Lake Restoration Solutions, Inc.

UTAH LAKE RESTORATION PROJECT

PROPOSAL

REDACTED

JANUARY 2018

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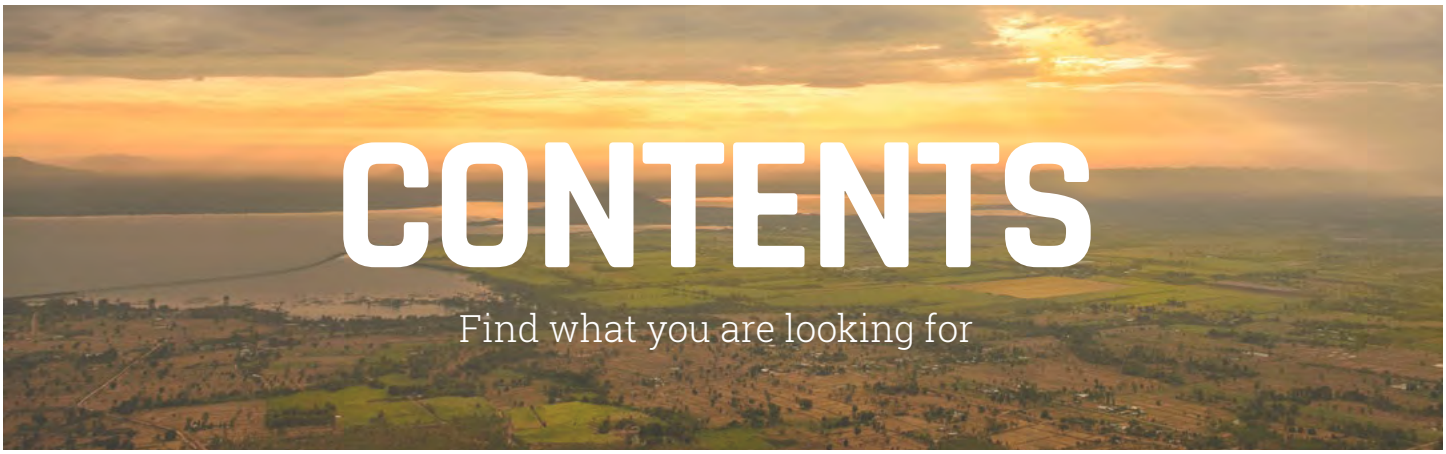

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Lake Restoration Solutions, Inc.

UTAH LAKE RESTORATION PROJECT

EXECUTIVE SUMMARY

The Utah Lake Restoration Project is a comprehensive plan for restoring Utah Lake. Considering the size, location, and ecological importance of Utah Lake, the promise of comprehensive restoration is an objective worthy of monumental collaboration and investment by the state of Utah and its citizens.

It will transform the Lake from an impaired, nutrient-loaded waterway, dominated by invasive species and prone to algal blooms, into a clear-water state lake with thousands of acres of restored native submerged plant zones, millions of June sucker, Bonneville cutthroat trout, and native fish species,

flocks of geese, pelicans, bald eagles, osprey, and shore birds. In short, comprehensive restoration will turn back the clock on 150 years of lake ecosystem degradation.

The Utah Lake Restoration Project will contribute billions of dollars in private funding to accomplish these restoration goals. A $2 billion dredging project will result in a deeper, clearer lake, dotted with Islands for recreation, conservation, and world class water-front living. Over 30 billion gallons of water conservation savings will be produced through reduced evaporation and removal of miles of invasive plant species. The Project will provide a vibrant crown jewel of waterfront living and outdoor recreation, adding to the already tremendous natural wonders of the State of Utah.

CONSERVATION SOLUTIONS

Dredging, island creation, controlling wind and wave action, water quality improvements, and restored native plant and animals will be accomplished through approximately $6.4 billion in private conservation investment.

DREDGING

The foundation of the Utah Lake Restoration Project is dredging the Utah Lake bottom, removing nutrient loaded sediments that feed toxic algal blooms, deepening the Lake to reduce forces that can disturb the lake bottom, and changing the lake bathymetry by creating deep-water channels to improve circulation and cool the water.

ISLAND CREATION

Dredged material is then formed into islands strategically engineered and placed to control wind and wave action on the Lake, expand fish and wildlife habitat, protect shorelines, and reduce evaporation.

WATER QUALITY

The Project also funds upgrades to 6 waste treatment facilities around the Lake and installs 40 biofiltration systems, ensuring that new water inflows are clean and clear. Each of these solutions combine to transform the Lake from a turbid, hypereutrophic state to a clean clear-water state.

RESTORING NATIVE PLANTS AND ANIMALS

Conservation investments allow for restoration of a thriving native aquatic and plant ecosystem, including removal of invasive species. This creates a self-sustaining ecosystem with clean water allowing native aquatic and terrestrial plant and animal species to thrive. Many of those same species help naturally heal the Lake by serving as filters to keep the water clean.

ISLAND DEVELOPMENT

Besides serving a critical conservation role, island creation provides tremendous recreational opportunities and lakefront living for hundreds of thousands of Utahns. Islands are the economic engine that attracts the private funding for the $6.4 billion conservation investment. The majority of new land created on the Lake will be open, public space, including parks, beaches, trail systems, and recreation islands.

Developed islands will create lakefront living at multiple price points with single and multi-family housing in low, medium, and high-density options. The main development will include residential, commercial and business districts, with upscale shopping and dining options for island residents and visitors. Environmentally conscious lake front living is designed to support and reinforce the conservation objectives of the Project.

IMPLEMENTATION

This Project proposal represents a decade of design, modeling, engineering and planning. The Utah Lake Restoration Project team is a world-class group of experts and infrastructure professionals, many of whom have led similar multi-billion-dollar island creation and infrastructure projects around the world. The implementation plan includes five phases:

1. Planning, detailed design, environmental analysis, and documentation
2. Restoration of Provo Bay
3. Dredging and island creation
4. Recreation island development
5. Main island development

The project will be completed in phases over the course of several years. Most conservation solutions will be implemented and operational within the first ten years of the project. Full development will continue much longer, perhaps as many as 25 years for full construction and development of Island communities.

PUBLIC TRUST

The Utah Lake Restoration Project contributes significantly to public trust values in the state of Utah. The following are areas of significant public trust benefits to the state of Utah and its residents:

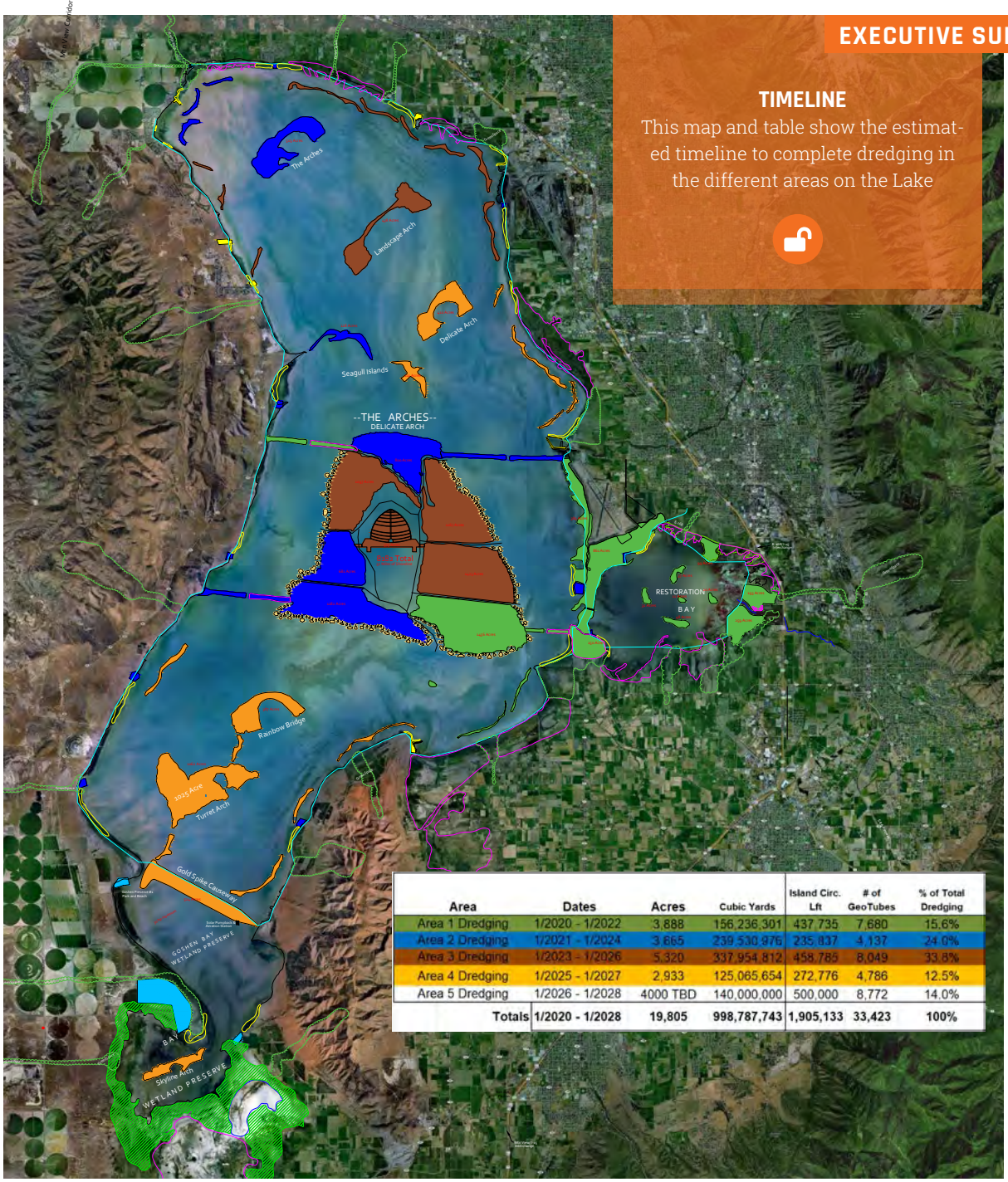
1. Commerce: Increasing tourism, economic development, and state tax revenues
2. Water: Improving water conservation, water clarity, and water quality
3. Environmental conservation: Restoring natural ecosystems, including native plant communities, wildlife, endemic, and endangered species
4. Growth: Sustaining population growth along the Wasatch Front, with affordable housing, sustainable green living, and commercial/business areas
5. Recreational opportunities: Restoring use of the Lake, and building recreation islands, open space, trail systems, docks, and public beaches
6. Transportation: Constructing causeways, public transportation, and enabling pedestrian traffic
7. Navigation: Increasing recreational utilization, access, and safety of the Lake

REVIEW CRITERIA

The five review criteria to evaluate competing bids include: (1) Income potential; (2) Ability of proposed use to enhance adjacent state property; (3) Proposed timetable for development; (4) Ability of applicant to perform satisfactorily; and (5) Desirability of proposed use. The following table is provided to assist in evaluation of this proposal. The sections which address the evaluation criteria are as follows:

REQUIREMENT		PAGES
1.	Income potential:	
	a. Public Trust, Commerce	209-218
	b. Implementation, Island Development	191-206
2.	Ability of proposed use to enhance adjacent state property:	
	a. Conservation Solutions	31-100
	b. Implementation	101-206
	c. Public Trust	207-240
3.	Proposed timetable for development: Implementation	4-6
4.	Ability of applicant to perform satisfactorily:	
	a. Ability of proposed project to produce conservation benefits: Conservation	225-228
	b. Ability of project implementation to be completed successfully: Implementation	101-206
	c. Ability of team to successfully complete the work: Team	241-243
5.	Desirability of Proposed Use:	
	a. Conservation Solutions	31-100
	b. Public Trust	207-240

Note: We can provide supplemental information at the request of the Sovereign Lands Program and the State of Utah.



TIMELINE

This map and table show the estimated timeline to complete dredging in the different areas on the Lake

Area	Dates	Acres	Cubic Yards	Island Circ. Lft	# of GeoTubes	% of Total Dredging
Area 1 Dredging	1/2020 - 1/2022	3,888	156,236,301	437,735	7,680	15.6%
Area 2 Dredging	1/2021 - 1/2024	3,665	239,530,976	235,837	4,137	24.0%
Area 3 Dredging	1/2023 - 1/2026	5,320	337,954,812	458,785	8,049	33.8%
Area 4 Dredging	1/2025 - 1/2027	2,933	125,065,654	272,776	4,786	12.5%
Area 5 Dredging	1/2026 - 1/2028	4000 TBD	140,000,000	500,000	8,772	14.0%
Totals	**1/2020 - 1/2028**	**19,805**	**998,787,743**	**1,905,133**	**33,423**	**100%**

CONCLUSION

This proposal is a comprehensive plan for restoring Utah Lake and the surrounding ecosystem. The solutions contained herein represent more than a decade of design, modeling, engineering, and planning by a team of world-class experts and infrastructure professionals. The team includes many who have led similar multi-billion-dollar island creation and infrastructure projects around the world. The engineering is innovative, the science is sound, and the team has combined decades of experience to complete the Utah Lake Restoration Project. The promise of comprehensive restoration of Utah Lake is an objective worthy of pursuing. We look forward to the consideration of the Sovereign Lands Program and the State of Utah on this important project.

BACKGROUND

THE RIGHT DIRECTION

As one of the largest natural lakes in the western United States, Utah Lake is a significant resource for the state of Utah. This plan is the road map to take Utah Lake in the right direction.

AN UNTAPPED RESOURCE

A restored Utah Lake holds invaluable potential as a resource for our growing state and its residents.

Utah Lake's importance, both ecologically and as a freshwater resource, is addressed by the Utah Lake Commission, "Utah Lake is a focal point of natural resource systems that contribute to the environmental health, economic prosperity and quality of life of area residents and visitors."

When pioneers arrived in the valley in the mid 1800s, Utah Lake was a clear-water lake with a vibrant ecosystem of freshwater vegetation, aquatic and terrestrial species, shorebirds, and waterfowl. The Lake continues to be home to many endemic fish, aquatic and terrestrial species, and serves as an important part of the Great Basin Flyway for migratory bird species. Tens of thousands of birds utilize the Lake every year for nesting, brood rearing, and spring and fall migrations. In recent years, however, the ecological impairment of Utah Lake has become a significant concern.

AN UNDERUTILIZED RESOURCE

Utah Lake has become significantly underutilized as a recreational destination, despite its easy accessibility by two million residents along the Wasatch Front. During the summer months, water quality degradation, including significant algal blooms and e-coli outbreaks, has led to closure of the Lake lasting for weeks at a time. This past year, during the prime recreational summer months, there were only between 10 to 30 boats on the Lake most days.

Factors that have negatively impacted the Lake include but are not limited to:

1. Fluctuating lake levels
2. Loss of aquatic plant species from invasive carp
3. Heavy phosphorus and nitrogen loading
4. Increased wind and wave action
5. Uncontrolled algal blooms
6. Loss of habitat to invasive plant species

Instead of a clean, clear-water lake, Utah Lake is now a turbid, hypereutrophic lake with significantly degraded water quality. This not only presents significant challenges from a water supply standpoint, but also heavily impacts the native terrestrial and aquatic species that utilize Utah Lake. To address each of these challenges, tremendous financial and infrastructure investments will be needed.

UTAH H.C.R. 26

1. WILDLIFE RESTORATION
Restore a vibrant fishery, including the Bonneville cutthroat trout population and recovering the June sucker, while improving habitat for waterfowl and other wildlife species.

2. PLANT RESTORATION
Accelerate solutions to remove invasive plant species, restore littoral zone plant communities, and restore native plant species on Utah Lake's shoreline.

3. RECREATIONAL ACCESS
Maximize and ensure recreational access and opportunities on Utah Lake, while also improving lake use for Utah and its citizens.

PUBLIC ACCESS
It is critical that any comprehensive plan include maintaining or even improving public access to Utah Lake and its resources.

RESTORATION EFFORTS

Extensive efforts have been made by the Utah Lake Commission and the State of Utah to restore the Lake, but it continues to degrade. In an effort to find a solution, the Utah Legislature passed a concurrent resolution during the 2017 legislative session which sets forth important objectives for the restoration of Utah Lake. The resolution, H.C.R. 26, sponsored by Representative Mike McKell and Senator Deidre Henderson, passed with significant bi-partisan support. We applaud the leaders of the State for their acknowledgment of the need for solutions to the Lake's significant challenges.

> Extensive efforts have been made...to restore the Lake, but it continues to degrade.

In response to H.C.R. 26, Lake Restoration Solutions has prepared a comprehensive and accelerated plan, named "The Utah Lake Restoration Project." This proposal provides additional detail to the application previously submitted in December of 2017 which formally began the process of applying as project contractor. The Utah Lake Restoration Project will restore Utah Lake in a manner that meets all of the objectives set forth by the Utah Legislature in H.C.R. 26.

PUBLIC TRUST

The Utah Lake Restoration Project contributes significantly to public trust values in the state of Utah. The following are areas of significant public trust benefits to the state of Utah and its residents: commerce, water conservation and quality, environmental conservation, growth, recreational opportunities, transportation, and navigation.

A RESOURCE FOR THE FUTURE

Our plan is a pathway to create a resource that Utahn's will be able to enjoy for generations to come. It will create a place people will want to visit and enjoy rather than avoid as they do now.

BACKGROUND

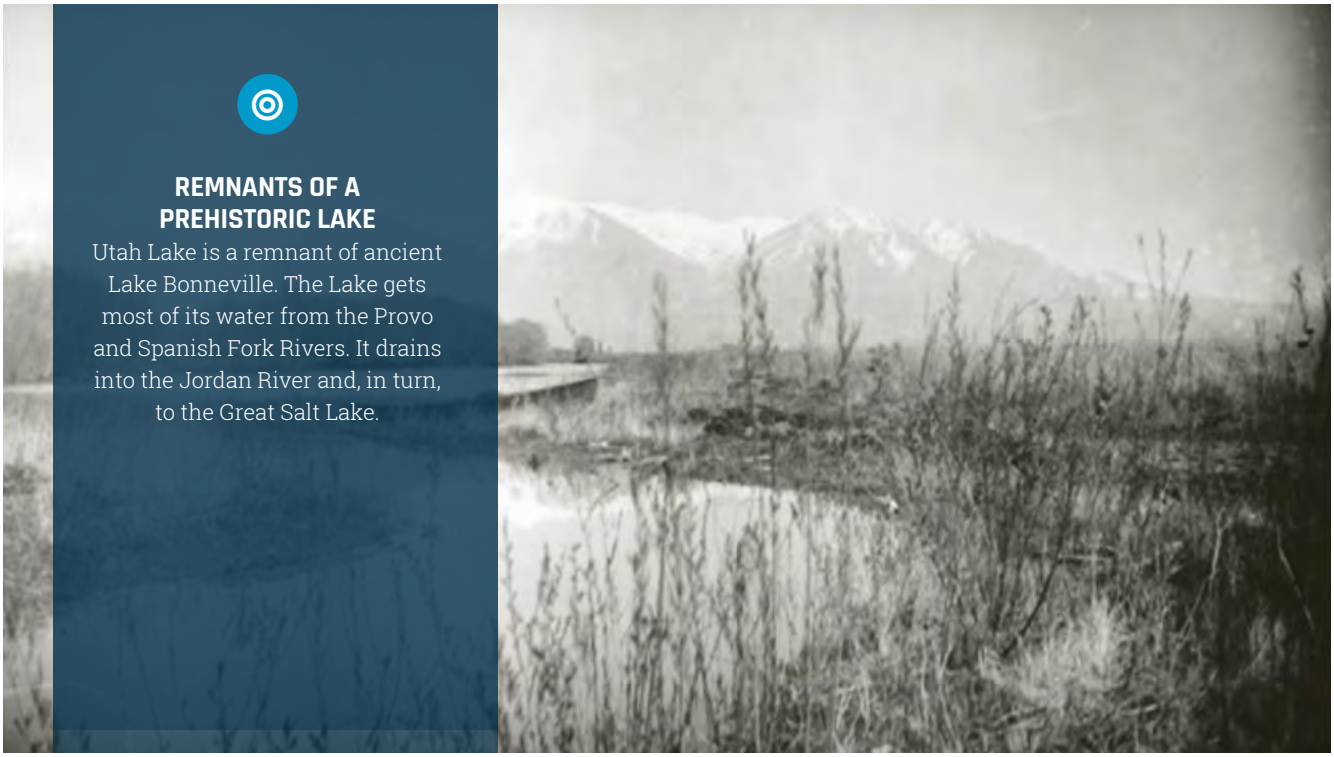
A BIT OF HISTORY

Utah Lake's journey to its current state is the complex result of thousands of years of history. It is important to understand how each issue affects the other to see a comprehensive restoration is necessary.

This proposal will demonstrate how the Utah Lake Restoration Project will implement a comprehensive plan to restore Utah Lake and provide ecologically responsible development to fund the extensive restoration investment on Utah Lake without requiring billions of taxpayer dollars to meet these restoration objectives.

We will also describe the expertise and background of the team that will implement the Utah Lake Restoration Project and the decades of global experience they have with the implementation of infrastructure projects of this size and scale.

UTAH LAKE MARINA
In 2017, during prime recreational Summer months, most days there were only between 10 to 30 boats on the Lake.



REMNANTS OF A PREHISTORIC LAKE

Utah Lake is a remnant of ancient Lake Bonneville. The Lake gets most of its water from the Provo and Spanish Fork Rivers. It drains into the Jordan River and, in turn, to the Great Salt Lake.

THE SETTING

Utah Lake is an expansive freshwater lake, surrounded by adjacent fertile lands of Utah Valley and towering mountain ranges. For thousands of years, the Lake and surrounding areas provided valued resources to the populations centered in Utah County and along the Wasatch Front.

Utah Lake is a remnant of the much larger Pleistocene era Lake Bonneville that once covered the Basin and Range Province from the Wasatch Front to the Sierra Nevada. It has covered 25 percent of Utah Valley for approximately 10,500 years and is among the largest naturally occurring freshwater lakes west of the Mississippi River.

Mountains surround Utah Valley and the Lake on three sides. They include the Wasatch Range to the east, Traverse Mountains to the north, and Lake Mountains to the West. The Lake's inflow is composed of surface inflows from 13 tributaries, the most important being the Provo and Spanish Fork Rivers from the Wasatch Range. Other sources of lake water include springs and annual precipitation. The Lake is shallow with an average depth of approximately 9 feet and maximum average depth of 13 to 15 feet. The Lake drains into the Jordan River, which flows north into the Great Salt Lake.

ABUNDANCE OF FISH

Prior to European settlement in 1849, a tremendous native fishery flourished in the Lake.

CENTER OF HUMAN ACTIVITY

This highly productive lake-river system on the eastern perimeter of the Great Basin has been a center of human activity and settlement for 6,000 years (e.g., Archaic, Fremont, and Late Prehistoric periods).

Prior to European settlement in 1849, limited historical accounts by Spanish explorers (1775-1820), fur trappers (1820-1850), and early settlers (from 1849) provide some insight, particularly of the tremendous native fishery that once flourished in Utah Lake. Trout and suckers were abundant for harvesting—supplying food for the local native people (Timpanogos) and settlers.

FACTS

96,400 ACRES

Utah Lake has covered 25 percent of Utah Valley for approximately 10,500 years.

Utah Lake covers about 96,400 acres (150 square miles) and has an average depth of approximately 9 feet.

Even today the Lake is highly valued. It continues to support fish populations, though the fish species on the Lake are primarily non-native and invasive. The Lake and wetlands support large avian populations of migratory, shore, and songbird populations. The Lake is used for summer and winter recreation including boating, fishing, swimming, picnicking, skiing, wind boarding, and ice skating.

DECADES OF DECLINE

A subnormal-cold winter in the mid-1800s caused much of the settlers' livestock to die. Fish were over harvested for food and, by 1870, overfishing severely depleted native fish populations. Introduction of non-native species, such as carp, in the early 1880s, further depleted native populations. Then, as the human population

"...and the valleys and the borders of the lake of the Timpanogos [Utah Lake]... is the most pleasant beautiful and fertile in all of New Spain.... The lake and the rivers which empty into the lake abound in many kinds of choice fish; there are to be seen there very large white geese, many varieties of duck, and other kinds of beautiful birds never seen elsewhere; beavers, otters, seals, and other animals which seem to be ermines by the softness and whiteness of their fur."

Father Silvestre Velez de Escalante, 1776

"I was at Utah Lake last week and of all the fisheries I ever saw, that exceeds all. I saw thousands caught by hand, both by Indians and whites. I could buy a hundred, which each weigh a pound, for a piece of tobacco as large as my finger. They simply put their hand into the stream, and throw them out as fast as they can pick them up.... Five hundred barrels of fish might be secured there annually...."

Parley Pratt, 1849

PRIOR CONDITIONS

Historical reports illustrate Utah Lake in a completely different light than its current condition. They give a glimpse into the potential of a comprehensively restored lake.

Effects of Agriculture
Over time, return flow and seepage of agricultural waste, including fertilizers and stockyard waste, have negatively impacted the Lake's chemistry.

Ambient Dust

Fertilizers

Stockyard Waste

Nutrient Loading

grew and agricultural use of the land increased, a dam at the source of the Jordan River was built (in the late 1800s) to facilitate management of Utah Lake water for culinary and agricultural-irrigation uses. Unfortunately, return flow and seepage of agricultural waste, including fertilizers and stockyard waste, affected the chemistry of the Lake. These factors contributed to adverse effects on water quality, aquatic ecology, and precipitated changes in shoreline vegetation. Non-native phragmites have flourished in the lake environment.

By 1900, only 50 years after the first settlers moved into the valley, the native fishery had been decimated due to over-utilization and exacerbated by the introduction of non-native fish such as carp, white bass, and walleye. The carp quickly consumed and destroyed native plant populations that secured bottom sediments. The loss of native vegetation led to turbidity of the water with increased sedimentation in the water column. Lost vegetation also resulted in loss of cover for

PHOSPHORUS AND INORGANIC NITROGEN

Some nutrients are necessary for a healthy lake, however Utah Lake has been overloaded with phosphorus and nitrogen through natural and man-made causes.

young, native fish, such as trout and the June sucker, allowing them to become easy prey for predator fish.

Other records document the decline in water quality of Utah Lake:

- In 1948, a study demonstrated Utah Lake was seriously polluted—raw sewage was being disposed of in the Lake.
- By 1954, cities had constructed or were in the process of constructing sewage treatment plants; though, raw sewage was still evident in the Lake by 1967.
- While the Lake was considered polluted through the 1960s, actions implemented as a result of the Water Pollution Control Amendments of 1972 enabled the Lake to be deemed safe for swimming and recreation.
- The Environmental Protection Agency National Eutrophic Survey Program conducted in 1973-1974 reported Utah Lake to be the most eutrophic lake of the 27 lakes surveyed in Utah.
- In 1981, the Lake was reported to be hypereutrophic with in-flows of high concentrations of phosphorus and inorganic nitrogen.
- In the early 2000s, Utah Lake exceeded Clean Water Act recommended values for phosphorus and total dissolved solids (TDS). High levels of phosphorus can result in high levels of nuisance algae growth, low dissolved oxygen, and elevated pH levels. Heavy nutrient loading into the Lake sustains algae growth (somewhat limited by turbidity restricting the penetration of light).

HYPEREUTROPHIC STATE

Since the 1950's, Utah Lake has degraded into a hypereutrophic state, which enables the algae growth and blooms on the Lake.

CHALLENGES ON UTAH LAKE

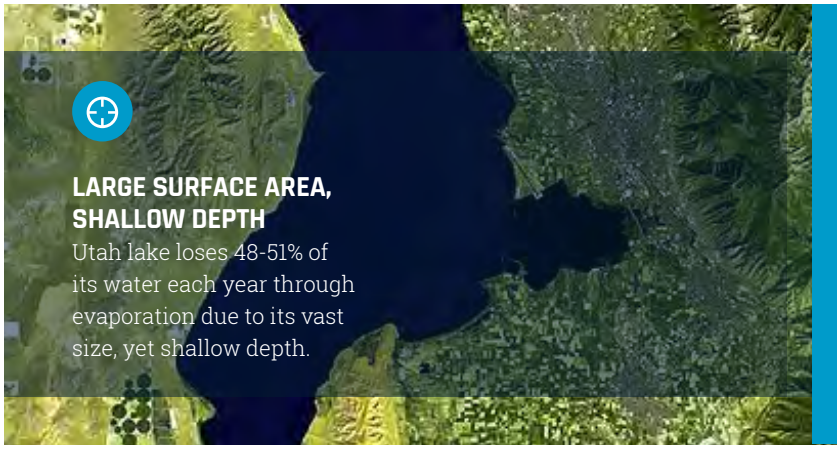
A number of significant issues in combination lead to the degradation of Utah Lake and create its highly impaired ecosystem.

Only addressing some of these challenges will not be sufficient to restore Utah Lake. Comprehensive restoration will require that all factors degrading Utah Lake be addressed. The following is a short overview of the most important challenges. In a later section, the solutions to address these challenges will be described.

EVAPORATION

Evaporation is a significant challenge on Utah Lake. The Lake covers approximately 96,400 acres (150 square miles). This large surface area, combined with the shallow depth of the Lake, means that a high percentage of the Lake's water is lost to evaporation every year. In fact, studies have estimated that approximately 48-51% of the Lake is lost to evaporation annually.

Considering the total volume of the Lake is 294.5 billion gallons, this means between 141-150 billion gallons are lost to evaporation annually. This is particularly interesting considering that 49% of the Lake's water volume flows through the Jordan River annually. In short, between evaporation and



1

For the past 150 years, nitrogen, phosphorus, and other waste solids have been released into Utah Lake. This nutrient pollution has brought the Lake to hypereutrophic state leading to massive and sometimes toxic algal blooms and other challenges.

