



Columbia River Water Use Plan

**CLBWORKS-30B Arrow Lakes Reservoir: Implementation of Wildlife
Physical Works – Arrow Reservoir**

PLANTING PLAN FOR PHASE 1 CONSTRUCTION

January 06, 2019

DETAILED PRESCRIPTIONS FOR WETLAND AREAS AND PLANTING MOUNDS

1 Introduction

As part of its continued implementation of Water License Requirements for the Arrow Lakes Reservoir (ALR), BC Hydro is constructing a wildlife enhancement project (CLBWORKS-30B) in the mid-reservoir drawdown zone at Burton Flats. According to the Columbia Order, Conditional Section, Clause 7.a., the objective of the enhancement program is *“to improve conditions for nesting and migratory birds, and wildlife within the drawdown zone of Arrow Lakes Reservoir”*. The Burton Flats Site (coordinates: 11 U 435757 E and 5536952 N) is located south of Burton, BC on the east side of the Arrow Lakes Reservoir, just northwest of Highway 6 and is accessed by Robazzo Road.

At Burton Flats, wetland habitat creation will incorporate shallow and deep pool configurations, as well as pools with and without connectivity, to allow a comparative study on the effectiveness of these types of configurations. Vegetated mounds to create nesting habitat at higher elevations (>439 m), and reed canary grass (RCG) suppression trials at selected locations, will also be incorporated into the design for continued learning about habitat enhancement within, and adjacent to, the drawdown zone (KWL 2017).

