# 4.0 Data Gaps

Technical data gaps have been identified that are required or are likely to be required to be filled as part of the planning, design, and implementation of the Capitol Lake conceptual maintenance dredging effort.

One of these data gaps includes conducting an updated bathymetric survey of Capitol Lake to accomplish the following: 1) determine the potential volume of material to be dredged within the two conceptual maintenance dredge areas; 2) determine where the dredged material could potentially be placed within Capitol Lake and/or Percival Cove for on-site beneficial reuse and habitat enhancement; and 3) provide water depth information relative to construction access and equipment launching.

Another data gap includes the characterization of the sediment within the conceptual dredged areas to assist in the evaluation of beneficial reuse or disposal options. Dredged material elutriate testing can also be a requirement for dredging projects depending on sediment chemical quality and site conditions, and is identified as a potential data gap that may be required to assess the potential impacts of the maintenance dredging on water quality.

Additional information is also required to fill data gaps regarding the invasive New Zealand mudsnail, including an updated survey of the New Zealand mudsnail coverage within Capitol Lake and its connected freshwaters, and possibly a control study to determine what treatment of the dredged material may be necessary if transport of the dredged material off-site is required.

Finally, there is the potential that dredge elutriate testing may be necessary to determine if the dredged material will likely have an adverse affect on the lake's water quality. This section describes each of these data gaps in further detail and provides proposed scopes and the estimated costs for filling each of these data gaps.

## 4.1 BATHYMETRIC SURVEY

Prior to the development of this maintenance dredging conceptual scope, the most recent bathymetric data available for Capitol Lake were from a survey completed by USGS in 2004 (Eshleman et al. 2006). Due to the continued input of an estimated 35,000 cubic yards of sediment annually from the Deschutes River into Capitol Lake and the amount of time that has passed since the last bathymetric survey data were collected, the updated bathymetry of Capitol Lake was immediately identified as a data gap that was necessary to be filled. DES elected to conduct an updated bathymetric survey of Capitol Lake in March 2013 to fill this data gap. The 2013 bathymetric data provide updated information on the amount of material that could potentially be dredged from the conceptual maintenance dredging areas and conceptual information on where and how much of this dredged material could be beneficially reused for habitat restoration in different areas of Capitol Lake and/or Percival Cove. Additionally, the bathymetric data provide information related to construction access and equipment launching for performing any dredging work.

The most recent bathymetric survey was performed on the North, Middle, and South Basins of Capitol Lake, as well as on Percival Cove. TerraSond conducted a singlebeam bathymetric survey between March 12 and 15, 2013. The bathymetric survey report prepared by TerraSond is provided in Appendix C, and includes the results of the survey along with information on the

survey coverage, the survey control and equipment used, and how the survey data were collected and processed. The 2013 bathymetry is shown on Figure 4.1.

A comparison of the 2013 bathymetric data to the 2004 bathymetric data was performed by Floyd|Snider to understand generally where filling has occurred in Capitol Lake over the past 9 years. The 2004 bathymetry, as reported by the USGS, is shown on Figure 4.2. The 2004 bathymetry is reported in meters Local Mean Sea Level (MSL) vertical datum, whereas the 2013 bathymetric data are reported in feet North American Vertical Datum of 1988 (NAVD 88). The 2004 MSL elevations were converted to feet NAVD 88 for this comparison of the 2004 and 2013 bathymetric survey data as described below (1 meter MSL is equal to 7.57 feet NAVD 88).[1]