2

When settler's arrived in 1847, there was an abundance of littoral zone, emergent, and shoreline plant species in and around Utah Lake. Those plants have all but disappeared as problematic invasive plant and animal species have been introduced to the ecosystem.

3

Populations of native fish species have been decimated due to water quality issues, native plant destruction, and introduction of invasive fish species. Some native species have disappeared entirely from the lake, and the June sucker is on the Endangered Species List.

outflow, approximately 100% of the lake water is emptied from the Lake every year.

Water utilization practices and changes to lake inflows have resulted in significant lake level fluctuations throughout the year. In Utah's arid climate, conservation of water and its usage is critical to the state.

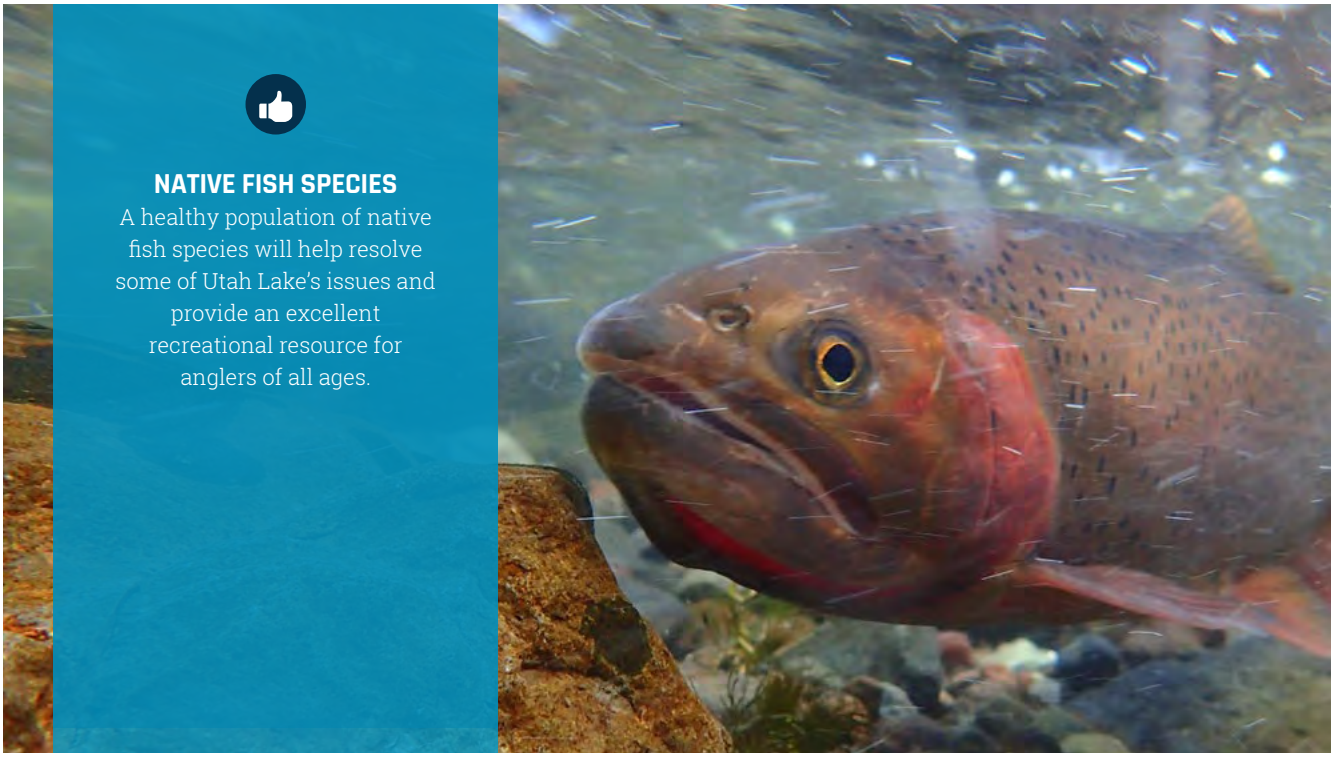
This is particularly important considering population growth projections and future water consumption needs along the Wasatch Front will increase significantly in coming years. Evaporation savings on Utah Lake means more water for Utah residents and for conservation needs.

LOSS OF AQUATIC PLANTS

When the settler's arrived in 1847, there was an abundance of littoral zone, emergent, and shoreline plant species in and around Utah Lake. These plants anchored the lake bottom, processed phosphorus and other nutrients, and provided food and habitat for fish, birds, and terrestrial species.

The Lake's shallow depth provided abundant light, nutrient rich sediments, and prime conditions for submerged plant growth. Because of the gradual slope of the lakebed and the shallow depth, the littoral zone extended across much of the Lake. Emergent plants, such as bulrush and cattails, provided significant benefits from a water quality standpoint. They filter the water and process high quantities of nutrients that can lead to algal blooms.

In short, the healthy aquatic plant communities helped anchor the lake bottom during wind/wave events, regulate nutrient levels, and control phytoplankton numbers. Loss of aquatic plants meant the loss of many natural mechanisms for protecting water clarity and quality. Restoring these plants is an important component of comprehensive restoration.



NATIVE FISH SPECIES
A healthy population of native fish species will help resolve some of Utah Lake's issues and provide an excellent recreational resource for anglers of all ages.

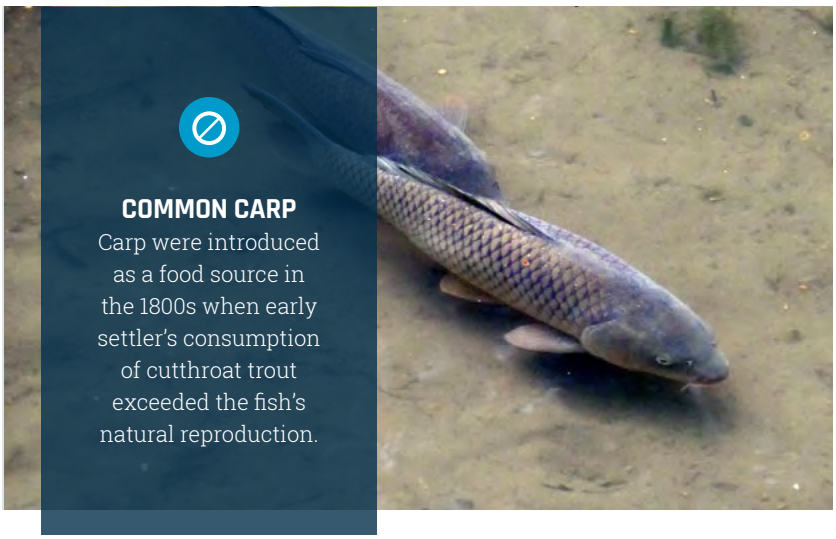
NATIVE FISH SPECIES

Littoral zone and emergent plants provide habitat for zooplankton and native minnow species that feed on phytoplanktons. Zooplankton breed, seek protection, and thrive in the cover of submerged plants in the Lake's littoral zones. Tiny minnows, such as the least chub, consume large quantities of phytoplankton. In turn, larger fish, rely on these smaller species.

The June sucker, which is indigenous only to Utah Lake, feed almost entirely on zooplankton. Other species, such as the native Bonneville cutthroat trout feed on minnow species and other endemic fish. In this way, zooplankton, minnows, and other fish benefit from a healthy food column and lake ecosystem. Birds and terrestrial species on Utah Lake are heavily reliant on fish and other aquatic species. Invertebrates, such as mollusks, also play a role in water quality by filtering lake water. The restoration of native fish and aquatic species is a major focus of the Utah Lake Restoration Project.

CARP

As consumption of Bonneville cutthroat trout began to exceed the natural reproduction of fish in the Lake, early settlers introduced the common carp to Utah Lake. Common carp reproduce readily, and grow quickly, both viewed as desirable characteristics as a



COMMON CARP
Carp were introduced as a food source in the 1800s when early settler's consumption of cutthroat trout exceeded the fish's natural reproduction.

food source. Unfortunately, the common carp are voracious and consume large quantities of submerged vegetation. This submerged vegetation defines larger littoral zones that hold lake sediments in place and provided shelter for the native fish populations.

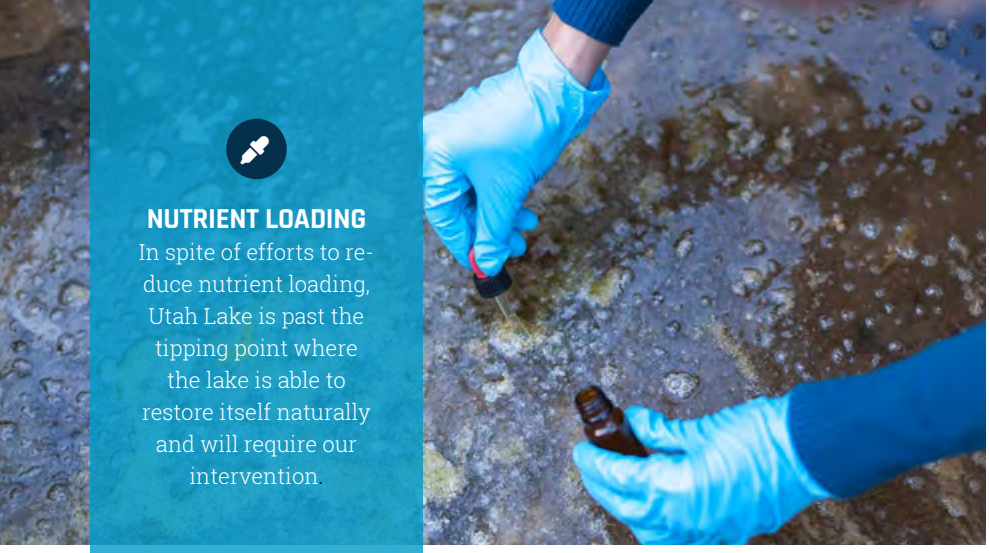
Eventually, carp populations consumed so much submerged vegetation that littoral zones began to shrink and disappear entirely. As the plants disappeared, the anchoring of the lake bottom was lost, wind and wave action more easily stirred sediments, and phosphorus and nitrogen levels increased. Suspension and re-suspension of the lake bottom caused the Lake to become increasingly unsuitable for plant life. Cloudy water began to restrict light penetration and severely limit plant growth. Any plants that successfully rooted in the lake bottom were quickly consumed by the explosion of carp populations. Today, the littoral zone plants are virtually non-existent in the Lake and the vast majority of the lake bottom is a moonscape devoid of plant life. This has led not only to the loss of native plants, but also of zooplankton, minnow, and the June sucker that depend on zooplankton as a food source. Today, it is estimated that carp account for 90% of the biomass on Utah Lake.

FACTS

NON-NATIVE FISH
Approximately 25 non-native fish species have been introduced to Utah Lake.

BIO-MASSIVE CARP
It is estimated that carp account for 90% of the biomass in Utah Lake.

BONNEVILLE CUTTHROAT
Bonneville cutthroat trout can still be found in tributaries of Utah Lake and in other parts of the state. Invasive species will be removed and native species will be brought back.



NUTRIENT LOADING

In spite of efforts to reduce nutrient loading, Utah Lake is past the tipping point where the lake is able to restore itself naturally and will require our intervention.

NUTRIENT-LOADED SEDIMENTS

For the past 150 years, nitrogen, phosphorus, and other waste solids have been released into Utah Lake. The sources of these nutrients have been both untreated and treated waste water, other waste solids, fertilizer, agricultural biomass, and other natural and man-made sources, which are high in nitrogen and phosphorus.

The sediments on the bottom of Utah Lake act as a "sink" absorbing these nutrients in high quantities. As a result, and without the natural removal of nutrients by littoral zone plants, these sediments become a persistent source of high nutrient pollution levels within the water column. Even with the reduction of nutrients from wastewater treatment facilities and other inflows, these sediments contain sufficient quantities of phosphorus and other particulate to maintain extremely high nutrient levels in the waters of Utah Lake for many years[2]. In fact, the Lake is no longer in a state where it can sufficiently recover and restore itself naturally. Currently, there are approximately 12-22" inches of these high nutrient loaded sediments covering the bottom of the 96,400 acre Utah Lake.

WASTEWATER TREATMENT

Wastewater treatment does a good job at killing harmful bacteria in water, but doesn't remove all nutrients from the wastewater. The facilities around the lake have greatly improved pollution since the 1950's, but have also contributed to nutrient loading.

NUTRIENT SOURCES

Waste treatment facilities, agricultural and storm-water runoff, residential fertilizers, and even ambient dust all contribute to the addition of nutrients in the Lake.

- **Wastewater Effluent**
- **Agricultural & Storm Runoff**
- **Residential Fertilizers**
- **Ambient Dust**

WASTE TREATMENT FACILITIES NUTRIENT LOADING

Treated water from waste treatment facilities is the primary source of nitrogen and phosphorus being loaded into Utah Lake according to several studies. Current levels of phosphorus from waste treatment facilities range from 1.31 mg/l to 3.4 mg/l.

While this may not seem significant, a report from the Utah Division of Water Quality estimated that phosphorus is accumulating in the Lake at a rate of approximately 214 tons per year.

The accumulation of nitrogen is occurring at much higher levels. The accumulation of phosphorus, nitrogen, and total dissolved solids contribute to unsustainable and unhealthy nutrient loading within the lake sediments.

Waste treatment facilities are not the only source of nutrients and total dissolved solids in the Lake. Agricultural and storm-water runoff, residential fertilizers, and even ambient dust all contribute to the addition of nutrients in the Lake. The high levels of phosphorus and nitrogen in these nutrient-loaded sediments is one of the reasons why there has been resistance to expensive waste treatment facility upgrades.

Total nutrient loading is estimated at 561,500 tons of Total Dissolved Solids (TDS) within the lake bottom. Not only do these nutrient volumes significantly degrade the Lake's water quality, but they are also a major causal factor in the Lake's dangerous algal blooms.

WIND AND WAVE ACTION

Wind events are a regular occurrence on Utah Lake. It is not unusual to have daily wind events in the 11- to 26-mile-per-hour range. Stronger winds exceeding 50 miles per hour can occur weekly, or several times per month, on the Lake. When a wind event occurs, large waves move across the shallow lake, leading to disruption and near constant re-suspension of the lake bottom.

This re-suspension is sufficient to cause significant turbidity of the water column. In fact, the high silt composition on the lake bottom means that approximately 12 inches of "ooze" exists today with a more solid "muddy" bottom beneath.

FACTS

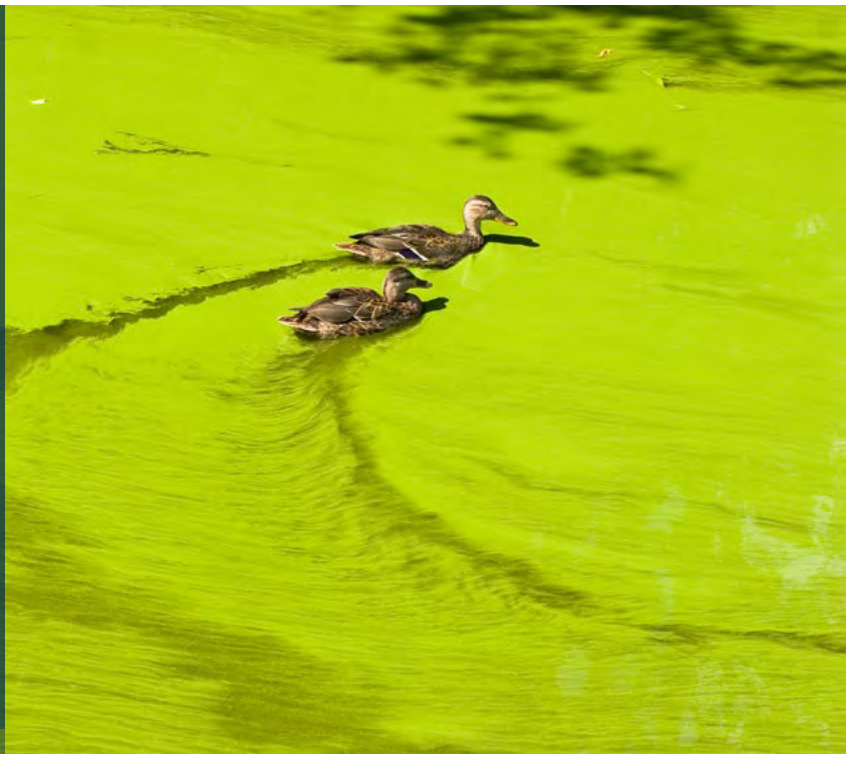
Increasing lake depth through dredging will decrease the amount of force on the lake bottom.

Islands will reduce waves by 60% across the Lake during a 26-mile-per-hour wind event.

Turbidity of the Lake and re-suspension of the lake bottom means that suspended solids and nutrients in the sediments are more able to leach into the water column. This is evident during wind events when the color of the lake water changes as silts, mud, and total dissolved solids are mixed into the water column. During these wind/wave events nutrient levels increase. Wind and wave action are not the only source of turbidity on Utah Lake. Due to the extremely shallow depth of the Lake, turbidity can also be caused by anthropogenic factors such as boat prop-wash by boaters recreating on the Lake.

BOATING

Wind and wave events make boating on Utah Lake dangerous. Our comprehensive plan for restoration will reduce wind and wave action and allow more recreational opportunities on the lake.



MASSIVE ALGAL BLOOMS

In recent years the algal blooms in Utah Lake have worsened to the point they have become toxic or harmful to both people and other species including fish and birds. A comprehensive restoration will reduce nutrient loaded sedimentation which leads to algal blooms.

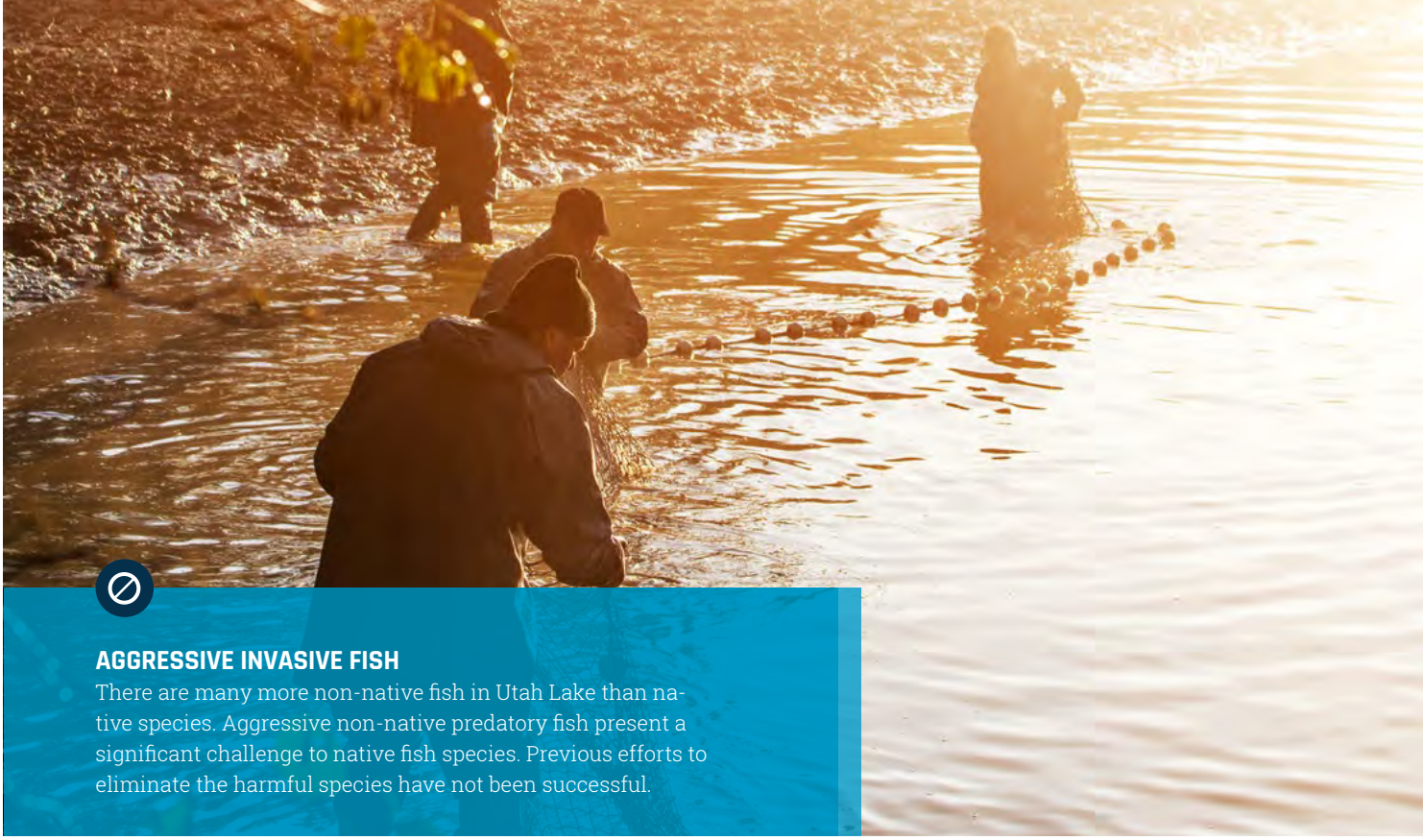
ALGAL BLOOMS

The nutrients within the sediments on the bottom of Utah Lake leach into the water column and result in high nutrient levels in the Lake's water. When the water inflows are already high in nutrients, leaching of these sediments and suspension of nutrient-loaded sediments during wind/wave events further exacerbates nutrient levels in the Lake's water. While the mechanisms that result in the release of nutrients from loaded sediments can be complex, it is sufficient to state that nutrient levels far exceed desirable levels in Utah Lake.

During the warm summer months, these nutrients feed the explosive growth of phytoplanktons and cyanobacterium, typically referred to as an "algal bloom." This is a result of the combination of increased nutrient levels, warmer water temperatures, and the increased photoperiod during the summer months. While some level of phytoplanktons exist in natural aquatic systems, the algal blooms on Utah Lake often grow out of control and produce toxic or harmful effects on people, fish, birds, and other aquatic, and terrestrial species. In fact, it was even unusable in 2017 for downstream irrigation.

TOXIC LEVELS

Marine cyanobacteria-derived toxins present in bright, green algal blooms have become a concern to local health officials.



AGGRESSIVE INVASIVE FISH
There are many more non-native fish in Utah Lake than native species. Aggressive non-native predatory fish present a significant challenge to native fish species. Previous efforts to eliminate the harmful species have not been successful.

INVASIVE FISH SPECIES

Approximately 25 non-native fish species have been introduced to Utah Lake. While many of these species have not been successfully integrated, carp, largemouth bass, white bass, black bullhead, channel catfish, walleye, goldfish, yellow perch, blue gill, black crappie, and northern pike can be found in the Lake today.

Many of these species are invasive and several were introduced illegally. As previously described, the dominant fish species on Utah Lake is the common carp which was introduced to Utah Lake in 1883. Aggressive non-native predatory fish present a significant challenge to native fish species.

The loss of littoral zone and emergent zone plants means there is little cover for young native fish species. This has led to extirpation of several species of native fish from Utah Lake.

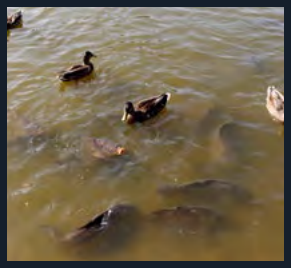
Today, of the Lake's original native fish species, only the threatened June sucker and Utah sucker are found..

An important objective of the Utah Lake Restoration Project is restoration and recovery of native fish species in Utah Lake. This will require removal of non-native fish species and reintroduction of several minnow species and cutthroat trout still found in several tributaries to Utah Lake and in other parts of the state.

ENDANGERED SPECIES
To recover the June sucker and other native fish, multiple challenges will need to be overcome, including restoring water quality and littoral plant communities, increasing zooplankton populations, and eradicating invasive fish.

A BROKEN ECOSYSTEM

A combination of challenging factors have contributed to the degradation of Utah Lake.



EVAPORATION
Utah Lake loses half of its water annually to evaporation.

LOSS OF AQUATIC PLANTS
Phragmites outcompetes native plants and displaces native animals.

CHALLENGES

IS RESTORATION POSSIBLE?
After ten years of research, specific to the needs of Utah Lake, a comprehensive restoration plan has been created. The science-based plan will support full restoration of the Lake, plants, and wildlife.

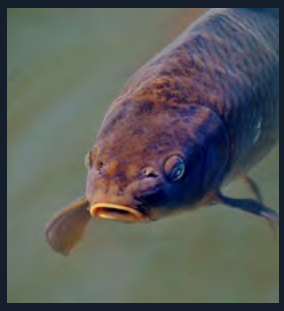
In short, it is not only possible--but it will also provide Utah residents and visitors with a beautiful environment in which to live, work, and recreate.

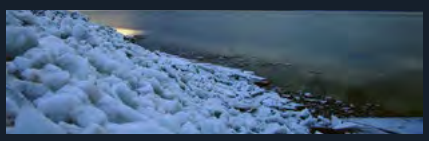
ALGAL BLOOMS
High nutrient levels combined with warm temperatures and increased photoperiods result in unhealthy algal blooms

NUTRIENT LOADED SEDIMENT
Increased phosphorus and nitrogen in lakewater harm native vegetation and wildlife.

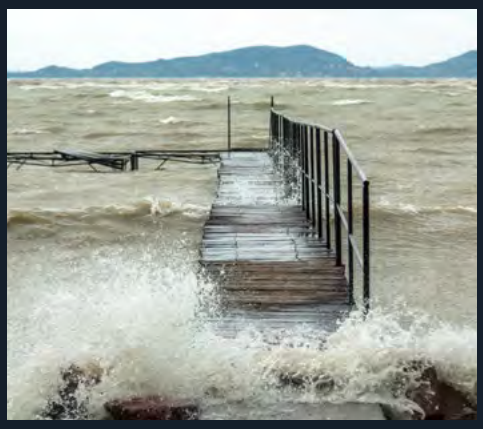
WIND AND WAVE ACTION
Large waves lead to disruption and re-suspension of the lake bottom.

INVASIVE FISH SPECIES
Carp are voracious and consume large quantities of submerged vegetation that hold lake sediments in place and provide shelter for native fish populations.





WATER QUALITY CHALLENGES
Other challenges include poor water flow and oxygenation, lake salinity, increased temperature, e-coli, ice flows, and shoreline erosion.



HARMFUL PLANTS

Invasive plant species are problematic to Utah Lake: Phragmites (Phragmites australis), Russian olive, and Salt cedar or Tamarisk.

Phragmites

Russian olive

Salt cedar (Tamarisk)

INVASIVE PLANTS

Invasive plants are problematic on Utah Lake including Phragmites (Phragmites australis), Russian olive, and Salt cedar or Tamarisk. Phragmites is a perennial, aggressive wetland grass that outcompetes native plants and displaces native animals.

Phragmites can grow to over 15 feet tall and create dense monotypic stands with as many as 20 plants per square foot. These stands of phragmites have replaced high-quality, complex communities of native plants in many areas around Utah Lake. Unlike native plant species, Phragmites provide little or no food and shelter for Utah Lake endemic wildlife. It also eliminates the natural channels and intermittent pool habitat that are needed to support natural refuges, nesting areas, and feeding grounds for invertebrates, fish, avian, and terrestrial species along Utah Lake.

Phragmites also consume large quantities of water. Current estimates are that Phragmites consume as much as 9.6 billion gallons of water on Utah Lake annually.

Phragmites can spread through windblown seeds, soil transfer, animals, extensive over-ground stolon and underground rhizomes, expanding by as much as 30 feet per year. Phragmites' dominance has resulted in adverse ecological, economic, and social impacts on the natural resources and utilization of Utah Lake. Phragmites are nearly impossible to remove by hand, requiring extensive and years-long professional removal efforts. Removal and ongoing control of Phragmites is an important component of The Utah Lake Restoration Project.

Salt Cedar or Tamarisk, is a deciduous shrub or small tree, which can grow as high as 25 feet. Tamarisk can grow in dense thickets and favor the alkaline soils surrounding Utah Lake. Tamarisk create saltier soils, increase water alkalinity, and, like Phragmites, consume huge quantities of water. The Utah Lake Commission has identified the following negative effects by Tamarisk on Utah Lake and its surrounding environment:

- Narrowing of waterways
- Displacing native vegetation
- Providing poor habitat for livestock and wildlife
- Increasing wildfire hazard
- Limiting human and animal use of the waterways

OTHER WATER-QUALITY CHALLENGES

To be successful, the Utah Lake Restoration Project will also address other factors that contribute to water-quality degradation and the impairment of Utah Lake.

These include poor water flow, lake salinity, poor oxygenation, heating of the upper water column from high silt content, turbidity, e-coli, ice flows, shoreline erosion, and other challenges.

The solutions that will be implemented as part of the Utah Lake Restoration Project, will address many of these challenges and are specifically designed to restore the water quality, water clarity, and healthy natural function of Utah Lake.

ICE FLOWS

During the winter months, ice builds up on the lake and wind pushes across resulting in massive buildup of ice which damages the shoreline.

ERADICATION OF INVASIVE FISH
An average of three million pounds of carp have been netted annually. After three to four years of netting, the Utah Lake Commission has reported a slight decrease in 2017.