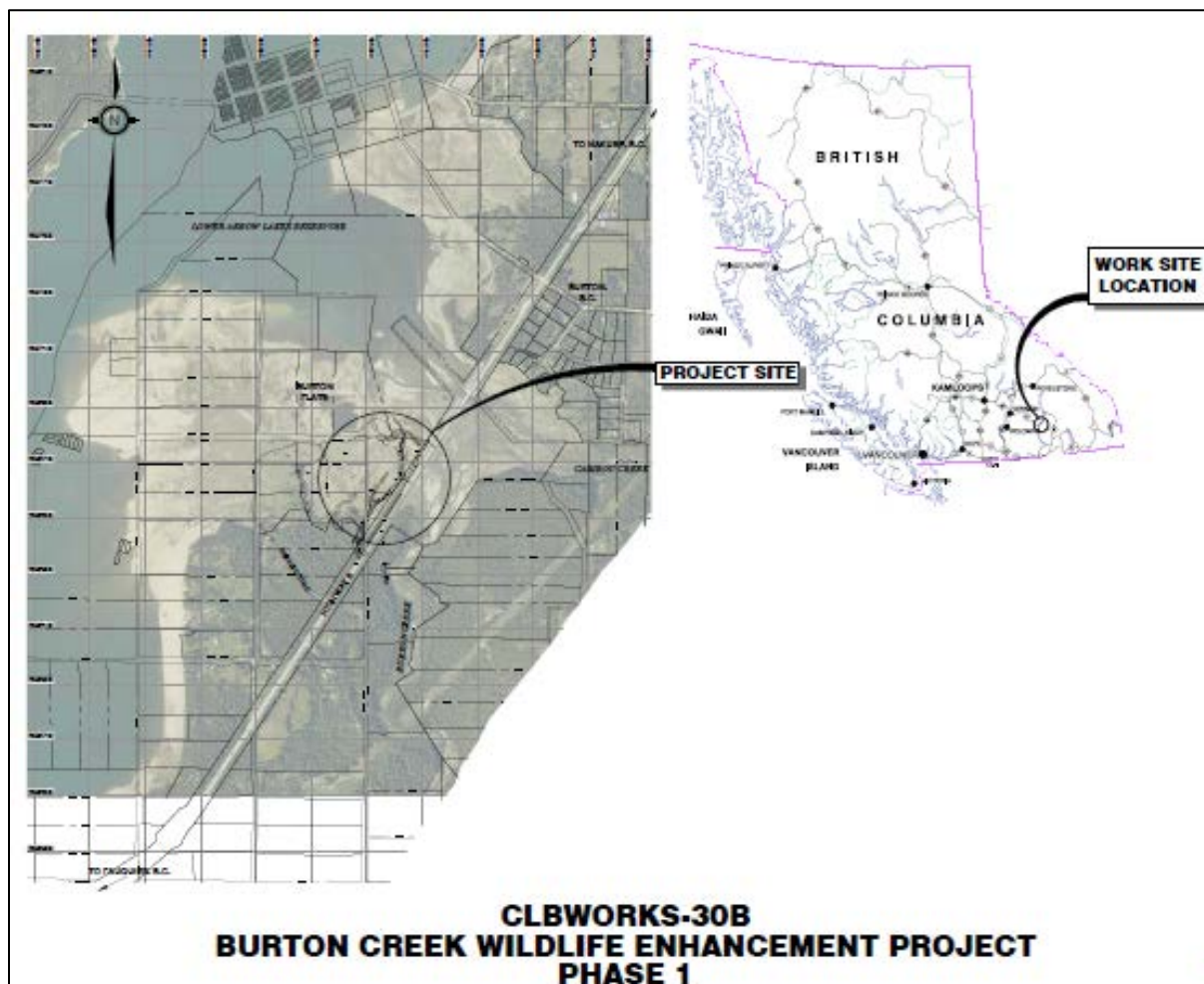


Figure 1: Burton Wetland Enhancement Project Location, Arrow Lakes Reservoir (KWL Detailed Design 2018).

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1.1 Revegetation Goals and Approach

The aim of the wetland enhancement project is to increase the spatial and temporal availability of wetland habitat for wildlife in the drawdown zone of the ALR by creating shallow and deep excavated pools between elevations 434 masl and full pool (440 masl), and enhancing riparian and wetland vegetation on the banks of the water features via a planting program, particularly above 438.5 masl.

According to the Columbia Water Use Plan (WUP) Order¹, the objective of the enhancement program is “to improve conditions for nesting and migratory birds and wildlife within the drawdown zone of Arrow Lakes Reservoir.” Therefore, the goal of the vegetation planting program is to create long-term, self-sustaining native plant communities that improve the available habitat for several wildlife species, including migratory birds, nesting birds, pond-breeding amphibians, reptiles, and mammals (e.g., bats). This goal will be accomplished by establishing emergent vegetation and shrub habitat to promote foraging and nesting, and by encouraging submergent vegetation to colonize wetland bottoms that can be used by amphibians, migrating waterfowl, and shorebirds. Elevation-specific planting of shrubs and trees will be carefully planned to avoid creating ecological traps at lower elevations, which become inundated by the reservoir during the bird nesting season.

Currently, upper elevation wetted areas in the proposed work area (the Site) are vegetated with native emergent sedges (small-flowered bulrush and beaked sedge), which decrease in abundance as the wetland descends the drawdown zone. More upland areas are dominated by reed canary grass (RCG) and two native sedges (Kellogg’s sedge and Columbia sedge). Previous cottonwood planting trials were completed in the vicinity by BC Hydro under CLBWORKS-2. The revegetation program associated with the CLBWORKS-30B Burton wetland project will augment the existing emergent vegetation community at high elevation ponds; promote submergent vegetation in ponds staggered across elevations; and attempt to establish a riparian habitat consisting of graminoids, shrubs, and trees along the wetland edges and on top of constructed mounds.

Key features of the planting program are as follows:

1. It will be carried out in phases (polygon subsets) to align with the phased approach for wetland construction.
2. Planting within polygons will be iterative, so that initial low density stocking and subsequent monitoring of plant survival can be used to adaptively guide a re-planting investment in later years to maximize revegetation success in terms of both density and diversity of plant species.
3. In addition to planting purchased plug and rooted stock, the planting program will depend heavily on opportunities to transplant salvaged plants and will utilize local sources of black cottonwood, red-osier dogwood, and willow stakes. It is known that there will be an abundance of beaked sedge, Kellogg’s sedge, and small-flowered bulrush available for salvage; Columbia sedge tussocks will also be available for salvage planting to a lesser degree.
4. The program will take a soft approach to target stocking density and diversity because revegetation success is challenging in drawdown zone environments, and due to uncertainties regarding the availability of both salvaged stock and purchased stock.
5. Detailed documentation of planting effort (spatially explicit density for each stock category) will be emphasized and adopted as a responsibility of the planting contractor.

¹ Conditional Section, Clause 7.a.

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2 Timing and Phasing of the Revegetation Plan

Wetland construction will occur in two phases; this vegetation plan is for phase 1 only, scheduled for the fall of 2019. Areas that will be altered by phase 2 will not be vegetated in phase 1. During phase 1 construction (fall 2019), the first round of revegetation will occur simultaneously; however, there may be a requirement to source stakes prior to construction.

Depending on the survival and vigor of phase 1 revegetation and the timing of phase 2 construction, an additional re-stocking of phase 1 features could be planned prior to phase 2 construction; however, the details of follow-up revegetation and construction have not been determined at this time.

