8,000.00	$2,071.07	
5	DE-WATERING SEDIMENT	950	CY	$20.00	$19,000.00	
6	SAMPLING & CHARACTERIZATION	1	LS	$12,825.00	$12,825.00	
7	LANDFILL TRANSPORT	1283	TON	$10.00	$12,825.00	
8	LANDFILL DISPOSAL	1283	TON	$45.00	$57,712.50	
9	STABILIZE, LOAM & SEED PILE	0	SF	$0.00	$0.00	
10	EROSION CONTROLS	1	LS	$20,000.00	$20,000.00	
11	STABILIZE, LOAM AND SEED STAGING AREAS	11277	SF	$2.00	$22,554.00	$180,487.57
12	PERMITTING	1	LS	$30,000.00	$30,000.00	
13	DREDGE PLAN	1	LS	$20,000.00	$20,000.00	
14	CONTRACTOR SOLICITATION	1	LS	$5,000.00	$5,000.00	
15	DREDGE OVERSIGHT	1	LS	$15,000.00	$15,000.00	
16					$0.00	
17					$0.00	
18					$0.00	
19					$0.00	
20					$0.00	
21					$0.00	
22					$0.00	
23					$0.00	
24					$0.00	

PARTICIPATING TOTAL= $286,585.09

SUBTOTAL= $286,585.09

30% CONTINGENCY= $85,975.53

TOTAL= $372,560.62

SAY $373,000.00