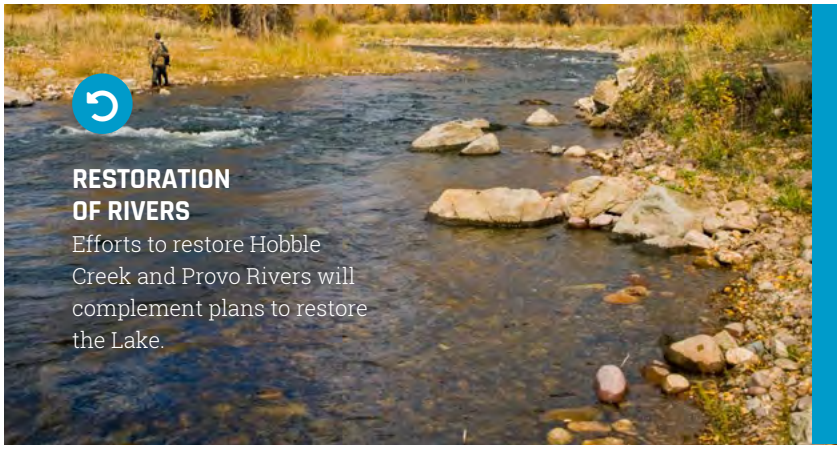
EFFORTS TO IMPROVE THE LAKE

Over the years there have been many ideas and efforts to restore Utah Lake, but never a comprehensive solution to address all issues.

Past proposals to restore Utah Lake have included: artificially raising or controlling the water level, allowing for the development associated with the lands adjacent to the Lake, draining the Lake, draining Provo and Goshen bays, creating an island for recreation or residential development, constructing a causeway across the Lake to open development on the western shores, and enhancing wetlands associated with the Lake.

A number of efforts have been planned, funded, and/or implemented that affect improvements to Utah Lake. Founded in 2007, the Utah Lake Commission, empowered by area governments of Utah County, Department of Natural Resources, and the State of Utah, focused on and actively engaged in improving the Lake.

In 2009, the Commission adopted the Utah Lake Master Plan to promote multiple public uses of the Lake, facilitate orderly planning and development in and around the Lake, and enable individual commission members to govern their own areas surrounding the Lake.



RESTORATION OF RIVERS
Efforts to restore Hobble Creek and Provo Rivers will complement plans to restore the Lake.

The immense Central Utah Project (the "CUP"), designed to deliver water resources for municipal, industrial, irrigation, and instream flow maintenance, is coming to completion and remaining projects are being implemented.

With the completion of the CUP, Utah Lake water levels could become more stable. Nonetheless, issues related to use and development of these water resources and the role of Utah Lake in the CUP have not been entirely resolved.

Other efforts are underway that assist in reducing negative impacts to the Lake including: carp removal, June sucker recovery plans, restoring the shoreline with controlled weed removal, Utah's Watershed Restoration Initiative, delta restoration plans (e.g., Hobble Creek and Provo River deltas), and others. None of the projects or proposals contemplated the comprehensive solutions needed to fully restore Utah Lake. Just as important, none of the projects and proposals included mechanisms to fund the billions of dollars needed to implement a comprehensive restoration of Utah Lake.

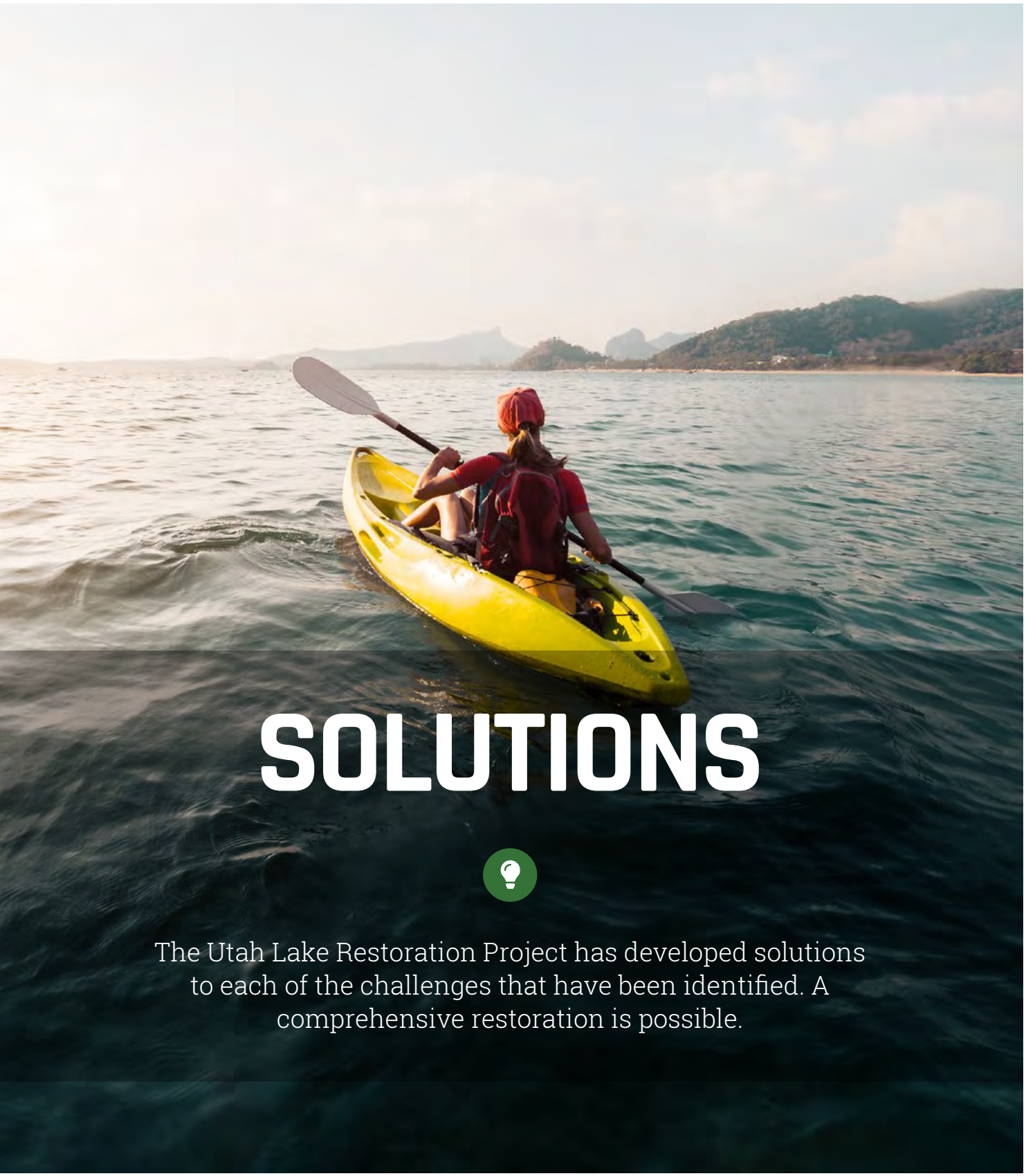
FACTS

Utah Lake is surrounded with more than 8,000 acres of invasive Phragmites, which expands by more than 10% per year.

To eradicate this problematic plant, increased funding is needed to facilitate aggressive phragmites treatment and removal.

THE LAKE TODAY

Even with efforts toward improvement, Utah Lake remains altered in its chemistry, turbidity, temperature, shoreline, and fish life. While several pilot projects have been implemented to begin addressing various challenges on Utah Lake, significant new investment is needed to stop the downward spiral of Utah Lake. There is a widespread awareness and support for restoration of Utah Lake.



SOLUTIONS

The Utah Lake Restoration Project has developed solutions to each of the challenges that have been identified. A comprehensive restoration is possible.

AN OVERVIEW OF PROPOSED SOLUTIONS TO IDENTIFIED CHALLENGES

DREDGING
A foundation of Utah Lake restoration — PG 35

ISLAND CREATION
Central to create conditions for water quality improvements — PG 41

WIND & WAVES
Allows restoring of plants to anchor lake sediments — PG 47

WATER QUALITY
Cleaner and clearer water is possible — PG 53

INVASIVE PLANT SPECIES ERADICATION
Invasive plants removed to restore clarity and native plant restoration — PG 67

NATIVE PLANT RESTORATION
Native vegetation secures the lake bottom and restore water clarity — PG 73

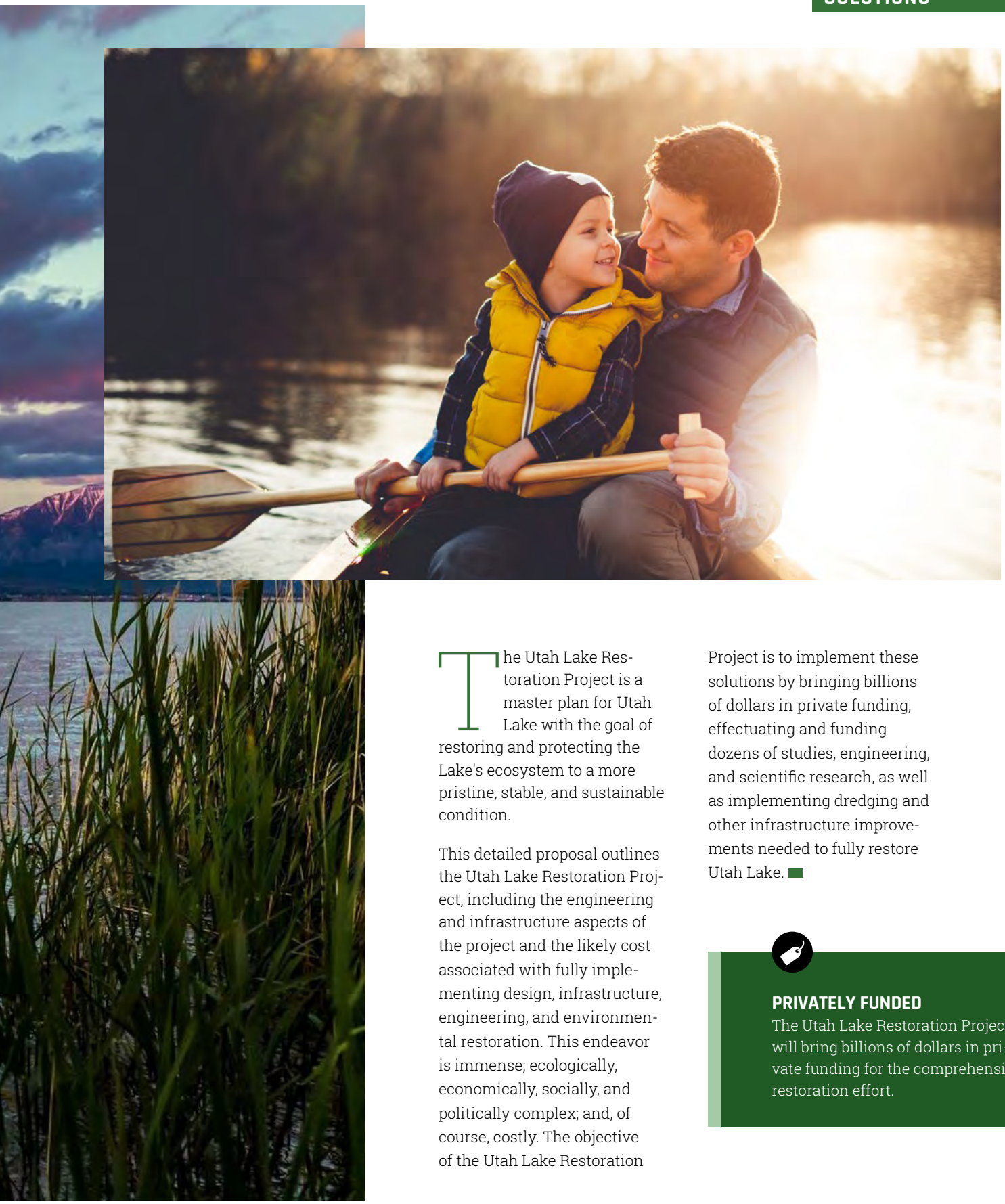
NATIVE FISHERY RESTORATION
June sucker, Bonneville cutthroat trout, and a healthy food source — PG 81

WILDLIFE HABITAT
Restored wildlife habitat is a benchmark of a restored lake — PG 91

SOLUTIONS

UTAH LAKE RESTORATION PROJECT

The Utah Lake Restoration Project will likely become the largest environmental restoration project in the country.



The Utah Lake Restoration Project is a master plan for Utah Lake with the goal of restoring and protecting the Lake's ecosystem to a more pristine, stable, and sustainable condition.

This detailed proposal outlines the Utah Lake Restoration Project, including the engineering and infrastructure aspects of the project and the likely cost associated with fully implementing design, infrastructure, engineering, and environmental restoration. This endeavor is immense; ecologically, economically, socially, and politically complex; and, of course, costly. The objective of the Utah Lake Restoration Project is to implement these solutions by bringing billions of dollars in private funding, effectuating and funding dozens of studies, engineering, and scientific research, as well as implementing dredging and other infrastructure improvements needed to fully restore Utah Lake.

PRIVATELY FUNDED
The Utah Lake Restoration Project will bring billions of dollars in private funding for the comprehensive restoration effort.

1

FINE PARTICULATE

Fine particulate from the top 8-12 inches of the lake bottom will be removed and encapsulated.

2

NUTRIENT POLLUTION

The top 22-36 inches of nutrient loaded sediments will be removed from the lake bottom.

3

LAKE DEPTH

Dredging deepens the Lake to reduce forces that can disturb the lake bottom.

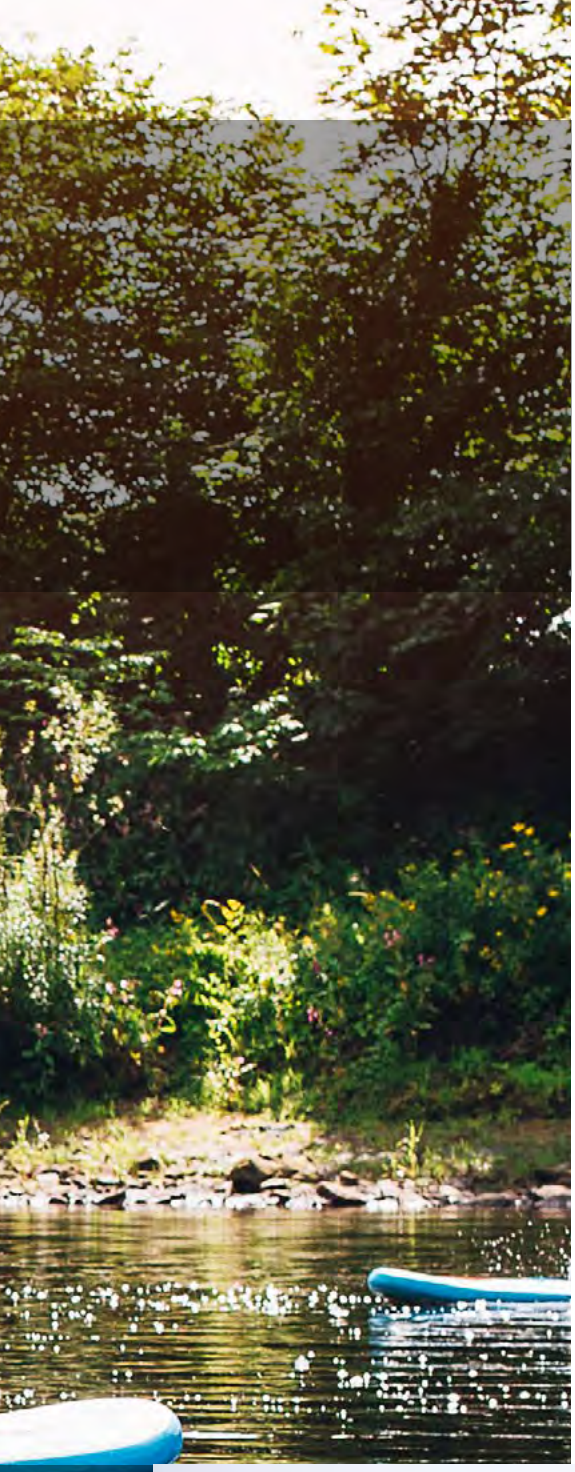
4

LAKE BATHYMETRY

New lake bathymetry will create deep-water channels to improve circulation and cool the water.

RETURN TO ROOTS

With the removal of nutrient-loaded sediment, improvement of the lake shoreline, and creation of islands, restored water quality and a restored Utah Lake is possible.



DREDGING

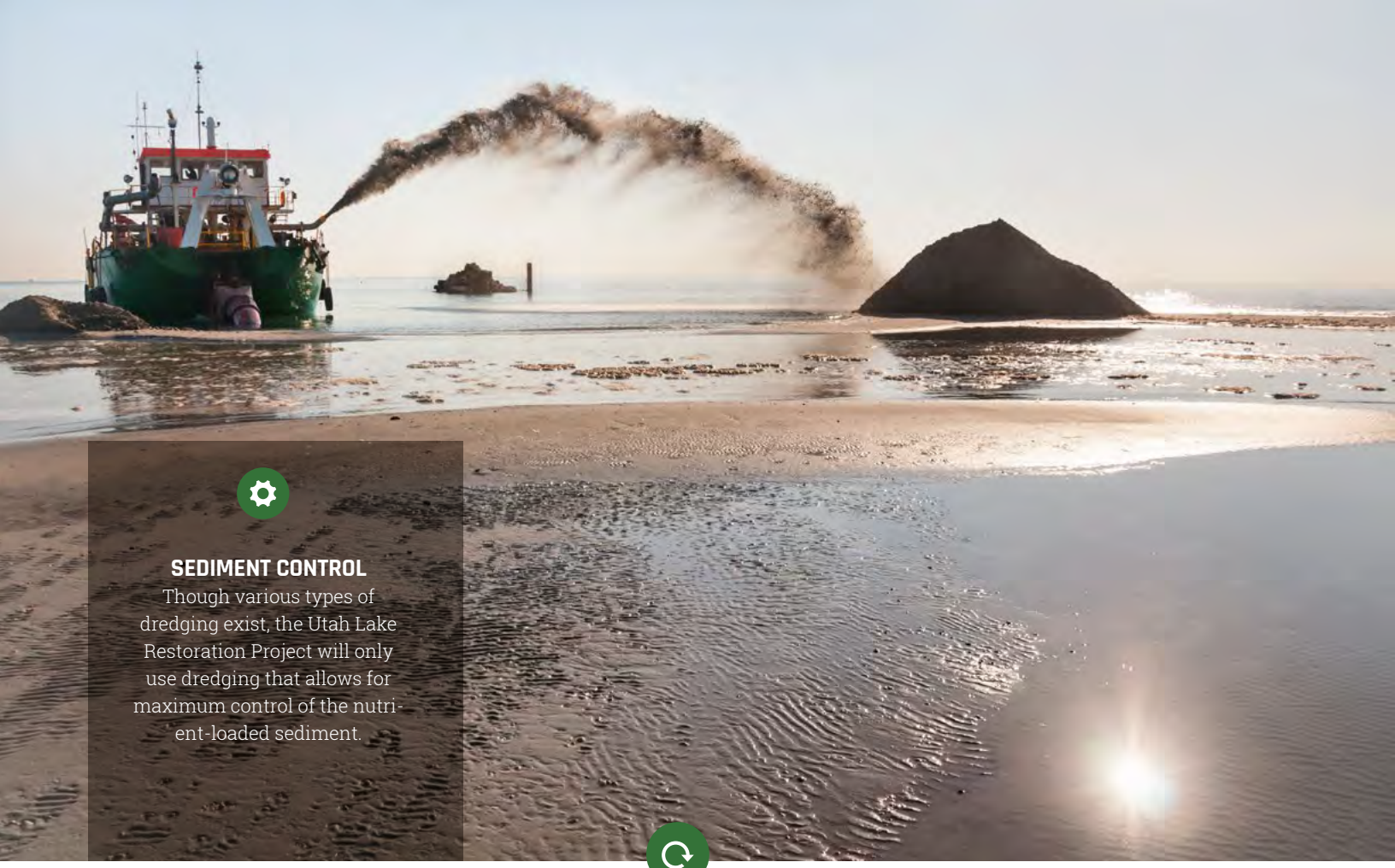
Dredging Utah Lake is a foundational component of the Utah Lake Restoration Plan.

Dredging allows the Lake to be deepened, removes nutrient-loaded sediments, and helps reduce turbidity of the Lake bottom. The objective will be to deepen the average depth of Utah Lake by approximately three to six feet, shape the underwater topography of the Lake, and provide channels to improve the temperature and circulation of water. Dredging will also increase the water-holding capacity of the Lake by an estimated 405,000 acre feet.

There are four primary objectives to dredging:

1. Remove and encapsulate fine particulate from the top 8-12 inches of lake bottom.
2. Remove nutrient-loaded sediments comprising 12-22 inches of lake bottom.
3. Deepen the Lake to reduce forces that can disturb the Lake bottom.
4. Change the Lake bathymetry and create deep-water channels to improve circulation and cool the Lake water.

Our team has been working for the last 10 years on complex engineering and science to dredge Utah Lake. Dredging



SEDIMENT CONTROL
Though various types of dredging exist, the Utah Lake Restoration Project will only use dredging that allows for maximum control of the nutrient-loaded sediment.

Dredging addresses major challenges and is necessary to initiate the healing of Utah Lake.

Utah Lake requires more than just simply removing three to five feet of lake sediment uniformly across the Lake. The depth of dredging will vary in different parts of the Lake based on data gleaned from core samples and on engineering design. Some areas may be dredged by as little as 18 inches, while other areas may be dredged up to 90 feet to create deep-water channels.

Our current engineering designs suggest that to deepen the Lake to the desired levels, upwards of one billion cubic yards of material will be dredged from the bottom of Utah Lake as part of this project.

It will take approximately 60 dredgers working 20 hours a day, six days a week, for eight years to move this quantity of material.

> It will take...60 dredgers working 20 hours a day, six days a week, for eight years...

DETAILED ANALYSIS

Designed by the Army Corps of Engineers, geotubes encapsulate, consolidate, and compress fine sediment. They also provide the outline shape of islands.

FINE PARTICULATE MATTER

The fine sediment currently found on the top 12 inches of Utah Lake's bed consists of particulate in the 150-200 micron range with some sediments being finer. This fine particulate, resembling baby powder when dried, can remain suspended in the water column for long periods of time. Additionally, this fine sedimentation has a degree of chemical attraction to phosphorus and nitrogen molecules resulting in very high nutrient levels which can be re-suspended in even mild wind/wave events. This not only leads to high nutrient levels within the water column, but also blocks light needed to re-establish littoral zone plants. These plants, such as cattails and lilies, as well as other indigenous native plants and animals, are necessary in restoring water clarity and a balanced lake ecosystem.

Initial dredging will gather and encapsulate these fine sediments, placing them into geofabric socks also known as "geotubes." Geotubes are used to encapsulate, consolidate, and compress fine sediment which prevents re-suspension of these solids within the water column. In mining, the practice of "encapsulation" or "capping" has proven an effective method to mitigate fine sediments while adding structural integrity to the material below and above the geotubes. The geotubes placed throughout Utah Lake will be used to create the outline shape of islands and are an approved technology of the Army Corps of Engineers.

Geotubes are designed to allow water to seep out of the tube, yet retain the sediments. The solids can be effectively encapsulated in a series of HDPE Socks which contribute to the structural capacity of the islands. Once in place and filled with the finer particulate matter, these tubes will be oriented to be secured to the bottom of the Lake and to each other. The islands are then formed by infilling the center of these geotubes. The annular configuration of geotubes holds dredged material comprising the island core and above-grade structures. A more detailed explanation of geotubes and island creation will be described hereinafter on pages 141-150.

NUTRIENT-LOADED SEDIMENTS

As described on page 21, approximately 12-22 inches of nutrient-loaded sediments reside on the bottom of Utah Lake. One of the primary purposes of dredging is to remove these sediments from the lakebed. By removing nutrient-loaded sediments, the levels of phosphorus and nitrogen will be significantly reduced in the water column, especially during high wind/wave events.

Lower nutrient levels in the water column lead to fewer and less dramatic algal blooms during the summer months. This not only improves water quality, but also provides a healthier environment for the restoration of submerged plants, fish, and other aquatic species.

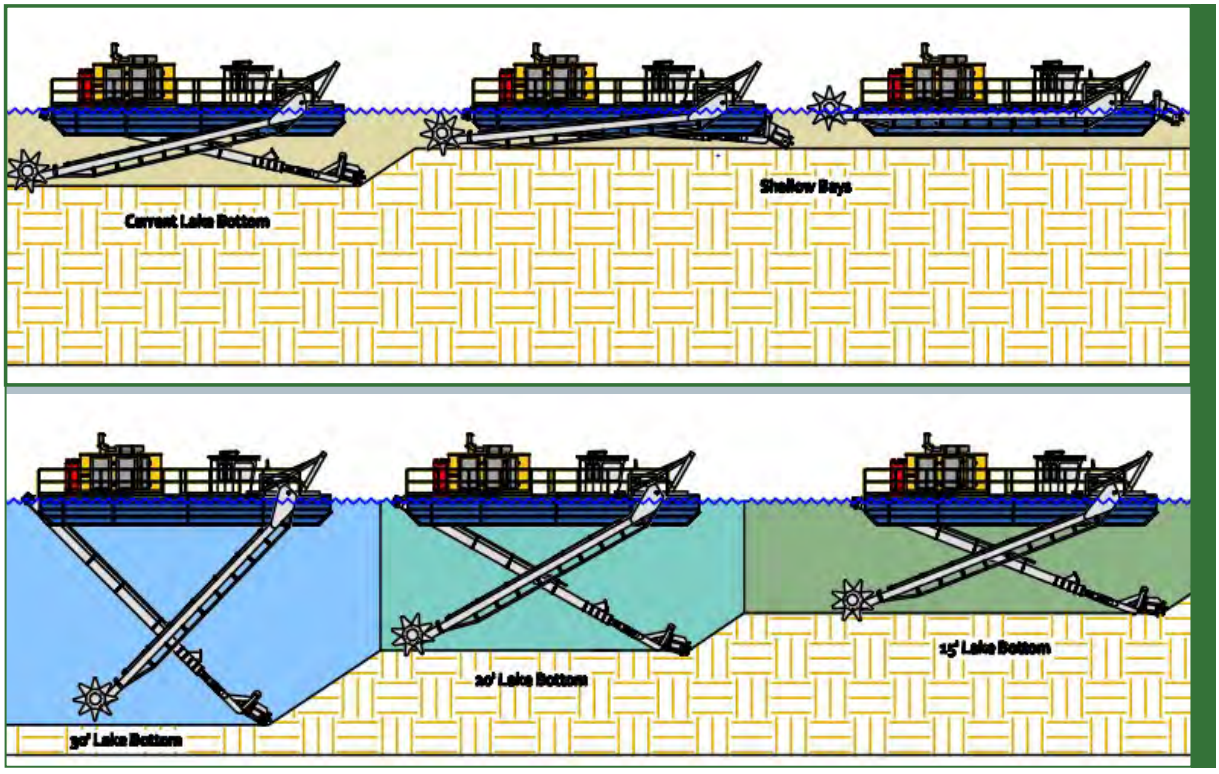
Dredging of nutrient-loaded sediments is critical to restoring Utah Lake. In other lakes where the external nutrient loading from lake inflows has been reduced, internal phosphorus loading still prevents improvement in lake water quality.

Because phosphorus can be released from sediment from depths as low as 20 centimeters (8 inches), our team suggests dredging a minimum of 22 inches to remove most phosphorus and nitrogen-laced sediments.

Through the removal of these sediments, natural nutrient levels will be restored upon completion of dredging, instead of waiting several decades for natural biological processes to gradually remove nutrients from lakebed sediments.

DEEPENING THE LAKE

Increasing lake depth via dredging removes nutrient-loaded sediment and significantly limits the re-suspension of solids during wind and wave events. Deepening the Lake creates an exponential decrease in the amount of force exerted by wave action which can disturb the bottom of the Lake. This



dynamic is explained in a 2007 report on Utah Lake by the Utah Division of Environmental Quality, "Water depth has a significant impact upon [Total Dissolved Solids] levels with the lake environment because of the re-suspension of sediment from shallow depth and wave action." See page 28, Utah Lake TDML-Loading Pollutant & Impairment Assessment Report, UDEQ, 2007. Less suspension of mud and sediments leads to significantly less nutrient pollution available within the water column. This, in turn, means cleaner, clearer water, and fewer algal blooms.

Deepening the Lake to an average of 12-13 feet deep produces a more pronounced thermocline with water strata at the lower level, allowing much cooler temperatures than currently present on Utah Lake. Projections by Aquaveo indicate that deepening the Lake will decrease water temperatures on the lake bottom. Cooler water is more dense and has significantly lower natural movement, meaning less movement. This is one of the reasons why deeper lakes rarely have algal blooms.

LAKE BATHYMETRY AND UNDERWATER CHANNELS

The final phase of dredging is designed to change the lake bathymetry and create deep water channels to improve circulation and further cool the lake water. The master dredging plan included in the Utah Lake Restoration Project is designed to improve lake hydrology. Using subsurface lake modeling, changes to the contour of the lakebed will provide variability in lake depth, increase the diversity of underwater topography, and introduce greater variability in the Lake's thermocline. The changes to lake bathymetry will also better support cutthroat trout in the Lake and other diverse aquatic species during the summer and fall months.