3 Treatment Areas

Details on the various physical works enhancements for Phase 1 are described elsewhere in detail (KWL 2017), but all essentially involve the excavation of ponds or the mounding of excavated material (Figure 2), which will be prescribed different planting prescriptions (described in Section 3). The phase 1 features are briefly summarized below.

A1-A4: Shallow Pond Wetland Complex

- Four shallow ponds (~0.3 to 0.5 m deep) will be excavated to enhance an existing shallow (unponded), stream-fed wetland that currently has low value for wildlife. The four ponds will be installed in series, progressing downstream along the watercourse ending at the height of land at approximately 436.5 masl (the A4 pond). The uppermost pond, A1 (~439 masl), is just downstream from a natural sedge-alder riparian wetland flowing towards the drawdown zone from a culvert under the highway.
- The upper two ponds, A1 and A2, will be planted to enhance riparian vegetation to improve wetland complexity and value for riparian/wetland wildlife, including nesting habitat for birds.
- The lower ponds, A3 and A4, will be planted in such a way to increase wildlife habitat while minimizing attractants for nesting birds.

B1: Isolated Pond

- This feature is somewhat experimental, and will attempt to create suitable pond habitat for wildlife (e.g., western toad, shorebirds) by excavation to the water table. Initially, this (possibly ephemeral) pond may be left disconnected from other wetland features to test the success of a disconnected system. Successful transplant establishment on the banks of this feature is expected to be challenging due to the nature of the substrate (course cobble, sand, etc.).

C2-C4: Mound Features

- The creation of mounds from excavated material near the proposed ponds (described above) will be designed to maximize crest elevation habitat near or above the full pool elevation (440.1 masl), thereby creating more safe nesting habitat and potentially an increased diversity of plants bordering the wetlands.
- Mounds will be staked and planted to promote nesting, as well as shading to promote RCG suppression/removal.

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- C2 is positioned next to the wetland water course (i.e., ponds A1-A4); due to its expected high organic soil content, C2 will be prioritized as the leading mound feature in terms of planting effort.

D1: Large Deep Low-elevation Pond

- A large deep wetland (up to 1.2 m deep with shallow fringes) will be created at the existing depression at the north end of the watercourse during Phase 1, provided the reservoir elevation is sufficiently low in the fall of 2019. This feature will be positioned at ~ 433 masl.
- There is no current plan to restore vegetation around D1, but sedges such as *C. lenticularis* could be effective at this elevation. After this pond has been created, the addition of submergent plants (macrophytes) should be considered.