Based on the annual input, over this timeframe approximately 315,000 cubic yards of sediment has entered Capitol Lake. Based on a general comparison, limited by the survey information from the previous 2004 USGS bathymetry survey, it is estimated that as much as 50 percent of this sediment may have accumulated in the North Basin. In 2004, a shallower area or mound was noted in the middle of the North Basin with two deeper channels appearing on either side of this area; however, the 2013 bathymetry shows that the surrounding channels, as well as the deeper portions of the North Basin, have experienced shoaling, making this mound much less pronounced. The other 50 percent of the sediment input over the past 9 years could be accounted for within the Middle Basin and part of the South Basin, with additional accumulation noted in the Middle Basin sediment trap area, as well as on the shallower shelves surrounding the former Deschutes River channel through this basin. It appears that generally over 2 feet of sediment has accumulated on the shallower shelf areas in the Middle Basin. Again, it should be noted that only a general comparison could be performed when estimating the loading to each of the basins due to the limitations of the available data from the 2004 bathymetric survey (only a contour map was available).

For the permit analysis, it is assumed that a total of approximately 100,000 cubic yards would be removed from Capitol Lake, with approximately 50,000 cubic yards from the Middle Basin sediment trap area and another 50,000 cubic yards from the North Basin main channel area. Based on the 2013 bathymetry, these sediment volumes could easily be removed from these two areas and not preclude any of the previously studied long-term lake management alternatives. The total dredge volume could remain the same or be increased based on the objectives of the dredging project to be performed. The dredging volume to be removed could also be determined based on the volume needed to create a habitat enhancement area within the lake.

## 4.2 DREDGED MATERIAL CHARACTERIZATION

Characterization of the material to be dredged as part of the conceptual Capitol Lake maintenance dredging effort is necessary to evaluate if this dredged material is suitable for beneficial reuse along the western shoreline of Capitol Lake or in Percival Cove. If this dredged material is determined not to be suitable for beneficial reuse within the lake, then sediment characterization data can be used to evaluate if this material can be used for upland reuse or to

[1] Using arbitrary elevations of 10 meters and 10 feet relative to Mean Lower Low Water (MLLW), National Oceanic and Atmospheric Administration (NOAA) VDatum Software was used to create conversions from MLLW to MSL and NAVD 88. To allow for the calculation of conversions between datum, the software requires an over-water marine location be specified as the point where the conversion applies. This is because the software is intended for use in aquatic/marine environments that typically reference vertical locations with respect to tidal datum. However, a conversion factor that is calculated for marine region can be used (with judgment) for terrestrial or freshwater lake locations that are nearby. A reference location was selected in nearby Budd Inlet to enable these conversions.

characterize this material for upland disposal. While previous characterization efforts have been performed on Capitol Lake sediments, the samples collected were often not collected within the current conceptual maintenance dredging areas, or if they were collected in these areas, then the samples were generally not collected to the necessary depths or with adequate spatial coverage for the conceptual dredged prisms. Additionally, the sediment characterization analytical data are generally either outdated (beyond typical recency guidelines) or do not include all of the required chemical analyses. For these reasons, sediment characterization of the material to be dredged is identified as a key data gap.

This section briefly summarizes the previous sediment characterization efforts performed to date within Capitol Lake and then provides a proposed scope with the level of effort and costs necessary to perform a current characterization of the sediment within the conceptual maintenance dredging areas.

It is anticipated that the sediment characterization data would be compared to Ecology's Freshwater Sediment Chemical Criteria from the revised Sediment Management Standards (SMS; Chapter 173-204 WAC, effective September 1, 2013).

### 4.2.1 Previous Sediment Characterizations

There have been multiple sediment characterization events within Capitol Lake over the past 38 years. The analytical data from these events have been compared to various regulatory criteria over time, but have not previously been compared to the current SMS Freshwater Sediment Chemical Criteria. The brief summary below of these sediment characterization events provides a comparison to these Freshwater Sediment Chemical Criteria to give an understanding of the general quality of the sediments within Capitol Lake.