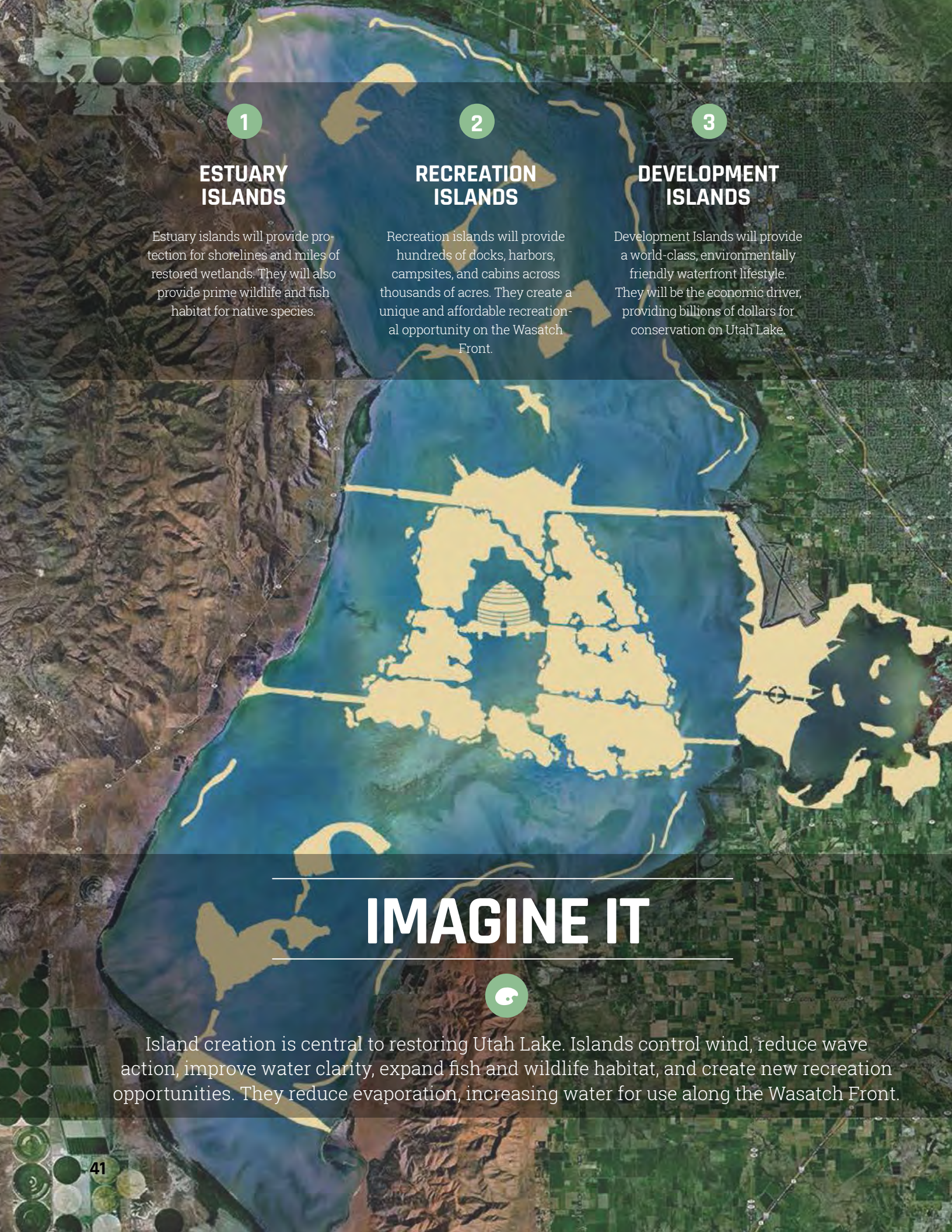
This plan will also include the dredging of deep-water channels in the Lake anywhere from 60-90 feet deep. These deep-water channels produce thermal cooling and create convection currents in the Lake, improving circulation and resulting in overall cooler water temperatures. Improved circulation by natural convection is an important component to improving water quality and clarity. Cooler water temperatures and improved water circulation help control algae levels.

Deep-water channels also control wave size and force. When waves traveling across the Lake cross a deep-water channel, the energy of the wave naturally dissipates and wave height is reduced. Deep water channels also provide a place for re-suspended solids to settle. At the depth of 60-90 feet, these dissolved solids are much less likely to re-suspend and are stored at substantially colder water temperatures where they will not contribute to algal blooms. In summary, the addition of contouring and deep-water channels improves water circulation, decreases water temperatures, reduces the likelihood of algal blooms, reduces wave action across the Lake, and provides a more natural, and diverse environment for fish and other aquatic species.

DREDGING AS A FOUNDATION FOR ISLAND CREATION

Dredging of Utah Lake will require moving almost one billion cubic yards of sediment over eight years. Through the utilization of dredged materials, islands will be formed that perform important functions that are critical to restoring the Lake's capacity to become a clear, vibrant resource to Utah. To provide the right composition for the formation of islands, mixing various sediments from different parts of Utah Lake will be required. Our team is experienced in the movement, placement, and management of massive quantities of ore, rock, sand, gravel, and other related materials. A more detailed explanation of island creation is provided on page 145-158

> Dredging...will require moving almost one billion cubic yards of soil.



1

ESTUARY ISLANDS

Estuary islands will provide protection for shorelines and miles of restored wetlands. They will also provide prime wildlife and fish habitat for native species.

2

RECREATION ISLANDS

Recreation islands will provide hundreds of docks, harbors, campsites, and cabins across thousands of acres. They create a unique and affordable recreational opportunity on the Wasatch Front.

3

DEVELOPMENT ISLANDS

Development Islands will provide a world-class, environmentally friendly waterfront lifestyle. They will be the economic driver, providing billions of dollars for conservation on Utah Lake.

IMAGINE IT

Island creation is central to restoring Utah Lake. Islands control wind, reduce wave action, improve water clarity, expand fish and wildlife habitat, and create new recreation opportunities. They reduce evaporation, increasing water for use along the Wasatch Front.

ISLAND CREATION

Creating islands with dredged material fills a vital role in the restoration of Utah Lake.

Island creation and design play a critical role in restoring Utah Lake. Islands created from dredged material allow areas to be deepened by as much as 90 feet. The formation of islands allow for the control of wind and reduction in wave height by up to 60%. These conservation actions will fundamentally transform the Lake from a dirty, turbid lake with a suspended mud bottom to a clear, blue-green lake ideal for fish, wildlife, and recreation.

1. Estuary Islands. These islands will provide protection for shorelines and miles of restored wetlands, wildlife and fish habitat.
2. Recreation Islands. These islands will provide hundreds of docks, harbors, campsites, and cabins across thousands of acres. They create a unique and affordable recreational opportunity on the Wasatch Front.
3. Development Islands. Designed for an unmatched, environmentally sustainable waterfront lifestyle, these islands will be the economic driver, providing billions of dollars for the conservation investments on Utah Lake.

DETAILED ANALYSIS

There are millions of tons of nutrient-loaded sediment across the bottom of Utah Lake, equating to two to three feet across 96,400 acres. Island creation not only provides a place to retain the sediment, but also provides a mechanism to fund the multi-billion dollar dredging project.

The islands are the first step to restoring the littoral zone plants that once defined the bottom of Utah Lake. Dredging deepens the Lake, islands decrease wave height and fetch length, and in short, stop the continual re-suspension of sediment which maintains the virtual moonscape on the lake bottom.

A critical part of any proposed dredging plan is what you do with the material that is dredged. Several previous ideas on dredging the Lake included filling in Provo Bay or the entire south section of the Lake with the dredged material. These proposals would result in the loss of important habitats for wildlife.

The Utah Lake Restoration Project takes the dredged material and uses it to create islands across the Lake designed to provide needed components for lake restoration. These islands serve multiple conservation purposes:

- Wind/wave breaks
- Added shoreline for shore, emergent, and littoral zone plants
- Estuary islands to protect critical littoral zones
- New and enhanced habitat for aquatic and terrestrial species
- Improved recreation possibilities
- Safe harbor during wind events and storms
- Ice flow containment and breakup to protect critical shoreline
- Reduction in surface area and evaporation
- Encapsulation and containment of nutrient-loaded sediment
- Funding source for conservation efforts to restore and improve the Lake

Islands effectively sequester both sludge and nutrient loaded sediments.

Lake Restoration Solutions has worked with Aquaveo, the leading marine modeling software developer in the United States, to create a computer model of the Lake that shows how wind moves along the water and makes waves. This wind model demonstrates that by placing islands in strategic locations wave height on the Lake will be significantly reduced. Strategic placement of the islands reduces fetch length and significantly reduces wave height and power. This creates a safer and more enjoyable boating experience for those recreating on the Lake, even during wind and wave events.

New islands created by the Utah Lake Restoration Project will create an additional 190 miles of shoreline (250% increase over existing shoreline). Areas surrounding the islands will include thousands of acres of restored littoral zones planted with beds of native submerged plants extending up to 150 feet into the Lake. These littoral zones will provide extensive fish habitat and waterfowl areas. Islands will be planted with native trees, shrubs, bushes, and grasses that will grow into natural forests for the public to explore and enjoy.

MAIN DEVELOPMENT ISLANDS
Affordable waterfront living along the Wasatch Front

ESTUARY ISLANDS
Protects lake shorelines from ice flows and allows restoration of littoral zone plants

ISLAND TYPES

There are three island types: estuary islands, recreation islands, and development islands.

ESTUARY ISLANDS

Estuary, or barrier, islands are designed to protect the inner shoreline of Utah Lake and allow for the creation of an inner littoral zone restoration area. Estuary islands act as a barrier to wind/wave events as well as providing protection of the shoreline from annual spring ice-flows. Barrier Islands create 50 miles of additional shoreline for birds, riparian plants, and provide a place for littoral zone plants to become re-established. The inner waterway between estuary islands and the Lake's shoreline provides protected areas for native fish and utilization by waterfowl for feeding, nesting, and brood rearing.

RECREATION ISLANDS

Recreation islands are sized and positioned to act as wind and wave breaks across the Lake. The arched configuration of islands also creates protected boating areas during storms and wind/wave events. The role of islands to control wind and wave action is covered in greater detail on pages 47-52.

Recreation islands are designed to provide a more diverse lake experience. Island design provides protected bays and coves allowing boaters to enjoy the Lake for longer periods of time throughout the day. Each of the recreation islands will have docks and other locations for shoring boats, including sailboats. Beaches for playing, pavilions for picnicking, overnight campgrounds, and cab-

ISLAND ROLES

STORE DREDGE MATERIAL

WIND WAVE ACTION

RESTORATION OF SUBMERGED PLANTS

> Islands create 190 miles of new shoreline for fish habitat and recreation.

ins will provide retreats for supporting increased recreational opportunities on the Lake. In total, there will be several thousand acres of recreational space to enjoy Utah Lake and its islands. New islands designated as "recreation" or "estuary" will be open to the public.

DEVELOPMENT ISLANDS

Development islands are designed for living, working, and recreating in harmony with the surrounding watershed. Housing, business, commercial, and entertainment centers are focuses on community-centered living. Village and townships provide quick access to parks, trails, waterways, and other open space that traverse and intersect the islands. In fact, over 60% of the combined acreage of the estuary, recreation, and development islands is reserved for public access, parks, recreation, and wildlife viewing habitats. Each of the communities will be walkable, with specific landscaping and design elements that supports and extends the living space from home and work for waterfront living. Development islands will include significant design aspects centered around protecting and preserving the watershed and health of the Lake. In this way, development islands support the continued restoration and natural maintenance of the Lake. More information on development islands is provided on pages 191-206 hereinafter.

ISLANDS WITH A PURPOSE

Island size, shape and placement are based on computer models and engineered for conservation purposes.

A SAILING DESTINATION

Addressing wind and wave action improves the safety and desirability of Utah Lake for sailing, paddleboarding, and other watersports.

WIND & WAVES

Controlling wind and wave action is critical for restoring the water quality of Utah Lake.

Controlling wind and wave action is critical for restoring the water quality of Utah Lake. By reducing the size and power of waves, Utah Lake can transform to a prime destination for sailing, water sports, fishing, and other recreational activities. It will also allow the Lake to be restored to a clear water lake, with tens of thousands of acres of native aquatic littoral zones, millions of Bonneville cutthroat trout, June sucker, minnow species, and support the return of abundant wildlife species.

The placement of islands across the Lake create safe zones with little wind and wave action during wind events. This improves the recreational experience and potentially saves lives.

DETAILED ANALYSIS

HOW CONTROLLING WIND AND WAVE ACTION HELPS UTAH LAKE

The Lake Restoration Solutions team has been working on complex engineering and science for reducing wind and wave action on Utah Lake for the last 10 years. The engineering design provides a high degree of predictability through scientific modeling of the impact of island design on wind and wave action.

Through scientific engineering and modeling the size, shape, and placement of islands have been designed to reduce wave height by 60% across the Lake during a 26 mile-per-hour wind event. Wave size will also be reduced to one foot or less during a typical wind event across 85% of Utah Lake. With a deepened lake through dredging, the force exerted on the bottom of Utah Lake will decrease by 500% as a result of this project.

WAVE HEIGHT AND INCREASED DEPTH REDUCE ORBITAL VELOCITY

Reducing wave height and increasing lake depth through dredging creates a direct linear reduction in the amount of force wave action exerts on the lake bottom. When wave height is reduced and lake depth is increased, the combined effect produces a significant reduction in forces exerted on the lake bottom by wave action thus reducing sediment resuspension.

> Improved depth and smaller waves decrease forces on lake bottom by 500%.

The following mathematical formula explains how wave height and lake depth change the amount of force (orbital velocity) which waves exert on the lake bottom.

$$w = [(pH)/T]ekz \sin(kx \pm wt)$$

The variables in the equation above are:

w = orbital velocity (m/s±1) (force)

H = wave height (m)

T = wave period (s)

k = wave number (2p/L; m±1)

L = wave length (m)

z = depth of observation (negative in the column; m)

w = radian wave frequency (2p/T; s±1)

x is the point or place of observation of the wave (m) in the horizontal direction

t is time of observation(s)

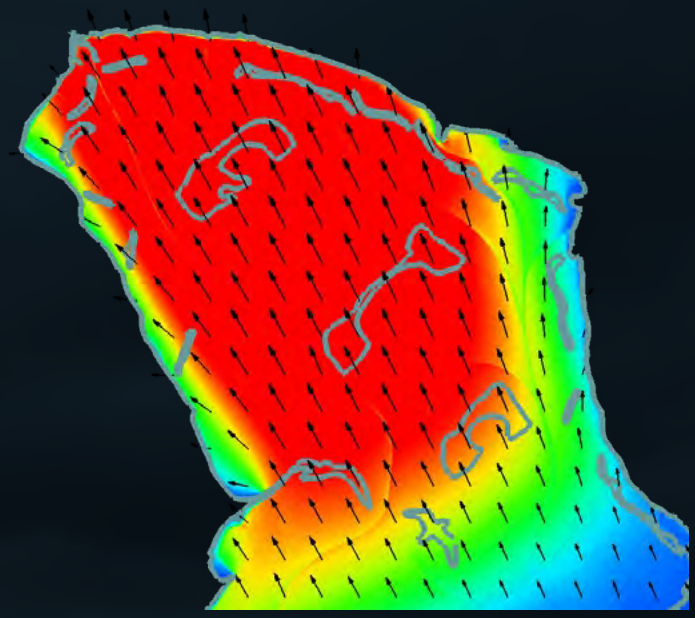
If wave period and wave number variables remain constant, then the variables which affect the force of waves are: (1) H-wave height; (2) z-depth of lake; and (3) [ekz sin(kx ± wt)]- which is the periodic component of wave velocity and a function of the natural variability of forces within a wave. The periodic component has a (periodic) maximum at values of x equal to 0.25L and 0.75L, between crest and trough when the elevation of the water surface is zero. The periodic component becomes less influential to change orbital velocity as the depth of the water increases.

WAVE HEIGHT MODELING

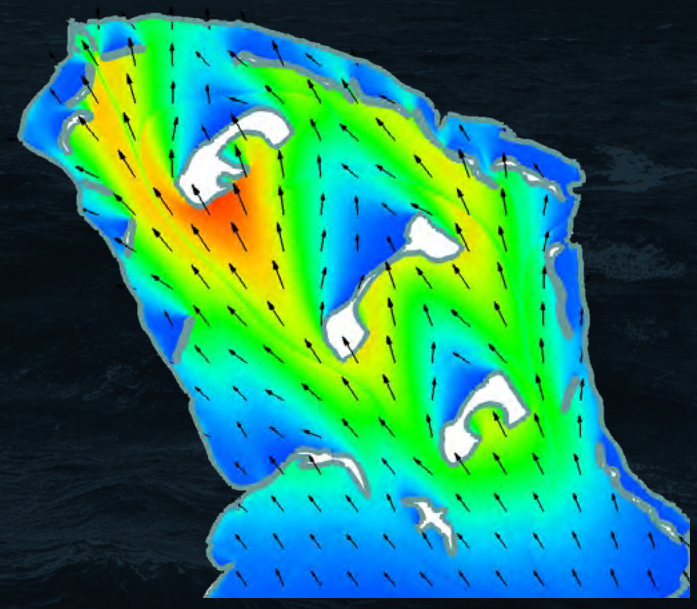
Modeling conducted by Aquaveo in connection with the Utah Lake Restoration Project shows that during a 26 mile-per-hour wind event, most of Utah Lake is covered in one to three foot waves in its current state. The placement and shape of estuary, recreation, and development islands will reduce the wave height to six inches or smaller on 62% of the Lake and 12 inches or smaller on 92% of the Lake.

In a 67 mile-per-hour wind event, 74% of Utah lake is covered in two to six foot waves in the absence of islands. With the addition of estuary, recreation, and development islands, during a 67 mile-per-hour wind event, islands reduce wave height to 6 inches or less across 32% of the Lake and one to two foot waves across 62% of the Lake.

WITHOUT ISLANDS



WITH ISLANDS



ADDITIONAL ISLAND BENEFITS

Islands do more than just reduce the size of waves across the lake.

Islands also create safe zones with little wind and wave action during wind events. This will improve the recreational experience and potentially save lives during extreme wind events.

Utah Lake is notorious for its large and dangerous swells during wind events. Many boats have sunk and unsuspecting boaters have drowned in the lake. There are two primary factors that contribute to the size of waves on Utah lake during windy days:

1. Size of the lake: Utah Lake is 24 miles long and 13 miles wide. This is the third largest natural lake in the western United States. The size of the lake allows waves to grow and pick up speed across vast areas of water. The result is large and fast-moving swells.
2. Depth of the lake: Utah Lake has an average depth of 9 feet. Large waves build much more easily and quickly in shallow water. The force of these waves travels more readily to the lake bottom in shallow water.

WAVES

Five hundred percent reduction in orbital velocity means dramatic decrease in re-suspension of bottom sediments.

Create Safe Zones

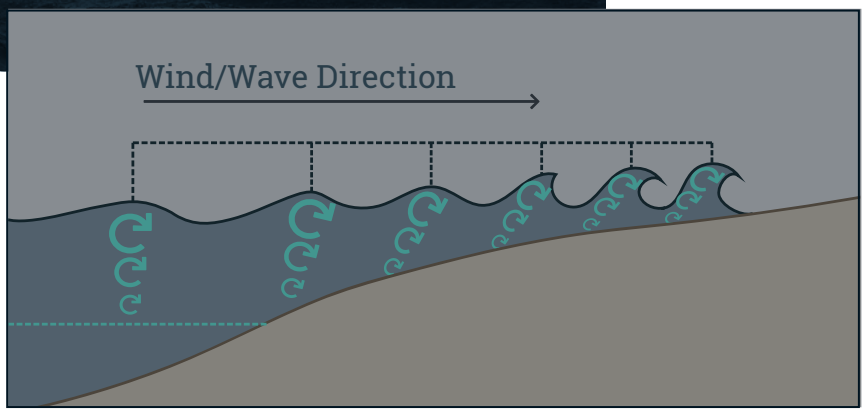
Lessen Wave Height

Improve Recreation

Save Lives

WAVE ENERGY

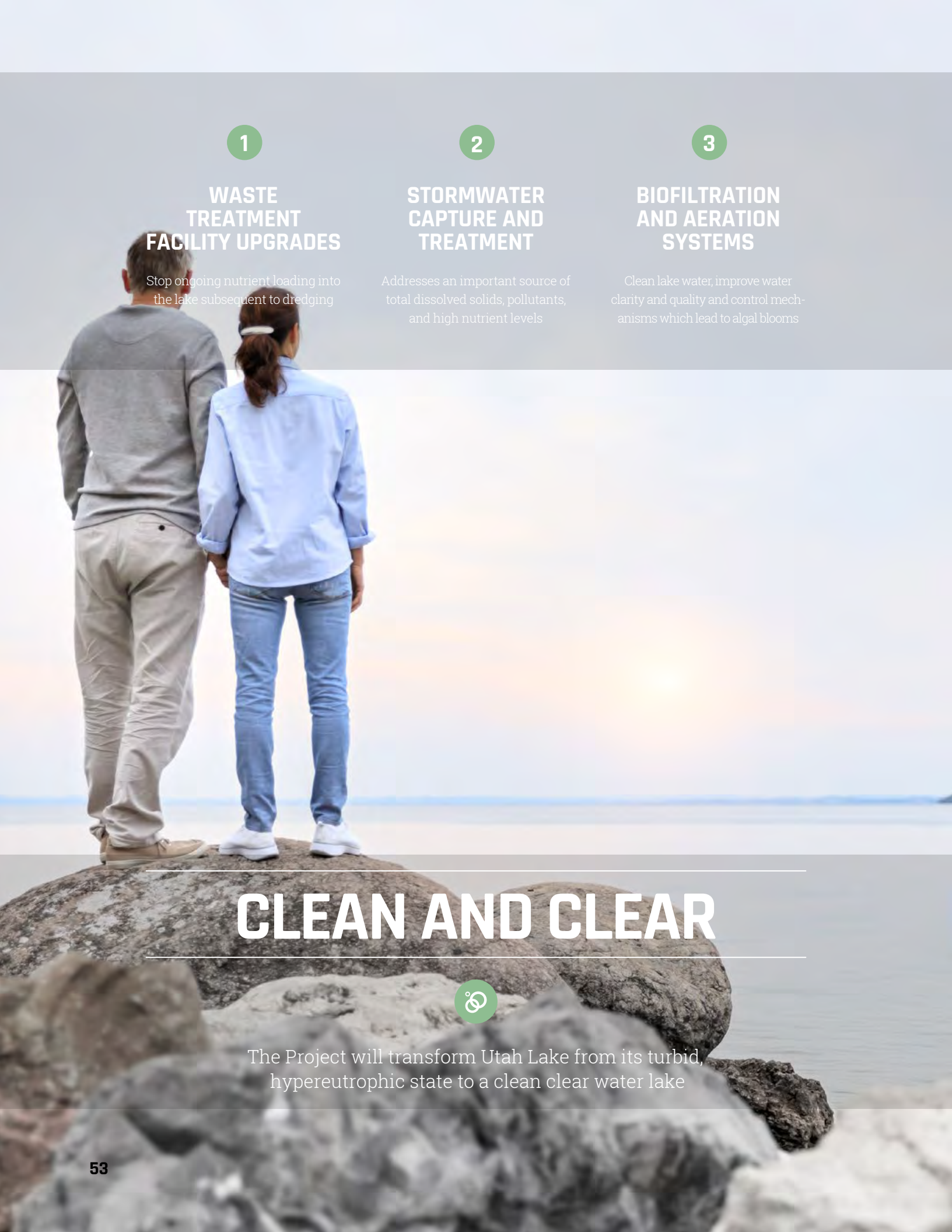
The deeper the lake bed, the less wave energy reaches the bottom of the lake. The more shallow the lakebed, the more energy reaches the bottom causing the waves to get taller and stir up sediment at the bottom.



At an average depth of nine feet, the most important variables affecting the force of waves on the lake bottom are H-wave height and z-depth of the Lake. This shows that a decrease in wave height produces a linear decrease in wave force, while increased lake depth exponentially decreases wave force. Because the Utah Lake Restoration Project decreases both wave height and increases lake depth, reduction in total forces on the lake bottom are maximized.

Our current wind and wave models along with our dredging projections, estimate that once dredging has been completed and islands have been created, wave force on the lake bottom (orbital velocity) will be reduced by 500% during a 26 mile-per-hour wind event, producing little or no re-suspension of the lake bottom, and dramatically improving water clarity. The reduced orbital velocity is also a degree of vertical force which is insufficient to uproot or break aquatic plants as they are becoming re-established along the lake bottom.

In summary, wind and wave action as well as lake bottom disruption will be reduced as a result of strategic dredging and island creation, thus allowing the Lake to transform from a turbid eutrophic state to a restored clear-water state.



1

WASTE TREATMENT FACILITY UPGRADES

Stop ongoing nutrient loading into the lake subsequent to dredging

2

STORMWATER CAPTURE AND TREATMENT

Addresses an important source of total dissolved solids, pollutants, and high nutrient levels

3

BIOFILTRATION AND AERATION SYSTEMS

Clean lake water, improve water clarity and quality and control mechanisms which lead to algal blooms

CLEAN AND CLEAR

The Project will transform Utah Lake from its turbid, hypereutrophic state to a clean clear water lake

WATER QUALITY

Restoring native wildlife and plant habitats is a core objective of the Utah Lake Restoration Project.

Dredging Utah Lake, which includes removing nutrient-loaded sediments, deepening the lake, creating islands, and controlling wind and wave action, will form a foundation for a lake with cleaner and clearer water.

These changes alone are insufficient to fully restore and maintain water clarity and quality. It is important to also address high nutrient inflows, remove invasive plant and fish species, and restore native plant populations and biodiversity. To accomplish this, the Utah Lake Restoration Project will implement and fund the following:

1. Upgrades to waste water treatment facilities
2. Storm water capture, retention, and treatment
3. Installing biofilters to clean lake water
4. Improve circulation through mechanical pumping
5. Improving oxygenation of lake water through aeration systems
6. Littoral zone restoration

NUTRIENT LOADING
Wastewater treatment facilities contribute over 200 tons of phosphorus to the lake annually.

The Utah Lake Restoration Project contemplates using a world-class environmental team to ensure success. The environmental team will be tasked with multiple focused responsibilities: monitoring upgrades to waste water treatment facilities, storm water capture and treatment, installation, design and operation of biofiltration systems, and lake circulation design and improvement.

The environmental team will report directly through the project manager and director levels to assure all environmental concerns are addressed at the very top of the Lake Restoration Solutions team. Some of the work will be seasonal, providing excellent employment opportunities for university level students in the biology, environmental, forestry, and recreation fields of study.

NEW TECHNOLOGIES
Clean water and low nutrient outputs are possible using new technologies

DETAILED ANALYSIS

WASTEWATER TREATMENT FACILITIES UPGRADES

Treated water from surrounding waste treatment facilities is the primary source of nitrogen and phosphorus loaded into Utah Lake. Current levels of phosphorus from waste treatment facilities range from 1.31 mg/l to 3.4 mg/l . While this may not seem significant at first, a report from the Utah Division of Water Quality estimated that phosphorus is accumulating in the lake at an alarming rate of approximately 214 tons per year.

Phosphorus, nitrogen, and total dissolved solids accumulation contribute to unsustainable nutrient loading of lake sediments. Upgrading the waste water treatment facilities will reduce the levels of phosphorus and nitrogen and is an important objective of the Utah Lake Restoration Project.

The Environmental Protection Agency (EPA) recognizes the importance of minimizing nitrogen, phosphorus, and other total dissolved solid levels in treated water from waste treatment facilities. The EPA is pushing for adoption of new standards. This proposed standard, called Tier 1-N, dictates that these facilities should limit their outflows to 0.1 mg/l for total phosphorus and 10 mg/l for total nitrogen. Water quality criteria for total phosphorus and total dissolved phosphorus in Utah Lake has been identified as .025 mg/l by the State of Utah.

> Monitoring systems regulate upgraded treatment systems.

BIOSWALES
Stormwater capture in bioswales uses natural systems to clean water before it enters the Lake

STORM WATER CAPTURE, RETENTION, AND TREATMENT

One of the sources of total dissolved solids, high nutrient levels, and pollutants to Utah Lake is inflows from storm water systems and run-off water in areas surrounding the lake. Additionally, farming and ranching interests are significant contributors in discharging unfiltered waste heavy in phosphorus, nitrogen, and biologics into the lake. One of the objectives of the Utah Lake Restoration Project is to improve filtration of water before it enters the lake. Our team will work in cooperation with cities and surrounding stake holders to determine the primary sources of these points of discharge. Through collaboration, we will design, plan, fund, and build bioretention basins and bioswales that will capture untreated water in "living drains" or biobasins. The drains and biobasins create a point where specifically selected plants and landscaping can clean the water before it is discharged into rivers, drainage ditches, or city storm water systems.

> Aquatic plant species are excellent water purifiers.

Bioswales and bioretention basins offer the unique opportunity for some of the rain water to replenish the groundwater supply which curb and gutter storm water systems do not provide. As water infiltrates through the biobasins, sediment and pollutants are filtered. Micro-organisms on plant roots and in the soil help to further break down harmful pollutants before any excess water is returned to the storm water system. These biobasins use hardy, strong rooted perennials (grasses, flowers, shrubs, and small trees) able to tolerate both wet and dry conditions.

All new developments created by Utah Lake Restoration Project will use this biobasin technology exclusively on all storm water drain systems. No water will be allowed to flow back into the lake without having run through a series of bioswales and into a bioretention basin before it flows back into the lake. This philosophy will be built into all development improvements and road systems. In summary, execution of these filtration methods and practices will work in collaboration with outlying communities to beneficially contribute to the Utah Lake watershed.

LOW NUTRIENT INFLOWS

Investing to produce low nutrient inflows are important to stop high nutrient levels in the lake.