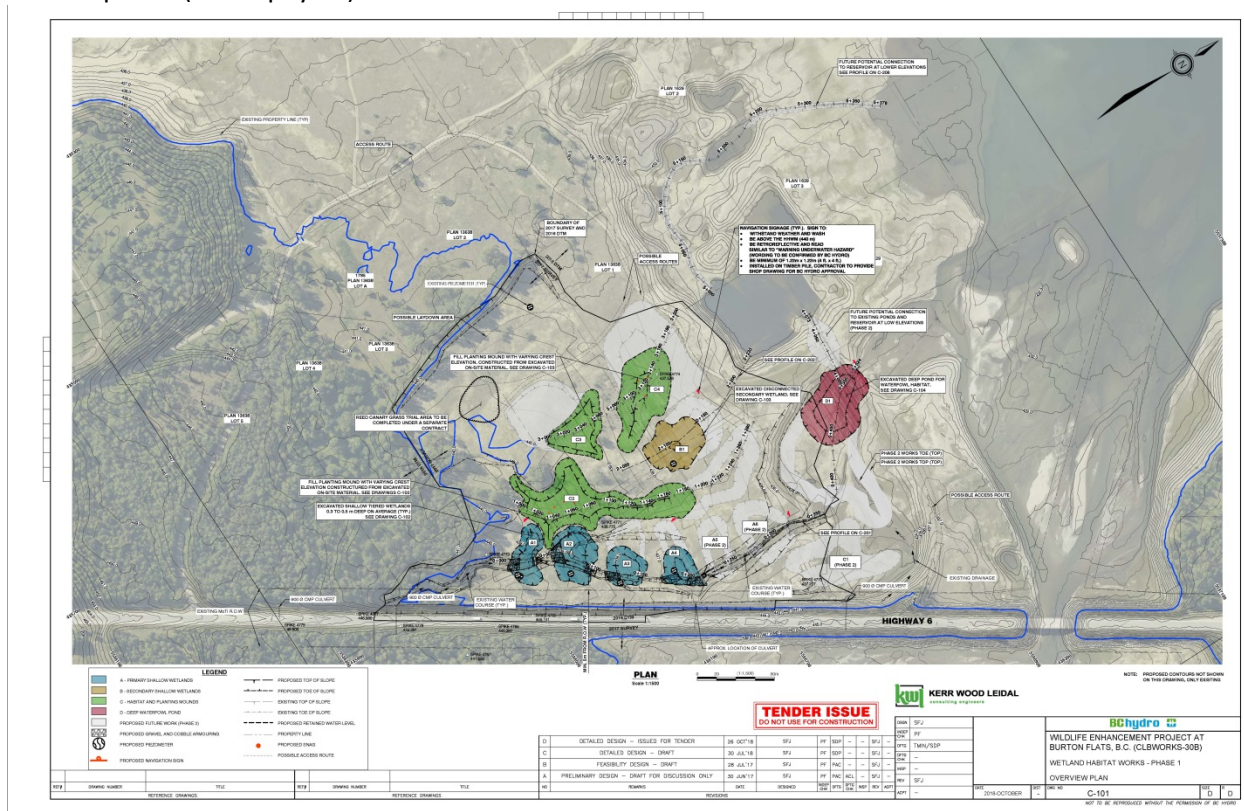


Figure 2: Burton Flats Wetland Enhancement Project Design Components – Phase 1 (KWL Detailed Design 2018). Features A1-A4 (Shallow Pond Wetland Complex) are shown in blue (A1 is the southern-most pond and A4 is the northern-most pond); the B1 feature (Isolated Pond) is beige; features C1-C3 (Mounds) are green; and Feature D1 (Large Deep Low-elevation Pond) is red. The blue line represents the full pool shoreline of Arrow Lakes Reservoir.

4 Considerations of the Revegetation Plan

The goal of the planting program is to establish native species with high wildlife habitat value in and around the wetlands. Where possible, the plants will align with culturally important native species and will result in a vegetation community that is similar to what might naturally become established at the site.

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In designing the revegetation plan, key considerations included:

1. plant species' relative value for wildlife,
2. the risk of bird nest flooding associated with different revegetation prescriptions across elevations,
3. plant tolerances to inundation,
4. the suitability of conditions for transplanted species at each microsite, and
5. the management of invasive weeds.

4.1 Valued Plants (for nesting birds)

CLBMON-36, a BC Hydro project that monitored bird nesting in Arrow Lakes Reservoir, assessed 1000's of nests in the drawdown zone over several years (Craig et al. 2018). Nests occurred in a variety of species including mountain alder, hardhack, birch, cedar, dogwood, elderberry, fir, hazel, pine, rose, snowberry, spruce, thimbleberry, twinberry, black cottonwood and willow (CLBMON-36 *unpublished data*). However, three shrubs were overwhelmingly more commonly used as nesting substrates: hardhack (*Spiraea douglasii*), willow (*Salix spp.*), and mountain alder (*Alnus incana ssp. tenuifolia*).

Hardhack and mountain alder were not widely distributed in the drawdown zone, and likely have relatively low tolerance to inundation; however, where they persist they are favoured for nesting by a wide variety of species including Common Yellowthroat, Song Sparrow, Chipping Sparrow, Willow Flycatcher, Alder Flycatcher, Cedar Waxwing and Yellow Warbler (over 250 nests for these species alone have been recorded). On the other hand, willow (primarily *Salix sitchensis* but including other *Salix spp.*) is relatively tolerant of inundation and is widely used by the same species listed above that use alder (over 801 nests recorded in Willow).

4.2 Nest Flooding

Within a reservoir, the ecological benefit of revegetating the drawdown zone as nesting habitat is reduced by the risk of nests flooding due to reservoir operations. Low elevation habitats have higher flooding risk and so the net benefit to birds is maximal at high elevations. Based on experience and findings from the CLBMON-36 monitoring program, it was determined that creating high quality nesting habitat should only be attempted at elevations greater than 438.5 masl (1.5 m below the full pool elevation). It is recognized that this is an estimate, and in truth the reality depends on species, plant morphology, and annual variability in reservoir operations. Below this elevation, the focus should be on establishing vegetation communities that are not commonly associated with high nests densities in the reservoir (e.g., Kellogg's sedge). Black cottonwood can also be used below 438.5 masl because this species does not typically provide suitable nesting habitat within 1.5 m of the ground.