The most extensive sediment characterization event within Capitol Lake occurred in 1975. During this event, 11 sediment samples, collected from 6 cores from the Middle and North Basins, were analyzed for total metals, polychlorinated biphenyls (PCBs), total chlorinated hydrocarbons, oil and grease, and conventional parameters (CH2M Hill 1976). In 1 of the 11 samples, mercury exceeded the Freshwater Sediment Chemical Criteria.[2] Mercury in this sample was detected at a concentration of 1.03 milligrams per kilogram (mg/kg), exceeding the mercury sediment cleanup objective of 0.66 mg/kg and the mercury cleanup screening level of 0.8 mg/kg by less than a factor of 2. No other analytes tested in these sediments exceeded the Freshwater Sediment Chemical Criteria.

In 2000, sediment characterization was performed within the Middle Basin sediment trap area, one of the conceptual maintenance dredging areas. Sediment samples covering both the surface and subsurface (0 to 2.5 feet deep) were collected from four sampling locations and analyzed for total metals, toxicity characteristic leaching procedure (TCLP) metals, total petroleum hydrocarbons, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), pesticides, PCBs, and conventional parameters (Herrera 2000). All metals were detected at concentrations less than the SMS Freshwater Sediment Chemical Criteria. There were no detections of total petroleum hydrocarbons, VOCs, pesticides, or PCBs in these

[2] The SMS Freshwater Sediment Chemical Criteria include both sediment cleanup objectives and cleanup screening levels. The freshwater sediment cleanup objectives are identified as the levels or concentrations where there are no adverse effects to the benthic community. The cleanup screening levels are identified as the levels or concentrations where there are minor adverse effects to the benthic community.

samples. A few SVOCs were detected in the samples; however, the concentrations were less than the SMS Freshwater Sediment Chemical Criteria.

An additional sediment characterization event was conducted in 2002 to assess the quality of the lake sediments adjacent to an outfall near the eastern shoreline of the North Basin (Thurston County Environmental Health Division 2003). Three sediment samples were analyzed for SVOCs and lead, with all detected concentrations less than the SMS Freshwater Sediment Chemical Criteria.

The most recent sediment characterization in Capitol Lake occurred in 2007 as part of a larger study to determine the nature and extent of dioxins/furans in Budd Inlet sediments (SAIC 2008). Two sediment samples from Capitol Lake were analyzed for dioxins/furans and conventional parameters, and one of these samples, from the North Basin, was also analyzed for metals, SVOCs, and PCBs. Dioxin/furan toxicity equivalency quotients (TEQs) calculated for the two samples were 2.0 picograms per gram (pg/g) and 3.9 pg/g. While there is no SMS Freshwater Sediment Chemical Criterion for dioxin/furan TEQ, for comparative purposes, the dioxin/furan TEQs detected in the Capitol Lake sediment samples were less than the DMMP open-water Disposal Site Management Objective of 4 pg/g TEQ. The dioxin/furan DMMP Site Management Objective is based on the sediment background concentrations as collected from the U.S. Environmental Protection Agency (USEPA) Ocean Survey Vessel Bold Survey for Puget Sound (USEPA 2008, DMMP 2009). There were no exceedances of the SMS Freshwater Sediment Chemical Criteria for the metals, SVOCs, and PCB detected in the North Basin sediment sample.

#### *4.2.1.1 Percival Cove Previous Sediment Characterization*

The removal of sediment from Percival Cove is not included within the scope of the conceptual maintenance dredging, but the summary of the previous sediment characterization event is provided below for completeness.

Starting in 1971, WDFW used Percival Cove for Chinook and Steelhead salmon rearing under a lease agreement with the former GA, the project area owner. Fish production activities were most intensive during the first 15 years (1971 through 1986). WDFW has not operated fish rearing net-pens in Percival Cove since 2007 and plans no further activities there. As was specified in a condition of the 2002 lease renewal with the GA, WDFW was required to conduct a sediment study to determine what impact, if any, its operations have had upon conditions within Percival Cove (GeoEngineers 2009).