BIOFILTRATION

In a healthy ecosystem, wetlands that surround lakes and river bottoms provide natural filtration that cleans water before entering the lake ecosystem. These natural processes rely on native plants, indigenous mollusks, and other aquatic species found along the shoreline and in shallow waters. In the case of Utah Lake, the ecosystem is significantly out of balance due to invasive species, such as Phragmites and carp, which have overpopulated shorelines and effectively eliminated healthy riparian and littoral zone ecosystems. Other challenges with high nutrient levels, total dissolved solids, and sedimentation have also contributed to poor water quality.

In the last 20 years, microbiologists have made great progress in understanding and recreating natural methodologies that are very efficient in cleaning and treating wastewater, storm water, aquaculture water, rivers, and lakes. Biofiltration restores aquatic environments by utilizing a biomimicry approach which harnesses the power of nature for restoration and remediation. These biofiltration technologies utilize the latest science to clean and restore water quality in impaired water systems. The Utah Lake Restoration Project will utilize a series of 40 biofilters around Utah Lake to restore and improve the water quality. .

DETAILED ANALYSIS

Currently Utah Lake has an impaired ability to filter phosphorus and nitrogen from its waters because of water quality issues related to the high quantity of Total Dissolved Solids (TDS) in the lake. Also contributing heavily to the impaired water quality are the proliferation of invasive species in the lake and the lack of indigenous riparian, emergent, and littoral zone plants.

The Utah Lake Restoration Project will utilize biofiltration technology to help restore water quality in Utah Lake, creating a more balanced lake ecosystem. The plan contemplates placement of approximately forty bio-filter pumping stations across the lake. These systems pump water onto constructed streambeds in areas surrounding the lake or on the islands of Utah Lake. These pumping stations will each process up to 250,000 gallons per hour. As the water flows through these

specially-designed rivers, filtration media, gravels, plants and aquatic life purify the water, balancing nutrient and acidity levels and oxygenating the water before it is returned to Utah Lake. These systems will appear as a natural stream coming out of rocks and running for ¼ to ½ mile before it returns to the lake.

The biofilters will treat the water for phosphorus, nitrogen, acidity, depleted oxygen, total dissolved solids, bacteria, and other water quality measures. Biofiltration media will be constructed using natural materials. Filter media commonly used include

PADDLEBOARDING ON THE LAKE
Restored water quality improves recreational experience for visitors to the Lake.

ACHIEVABLE BIOFILTRATION TREATMENT PERFORMANCE REDUCTIONS

Nutrient	% Reduction
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	72%
Total Suspended Solids (TSS)	61%
Chemical Oxygen Demand (COD)	89%
Biological Oxygen Demand (BOD)	89%
Chlorophyll (Algae)	80%
Clarity	72%
Metals	95%
Pathogens	90%

shredded palm tree and or coconut husks. This media retains sufficient air in their membranes to float and support the growth of aquatic and riparian zone plantings that naturally filter the water. These bio-filters also function by removing nutrients and pollutants through biofilm contact with specially selected native plant roots. All of the biofilter streambeds will be lined with poly-uria-lined geofabric so that a minimum amount of water is lost to the surrounding soils. Biofiltration will also be provided through the reintroduction of local mollusk populations native to Utah Lake. These native mussels, snails, and clams have the remarkable ability to filter large bodies of water in short periods of time. They will further refine the water by filtering out suspended solids, nutrients, and contaminants from the water. Bringing properly sized and operated bio-filtration improvements to the shoreline of Utah Lake will help mitigate the years of damaging effluent and out-of-balance invasive species. These forty bio-filtration systems will provide ongoing cleaning and improvement of water quality of Utah Lake for many years to come.

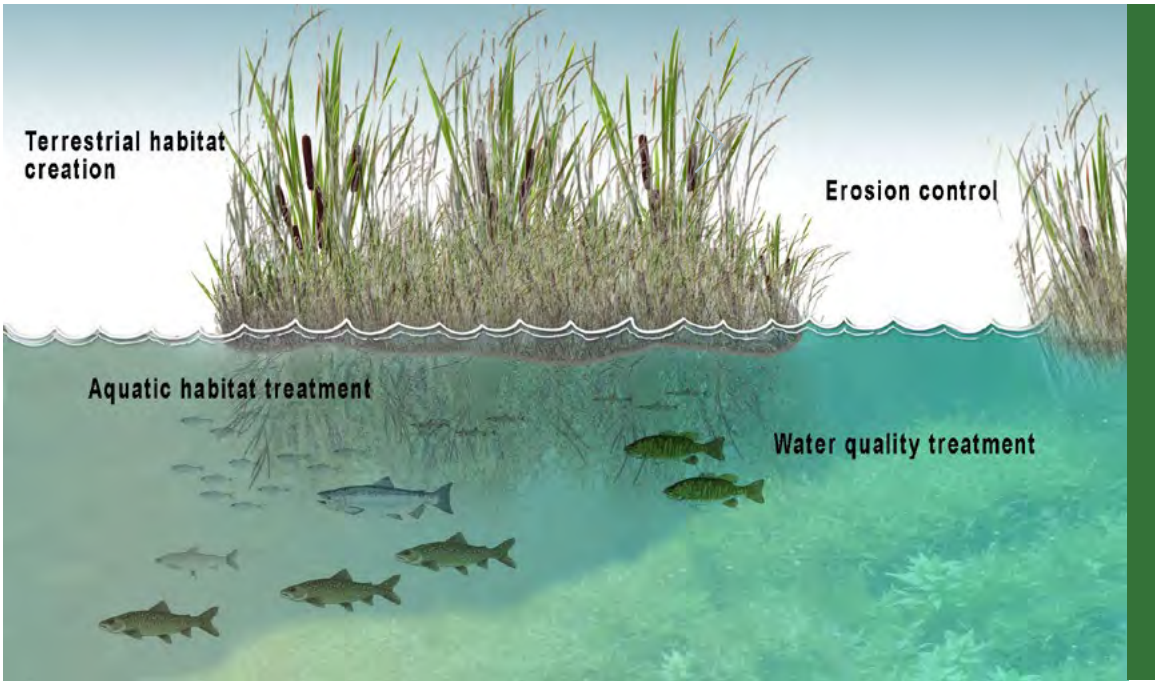
Biofilter pumps will be solar powered and will have variable frequency drives that can output from 100 gallons per minute up to 4,166 gallons per minute with vital water quality monitoring at the inlet and outlet for plant maintenance and measuring other key performance indicators. Biofilters will be semi-autonomous and will start-up and shutdown via readings from the SCADA water quality buoys spread around the lake close to system inlets. Manual control of the system will also be available to water managers. Biofilters will utilize floating wetland technology, particularly within sewage treatment trains or retro-fitted into detention wetlands at the discharge areas. Detention basins can be designed larger and deeper, effectively providing more storage and hydraulic retention time (HRT). Wetlands can also be smaller due to increased retention time, reducing operating costs, achieving best practice while effectively treating phosphorus, nitrogen, suspended solids, chemical oxygen demand, biological oxygen demand, algae, and reducing heavy metals.

BIOFILTERS
40 biofilters surrounding the lake will enhance beauty as well as water quality.

TWO-PHASED APPROACH

The Utah Lake Restoration Project includes a two-phased approach to utilize biofiltration technology to help restore Utah Lake's water quality. The first phase will happen early in the project and involve developing bio-filtration space and facilities to intercept the effluent for all townships and cities currently discharging treated waste into Utah Lake. Phase two will involve building bio-filtration islands, which will effectively treat waste water and provide a buffer zone between the Lake and waste treatment facility outfalls.

Large farming and ranching interests in the southern shorelines of Utah Lake will also be approached early in the project to allow installation of biofiltration facilities at their ranches and farms. This early work will allow a significant reduction of rain driven chemical runoff from orchard spraying and animal waste runoff into the Lake.



MECHANICAL PUMPING

Water circulation has been an ongoing challenge for Utah Lake. Although the Lake receives healthy inflows of water from a number of different tributaries, such as the Provo and Spanish Fork Rivers, it does little to create current within the Lake. Most of the water from these inflows moves north toward the Jordan River. This leaves the circulation patterns on the south end of the Lake, including Provo Bay and Goshen Bay, largely independent from the circulation of the main body of the Lake. As a result, portions to the south are largely stagnant and have developed a degree of salinity. One objective of the Utah Lake Restoration Project is to improve water circulation throughout Utah Lake through scientifically placed islands and mechanical pumping using the latest technologies.

DETAILED ANALYSIS

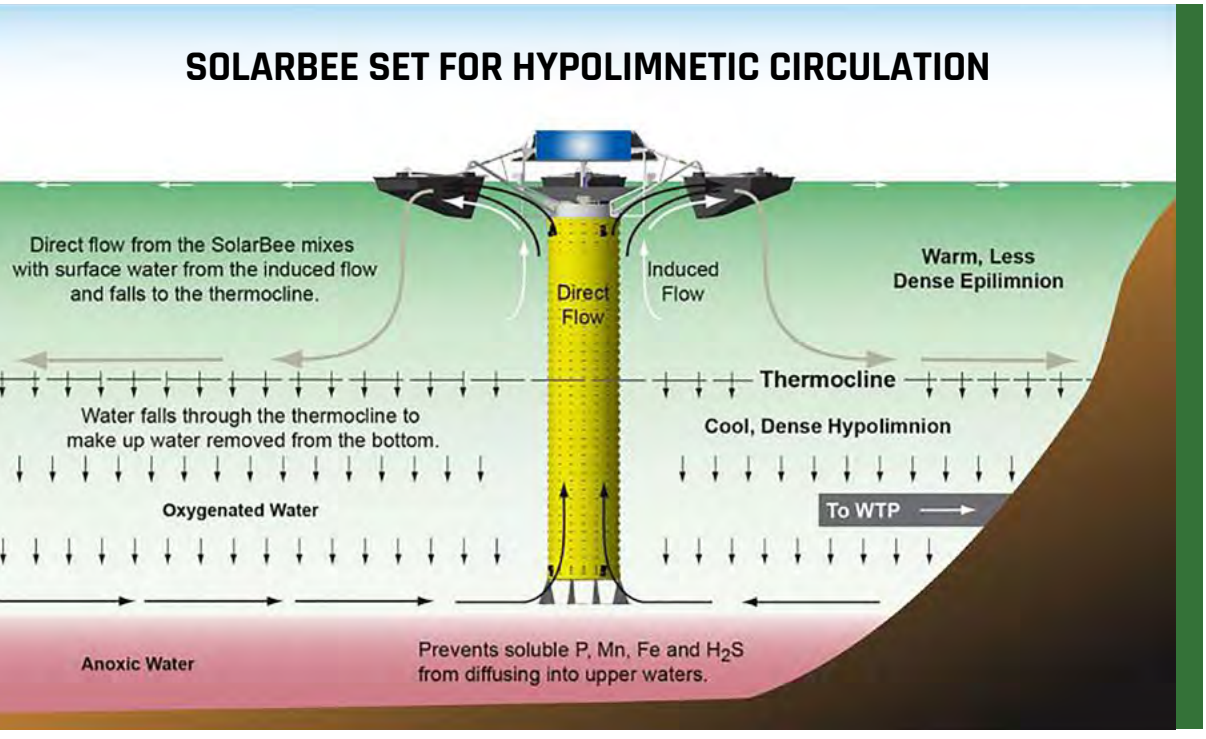
While the migration of water from Utah Lake's tributaries to its single outflow at the Jordan River play a role in water circulation, most water movement in the Lake is attributable to wind and related shear forces. The predominant wind direction on Utah Lake is the South-Southeast-East approximately 40% of the time during the year and approximately 50% of the time during the critical summer season. See https://goo.gl/zimwcP, page 3. Higher magnitude winds occur from the Northeast for a significant portion of the season as well. As previously discussed on pages 47-52, wind and shear forces are problematic as they can lead to sediment re-suspension and eventually contribute to algal blooms.

As wind and wave patterns are reduced through the placement of islands across the Lake, the Utah Lake Restoration Project will place pumping stations at strategic locations around the Lake to ensure effective circulation. Selection of water pumping sites will be based on a number of factors including lake bathymetry, dissolved oxygen, nitrogen and phosphorus concentrations, algal counts, land use practices, and nutrient loading rates. *See https://goo.gl/mwdumU page 3.*

Mechanical pumping will be utilized to improve flow rates in and around the islands to ensure lake water is guided from inflows to each part of the Lake. Existing solar powered pumping systems are designed to move up to 10,000 gallons of water per minute. These systems will be installed to not only improve lake circulation, but also provide continuous aeration of lake water.

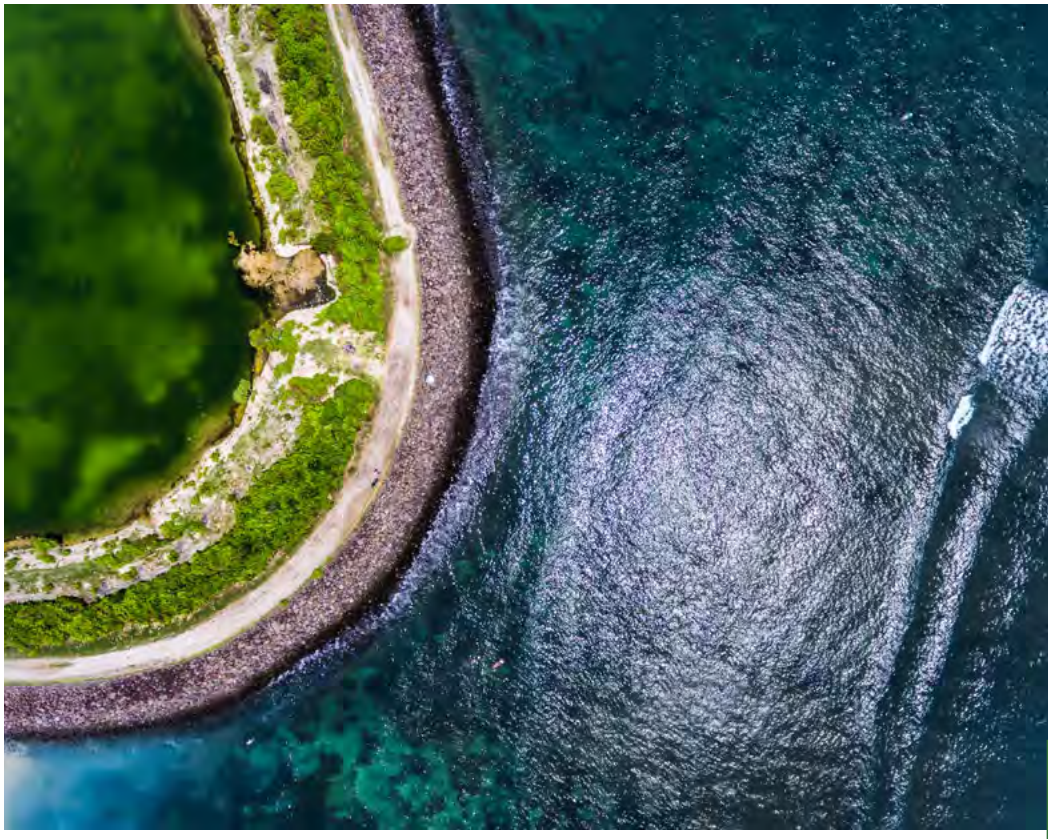
Through the use of solar-powered pumps, stagnant water will be drawn into a rotating mechanism. These mechanisms rapidly gyrate the water, adding energy and movement, which is then released back into the lake body. Outflow from these pumps increase water circulation, which assists in fighting algal blooms and other water quality problems. The mixing action can promote diatom and zooplankton while at the same time limiting and preventing impacts from blue-green algae.

The placement of these pumps will be determined using advanced computer modeling of the Lake to determine where water quality deficits have developed, or could develop, as a result of poor water circulation. Where these problem areas are identified, mechanical pumping stations will be placed in collaboration with the strategic placement and design of islands, deep water channels, and changes in the lake's bathymetry to improve lake circulation. One specific objective of these designs is to move inflowing waters to the southern parts of the Lake. Circulation models also anticipate moving stagnant waters into



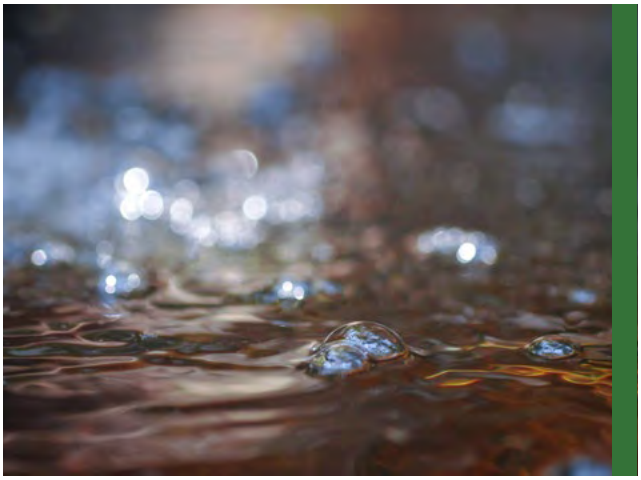
AERATION AND CIRCULATION

Aeration and circulation improve water quality and controls TSS levels.



LOW OXYGEN
Low oxygen leads to poor water quality and high algal levels, aeration in adjacent waters produce clear, clean waters

biofiltration areas, where lake water will be filtered and cleansed. These treated waters can then be circulated throughout the rest of the Lake through mechanical pumping and additional means, such as rerouting of inflows from natural springs, to create circulation from the southern end of the Lake northward toward the Jordan River outflow.



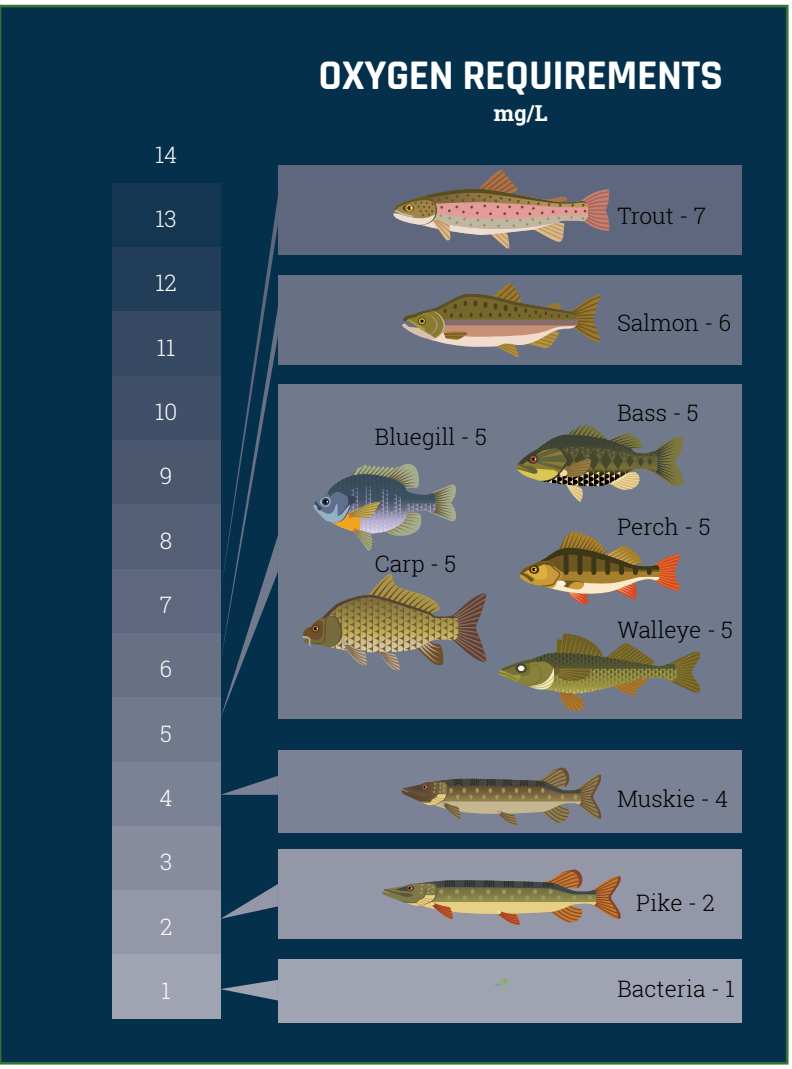
As water circulation throughout the Lake is increased, water quality will improve rapidly. Many of these water quality improvements will be implemented within the first ten years of the Utah Lake Restoration Project. This will allow the Lake to increase in water clarity, water quality, and to support abundant native plant and aquatic life. By utilizing carefully modeled and engineered circulation patterns, not only can circulation around Utah Lake be ensured, but it can be improved to address areas of poor water movement, stagnation, and salinity. In short, the Utah Lake Restoration Project will improve water quality by designed water circulation and mechanical pumping of water in and around the Lake. Mechanical pumping assists the littoral plants as a biofiltration mechanism. The combination of both are designed to ensure water quality improvements.

AERATION

A vital part of restoring water quality on Utah Lake is addressing deficits of dissolved oxygen. Water

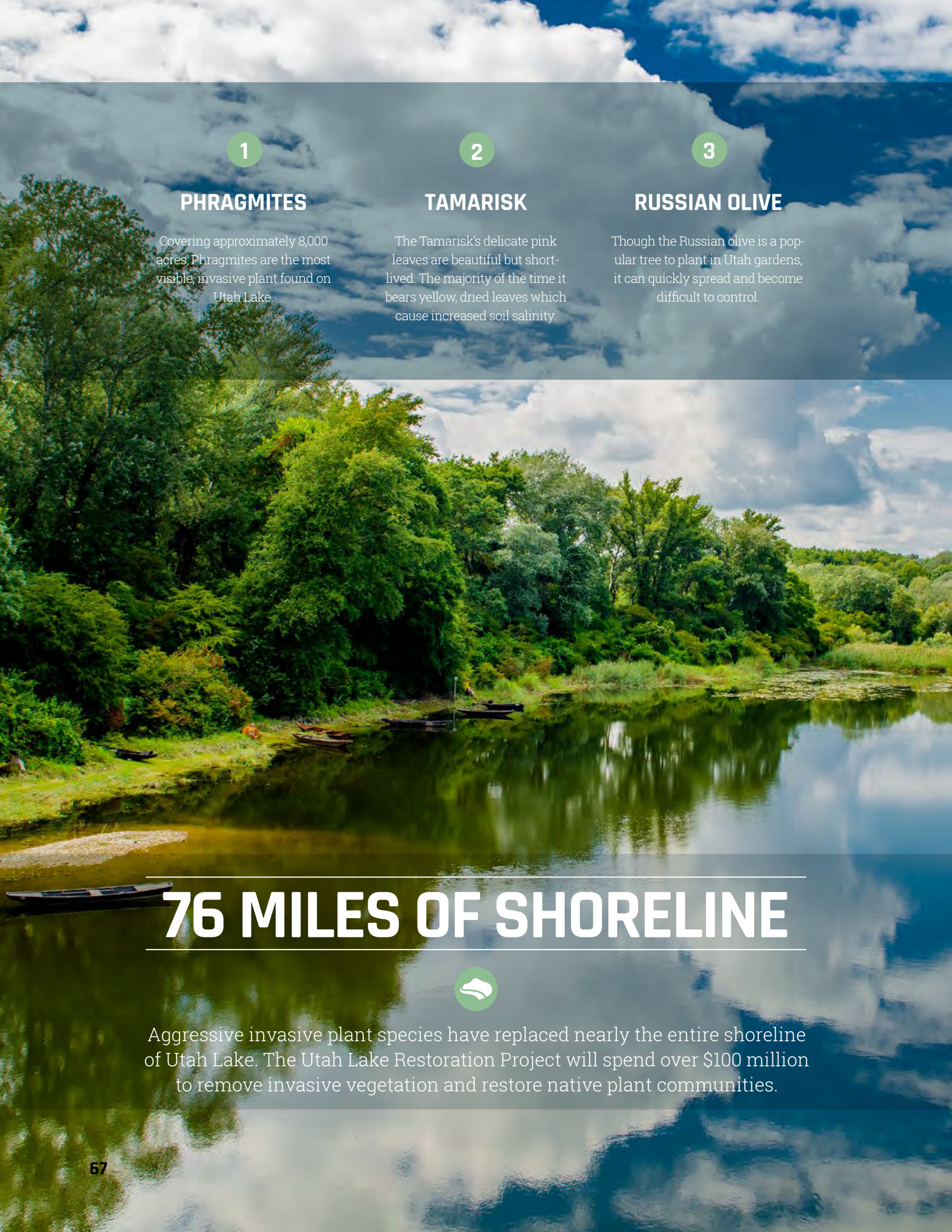
circulation on portions of Utah Lake, particularly the southern end of the Lake, has led to stagnant, even slightly saline water. When water sits and stagnates, it loses oxygen and becomes increasingly acidic thru an anaerobic bacterial process. This process releases toxic gases, including hydrogen sulfide, ammonia, carbon dioxide, and methane, into the water column. These gases are all toxic to fish, insects, and beneficial bacteria.

The Project will utilize aeration systems in portions of Utah Lake to address these challenges. Aeration systems increase dissolved oxygen in the water column and improve water quality. Aeration systems gently turn water over and bring foul-smelling gases to the surface where they are neutralized by the atmosphere. Oxygenated surface water is circulated back to the bottom where the oxygen kills anaerobic bacteria that produce toxic gases. These processes also circulate blue-green algae, which only grow on the Lake surface, to the bottom of the Lake where it cannot bloom due to lack of sunlight. By oxygenating the problem areas, iron and manganese oxide sink and are deposited on the lake bottom. Both oxidized iron and manganese are useful in binding phosphorus and nitrogen to the bottom sediment making them no longer available for algal growth.



The Project will use solar powered subsurface aeration systems to increase dissolved oxygen levels in the Lake to a minimum of 7 milligrams per liter (mg/L). Currently, Utah Lake dissolved oxygen levels have been measured at levels as low as 3 mg/L . Scientific studies suggest that 4-5 mg/L of dissolved oxygen is the minimum amount that will support a large, diverse fish population. The dissolved oxygen level in great fishing waters generally averages about 9 mg/L while good trout habitat maintains at least 7 mg/L.

The Project will use 3D modeling simulations and water testing during the design phase to see where dissolved oxygen issues will likely be. Solar aeration stations will be designed and implemented in the deeper channels where testing shows there is a need for greater oxygenation. These stations will be electronically controlled with variable frequency drive compressor stations that vary aeration based off measurements taken from water quality test buoys scattered around the Lake. Early indications are that at least 23 of these systems will be needed around the Lake to control stratification and historical blue-green algae problem areas. These systems will also help maintain healthy dissolved oxygen levels for the native fishery. As the littoral zone becomes re-established, dissolved levels from littoral zone plants will make up the majority of the dissolved oxygen needs of the Lake. At that point, it is anticipated that pumps will only run in the late fall to maintain desired oxygen levels. ■



1

PHRAGMITES

Covering approximately 8,000 acres, Phragmites are the most visible, invasive plant found on Utah Lake.

2

TAMARISK

The Tamarisk's delicate pink leaves are beautiful but short-lived. The majority of the time it bears yellow, dried leaves which cause increased soil salinity.

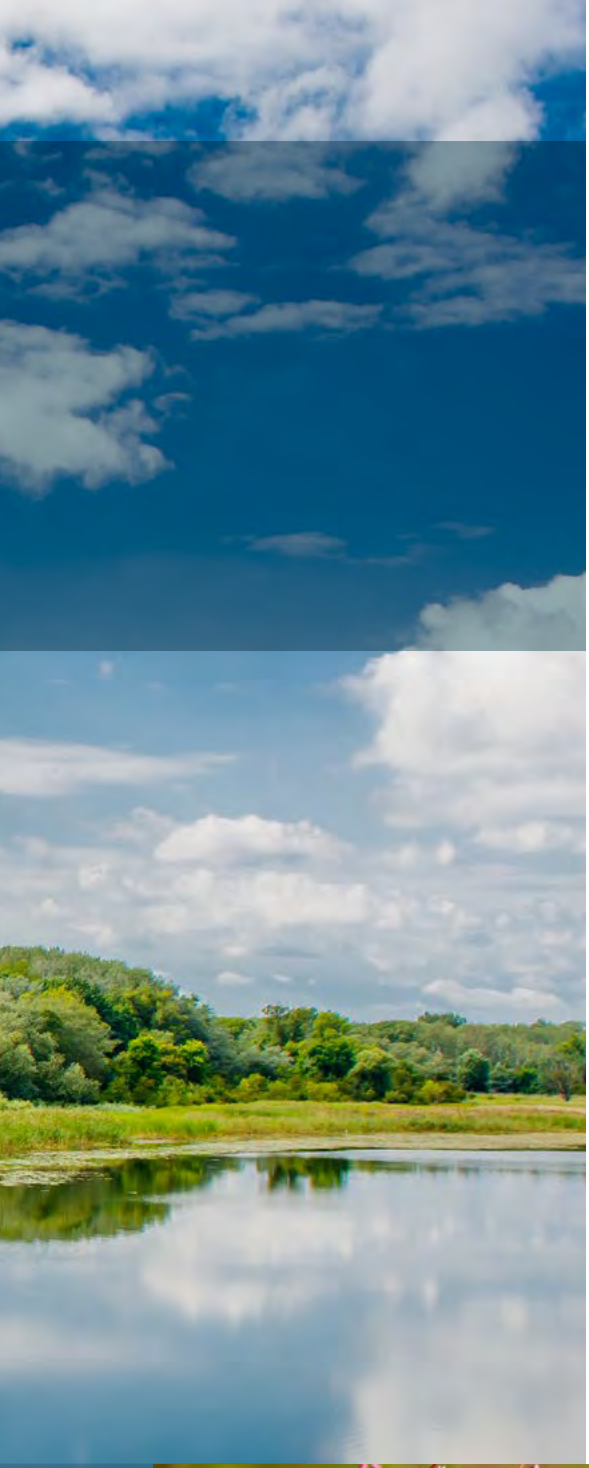
3

RUSSIAN OLIVE

Though the Russian olive is a popular tree to plant in Utah gardens, it can quickly spread and become difficult to control.