4.3 Plant Tolerance for Inundation

The operation of Arrow Lakes Reservoir has created vegetation bands stratified by elevation, reflecting differing tolerance for inundation among plant species. The establishment of these vegetation communities is also affected by other factors including substrate type and morphology, and influence of reservoir operations on seed germination (Miller et al. 2015). The latter in particular is poorly understood, and both factors create some uncertainty around the true tolerance of particular plant species and the outcome of re-vegetation efforts.

The approach taken in this project is that initial stocking effort should: (1) be experimental; and (2) reflect confidence in success, with higher stocking densities applied in high-confidence settings. Past

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experience has determined that willows and black cottonwood are relatively inundation-tolerant, and these species are emphasized in the initial planting prescriptions. The phase 1 planting plan will ideally stock these species to their target density.

In other instances, a lower stocking effort will be used to experimentally learn where a diversity of different species can be successfully planted. The project will judiciously test tolerances for a wide diversity of species and monitor interim survival. Strategic re-stocking of successful species at specific sites and elevations will occur subsequently under a different planting plan.

It is anticipated that the semi-aquatic emergent sedges already thriving at site (small-flowered bulrush, beaked sedge) have capacity to spread and populate the enhanced pond margins that will be created. Stocking will be done using locally salvaged plants and distributed evenly throughout new shorelines.

4.4 Microsite

When planting in the drawdown zone of a hydroelectric reservoir, cues about microsite preferences should be derived from the distribution of the local flora wherever possible. A subject matter expert on reservoir vegetation community ecology will supervise the planting to ensure that transplant species are matched, to the extent possible, with appropriate microsite conditions to maximize re-vegetation success.

4.5 Invasive Weeds

The existing reservoir drawdown zone plant communities are a combination of native and non-native species arrayed by habitat preferences and by competitive tolerances. On many open terrestrial substrates, reed canarygrass (*Phalaris arundinaceae*) is a dominant semi-invasive species where it out-competes most other herbaceous plants, and likely suppresses establishment of many other species. Much of the planting for this project will occur in fresh unvegetated soils, allowing woody shrubs a chance to become established prior to reed canarygrass invasion. The eventual development of an overhead canopy will, it is expected, reduce the competitive edge of reed canarygrass and allow other herbaceous species to become established. Aside from promoting a canopy of native shrubs and trees, no further effort is being made to control invasive plant species via stocking; however, the Environmental Management Plan for the project will have strict control measures to prevent the spread of noxious weeds.

5 Sourcing of Planting Stock

5.1 Vegetation Salvage

A limited supply of planting material may be obtained by salvaging existing vegetation immediately prior to construction. Therefore, as many existing native sedges and shrubs within the construction footprint as feasible will be flagged and salvaged immediately before work is started at each wetland. This may require fall flagging if construction takes place in spring/early winter. Salvaged stock will be re-planted at immediately following or soon after construction as directed by the on-site vegetation specialist, in accordance with the feature-specific prescriptions (Section 7). An excavator may be used to remove desirable native plants, set them aside, and replant them the same day. Preliminary site visits have highlighted several key species to salvage (Table 1).

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Table 1. Species that have been noted for salvage at the Burton Site. Elevations, abundance, and distribution are qualitative; mid elevations are approximately 436- 438 m asl.

Species	Habitat	Elevation	Abundance	Distribution
Kellogg’s sedge	terrestrial	Low, Mid	High	Throughout area and within footprint
Columbia sedge	terrestrial	Mid	Moderate	Throughout area and within footprint
beaked sedge	semi-aquatic (emergent)	High	High	In water course (footprint) only
small-flowered bulrush	semi-aquatic (emergent)	High	Low	In water course (footprint)only
water smartweed	amphibious (aquatic and semi-terrestrial)	Mid	Low	Throughout area and within footprint

5.2 Nursery Plugs and Rooted Stock Specifications

To ensure sufficient stock is available for the revegetation areas, some nursery plugs and rooted shrub stock will need to be grown prior to start of construction. An accompanying Excel spreadsheet provides approximate numbers for required plugs and rooted stock based on desired planting densities, size of treatment area, and desired spacing for nursery plugs.

Nursery plugs will be grown to a 512B (5 cm across and 12 cm deep) size to maximize chances of plug survival, while remaining cost effective. Rooted cuttings will be 1 gallon in size.

5.3 Live stake collection and planting

Live stakes will be comprised of black cottonwood and Sitka willow and should be collected in the general vicinity of the wetland sites in the late fall of 2019, just prior to (or coincidental with) wetland construction. Stakes should be direct-planted (i.e., cut immediately prior to planting with no intermediate storage). Ideally, cuttings will have a minimum base diameter of 2.5 cm, with larger diameters being preferred, and a minimum top diameter of 1.5 cm. The preferred minimum cutting length is 1.5-2 m. However, it is acknowledged that these dimensions, especially diameters, may be overly-prescriptive and may not always be achievable in the case of locally collected salvage stock.