In March of 2009, on behalf of WDFW, GeoEngineers collected a total of 10 surface sediment samples and 2 sediment cores from within Percival Cove. Of the samples, 10 were analyzed for conventionals (total organic carbon, total solids, and grain size), PCBs, and phthalates. Eight of the samples were analyzed for porewater ammonia, total sulfides, and Microtox bioassay testing. Three phthalates, bis(2-ethylhexyl) phthalate (DEHP), butyl benzyl phthalate, and diethyl phthalate, were detected in nine of the surface sediment samples at relatively low concentrations. PCBs and porewater sulfides were not detected in samples obtained from the study area. Analyses of sediment samples obtained from Percival Cove did not identify chemical or biological effects resulting from former net-pen operations.

### 4.2.2 Potential Dredged Material Characterization

To adequately characterize the conceptual dredged material, it is recommended that sediment sampling and chemical analysis be performed on sediment from both of the conceptual maintenance dredge areas. The suggested sampling scheme and chemical analyses to be performed in these two dredge areas is included below, along with the associated estimated costs to perform this work.

Based on the footprints of the two conceptual maintenance dredge areas, it is recommended that four sediment cores be collected in the North Basin dredge area and that three sediment cores be collected in the Middle Basin dredge area. Sediment cores in the North Basin maintenance dredge area would be collected to a depth of approximately 3 feet below the mudline, which is generally the conceptual dredging depth in this area. From each of the North Basin cores, one sediment sample would be collected from the core sample interval for chemical analysis. The Middle Basin sediment cores would be collected to depths of approximately 7 feet, the estimated dredging depth in this maintenance dredge area. Sediment samples would be collected from two depth intervals in each Middle Basin core for chemical analysis. For the purpose of estimating the costs to collect these sediment cores, it was assumed that the cores would be collected using the MudMole™ sediment coring system and that core collection and processing would occur over a 2-day period.

Sediment samples collected from the conceptual dredge areas would be analyzed to determine sediment suitability for beneficial reuse and upland disposal. To make this determination, it is recommended that each sediment sample be chemically analyzed for total metals, SVOCs, PCBs, pesticides, butyltins, petroleum hydrocarbons, dioxins/furans, and TCLP metals. This list of analytes would allow comparison of the sediment data to the SMS Freshwater Sediment Chemical Criteria, for determining the acceptability of in-water reuse within Capitol Lake, as well as the Washington State Model Toxics Control Act (MTCA) cleanup levels to determine if the sediments are suitable for upland reuse. The TCLP metals testing acts to simulate leaching through a landfill and identify metal concentrations that would be unsuitable for uplands landfill disposal. Additionally, conventional analyses should be performed on the sediment samples, including grain size, total solids, total organic carbon, ammonia, and total sulfides.

The total estimated cost to perform this sediment characterization work is approximately $129,000. A general breakdown of the total estimated cost is provided below in Table 2.

**Table 2. Dredge Material Characterization Estimated Costs**

| Task | Estimated Cost |
|---|---|
| Field Sampling Preparation | $18,000 |
| Sediment Sample Collection/Processing | $55,000 |
| Sediment Sample Analysis | $34,000 |
| Data Validation and Reporting | $16,000 |
| Agency Coordination and Characterization Permitting | $3,000 |
| Task Management | $3,000 |
| **Total Estimated Cost:** | **$129,000** |

## 4.3 NEW ZEALAND MUDSNAIL SURVEY AND CONTROL STUDY

A New Zealand mudsnail survey was performed in Capitol Lake in June 2011. During this survey the New Zealand mudsnail was observed throughout the North and Middle Basins, but was not observed in the South Basin or at one survey location in Percival Cove. An updated survey of the coverage of the New Zealand mudsnail in Capitol Lake and its connected freshwaters is needed as part of the conceptual maintenance dredging planning and permitting processes to determine if the New Zealand mudsnail is present in the areas where in-lake placement of the dredged material may occur for beneficial reuse of the sediment or in potential areas of the lake that may be used for staging, transport, or handling of the dredged material.