76 MILES OF SHORELINE

Aggressive invasive plant species have replaced nearly the entire shoreline of Utah Lake. The Utah Lake Restoration Project will spend over $100 million to remove invasive vegetation and restore native plant communities.



INVASIVE PLANT SPECIES ERADICATION

Invasive plant species surrounding the Lake shore and lower river channels are primarily Phragmites, Tamarisk, and Russian olive.

These plants negatively impact the native environment by consuming large quantities of water, displacing native plant species, and altering the natural landscapes on and around Utah Lake. An important objective of the Utah Lake Restoration Project is to eradicate Phragmites, Tamarisk, and Russian olive from Utah Lake and as needed in the surrounding watershed.

It is important to note that efforts made by current state and non-governmental agencies include many aspects that demonstrate eradication of invasive species is possible. We applaud these efforts and are committed to providing additional funding and resources to ensure program success and the ultimate return of indigenous plant species along the shores of Utah Lake.

PHRAGMITES

Phragmites are the most visible, invasive species on Utah Lake. Mapping shows that Phragmites surround the vast majority of the 76-mile lake shoreline and cover approximately 8,000 acres in and around the lake shore. Phragmites consume many times the amount of water of native cattails. They also cover larger sections of the shoreline and at much higher densities. This means that Phragmites dominance is highly adverse from a water conservation standpoint. Phragmites stands also expand rapidly. In fact current estimates suggest that Phragmites multiply at a rate of 10% of their current population annually. Current control efforts treat approximately 7% of the total population, meaning the annual growth rate exceeds current control rates.

The Utah Lake Restoration Plan will fund a multi-year removal plan which will treat all 8,000 + acres each year. We anticipate that initial removal will require 3 to 5 years of treatment to effectively

INVASIVE GIANT

Phragmites can grow to over 15 feet tall and create dense monotypic stands with as many as 20 plants per square foot.

SHORELINE OVERGROWTH
A bird's-eye view reveals how pervasive Phragmites have become. Efforts to return indigenous plants to the Lake's shoreline will be expensive and ongoing.

eliminate Phragmites from Utah lake. Ongoing maintenance to ensure new stands do not become re-established will likely be required for as many as 20 years.

There are significant benefits to removing Phragmites from Utah Lake and surrounding areas. The best available science indicates that phragmites consume 1,198,863 gallons of water per acre annually. Mapping by the Utah Lake Commission indicates that there are 8,000 acres of Phragmites on Utah Lake. This means that Utah Lake Phragmites stands consume 9.61 billion gallons of water annually. By comparison if the total area of Phragmites were replaced with a natural acreage of indigenous cattails and lilies, water consumption would be 471 million gallons annually. This is a reduction of 96% and a saving of 9 billion gallons of water annually.

Just as importantly, once Phragmites are controlled, native species which provide food, cover, and breeding habitats for fish, birds, and other wildlife can be restored. These native plant species not only consume less water and provide habitat for native wildlife, they also remove phosphorus and nitrogen from the water column and filter other dissolved solids. Restoration of these native plant species thus provides natural mechanisms to restore water quality in and around the Lake that is not provided by Phragmites.

> As Phragmites are replaced with native plants, water consumption can be reduced by up to 96%.

SALTY LEAVES

Tamarisk leaves are high in sodium. When their leaves are dropped, salt levels in the soil increase, making it difficult to support other plants.

TAMARISK

Tamarisk are another invasive plant species that can choke out and kill other native plants. Tamarisk produce salt laden leaves that drop to the ground and kill native plants and increase soil salinity. Tamarisk can be controlled by the Tamarisk beetle, (Diorhabda carinulata) which consumes the tree leaves. Once the Tamarisk has been defoliated it can no longer photosynthesize and eventually the tree dies.

Estimates vary on how long this process takes and can depend on several variables including the vigor of the tree and the duration of exposure to the beetle. Recent observations indicate that a tree can be killed within 3-5 years of beetle infestation.

Full eradication requires the trees to be cut down and roots removed mechanically and burned. Currently the Utah Department of Natural Resources is using the Tamarisk Beetle to kill Tamarisk Trees in southern Utah. The Utah Lake Restoration Project will work with the Utah Department of Natural Resources to plan and fund all Tamarisk removal around Utah Lake.

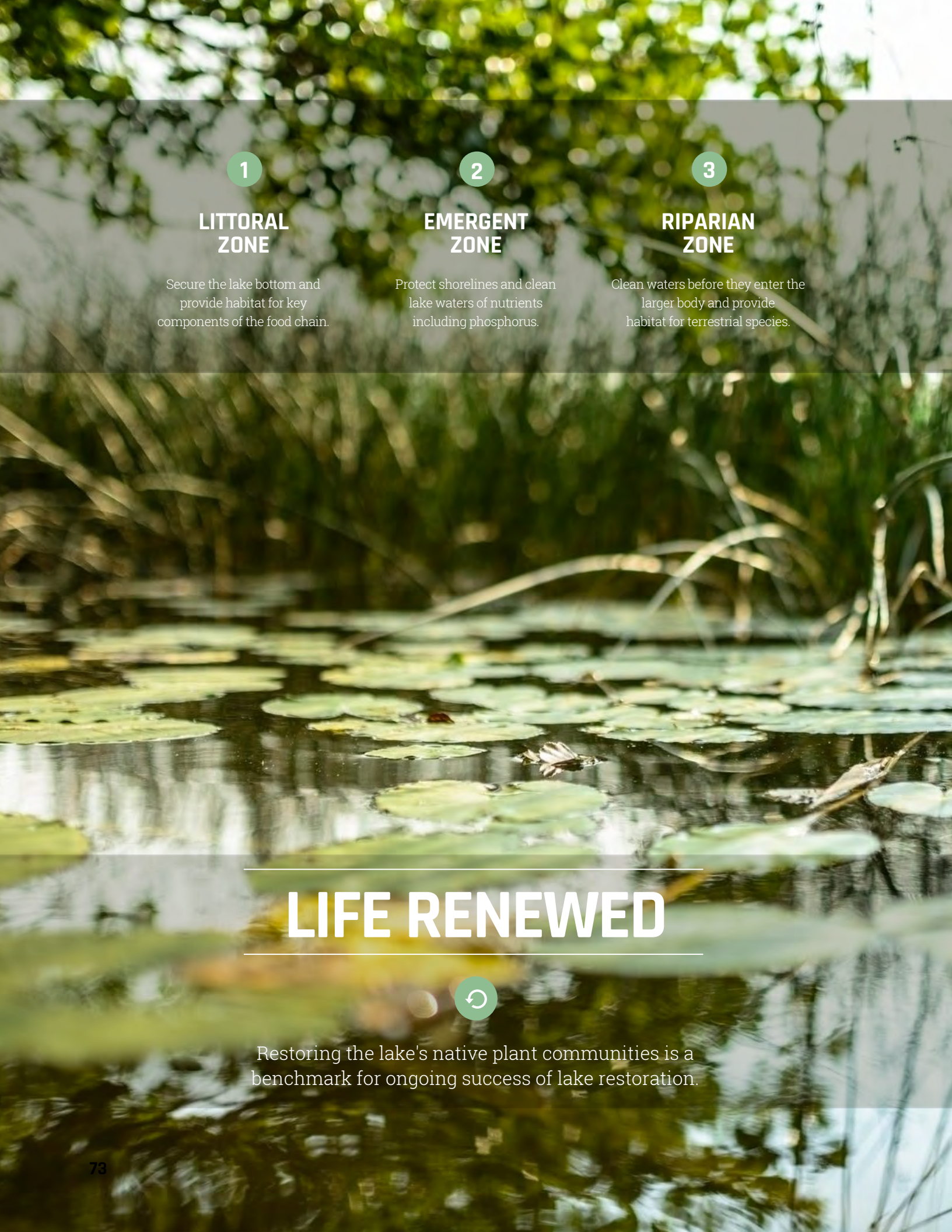
RUSSIAN OLIVE

Russian olive historically was considered a horticulturally desirable species, and the tree is still sold in Utah nurseries. In the past, it was promoted by various agencies for conservation plantings in cropland environments. Some of these same agencies are now spending large sums of money to control it. While the popularity of using Russian olive as a drought-resistant planting option is not as common as it was in the past, public education is still needed to raise awareness of the tree's invasive shortcomings.

It is extremely difficult to restore native plant communities in areas where Russian olive has become well established. The first priority in Russian olive management is to prevent establishment by monitoring its first appearance. Small infestations on otherwise healthy sites should be treated early, and the goal should be to remove all trees. Treatments such as cutting, mechanical removal, and burning, can effectively eliminate aboveground growth but do little to control the root system and limit expansion. Control efforts must also focus on the destruction of the root system. It may be impractical to eradicate Russian olive completely when growing in larger infestations, but trees should be controlled to the best extent possible. Russian olive management requires a long-term commitment that will likely take 3 or more consecutive years of treatment followed by years of monitoring for regrowth.

LONG-TERM COMMITMENT

Russian olive management will likely take three years of treatment followed by years of monitoring for regrowth.



1

LITTORAL ZONE

Secure the lake bottom and provide habitat for key components of the food chain.

2

EMERGENT ZONE

Protect shorelines and clean lake waters of nutrients including phosphorus.

3

RIPARIAN ZONE

Clean waters before they enter the larger body and provide habitat for terrestrial species.

LIFE RENEWED

Restoring the lake's native plant communities is a benchmark for ongoing success of lake restoration.

NATIVE PLANT RESTORATION

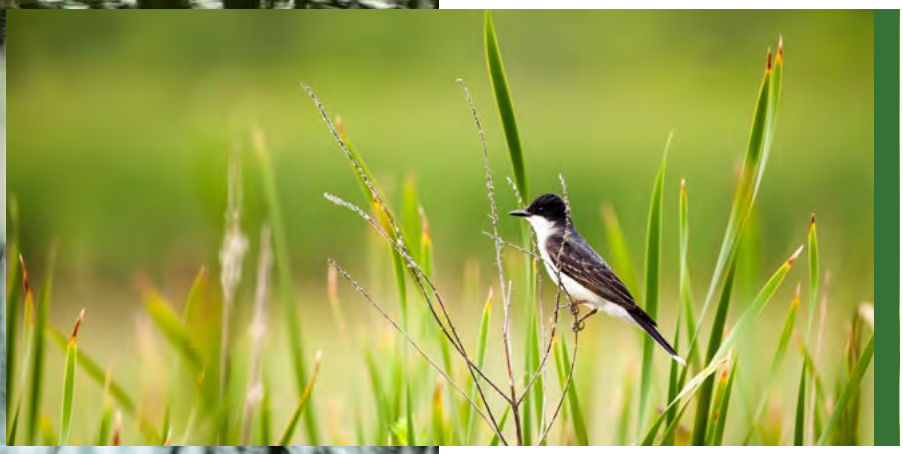
Restoration of native vegetation, including littoral, emergent, and riparian zones, is a core objective of the Utah Lake Restoration Project.

Once re-established, vegetative communities will naturally manage nitrogen and phosphorus levels, secure the lake bottom, and play a significant role in naturally maintaining water quality.

Following the removal of Phragmites and other invasive species, restoration of native plants can begin in earnest. Native plant communities of the freshwater shoreline in and around Utah Lake include three separate zones of vegetation:

1. Littoral
2. Emergent
3. Riparian

Re-establishing native plant communities will restore many of the natural filtering, oxygenation, and water quality improvements that originally existed in the Utah Lake ecosystem. They will provide important native habitats for abundant populations of zooplankton, invertebrates, fish, birds, and terrestrial species as well as restore a healthy, and intact food chain. These natural processes will signal the implementation of some of the final conservation solutions to Utah Lake.



DETAILED ANALYSIS

LITTORAL ZONE

The shallow nearshore waters of the lake where light penetrates all the way to the bottom, is referred to as the littoral zone. The littoral zone is considered the most diverse and abundant biological community in lakes. This community is made up of plants, or macrophytes, rooted in the sediments that receive enough light to grow. The original littoral zone of Utah Lake was expansive, covering much of the lake bottom. It anchored bottom sediments to provide water clarity and functioned to oxygenate and clean the lake water while also processing nutrients. Loss of the littoral zone by invasive carp species was a precipitating factor in the degradation of the lake.

The diversity of plants and the structure in the littoral zone attract an abundance of aquatic life. Many aquatic invertebrates and zooplankton originate here. Minnows and young fish feed and find protection from predators. Aquatic insects, which provide food for many fish, live on and feed among the plants and sediments. The endangered June sucker relies on the littoral zone for cover and feeding. In short, the littoral zone plays a vital role in establishing a healthy food chain and for restoring native fish populations in Utah Lake.

> The littoral zone is considered the most diverse and abundant biological community in lakes.

The environmental team will work in collaboration with the Utah Department of Natural Resources to determine desirable plant species to be used in littoral zone restoration and to secure seed, seedlings, and density rates for planting. As water clarity improves, the increased depth of sunlight penetration will effectively extend the littoral zone further and further into the lake. Water clarity to 15 feet deep is possible with a properly balanced lake ecosystem.

As part of the initial littoral zone restoration project, Lake Restoration Solutions will grow mats of littoral zone plants. These mats will be secured to the lake bottom during the early stages of littoral zone restoration. Additionally, as discussed in pages 47-52, reduced orbital velocity as a result of dredging and island creation means that littoral zone plants can become re-established without being uprooted during normally occurring wind and wave events. Areas between the lake shoreline and estuary islands will be prime targets for initial littoral zone restoration due to controlled wind/wave action, water clarity and depth, and accessibility. Ongoing planting and expansion of littoral zones will occur over several years. Eventually, littoral zone expansion will occur naturally through normal biological processes as water quality, water clarity, and other conditions in the lake continue to improve.

INTERCONNECTED LIFE

Minnow species rely on healthy littoral zones and are an important part of a restored lake food chain.

NATIVE PLANTS
Cattails, bullrush, and emergent species conserve and clean lake water.

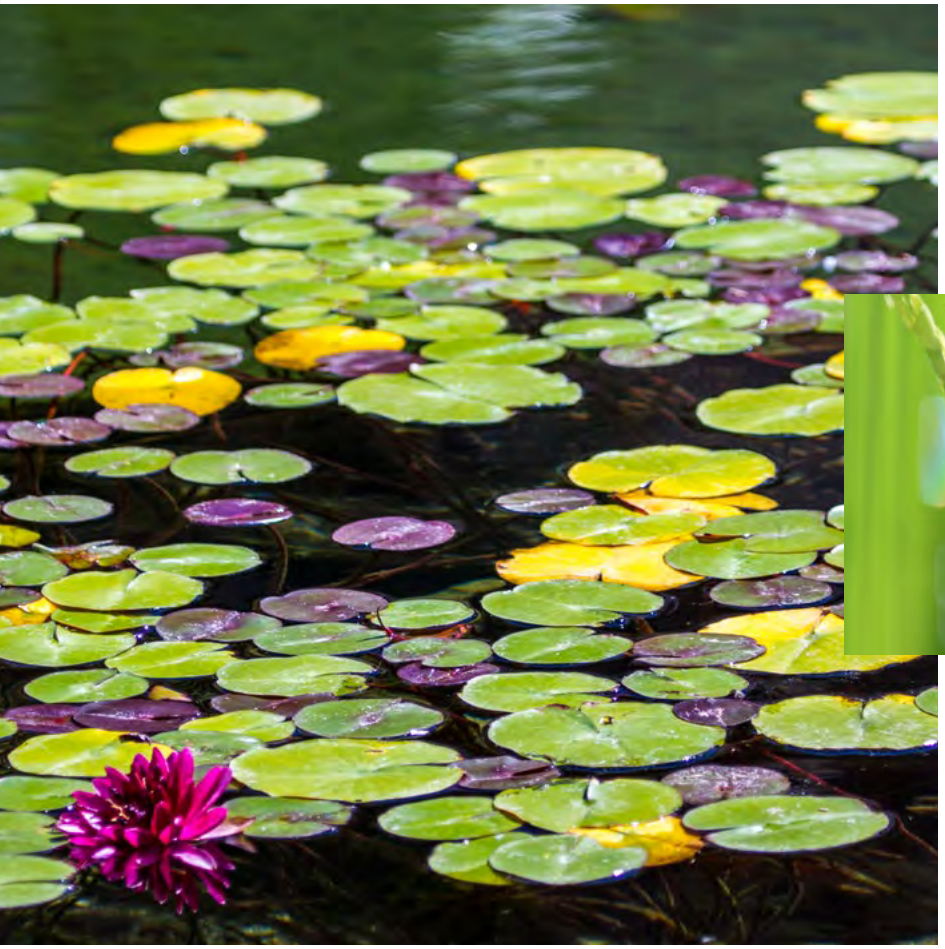
EMERGENT ZONE

The emergent zone is the area between the littoral and riparian zones. Defined by emergent plants, such as cattails and bulrush, the native vegetation of the emergent zone is highly effective at managing nutrients flowing into the lake from surrounding areas. Sometimes referred to as the "upper littoral zone," this area is typically defined by shallower waters and a higher penetration of sunlight needed to support emergent zone plants. Emergent plants are rooted in lake bottom sediments with leaves, stems, and reproductive parts above the water surface. Emergent plants break wave energy, reduce shoreline erosion, and help anchor shallow water sediments. The emergent zone provides important transitional habitats for

> A rich plant biodiversity is critical to a healthy lake.

fish, amphibians, reptiles, mammal, and bird species moving to and from areas for feeding, living, and breeding in littoral and riparian zones.

The Utah Lake Restoration Project will restore emergent zone plants to Utah Lake. These plants are vitally important to reduce turbidity and nutrient cycling that can lead to algal blooms. Cattails and bulrush sequester phosphorus, an essential nutrient in algal blooms. Some emergent zone plants strip nutrients from the water and use them for growth. Biotic uptake accounts for short-term removal of phosphorus, while sorption onto soil particles and accretion from wetland soils account for long-term removal. *See https://goo.gl/g2EgAo.* The environmental team will work with the Utah Department of Natural Resources to finalize desired emergent zone plants, densities, and desired combination for restoration areas along the shoreline of Utah Lake and on lake islands.



WATER LILIES
Water lilies provide beautiful and important habitat for native species

LAKE INSECTS
Lake insects thrive in native plant communities

> Riparian zones are an important component of healthy ecological function.

RIPARIAN ZONE

Riparian areas are the narrow body of land adjacent to streams, rivers, lakes, ponds, and wetlands. They are characterized by plant species that are adapted to a wet environment. In arid and semi-arid climates, such as Utah, riparian areas can usually be clearly distinguished as the green areas adjacent to streams, rivers, and lakes.

While riparian areas are relatively small, they are an extremely important component of healthy watersheds and ecological function. Riparian zones provide critical habitat for wildlife, act as buffers between upland areas and open water, and they help filter pollutants such as excess nutrients and sediment. Healthy riparian vegetation reduces shoreline erosion and maintains stable shore geomorphology. Riparian vegetation provide shade throughout the day which lowers water temperatures in areas around the lake. Riparian zones provide extremely important habitat to shore birds and terrestrial species.

Estuary islands are extremely important to riparian zone plant restoration. They provide a physical boundary to break up wind and wave action that could disrupt delicate plants during early phases

of restoration. They also provide a boundary where ice flows can pile up which can be particularly destructive to vegetation. In some years, these ice flows have grown to 30 feet tall.

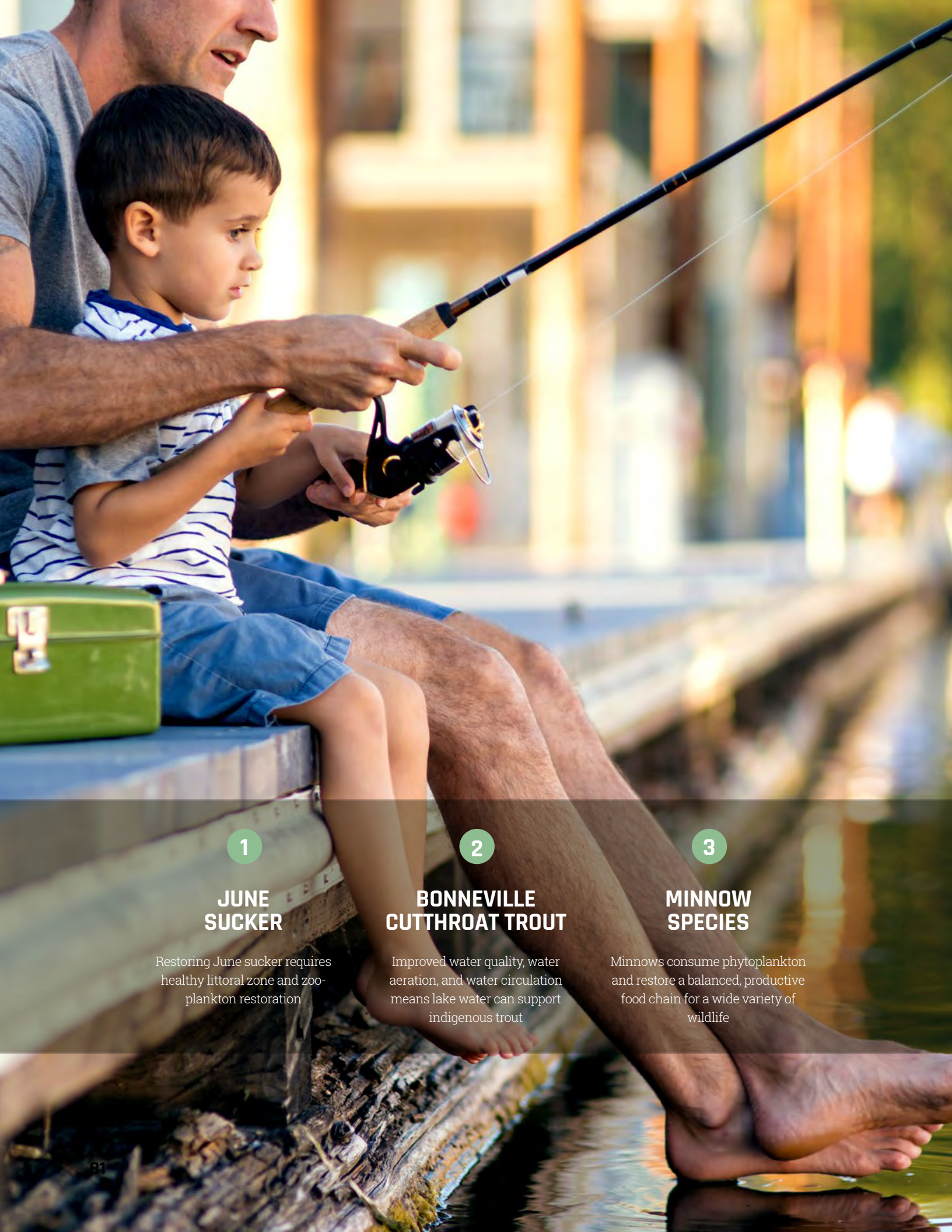
The environmental team will work in collaboration with the Utah Department of Natural Resources to determine desirable plant species to be used in riparian zone restoration and to secure seed, seedlings, and density rates for planting.

UTAH LAKE NATIVE LITTORAL, EMERGENT AND RIPARIAN ZONE PLANT SPECIES

Scientific name	Common name	Riparian[1]	Wet meadow[2]	Emergent[3]	Littoral[4]
Argentina anserina	silverweed cinquefoil		✓		
Berula erecta	cutleaf waterparsnip			✓	
Bidens cernua	nodding beggartick		✓		
Carex nebrascensis	Nebraska sedge		✓		
Distichlis spicata	saltgrass	✓	✓		
Eleocharis palustris	common spikerush		✓	✓	
Elodea canadensis	Canadian waterweed				✓
Epilobium ciliatum ssp. ciliatum	fringed willowherb			✓	
Glaux maritima	sea milkwort		✓		
Hordeum jubatum	foxtail barley	✓	✓		
Iva axillaris	povertyweed		✓		
Juncus balticus	mountain rush		✓		
Lemna minor	common duckweed			✓	
Lycopus asper	rough bugleweed		✓	✓	
Myriophyllum verticillatum	whorl-leaf watermilfoil	✓			
Panicum capillare	witchgrass		✓		
Polygonum amphibium	water knotweed		✓		
Polygonum amphibium var. emersum	longroot smartweed		✓		
Populus fremontii	Fremont cottonwood	✓			
Potamogeton foliosus	leafy pondweed				✓
Potamogeton praelongus	whitestem pondweed				✓
Ranunculus cymbalaria	alkali buttercup		✓		
Ranunculus trichophyllus var. trichophyllus	threadleaf crowfoot				
Ruppia maritima	widgeongrass				✓
Salix amygdaloides	peachleaf willow	✓			
Salix exigua	narrowleaf willow	✓			
Schoenoplectus acutus	hardstem bulrush			✓	
Schoenoplectus americanus	chairmaker's bulrush		✓	✓	
Schoenoplectus tabernaemontani	softstem bulrush		✓		
Spirodela polyrhiza	common duckmeat			✓	
Sporobolus airoides	alkali sacaton		✓		
Stuckenia filiformis ssp. filiformis	fineleaf pondweed				✓
Stuckenia filiformis ssp. filiformis	fineleaf pondweed				✓
Stuckenia pectinata	sago pondweed				✓
Suaeda calceoliformis	Pursh seepweed		✓		
Symphyotrichum ciliatum	rayless alkali aster		✓		
Symphyotrichum frondosum	short-rayed alkali aster				
Typha latifolia	broadleaf cattail			✓	
Utricularia minor	lesser bladderwort				✓
Xanthium strumarium	rough cocklebur	✓	✓		
Zannichellia palustris	horned pondweed				✓

Source: Brotherson, Jack D. 1981. Aquatic and semiaquatic vegetation of Utah Lake and its bays. Great Basin Naturalist Memoirs. 5(5):68-84.
Available at: http://scholarsarchive.byu.edu/gbnm/vol5/iss1/5

[1]Riparian= all Lowland Woody native species listed in Brotherson (1981)
[2]Marsh= all Bulrush-Cattail Marsh native species listed in Brotherson (1981)
[3]Wet meadow= all Semi-aquatic Herbaceous Meadow and Grass-Rush-Sedge Meadow native species listed in Brotherson (1981)
[4]Submerged= Species listed in Brotherson (1981) with a submerged growth habit



1

JUNE SUCKER

Restoring June sucker requires healthy littoral zone and zoo-plankton restoration

2

BONNEVILLE CUTTHROAT TROUT

Improved water quality, water aeration, and water circulation means lake water can support indigenous trout

3

MINNOW SPECIES

Minnows consume phytoplankton and restore a balanced, productive food chain for a wide variety of wildlife

NATIVE FISHERY RESTORATION

The recovery of June sucker, Bonneville cutthroat trout, and other fish to Utah Lake is possible through conservation investments to restore healthy, vibrant waters and habitat to the Lake.

Restoration of native fish and other aquatic species is a core objective of the Utah Lake Restoration Project. Included as part of this objective will be the following:

1. Fully recovering the threatened June sucker,
2. Restoring abundant populations of Bonneville cutthroat trout for which the lake was once famous, and
3. Restoring minnow species no longer found in the lake but still existing in tributaries. These minnow species are not only valuable as an endemic species, but also in restoring water quality and playing an important role in the lake's food chain for fish and other dependent wildlife.

DETAILED ANALYSIS

Utah Lake has tremendous potential as a native fishery for the state of Utah. When settlers first arrived in the valley, the Bonneville cutthroat trout numbered in the hundreds of thousands. The size and quality of these fish were remarkable, with some fish measuring between 36 inches to 48 inches long. These early pioneers relied heavily on these trout for subsistence.

Restoring native fisheries will require significant investment. To be successful, it will require restoring water quality, native fish habitats, and the natural food chain within the lake. As aquatic plant species become re-established and as the June sucker, minnow species, and Bonneville cutthroat trout increase in numbers, they will help improve the lake's water quality. Our long-term objective is for aquatic plant and fish native to Utah Lake to become self-sustaining.

Recovery of native fish in Utah Lake will require the following conservation investment:

1. Removal of all carp from the lake
2. Removal of all predatory species from the lake
3. Establishing a world-class fish hatchery specifically designed for native fish recovery
4. Establishing a nursery population within Provo Bay of approximately 50,000 June sucker
5. Re-establishing aquatic plants including tens of thousands of acres of native shore plants and littoral zone plants
6. Re-establishing healthy populations of zooplankton, native insects, invertebrates, bi-valves, and other components within the lake's food chain
7. Restoring minnow species, June sucker, and Bonneville cutthroat trout

REMOVAL OF CARP AND PREDATORY FISH SPECIES

Removal of carp and predatory fish is an important step both for restoring littoral zone plants and for restoring native fish species to the lake. Carp are largely responsible for decimating littoral zones on the lake that are needed to secure the lake bottom sediments, process nutrients in lake sediments, and control algae levels on the lake. Healthy littoral zones are also required for thriving populations of zooplankton on which June sucker rely as a food source.