Cuttings will be collected from healthy dormant plants; diseased or otherwise damaged cuttings will not be used. Following removal from the parent plants, the cuttings will be pruned down to one main stem, taking care not to damage the bark of the stem (pruning will minimise the leaf area, thereby minimising the chances of the cuttings desiccating prior to root development).

Where possible, live stakes should be planted with a compact excavator, since excavator planting has produced comparable survivorship to the hand planting alternative and is less labour-intensive (CLBWORKS-2). Planting depth of each cutting should be at least 1 m, substrate permitting, and at least half of cut length (but preferably the majority of cut length, especially in the case of willow). In general, Longer cuttings will be planted at lower elevations, while shorter lengths may be adequate at upper elevations, though all live stakes will be planted in the upper elevation zone.

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6 Proposed Vegetation Species and Planting Elevations

The existing wetland/watercourse at the site supports emergent sedges and mountain alder. Above full pool, the wetland is largely enclosed by forest canopy. The project will enhance the drawdown zone, which has limited potential to be shaded by a forest canopy even after habitat enhancement. A preferred vegetation community—one that extends the naturally existing wetland into a non-shaded opening—is a ponded complex supporting emergent and terrestrial sedges; shrubs such as hardhack and alder; and nearby cedar, pine and birch growing sporadically on hummocks, with occasional dead conifers (cedar, pine) acting as coarse woody debris. This describes the basic vision for the upper elevation riparian zones (Ponds A1-A2 and associated matrix habitat/banks).

The planned mound features (C1-C3) present a novel situation for revegetation attempts in Arrow Lakes Reservoir, and pose a specific set of challenges. Over the course of a growing season, these microsites will alternate between being well-drained and hot, and saturated, due to the highly variable water table controlled by the reservoir. The approach here is to experiment with a diversity of upland species; especially those which can potentially tolerate drought and periodically raised water tables. The revegetation goal is to establish a diverse and dense multi-storied vegetation community, but the target species assemblage is not strictly defined.

At lower elevations, species that are conducive to bird nesting near the ground (e.g., most shrubs other than cottonwood) will be avoided. The focus at these elevations will be on establishing an initial ground cover of sedges.

A qualitative summary of the planned phase 1 planting prescription categories is provided in Table 2. A quantitative summary of species-specific target densities is provided in Table 3, with further details provided in the accompanying Excel spreadsheet. The spatial layout of where planting prescriptions are applied is mapped out in the detailed construction plan (Kerr Wood Leidal Consulting Engineers 2018).

Table 2. Quality summary of planned planting prescription categories for the Burton Site.

Planting Prescription Category	Description
1: Emergent Sedges	High-elevation pond emergent sedges (beaked sedge, small-flowered bulrush). Salvaged, and supplemented by plugs. At ponds positioned below elevations where these emergents are growing naturally, a low density of plugs will be planted as a trial.
2: Riparian	A dense irregular mix of riparian shrubs (e.g., hardhack, twinberry, Sitka willow, mountain alder, red-osier dogwood) to encourage nesting intermixed with graminoids (e.g., Kellogg's sedge, Columbia sedge, bluejoint reedgrass).
3: Terrestrial Sedges (upper)	High-elevation graminoid prescription that includes woody species to encourage nesting. Variable density stocking with salvaged sedges (Kellogg's sedge, Columbia sedge), and stakes of three species (black cottonwood, red-osier dogwood, Sitka willow) stocked to a density target. Microsites can be restocked in future where good survivorship is observed.

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4: Terrestrial Sedges (lower)	Low elevation terrestrial prescription that should not include species that encourage nesting. Variable density stocking with salvaged Kellogg's sedge (<i>C. lenticularis</i> var. <i>licocarpa</i>); this is a more reliable species at low elevations. Restock microsites in future where survivorship is observed.
5: Terrestrial Mix (general)	These polygons span elevations and will be planted with PP3 or PP4, depending on site elevations.
6: Mound Mix	Moderate-density and high-diversity shrub mix (e.g., soapberry, paper birch, western white pine, hazelnut, twinberry, Bebb's willow, saskatoon, snowberry, cottonwood, dogwood, and/or prickly rose). This is very much experimental to see which species thrive on the likely arid conditions on mound summits.