A consideration of the dredge and beneficial use design would be to avoid dredging sediment from an area of high invasive species infestation and then using that sediment for habitat enhancement in an area of low infestation. Depending on the timing of the project relative to DES's existing annual Eurasian watermilfoil control efforts and surveys, it is possible that a Eurasian watermilfoil survey may also be needed at additional cost.

Placement of any dredged material containing the New Zealand mudsnail into areas of the lake or Percival Cove that do not currently contain this snail should be avoided. Updated New Zealand mudsnail survey information is needed whether the dredged material is placed in Capitol Lake or Percival Cove or taken off-site for upland beneficial reuse or disposal in a landfill. Additionally, this updated survey will also be conducted upstream of the lake in connected freshwaters (Deschutes River and Percival Creek) to help provide information for the future planning of New Zealand mudsnail control or eradication efforts within Capitol Lake, separate from the conceptual dredge scope.

If it is determined that the conceptual dredge material will be transported off-site, then additional information regarding the effectiveness of control methods for the treatment of the New Zealand mudsnail in the dredged material to be transported off-site will be needed. This control study would only evaluate the effectiveness on the dredged material to be transported off-site and would not include an evaluation of the potential effectiveness of methods for New Zealand mudsnail control or eradication in Capitol Lake or its connected waters.

Included below is a brief summary of the proposed scopes and costs associated with performing an updated New Zealand mudsnail survey and a New Zealand mudsnail control study.

If it is assumed that the dredged material will likely be beneficially reused on-site, in Capitol Lake or Percival Cove, then only an updated New Zealand mudsnail survey would be necessary. For this updated survey, it is recommended that surface sediment grab samples be collected at approximately 12 locations within or in the vicinity of Capitol Lake to determine the presence or absence of the New Zealand mudsnail. A brief report would be prepared to present the survey data. The total estimated cost to perform only the updated survey is approximately $16,000. A general breakdown of the total estimated cost is provided in Table 3.

**Table 3. New Zealand Mudsnail Survey Estimated Costs**

| Task | Estimated Cost |
|---|---|
| Sampling and Analysis Plan | $3,000 |
| Sediment Sample Collection | $4,000 |
| Mudsnail Sample Analysis | $1,000 |
| Data Analysis and Reporting | $6,000 |
| Task Management and Meetings | $2,000 |
| **Total Estimated Cost:** | **$16,000** |

If it is determined that the dredged material will be taken off-site, then both an updated survey and a control study would be needed based on input from WDFW and WSDA. The field work for both of these efforts would be performed concurrently. It is recommended that surface sediment grab samples be collected at approximately 12 locations within or in the vicinity of Capitol Lake to determine the presence or absence of the New Zealand mudsnail. Additionally, it is recommended that surface sediment grab samples be collected at three sampling locations within each of the two conceptual dredging areas, collecting five replicates at each of these sampling locations, to determine the presence or absence of the New Zealand mudsnail and to collect the sediment needed to perform the control study laboratory testing. For the control study laboratory testing, it is assumed that each of the five replicates collected from the six proposed dredge area sediment sampling locations would undergo six different types of treatment. Immediately following the treatment testing, each of the replicates would be enumerated for the number of live and dead snails. Based on the outcome of the control study, a report would be prepared that provided the recommended methods to control the New Zealand mudsnails in the dredged materials. This report would also include the results of the updated New Zealand mudsnail survey and would form the basis of the transportation control approach required as part of the WDFW and WSDA invasive species transport letters of approval processes.

The total estimated cost to perform both the updated survey and control study is approximately $50,000. A general breakdown of the total estimated cost is provided below in Table 4.