Restoring littoral zone plants will not be practical until carp are eradicated entirely from Utah Lake. Carp are extremely difficult to control. They are flexible, opportunistic feeders that can switch to alternative diets according to food availability. They can survive in higher water temperatures and at lower oxygenation levels. They are also highly prolific breeders, laying hundreds of thousands of eggs, and maturing in just a few years. 92% of all fish in Utah Lake are the common carp.

Predatory fish, including Northern pike, white bass, and walleye have also wreaked havoc on the native fish species in the lake. In fact, of the original 13 native fish species in the lake, only the June sucker and Utah sucker are still found in the lake. Once numbering over one million fish, June sucker only accounts for 0.03% of fish in Utah Lake.

In recent years, June sucker have successfully spawned in the Provo River and Utah Lake tributaries. Unfortunately, almost 100% of the fry from spawning have been consumed by predatory fish before they could return to the lake and establish new generations of June sucker in the lake. This is yet another reason why the removal of predatory fish is so important for native fish recovery.

COMMON CARP

92% of all fish in Utah Lake are the common carp.

NECESSARY REMOVAL

Restoring littoral zone plants will not be practical until carp are eradicated from Utah Lake.

PROVO BAY
Provo Bay will be restored as a proof of concept of the larger Utah Lake recovery program.

FISH HATCHERY

The Utah Lake Restoration Project has prioritized the construction of a 140,000 square feet world-class fish hatchery on the shores of Provo Bay. The hatchery will be the biggest in the continental United States and will be used to re-establish not only June sucker, but also Bonneville cutthroat trout and seven species of minnow. Minnow species which will be recovered include least chub, Bonneville redside shiner, mottled sculpin, northern and southern Leatherside chub, longnose dace, and speckled dace. Placement of Junes-Sucker in the fish hatchery will be conducted in coordination with the restoration of Provo Bay.

PROVO BAY RESTORATION

Provo Bay will be restored as a proof of concept of the larger Utah Lake recovery program. The initial step will be to isolate Provo Bay from the rest of Utah Lake. Once all control measures are in place to isolate Provo Bay, the Utah Lake Restoration Project will net all possible June sucker from the Provo Bay and its tributaries. This netting process will also help to remove carp and predatory fish. Upon placement of netted June sucker in fish hatcheries, the bay will be treated with Rotenone (cir..5000 acres of Provo Bay). Timing of the netting and Rotenone treatment of Provo Bay will be vital to minimize the presence of June sucker in the treatment area.

Once Provo Bay has been netted and treated, the bay will be further isolated from the rest of Utah Lake. Restoration of Provo Bay will follow the model for the rest of the Utah Lake Restoration Project including dredging, island formation, carp and predatory fish species removal, and native plant

restoration. With the restoration of littoral zones in Provo Bay, healthy populations of zooplankton can be re-established. Zooplankton restoration will be an important step in preparing Provo Bay for June sucker recovery primarily because zooplankton are the principle food source for June sucker. Upon the restoration of Provo Bay, recovery of the June sucker population will begin.

ROTENONE TREATMENT OF UTAH LAKE

Success of June sucker re-wilding will be based on spawning numbers and healthy population counts entering back into Provo Bay. Upon establishment of a healthy June sucker population in Provo Bay and in fish hatcheries, Rotenone treatment of Utah Lake can be undertaken.

Rotenone treatment of Utah Lake will be a sizeable undertaking. Utah Lake covers roughly 5.7 times the surface area of Strawberry Reservoir (17,000 Acres), therefore treating the lake will be no easy task. Due to its vast surface area (96,600 acres), the quantities of rotenone needed to treat the lake will be significant. In order to obtain the required quantities of Rotenone (which is in limited supply worldwide) and to maximize desired use of available chemicals, treatment will happen in stages. Stocks of Rotenone will be bought yearly and stored. All rotenone treatments will be undertaken within the strict direction of the Utah Division of Wildlife Resources. The Utah Lake Restoration Project will pay for all costs to treat Utah Lake with Rotenone and will supply all manpower, protective equipment, and training necessary. Implementation of Rotenone treatments will be described in greater detail on pages 157-162.

RESTORATION OF NATIVE FISHERIES

A key goal for the Utah Lake Restoration Project is to assure the June sucker's progress and eventual removal from the Endangered Species List. The June sucker only consumes zooplankton and can grow anywhere from 18 - 24 inches in length and weigh up to 8 pounds, which suggests the need for a large quantity of zooplankton to restore a healthy June sucker population. This will be made possible through the restoration of a healthy littoral zone and the associated increase of zooplankton populations.

RECOVERING THE JUNE SUCKER

1. LAKE RESTORATION
Each component for a natural lake ecosystem and thriving zooplankton population will be addressed.

2. LITTORAL ZONE
Restoration of a heathy littoral zone creates habitat for zooplankton.

3. ZOOPLANKTON
As the only food source for the June sucker, large quantities of zooplankton are needed.

PRIMARY FOOD SOURCE
Zooplankton serve as the primary food source for the threatened June sucker.

RESTORATION OF LAKE ECOSYSTEM

The loss of the natural lake ecosystem has been a primary source of native fish loss in the lake. With removal of common carp from Utah lake and its tributaries, restoration of littoral zones can be successful. Littoral zones are the most productive zone in any lake. Zooplankton reproduce and hide from predators in littoral submerged zone plants. Once Utah Lake's littoral zones are restored, zooplankton will be augmented by natural reproduction and introduction of native zooplankton species from the fish hatchery on Provo Bay. Recovery of zooplankton is a foundational and necessary component for recovery of native fish populations in Utah Lake.

ZOOPLANKTON

Zooplankton are microscopic floating animals that serve as the primary food source for the threatened June sucker fish. Recovery of zooplankton is a foundational and necessary component for native fish populations recovery. In a healthy well-balanced ecosystem, this microscopic animal can keep levels of algae under control while also sustaining healthy and abundant fish populations.

Restoring water clarity and reducing nutrient levels is important for zooplankton population health. Utah Lake's poor water quality is far less than ideal for the zooplankton organisms to thrive. One of the limiting factors to Utah Lake's zooplankton population is the unnatural levels of phosphorus and nitrates in the water that have led to such high levels of algae. Although zooplankton feed on algae, high levels of algae counterintuitively lead to reduced zooplankton populations. The ratio of zooplankton to phytoplankton biomass decreases as phytoplankton biomass increases among lakes. *See Empirical Relationships Between Phytoplankton and zooplankton Biomass in Lakes; Edward McCauley and Jaap Kalff; Published on the web 10 April 2011.*

LAKE RESTORATION AND ZOOPLANKTON RESTORATION

The Utah Lake Restoration Project will address each issue necessary for a natural lake ecosystem and thriving zooplankton population, including:

- Restoring the water quality (see Water Quality Restoration, pages 53-66 and 151-156)
- Dredging to remove phosphorus and nitrates from the lakebed (see Dredging, pages 35-40)
- Control wind and wave activity through strategic island creation (see Wind and Wave Action, pages 47-52)
- Restoring and expanding littoral zones to secure the lakebed (see Native Plant Restoration, pages 73-80 and 157-162)

These combined actions will allow the lake to naturally regulate water quality and preserve clean fresh water, allowing zooplankton to thrive once again in Utah lake.

It is also important to note that the Utah Lake Restoration Project will actually improve littoral zone breeding areas for zooplankton by removing and replacing the Phragmites with native plant communities, while also expanding the shoreline from 76 miles to 284 miles.

A large percentage of these areas will be covered with natural littoral zone plants. The improved water quality and expanded breeding areas will allow zooplankton to return to natural healthy population numbers which can then help naturally regulate algae levels in the lake.

BREEDING ZONES
The Project will bring back littoral zone breeding areas for zooplankton.

WORLD CLASS HATCHERY

The world-class fish hatchery will breed and restore the entire native fishery, including June sucker and Bonneville cut-throat trout.

RESTORING FISH SPECIES AND OTHER COMPONENTS OF NATURAL FOOD CHAIN

The objective of the Utah Lake Restoration Project is to restore the natural habitats, food sources, and water quality needed to support restoration of native fish species in the lake. This, combined with other water quality improvements will allow the lake to naturally regulate nutrient levels and algae. The success of native plant restoration and native aquatic species are important final steps in a self-regulating lake ecosystem.

The world-class fish hatchery will be utilized to breed and restore littoral zone plants, zooplankton, invertebrate species, minnow species, June sucker, and Bonneville cutthroat trout for many years. The Utah Lake Restoration Project will also add other important components to the lake that will improve native fish habitats:

- The removal of carp and invasive predatory fish to significantly improve native plant communities and minnow species

> Full restoration will allow the Lake to naturally regulate algae.

- Aeration systems to improve oxygenation levels within the lake for Bonneville cutthroat trout and other fish species dependent on high levels of oxygen
- Deep water channels, mechanical pumping, and improved lake circulation to cool lake waters and improve desired stratification within the water column
- Filtration systems to add important inflows which will provide food sources and ideal habitat for fish populations
- Islands and littoral zones to increase shoreline, underwater structures, and feeding areas to support healthy fish populations

The ultimate objective of these efforts is to produce conditions in Utah Lake to restore the natural systems, food chain, and reproductive ability for self-sustaining fish and aquatic species of Utah Lake.

NATURAL SYSTEMS
The ultimate objective is to produce conditions in Utah Lake to restore natural systems

RESTORED ECOSYSTEM
A restored ecosystem will support an entire food chain of aquatic, avian, and terrestrial species.

1

WATERFOWL

Conservation measures ensure suitability of shallow ponds on which birds rely to feed, rest, and breed.

2

TERRESTRIAL SPECIES

Restoration of a healthy food chain will sustain sensitive terrestrial species, including reptiles, mammals, and birds.

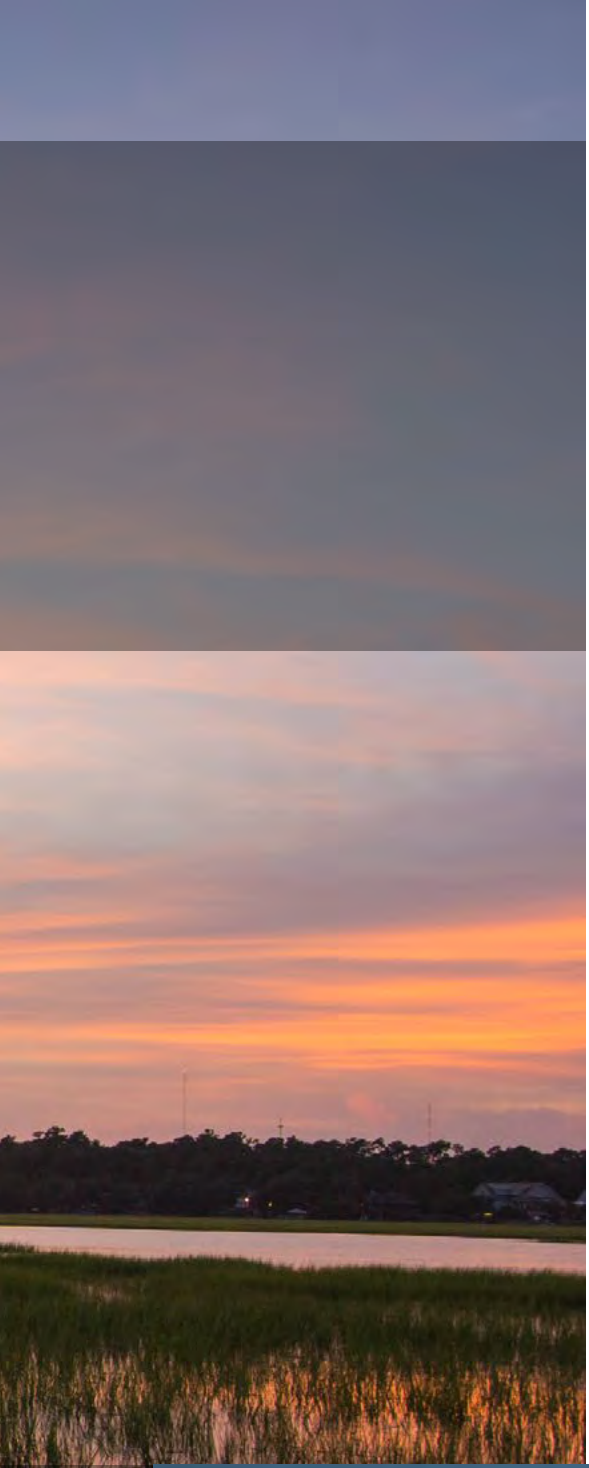
3

AQUATIC SPECIES

Comprehensive restoration helps sensitive aquatic species and may even restore species no longer found in Utah Lake.

A HOME FOR WILDLIFE

Utah Lake once held millions of Bonneville cutthroat trout and other fish, huge flocks of pelicans, bald eagles, osprey, and other wildlife.



WILDLIFE HABITAT

Restoring the native wildlife and habitats is a core objective of the Utah Lake Restoration Project.

Restoring Utah Lake means restoring the abundant populations of fascinating varieties of wildlife species including waterfowl, upland bird, mammalian, reptile, aquatic, and amphibian species. These species rely on the lake, its shoreline, and tributaries for habitat and as a food source. Many of the animal species that utilize the lake have been adversely affected by the diminished water quality on the lake, loss of native plant and animal species, algal blooms, and fluctuating lake levels.

Our goal is not only to make the lake and its surrounding areas better for wildlife, but to also return the eagles, osprey, flocks of waterfowl, pelicans, mammals, abundant fisheries, and aquatic species that once dominated the lake.

The Utah Lake Comprehensive Conservation Plan is a landscape-level conservation effort designed to benefit the wildlife on the lake. As we restore the clarity of the water, repopulate native plant species, and restore millions of native fish to the Lake, dependent species will return and flourish. Multi-dimensional conservation implementation is crucial, including removal

of nutrient-loaded sediments, nutrient control of treated waste water, decreasing evaporation, controlling algal blooms, lake level management, and restoration of littoral zone to anchor the lake bottom. Improving the niche habitats and suitability of the lake for endemic wildlife comes from on-the-ground implementation of these engineered restoration measures.

Not only will these conservation actions benefit indigenous wildlife, they will become the ecological driver for conservation and restoration of many important sensitive and endangered species. This benefits Utah's wildlife species and contributes to the enjoyment of the public who interacts with these wildlife species.

UTAH LAKE BIRD POPULATIONS

Surveys conducted by the state of Utah show the abundance of bird species which utilize Utah Lake.

WATERFOWL

Mallards	12,200+
Northern Pintail	3,800+
Green-winged Teal	14,600+
Northern Shoveler	1,300+
Cinnamon Teal	3,800+
Canada Geese	400+

WADING BIRDS

American White Pelicans	600+
White-faced Ibis	6,200+
Snowy Egrets	120+

SHOREBIRDS

American Avocet	4,000+
Black-necked Stilts	1,000+
Wilson's Phalaropes	600

DETAILED ANALYSIS

The following provides an overview of some of the species on Utah Lake that will benefit from billions of dollars invested in conservation of the Lake.

WATERFOWL RESTORATION

The Lake lies within the Great Basin Flyway and is one of the most important habitats in the state of Utah for migratory species. Tens of thousands of migratory birds utilize the Utah lake annually. The Audubon society explains how important Utah Lake is for avian species:

"Utah Lake is one of the most important wetlands systems in Utah for waterfowl and shore bird populations in terms of actual bird use. Approximately 90-95% of lake use occurs in both the Provo and Goshen Bays depending on lake levels.

Shorebirds and migratory birds seek flat, shallow ponds on which to feed, rest, and breed. Therefore, when lake levels are high the birds tend towards Goshen Bay.

However, when lake levels are low, as they currently are and have been in recent years Provo Bay provides the most valuable habitat for shorebirds and migratory birds." *See http://www.audubon.org/important-bird-areas/provo-bay-utah-lake-ut06.*

Waterfowl, wading birds, and shorebirds rely heavily on aquatic insects, invertebrate, fish, amphibian, and native plant species. As water quality degrades and invasive plant and animal species dominance has emerged on the lake, habitat, and food become less desirable and less available for endemic species.

The Utah Lake Restoration Project is designed to restore the health and abundance of foundational ecological components of the lake. These ecosystem level conservation measures ensure suitability of flat shallow ponds on which shore birds and migratory birds rely to feed, rest, and breed. Some of the other actions which are important to avian species include controlling lake levels, lessening evaporation, managing water levels in Provo Bay, and protecting the habitats of Goshen Bay.

IMPORTANT WETLAND SYSTEM

Utah Lake is one of the most important wetland systems in Utah for waterfowl and shore bird populations.

SENSITIVE TERRESTRIAL SPECIES

Abundant waterfowl are just one component of the complexity of life on Utah lake. There are also a number of sensitive species that are found, or are likely to be found, within the restoration area.

A few of these sensitive species include:

Reptiles: Milk Snake, Smooth Green Snake

Plants: Ute ladies Tresses

Birds: Northern Goshawk, Osprey, American White Pelican, Swainson's Hawk, Ferruginous Hawk, Long-billed Curlew, Caspian Tern, Black tern, Yellow-billed Cuckoo, Short-eared Owl, Burrowing Owl, Black Swift, Common Yellowthroat, Blue Grosbeak, Bobolink

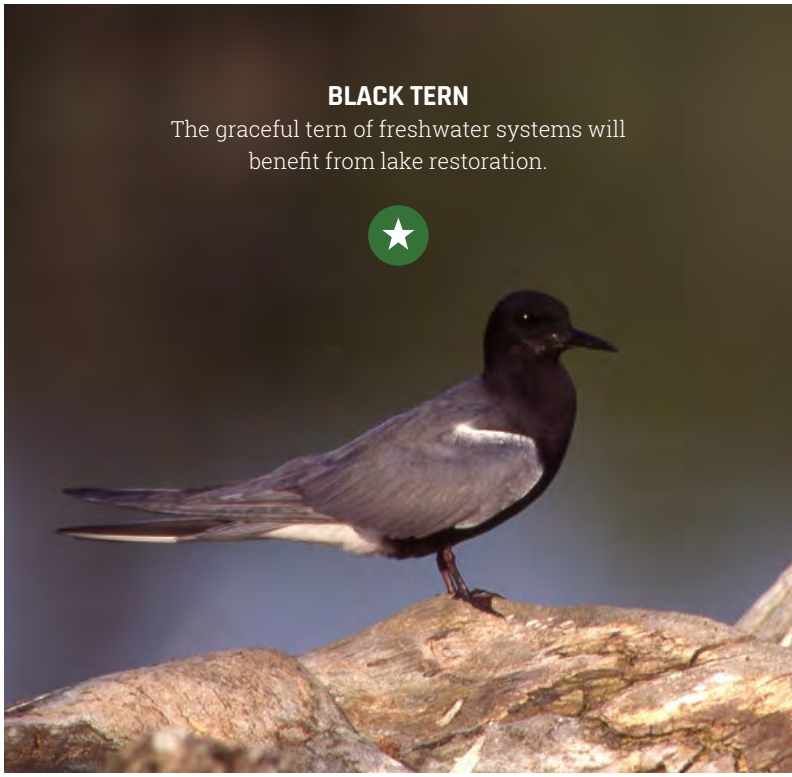
Mammals: Spotted Bat, Townsend's Big-eared Bat, Brazilian Free-tailed Bat, Northern River Otter

Many of the sensitive terrestrial wildlife species on the lake are heavily reliant on the health of fish, amphibians, and other aquatic wildlife species as a primary food source. Removing invasive and predatory fish species and restoring littoral zone plants restores a healthy food chain needed to restore terrestrial wildlife species. These actions also improve the water clarity and water quality of the fish species on which terrestrial wildlife depends.

VIRTUOUS CYCLE

1. WE HELP THEM
Improving water quality sustains a proliferation of native plant and animal species.

2. THEY HELP US
Many of these native species in turn help to continue improving and sustaining water quality through natural processes.



BLACK TERN
The graceful tern of freshwater systems will benefit from lake restoration.

Another key component of the restoration program is addressing serious concerns regarding the suitability of wildlife habitat. One invasive plant species, Phragmites, dominate many of the wetlands surrounding the lake. It has degraded huge swaths of the shoreline to the point that they are nearly unusuable by most native wildlife. Removal of phragmites is vital to bringing back desirable native plant species, but also to restore the suitability of these habitats for terrestrial wildlife. This is one more way the Comprehensive Restoration Plan begins the process of restoring wildlife species on the lake.

> The restoration project will benefit a number of sensitive species.

SENSITIVE AQUATIC SPECIES

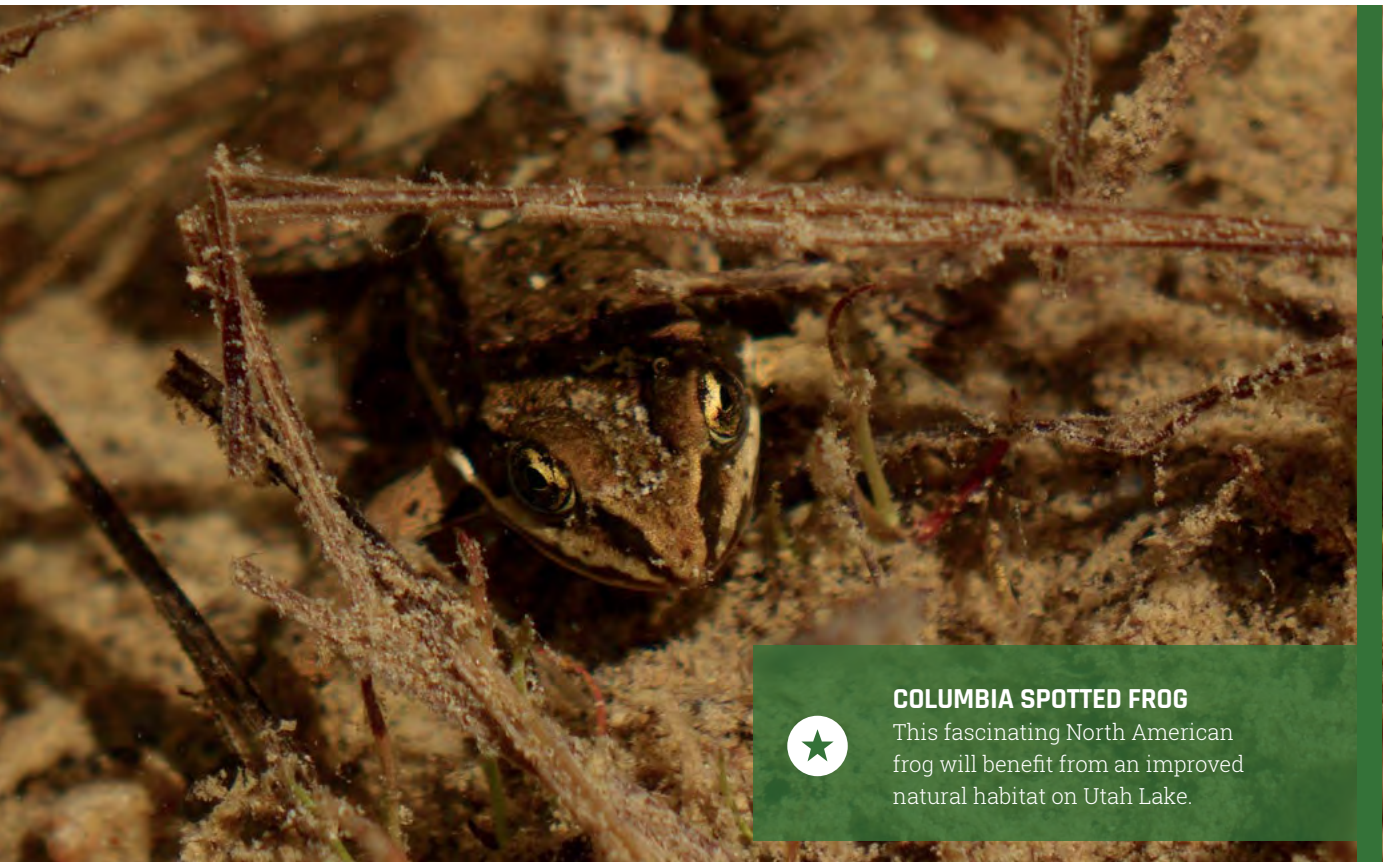
Utah Lake is home to a diverse aquatic species including fish, amphibians, and invertebrates. Native fish species historically found in the lake include: Bonneville cutthroat trout, June sucker, Utah sucker, Utah Chub, Mountain Whitefish, Mountain Sucker, Bonneville Redside Shiner, Speckled Dace, Longnose Dace, Leatherside Chub, Least Chub, Utah Lake Sculpin, and Mottled Sculpin.

Of these indigenous species, only June sucker and Utah sucker are still found in Utah Lake. While the threatened June sucker has received much of the attention of fish species on Utah lake, several of the other species still occur in Utah Lake tributaries. Timely restoration of habitat within the lake and removal of the 16 invasive and predatory fish species provides an opportunity to restore native fish to the lake at a critical time. A more detailed restoration plan for native fish is described on pages 81-90.

Two sensitive species of native amphibians historically were found in the wetlands surrounding Utah Lake. The Columbia Spotted Frog is now only found in one isolated spring/wetland complex near Springville, Utah and is no longer found in Utah Lake. The other is the Western Toad, a species that no longer is found in Utah Valley.

Similarly, four native mollusk species were found in Utah Lake and its surrounding habitats. The California Floater, the Glossy Valvata, the Desert Valvata, and the Utah Physa. The Desert Valvata no longer occurs in Utah and the other three have not been observed in Utah Valley for many years.

Restoration of Utah Lake provides an opportunity to help sensitive aquatic species and even restore species to the lake that are no longer found there. While each aquatic species has separate requirements, the Utah Lake Restoration Project implements the foundational elements needed for restoration of most or all of these species.



COLUMBIA SPOTTED FROG
This fascinating North American frog will benefit from an improved natural habitat on Utah Lake.

NATURAL COMPETITION

Aquatic plants compete with algae for nutrients and sunlight, providing a natural buffer for algal blooms.

WATER CLARITY AND QUALITY

Restoration of aquatic plants is prerequisite for water clarity and quality.

A key to the restoration efforts center around converting Utah Lake from a turbid eutrophic state with frequent algal blooms, to a clear water state with restored aquatic plant and zooplankton communities. Restoration of aquatic plants is a powerful prerequisite for restoring water clarity and water quality.

A recent EIS explained the multifaceted benefits of restoring aquatic plant communities:

> Rooted aquatic plants are important for a number of ecological reasons. In terms of water quality, rooted aquatic plants anchor bottom sediments thereby preventing sediment resuspension and reducing turbidity and nutrient availability in the water column. Aquatic plants provide habitat complexity and a predation refuge for zooplankton, which consume algae, thereby promoting water clarity. Rooted aquatic plants also compete directly with algae for nutrients and sunlight, and their presence provides a buffer against algal blooms. See *https://www.fws.gov/mountain-prairie/federalassistance/nepa/utah-lake-carp/Carp-Removal-NEPA-FEA-1-26-10-mdm.pdf page 33.*

UTE LADIES' TRESSES

Ute Ladies' Tresses are a perennial orchid found along riparian edges, gravel bars, old oxbows and moist to wet meadows along perennial freshwater streams and springs at elevations ranging from approximately 4,300 to 7,000 feet (USFWS 1992; Stone 1993). It is an early to mid successional species that is well adapted to low floodplain terraces along alluvial streams where scouring and sediment deposition are natural processes.

The plants bloom from late July through August (sometimes September), setting seed in the early fall. Ute ladies' tresses are known to occur in areas around Utah Lake and its tributaries, with populations documented in areas near Springville and American Fork cities. Ute ladies'-tresses were listed as threatened on January 17, 1992 (57 FR 2053). (See https://goo.gl/JQ5n8t, page 29.)

RARE BEAUTIES
The threatened Ute Ladies' Tresses will thrive in the restored Utah Lake ecosystem

"The best remedy for those who are afraid, lonely, or unhappy is to go outside...

-Anne Frank

PUBLIC TRUST BENEFITS

The Utah Lake Comprehensive Restoration Project is designed to protect and promote public trust. Public trust values enhanced by the Utah Lake Restoration Project include, but are not limited to:

Restoring water clarity and water quality	Conserving water resources	Preserving water storage and water supply functions	Removing invasive plants and fish species like phragmites and carp	Restoring littoral zone and other plant communities
Restoring native fish and aquatic species like Bonneville Cutthroat and June sucker	Increasing suitability for shore birds, waterfowl, and other avian species	Improving navigability	Maximizing and ensuring recreational access	Enhancing recreational opportunities and improving use for residents and visitors

IMPLEMENTATION

The Utah Lake Restoration Project has developed a detailed approach to implementing its solutions.

A DETAILED EXPLANATION OF PROPOSED SOLUTIONS IMPLEMENTATION

PLANNING, PERMITTING, AND COMMUNITY DESIGN
Significant technical environmental and conservation planning, permitting, infrastructure solutions, and development.
PG 111

RESTORATION OF PROVO BAY
Smaller scale version of the much larger project.
PG 131

DREDGING AND ISLAND CREATION
Provide the foundation for restoring the entire lake ecosystem.
PG 141

WATER QUALITY UPGRADES
Efforts to improve water quality and address dangerous algal blooms. .
PG 151

RESTORED NATIVE PLANT AND FISH COMMUNITIES
Removal of invasive plant and fish species and restoration of native plant and fish communities
PG 157

SHORELINE
Network of public access, trail systems, and public beaches improve public access to and use of the restored lake.
PG 163

TRANSPORTATION
Comprehensive proposal for alleviating existing and anticipated traffic congestion in Utah County.
PG 169

INFRASTRUCTURE
Large infrastructure investments to support island residents.
PG 175

RECREATION ISLAND DEVELOPMENT
Provide areas to boat, relax, picnic, recreate, camp, or simply reconnect with nature.
PG 183

DEVELOPMENT ISLANDS
The economic foundation providing the billions of dollars needed to restore Utah Lake.
PG 191

IMPLEMENTATION

PROJECT IMPLEMENTATION OVERVIEW

Restoration of Utah Lake will require approximately $6.4 billion in private investment from Lake Restoration Solutions, Inc.