Table 3. Target stocking densities for species, if these can be sourced. This table provides guidance only; the availability of stock and salvaged plants will influence the realized stocking densities. The application of prescription categories by location is provided in the detailed construction plan.

Species	Prescription Category						Total	Source
	1	2	3	4	5	6		
Beaked Sedge	102	0.0	0.0	0.0	0.0	0.0	102	Salvage
Small-flowered Bulrush	102	0.0	0.0	0.0	0.0	0.0	102	Salvage
Hardhack rooted stock	0	58.8	0.0	0.0	0.0	91.0	150	Purchase
Twinberry rooted stock	0	29.4	0.0	0.0	0.0	181.9	211	Purchase
Mountain Alder rooted stock	0	29.4	0.0	0.0	0.0	91.0	120	Purchase
Bluejoint Reedgrass plug	0	587.8	171.2	0.0	615.0	909.5	2284	Purchase
Water Smartweed	26	29.4	0.0	0.0	0.0	0.0	55	Salvage
Columbia Sedge plug	0	58.8	68.5	0.0	30.8	91.0	249	Salvage
Kellogg's Sedge plug	0	147.0	171.2	57.4	153.8	91.0	620	Salvage
Dogwood stakes	0	587.8	342.4	0.0	0.0	454.8	1385	Stake
Sitka Willow stakes	0	587.8	342.4	0.0	0.0	454.8	1385	Stake
Cottonwood stakes	0	0.0	342.4	0.0	153.8	0.0	496	Stake
Soapberry rooted stock	0	0.0	0.0	0.0	0.0	454.8	455	Purchase
Paper Birch rooted stock	0	5.9	0.0	0.0	0.0	454.8	461	Purchase
Western White Pine rooted stock	0	5.9	0.0	0.0	0.0	91.0	97	Purchase
Bebb's Willow rooted stock	0	0.0	0.0	0.0	0.0	454.8	455	Purchase
Saskatoon rooted stock	0	0.0	0.0	0.0	0.0	272.9	273	Purchase
Snowberry rooted stock	0	0.0	0.0	0.0	0.0	272.9	273	Purchase
Hazelnut rooted stock	0	0.0	0.0	0.0	0.0	91.0	91	Purchase

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7 Feature-Specific Prescriptions

7.1 Ponds A1 and A2

At A1 and A2, the planting treatment on the new pond margins will extend, and merge with, the natural emergent sedges that are already established along the existing water course. Salvaged emergent sedges (beaked sedge and small-flowered bulrush) will be transplanted into a 1-1.5 m pond edge of shallow water (< 25 cm deep) and can possibly be supplemented with additional plug stock. Logs—preferably cedar—can be added as features, provided it is possible to anchor them sufficiently to withstand inundation. Logs will be positioned as if fallen into the pond with out rootwads. It may be possible to colonize these logs with typical wetland log plants (e.g., mosses, small woody shrubs, etc.). Approximately 4 major logs are recommended for Pond A1. Minor logs or stumps can also be added. To promote vigorous growth and propagation of emergent sedges, a priority will be to ensure that the margins of these ponds are retained with good quality organic soil.

Surrounding the ponds, shorelines will be planted to encourage a rich wetland riparian community, including a dense irregular mix of riparian shrubs (e.g., hardhack, twinberry, willow, alder, dogwood etc.) intermixed with graminoids (Kellogg's and Columbia sedge, bluejoint reedgrass). Establishment of hardhack with spaced alders is the primary aim. However, because of concern that alders may not survive well in the drawdown zone, a mix of alder, willow, twinberry, and dogwood will be trialed. Additional features will include a few specimen trees (e.g., western white pine, paper birch), snags (cedar spires), stumps, brush, and several fallen-log features (preferably of cedar). To foster a rich habitat, the upslope banks surrounding the ponds will be prioritized for augmentation with the best growing soils available on site.

7.2 Pond A3

Experimental planting (low density) of emergent sedges (beaked sedge and small-flowered bulrush) can be undertaken at the pond edges, using salvaged plants or plug stock. This area might be too far removed from the permanent water/seepage course for these species to flourish.

Due to the lower elevation (< 438 masl), shrubs such as red-osier dogwood and willow are not suitable for birds to nest in. Around the margins of the pond, locally-occurring terrestrial sedges (Kellogg's sedge and Columbian sedge) will be salvage-planted (at low density) in conjunction with black cottonwood stakes. Note that cottonwoods do not provide nesting habitat until they are large enough to be well above the maximum water line; thus, they do not represent an ecological trap for nesters. This will be experimental stocking, with an opportunity to re-plant where plants have survived, which may vary considerably depending on micro-site conditions.