**Table 4. New Zealand Mudsnail Survey and Control Study Estimated Costs**

| Task | Estimated Cost |
|---|---|
| Sampling and Analysis Plan | $12,000 |
| Sediment Sample Collection | $5,000 |
| Laboratory Treatment Testing | $7,000 |
| Mudsnail Sample Analysis | $6,000 |
| Data Analysis and Reporting | $15,000 |
| Task Management and Meetings | $5,000 |
| **Total Estimated Cost:** | **$50,000** |

## 4.4 DREDGED MATERIAL ELUTRIATE TESTING

The dredged material elutriate test is a laboratory analysis that is performed to assess the potential impacts of dredging on water quality. This test is typically requested by regulatory agencies in dredging locations where metals are the primary chemicals of concern and the location is influenced by river flow and/or tides. While Capitol Lake sediments are not subject to these transport influences, the dredged material elutriate test may still be required as part of the conceptual maintenance dredging effort; however, the need for this testing will be largely based on the sediment characterization results and the implementation of physical best management practices during the dredging to control suspended sediment and to minimize any adverse effects to water quality during dredging.

Chemical analyses performed on the elutriate collected from the laboratory tests are compared to the Washington State surface water quality standards for the protection of aquatic life (WAC 173-201A) in order to determine if the dredged material will likely have an adverse affect on the lake's water quality.

This section briefly summarizes the previous dredged material elutriate testing performed on Capitol Lake sediment and then provides a proposed scope with an estimated level of effort and cost necessary to perform dredged material elutriate tests within the conceptual maintenance dredging areas, if determined to be needed.

### 4.4.1 Previous Dredged Material Elutriate Testing

In 2000, elutriate testing was performed on Capitol Lake sediments collected within the Middle Basin sediment trap area. The elutriate testing was performed on sediment samples including both the surface and subsurface (0 to 2.5 feet deep) collected from four sampling locations within the sediment trap area combined with surface water collected at one of the sampling stations. The elutriate from each sample was analyzed for selected metals (arsenic, cadmium, copper, lead, mercury, and zinc) to determine if surface water quality standards would be exceeded for these metals during dredging operations (Herrera 2000). The lake surface water was also analyzed to determine background concentrations of these metals. Test results showed that acute toxicity surface water quality standards for these metals were not exceeded in any of the elutriate samples. Mercury, detected in three of the four samples, was the only analyte to exceed the chronic toxicity surface water quality standards. Detected mercury concentrations in the elutriate samples ranged from 0.2 to 24 micrograms per liter (µg/L), whereas the chronic water quality criteria for mercury is 0.012 µg/L.

### 4.4.2 Potential Dredged Material Elutriate Testing

If an assessment of the potential impacts of the conceptual Capitol Lake maintenance dredging on the lake's water quality is required, then it is recommended that dredged material elutriate testing be performed on sediment collected from both of the conceptual maintenance dredge areas. Dredged material elutriate testing can be performed on sediment collected as part of the dredged material sediment characterization effort, described above in Section 4.2. Lake surface water within both of these dredged areas would also need to be collected during this sediment sampling field work for use in the elutriate testing and to analyze for background surface water concentrations within the lake.

It is estimated that one sediment sample from each of the conceptual maintenance dredge areas would be collected for elutriate testing as well as one surface water sample from each of these areas.

Based on the previous elutriate and sediment chemical testing results, it is recommended that the elutriate collected from each of the sediment samples tested, along with the surface water samples, be chemically analyzed for metals. Additionally, an analysis of water hardness should be performed on the elutriate sample and surface water samples, as the surface water quality standards for metals are hardness dependent.

Costs for the collection and processing of the sediment samples and water samples necessary to perform the dredged material elutriate testing are already generally included in the dredged material sediment characterization field effort (refer to Section 4.2), assuming that these sampling efforts are performed concurrently. The total estimated cost to perform the dredged material elutriate testing and analysis, plus data validation and reporting is approximately $5,000. A general breakdown of this estimated cost is provided below in Table 5.

**Table 5. Dredge Material Elutriate Testing Estimated Costs**

| Task | Estimated Cost |
|---|---|
| Sample Analysis | $1,000 |
| Data Validation and Reporting | $4,000 |
| **Total Estimated Cost:** | **$5,000** |