7.3 Pond A4

Experimental planting (low density) of emergent sedges (beaked sedge and small-flowered bulrush) can be undertaken at the pond edges, using salvaged plants or plug stock. This area might be too far removed from the permanent water/seepage course for these species to flourish.

Around the margins of the pond, only Kellogg's sedge will be salvage-planted (at low density). This species can survive extended inundation at this band of the drawdown zone and hence is recommended. Experimental stocking density will be used with opportunity to re-stock where sedge survival is observed.

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7.4 Pond B1

Pond B1 will occur at the elevation of the water table. Revegetation goals for the slopes and banks of this pond are primarily to promote moderate-density vegetation that will not attract nesting birds. Around the lower margins of the pond, only Kellogg's sedge will be salvage-planted (at low density). Experimental stocking density will be used with opportunity to re-stock in the future where good survival is observed. Excludes area to be disturbed in Phase 2.

Higher on the bank, low density stocking with a mix of sedges (Kellogg's and Columbia sedge) will be applied. A low density of cottonwood stakes will also be applied. Willow and red-osier dogwood should not be applied in this area due to its relatively low elevation (< 438 mASL). This will be experimental stocking, with an opportunity to re-plant where plants have survived, which may vary considerably depending on micro-site conditions. Excludes area to be disturbed in Phase 2.

7.5 Pond D1

Pond D1 has no planting plan prescribed at present. This feature is at very low elevation in the drawdown zone (~433 masl), where few terrestrial plants occur naturally. Additionally, the site will likely not be available for construction and planting in the fall due to reservoir operations. This pond may develop into a suitable receptor site for emergent wetland plants and/or aquatic macrophyte translocations in the future.

7.6 Mound C2

This mound feature has been designed to have maximal high-elevation habitat, and being adjacent to the wetland and riparian habitat, will be a priority for establishing a multi-storied upland habitat. As noted previously, there may be challenges associated with getting plants established at this site. To increase the probability of success, a wide diversity of plant species will be trialed, and to promote vigorous growth and propagation of the mound vegetation, the crest of this mound will be a high priority for organic soils.

Within the mound's perimeter disturbance allowance, low-density stocking of willow, dogwood, cottonwood, and sedge will be applied. Red-osier dogwood and willow will not be planted below 438.5 masl. Excludes area to be disturbed in Phase 2.

The lower portion of the mound will be stocked at low density with a mix of Kellogg's and Columbia sedge, as well as black cottonwood, red-osier dogwood, and Sitka willow stakes (elevation permitting for the latter two species). This will be experimental stocking, with an opportunity to re-plant where plants have survived, which may vary considerably depending on micro-site conditions. Excludes area to be disturbed in Phase 2.

The summit of this mound will be planted to foster a diverse upland multi-layer vegetation community, suitable for nesting birds, roosting bats, and other terrestrial wildlife. A moderate-density and high-diversity terrestrial vegetation mix will be applied (e.g., soapberry, birch, white pine, twinberry, Bebb's willow, saskatoon, snowberry, cottonwood, dogwood, and/or prickly rose etc.). Snags can be added as features in this area. Additionally, several specimen trees (e.g., cedar, hemlock), logs, and stumps can be included. Excludes area to be disturbed in Phase 2.

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7.7 Mounds C3 and C4

These mounds will be planted to promote typical drawdown zone vegetation types (willows, black cottonwood) which are used by wildlife, but locally uncommon in the drawdown zone.

As for C2, the disturbed perimeters will be restored with a low-density stocking of willow, dogwood, cottonwood, and sedges, with reduced diversity at low elevations. Dogwood and willow will not be planted below 438.5 masl.

As for C2, the lower portion of C4 will be stocked at low density with a mix of Kellogg's and Columbia sedge, as well as black cottonwood, red-osier dogwood, and Sitka willow stakes (elevation permitting for the latter two species). This will be experimental stocking, with an opportunity to re-plant where plants have survived, which may vary considerably depending on micro-site conditions.

As for C2, the summits of both mounds will be stocked with a moderate-density and high-diversity terrestrial vegetation mix including soapberry, birch, white pine, twinberry, Bebb's willow, saskatoon, snowberry, cottonwood, dogwood, and/or prickly rose etc.). Snags can be added as features in this area. Additionally, some specimen trees (e.g., cedar, hemlock), logs, and stumps can be included. In contrast to C2, these mounds are not high priority areas for substrate augmentation.

8 References

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