1 Planning, Permitting, Research, and Studies

2 Conservation Solution Implementation

3 Island Development

Restoration of Utah Lake will require approximately $6.4 billion in private investment from Lake Recovery Solutions, Inc. The Utah Lake Restoration Project will not only be costly, it will take years of significant technical environmental and conservation planning, permitting, infrastructure solutions, and development.

The Utah Lake Restoration Project team members have decades of experience with projects of this size, complexity, and magnitude.

There are three key phases to the Utah Lake Restoration Project:

Phase I- Planning, Permitting, Research, and Studies

Phase II-Conservation Solution Implementation

Phase III-Island Development

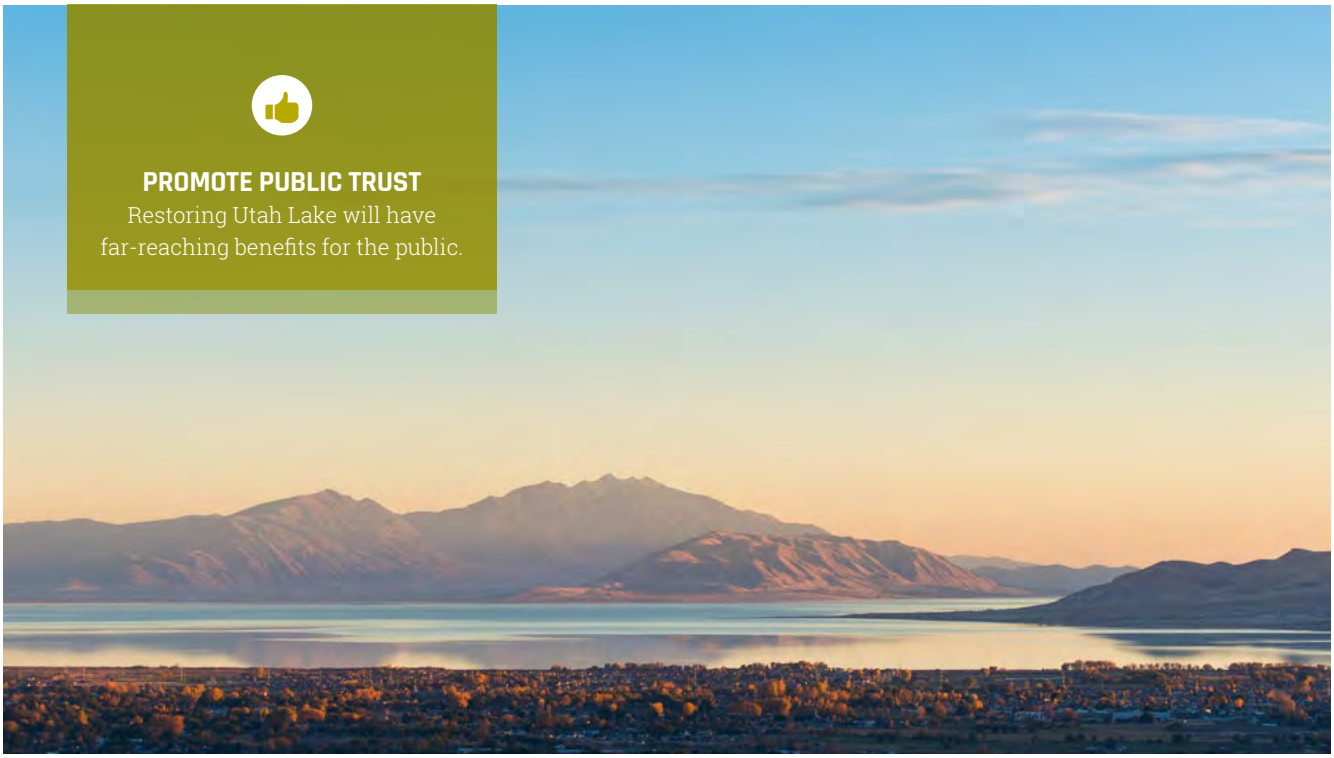
CURRENT COST ESTIMATES FOR UTAH LAKE RESTORATION PROJECT

$2.2 billion	Dredging 900,000,000 cubic yards of sediment
$357 million	Rock/stone for islands and lake restoration
$162 million	Water treatment upgrades
$550 million	Studies, science modeling, research, and engineering
$1.2 billion	Provo Bay, tributaries upgrades, and trails
$400 million	Wetlands, littoral zone restoration, and water circulation
$565 million	Fish hatchery and fish restoration
$500 million	Recreation development projects

PLANNING, PERMITTING, RESEARCH, AND STUDIES

Before on-the-ground implementation of the conservation solutions to restore Utah Lake, significant planning and permitting will be required at the federal, state, and local levels. These planning and permitting processes will describe impacts (beneficial, adverse, or both), as well as ways to mitigate (avoid, reduce, or minimize) predicted or potential negative effects. In this early phase of the project, an environmental impact statement (EIS) will be prepared. Sufficient information must be included in the EIS for decision-makers to evaluate the relative merits of the proposed action and a reasonable range of alternatives and identify an alternative that is preferred over others.

The EIS will serve not only to comply with the National Environmental Policy Act (NEPA), but also will serve as a foun-



PROMOTE PUBLIC TRUST
Restoring Utah Lake will have far-reaching benefits for the public.

dation for sound, defensible project planning. We anticipate that federal planning and permitting will require from approximately 18 months to several years to complete. More information of the federal planning and permitting for the Utah Lake Restoration Project is provided on pages 111-118.

We will work with state agencies, including the Department of Natural Resources, the Utah Lake Commission, Utah Division of Forestry, Fire, and State Lands, Utah Department of Environmental Quality, Utah Division of Water Quality, Utah Division of Wildlife Resources, Utah Department of Transportation, and many other state agencies to ensure the Utah Lake Restoration Project accomplishes the restoration objectives for the Lake, water quality, native vegetative species, wildlife species, and to promote public trust values in the state of Utah.
The Utah Lake Restoration Project Team will also work closely with Utah County, cities surrounding the Lake, stakeholders, and interested citizens. This is a massive infrastructure project with long-reaching impacts. Our commitment is to work to maximize collaboration, communication, and input to achieve the conservation and development objectives that will work for the state of Utah, its natural environments, and its citizens.

DWR FEEDBACK
DWR will provide critical feedback to ensure restoration goals are achieved.

INVESTMENT IN SCIENCE AND RESEARCH

This will likely be the largest environmental restoration project of this kind in the country. New scientific research, insights, designs, and models will be developed as a result of the project.

The Utah Lake Restoration Project anticipates funding approximately $500,000,000 in new research, modeling, monitoring, and engineering to ensure all objectives of the project are fully implemented using the best available data, research, and science.

During this period, and throughout the project, these dollars will be invested in scientific research, field studies, core samples, computer modeling, engineering, and design. These efforts will create a more in-depth understanding of the best mechanisms to restore Utah Lake and its natural ecosystems. They will continue to inform designs for detailed dredging, lake bathymetry, wind and wave control, lake circulation, filtration system design, and aeration system placement.

Continual monitoring and research related to water quality, invasive species removal success, native plant, and wildlife restoration will provide new insights and continue to inform the best available science on conservation response to recovery project implementation.

CONSERVATION SOLUTION IMPLEMENTATION

Once necessary planning and design has been completed and all permits have been obtained, implementation of on-the-ground conservation actions can be commenced in full. Precise coordination, timing, and implementing of the various phases will be required throughout the project. We anticipate that implementation of conservation projects will require several billions of dollars of infrastructure investment and will take approximately 8-10 years.

Phase II will begin with restoration of Provo Bay. Provo Bay is seriously impaired by Phragmites and other invasive species dominance. A restored Provo Bay will provide restored habitat for birds, fish, and other wildlife. It will also serve as a recovery nursery for thousands of June sucker and other fish species. A world-class fish hatchery will be constructed on the shore of Provo Bay to support June sucker, Bonneville cutthroat trout, least chub, other native minnow species, zooplankton, littoral zone, and riparian plants. Provo Bay will also demonstrate how invasive plant removal, island creation, controlling wind and wave action, restoring littoral, emergent, and riparian zone

plants, and other water quality improvements can restore a natural ecosystem.

Completion of Provo Bay, and establishment of a healthy June sucker population in Provo Bay will allow completion of full restoration of Utah Lake. In particular, final removal of invasive common carp from Utah Lake and restoration of littoral zones around the Lake can be fully implemented. Full completion of Phase II includes implementation of the following conservation solutions on Utah Lake:

- Dredging
- Island creation
- Controlling wind and wave action
- Water quality improvement
- Upgrades to waste water treatment facilities
- Stormwater capture, retention, and treatment
- Placement of biofilters
- Placement of mechanical pumping and circulation systems
- Aeration systems
- Invasive plant eradication
- Restoration of native plant communities
- Removal of invasive fish
- Restoration of native fishery
- Restoration of native wildlife

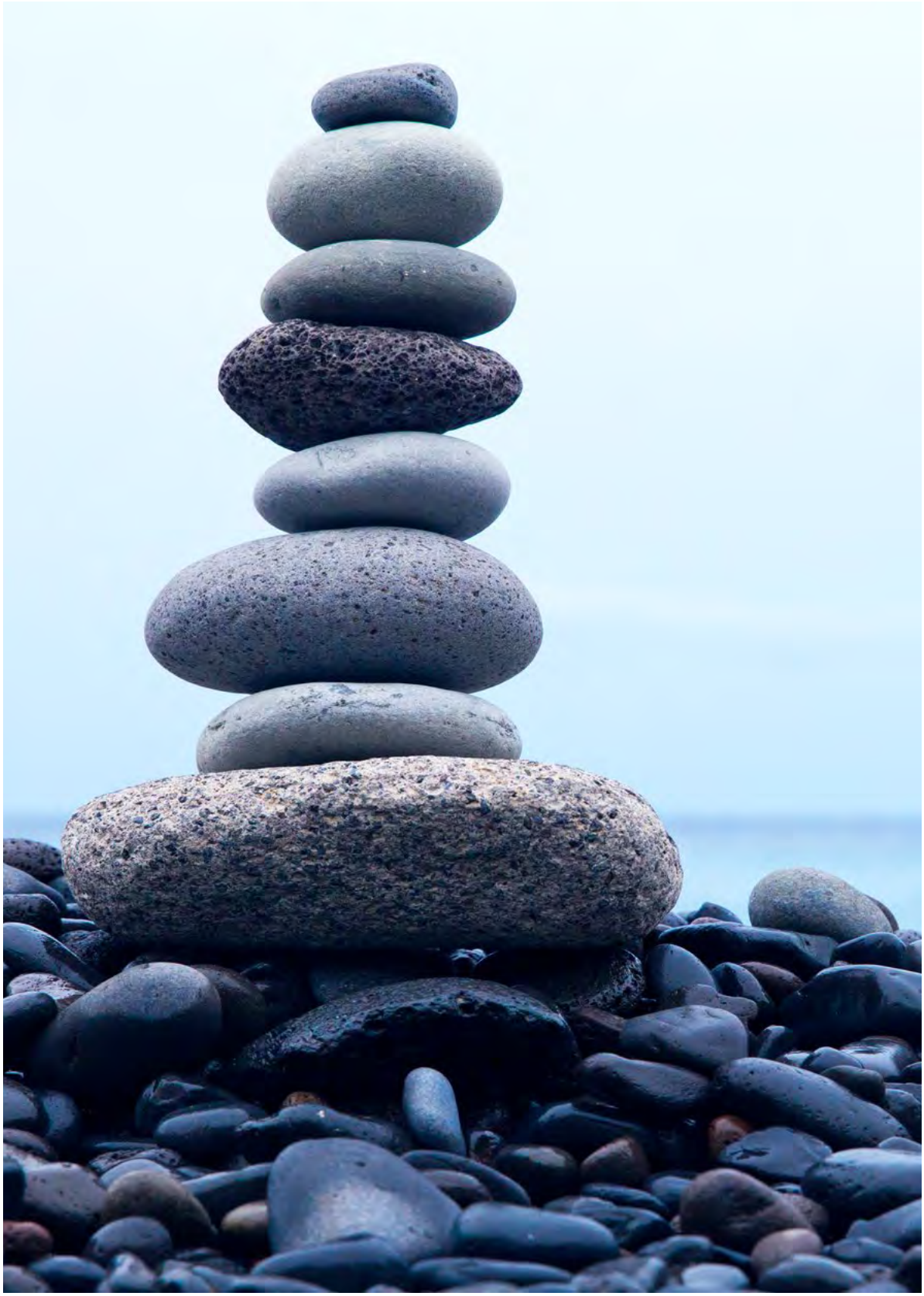
A detailed explanation of conservation strategies is discussed on pages 31-100.

ISLAND DEVELOPMENT

As previously discussed, islands fill a vital role in restoration of Utah Lake by controlling wind, reducing wave action, improving water clarity, expanding fish and wildlife habitat, and creating recreational opportunities on the Lake.

Islands also provide a mechanism to fund the multi-billion dollar dredging and restoration of Utah Lake. After the preliminary phases of dredging and island creation, further development of islands will occur for a number of years.

The Utah Lake Restoration Project will create three primary island types on Utah Lake: estuary islands, recreation islands, and development islands. Each island type will have different development needs to accomplish their function. Estuary islands' fundamental role is to provide protection for shorelines and restored wetlands, wildlife, and fish habitat. In this role, estuary island creation is relatively simple. Recreation islands control wind and wave action and provide recreational opportunities on the Lake. Development islands will provide areas for recreation, parks, trails, housing, transportation, commercial, and business. Due to the complex engineering requirements that must be met to develop these islands, development will take longer than the other phases. In fact, completion of final development of the main island may continue for as many as 20 years with economic indicators also playing a role in the development timeline. A detailed outline of implementation island development is included hereinafter on pages 183-206.



IMPLEMENTATION

PLANNING, PERMITTING, AND COMMUNITY DESIGN

Restoration of Utah Lake will require approximately $6.4 billion in private investment from Lake Restoration Solutions, Inc.

CONSERVATION PLANNING

The Utah Lake Restoration Project recognizes the value of the environment within the region and embraces the responsibility to protect and improve the Lake's ecosystem. Conservation planning will be undertaken with a vision focused on environmental excellence and to improve quality of life for those who live, work, and recreate in and around the development and lake.

To this end, from the outset, we will implement state of the art technologies to protect and enhance the environment for the benefit of residents, the state of Utah, and visitors to Utah Lake. The Utah Lake Restoration Project will most likely be the largest environmental restoration of its kind in the country.

As part of this planning process, there will be significant focus on June sucker recovery; littoral, emergent, and riparian zone design and restoration; and native plant and animal restoration.

ENVIRONMENTAL SUSTAINABILITY STRATEGY

Underlying all these efforts will be an environmental sustainability strategy. The approach to this strategy will focus on both the local and regional impacts. Consideration will be given not only to minimizing the impact on the environment, or 'touching the earth lightly', but also improving the environment, enhancing open space, and increasing biodiversity, all of which will contribute to making the community an attractive place, both to live, work, and spend time with family.

Unprecedented environmental sustainability covers multiple areas. Within this theme the overarching principles are proposed:

- Energy/carbon – minimize energy use and carbon emissions from the site
- Water – minimize impact on wider water resources from reusable water on the site
- Waste and materials – minimize waste generation and maximize re-use and recycling of materials during construction, operation, and commissioning in line with applying the waste hierarchy
- Ecology and biodiversity – enhance and protect biodiversity and ecology of while integrating landscaping with the storm water drainage
- Pollution prevention – minimize impacts on water, air, noise, and land

The new blueprint for environments that promote biodiversity and enhance green open space will be the key driver in the development of the entire community. The opportunity to harness and integrate the water resources on the site and the existing green spaces into a combined network that increase intelligent strategies for biodiversity on the site will be embraced.

THE OBJECTIVE OF RESTORING BIODIVERSITY

Restoring biodiversity on Utah Lake is a core objective of conservation planning and implementation of the Utah Lake Restoration Project. Enhancing biodiversity can best be accomplished by recovery of endemic species, particularly species such as the June sucker, that are endemic and unique to Utah Lake.

Also critical to these restoration efforts are restoring the native plant communities, particularly littoral zone and riparian zone design, as well as native wildlife restoration. For more information on June sucker and endemic species restoration see pages 81-90 and pages 157-158. For more information on littoral zone and riparian zone restoration, see pages 73-80 and pages 157-162. For more information on native fish and wildlife species restoration see pages 81-90 and pages 157-162.

Each of these topics will be part of the federal and state planning, coordination, and permitting processes and will be conducted according to the Utah Lake Restoration Project environmental sustainability strategy. The ultimate objective of these efforts is to produce conditions in Utah Lake to restore the natural systems, food chain, and reproductive ability for self-sustaining fish and aquatic species of Utah Lake.

ENVIRONMENTAL ANALYSIS AND DOCUMENTATION

Environmental planning and permitting will be a significant undertaking throughout and integral with other activities of the Utah Lake Restoration Project.

Before ground disturbance, invasive species removal, or many of the related on-the-ground restoration and conservation actions can begin, a succession of permits will be required from federal, state, and local agencies. The permitting process includes substantial planning, documentation, and reviews. Notably, the federal status of the June sucker (*Chasmites liorus*) as an endangered species, endemic and unique to Utah Lake, will require conscientious and collaborative planning, permitting, and approvals before dredging and removal of invasive carp species can begin.

We anticipate that the June sucker Recovery Plan (U.S. Fish and Wildlife Service [USFWS] 1999) and subsequent associated conservation direction will have to be reviewed, amended, and adopted. We anticipate that these planning and permitting efforts will take a minimum of 18 months, but could take several more years.

The Utah Lake Recovery Project includes full-time planning and permitting efforts that will be coordinated with the State of Utah, Department of Natural Resources, Division of Forestry, Fire, and State Lands, and Division of Wildlife Resources.

DETAILED ANALYSIS

Prior to implementation of ground-disturbing activities, an EIS will be required in accordance with NEPA. The bed of Utah Lake, along with other natural lakes in Utah, was granted to the State on admission of the State to the Union in 1896, and, in 1987, the U.S. Supreme Court ruled that the State of Utah (Department of Natural Resources, Division of Forestry, Fire, & State Lands [FFSL]) administers the land beneath the Lake. However, because:

- Utah Lake is a traditional navigable water of the United States (State of Utah through Division of Parks and Recreation v. Marsh, August 1984) with associated wetlands, over which the U.S. Army Corps of Engineers (USACE) has jurisdiction in accordance with the Clean Water Act;
- Utah Lake is a critical habitat of the federally listed endangered June sucker, a fish species endemic to Utah Lake and the Provo River and under the purview of the USFWS; and
- Due to the magnitude of the action proposed to restore the Lake,

the proposed project will be considered by the Environmental Protection Agency (EPA), USACE, USFWS, and other applicable federal agencies a major federal undertaking requiring preparation of an EIS in accordance with NEPA and other applicable laws and regulations. These federal laws and regulations require the federal government to evaluate the effects of its actions on the environment and consider alternative courses of action. "The NEPA process is intended to help public officials make decisions that are based on the understanding of environmental consequences, and take actions that protect, restore, and enhance the environment" (40 CFR 1500.1(c)).

An EIS is a document prepared to analyze and disclose the consequences, or effects, of a proposed action on the environment and to consider alternative courses of action. The EIS describes impacts (beneficial, adverse, or both), as well as ways to mitigate (avoid, reduce, or minimize) predicted or potential negative effects. Sufficient information must be included in the EIS for decision-makers to evaluate the relative merits of the proposed action and identify a reasonable range of alternatives.

The NEPA process is a sound and systematic process that, if adhered to and conducted in the spirit and intent of the law and properly documented, the outcome is firmly defensible, and will contribute to environmentally sound design and engineering, and future environmental planning and sustainability. The process is complex and can become cumbersome and delayed if not vigilantly and effectively managed. In an effort to streamline the NEPA process to minimize delays, the Utah Lake Restoration Project is proposing to proactively plan for and prepare much of the early planning documentation and materials to support the lead federal agency in commencing the process.

The federal Lead Agency will require a bid process to identify a qualified third-party environmental consulting team to provide services needed to prepare the EIS. The consulting team will contract with Lake Restoration Solutions for payment of services but will receive direction on preparing the EIS from the Lead Agency.

Although the Utah Lake Restoration Project Team (or "Team") includes environmental planning personnel highly qualified to conduct the environmental analyses to prepare the EIS, it most likely would be considered a conflict of interest for the Team to pursue the preparation of the EIS.

However, the Team proposes a plan to (1) complete as much draft work in anticipation of the NEPA effort during the pre-NEPA period to benefit the Lead Agency and project schedule, (2) support the NEPA team during public scoping to the extent allowable during the NEPA process, and (3) contribute to and support project implementation and monitoring. A description of each follows.

PRE-NEPA ACTIVITIES

The period before an application for the project is submitted to the federal Lead Agency is the opportunity for the Utah Lake Restoration Project Team to (1) demonstrate the Team's knowledge and strong intent to begin on a solid footing with the Lead Agency and (2) be prepared to facilitate steps of the NEPA process to the extent allowable and practicable. Once the NEPA process commences, the Team's role and involvement in the NEPA process is limited or severely restricted, depending on which agency has the role as lead (as some agencies abide by stricter policies).

The Team has no control over the activities of the lead and cooperating agencies during the NEPA process other than monitoring schedule and budget and providing supplemental technical information, as needed (in accordance with stipulations developed in a Memorandum of Understanding between the Team and Lead Agency).

The NEPA process is to be conducted impartially; therefore, agencies must use caution in the means by and the degree to which the Team is involved to ensure other agencies and the public that the Team has no influence over the process or ultimate decisions made. The Utah Department of Natural Resources and/or the Division of Forestry Fire and State Lands may request status as a Co-Lead Agency, which allows more involvement in the preparation of the EIS.

Over this period the project team will take the opportunity to prepare (1) materials that are required and (2) optional materials that could assist in facilitating and expediting steps of the NEPA process. All materials will be comprehensive and detailed as possible. Any changes to the description of the project during the NEPA process may require revisions to the analysis and document, which could result in delays to the schedule and require additional funding.

Preparatory activities and information that should be developed include the application, draft Memorandum of Understanding (MOU), and pre-application meeting. Preparation and submittal of an application to the Lead Agency triggers the agency's requirement to respond to the application.

Federal applications often require a statement of purpose and need, project description, preliminary plan of development, description of probable effects, design features of the project for environmental protection, project schedule, statement of economic feasibility, and statement regarding legal status and solvency.

A draft Memorandum of Understanding (MOU) for agency review would expedite discussion of roles and responsibilities and agreements for cost recovery, if required. This should include Team's monthly fiscal-reporting requirements for the Lead Agency and third-party contractor (e.g., monitoring progress, schedule, and budget). A pre-application meeting with the assumed Lead Agency to discuss requirements for completing an application, NEPA process requirements, content of the MOU, cost recovery for agency participation, next steps, is helpful in preparing to follow up with the required and supplemental materials as soon after the meeting as possible.

Other materials that could be prepared by the Team during this pre-application period to facilitate commencement of the NEPA process include a draft management strategy, draft communication plan, list of potential cooperating agencies (Figure I), list of regulatory requirements, list of permitting requirements, list of American Indian tribes potentially involved, preliminary list of project issues, comprehensive resource reports, and draft request for proposal for environmental services to prepare an EIS.

FIGURE I. DRAFT LIST OF POTENTIAL COOPERATING AGENCIES

AGENCY	RESPONSIBILITIES	LEGAL AUTHORITY
Lead Agency(s)		
Federal Lead – U.S. Army Corps of Engineers	Navigable water and wetlands protection	Clean Water Act, NEPA, Harbors and Rivers Act
Co-Lead (?) – Utah Department of Natural Resources (DNR), Division of Forestry, Fire & State Lands	Planning, administration, protection, and management of lake bed and shoreline	U.C. 65A
Potential Cooperating Agencies		
Federal		
Bureau of Reclamation (USBR)	Management of withdrawn lands adjacent to Utah Lake and USBR water rights associated with Utah Lake	Reclamation Act 1902, NEPA
Bureau of Land Management (BLM)	Management of BLM-administered lands adjacent to Utah Lake	Federal Land Policy and Management Act 1976, NEPA
Environmental Protection Agency	Protection of human health and the environment	NEPA, Clean Water Act
National Park Service	Protection of archaeological and historic resources	Archaeological and Historical Preservation Act 1974, NEPA
Utah Reclamation Mitigation and Conservation Commission	Management of Utah Lake Wetland Preserve and mitigation for Central Utah Project	Public Law 102-575, Titles II-VI, Central Utah Project Completion Act 1992, NEPA
State of Utah		
DNR, Division of Water Resources	Manages water resources of Utah Lake basin	U.C. 73-10-18
DNR, Division of Water Rights	Administers Water Rights of Utah Lake basin	U.C. 73-10-18
DNR, Division of Wildlife Resources	Manages and protects wildlife	U.C. 73-2-1
DNR, Division of Parks and Recreation	Regulatory authority over populated waterways. Manages Utah Lake State Park, law enforcement, search and rescue operations, and navigational hazards	U.C. 63.11.17.1, U.C. 73-18
Department of Environmental Quality (DEQ), Division of Water Quality	Protects water quality of Utah Lake and tributaries	Utah Water Quality Act 19-5
Department of Community and Culture, Division of State History	Preservation of historic and archaeological properties	National Historic Preservation Act Section 106, Utah Annotated Code 9-8-404
Other Government Agencies		
Utah Lake Commission	Planning and coordination among agencies	Interlocal Agreement Creating Utah Lake Commission, HCR 1 2007
Central Utah Water Conservancy District	Management of water resources and water rights under its jurisdiction in Utah Lake	Central Utah Project Completion Act, P.L. 102-575
Utah County	Land uses adjacent to Utah Lake and law enforcement	
Municipalities	Land uses adjacent to Utah Lake and enforcement of laws and ordinances	Municipal statutes

NEPA PROCESS

As mentioned previously, the NEPA process is a systematic, defensible process; however, considering the magnitude of the project, its multiple components, and the volume of resource data involved, the EIS project will be complex and will require proactive planning and vigilant management.

The steps of the NEPA process include (1) scoping, a process open to the public and conducted early in the NEPA process to engage the public and relevant agencies, solicit opinions regarding the proposed actions and associated uses, and identify and frame the issues to be studied and addressed in the EIS; (2) collection and compilation of existing natural, social, and cultural resource data to document the existing condition of the environment and serve as a baseline for analysis; (3) impact assessment; (4) mitigation planning; (6) documenting the results (i.e., preparation of the Draft EIS for public review, preparation of the Final EIS, and preparation of the Record of Decision). Processes conducted in parallel with the NEPA process include Endangered Species Act (ESA) Section 7 consultation, National Historic Preservation Act Section 106 coordination and consultation, government-to-government tribal consultation, and Clean Water Act Section 404 coordination, each of which is guided by its own unique process. The scopes of and schedules for these processes and resulting documents are determined early in the NEPA process during scoping. Figure II illustrates the flow of the NEPA process.

There are natural, human, and cultural resources that must be addressed in the EIS, but because EIS data and analyses must be commensurate with the importance of the impact, the emphasis will be placed on the complex issues associated with the project. Effects will be

FIGURE II. SUMMARY OF NATIONAL ENVIRONMENTAL POLICY ACT PROCESS TASKS

Scoping	**Alternatives Evaluation and Analysis**				**Environmental Impact Statement**		**Record of Decision**
	Resource Data Inventory	Impact Assessment and Mitigation Planning					
		Initial Impact Assessment	Mitigation Planning	Residual Impacts	Draft	Final	
Process open to the public, early in the NEPA process, to engage public and agencies, identify and frame issues to be addressed in EIS. Tool for discovering problems and opportunities, identifying a reasonable range of alternative actions, and identify potential significant impacts early in the process.	Prepare the baseline resource inventory data needed to assess impacts resulting from the proposed action.	Evaluate effects of project disturbance on the resources to determine the initial impacts that would result.	Based on impacts evident in initial analysis, identify and plan for measures to avoid, reduce, minimize or otherwise mitigate impacts.	Impacts remaining after applying measures to mitigate the impacts.	Distribute the draft EIS broadly to the agencies and interested parties to review and comment on the adequacy of the EIS.	Review comments received on Draft EIS, respond to substantive comments, and revise the EIS accordingly.	Formal record of the agency's decision under NEPA.

analyzed for the Lake restoration activities as well as the effects of development. The Utah Lake Restoration Project Team has a firm understanding of the issues that will have to be addressed in the EIS. Resources and subjects that may need to be addressed during the NEPA process include, but are not limited to, the following:

Climate and air quality

Earth resources
(geology and soils)

Paleontological resources

Water quality:
- Shallow lake (water temperature, evaporation, wind and wave action, boat prop wash, ice flow)
- Shore erosion
- Suspended bottom
- Phosphorus- and nitrogen-loaded sediments
- Algae and E-coli
- Poor water flow, aeration, filtration

Wetland and riparian areas
- Loss of littoral and emergent zone
- Invasive species (phragmites, tamarisk)

Plant communities

Wildlife
(reptile, amphibian, small mammals, avian)

Special status species

Fish
- June sucker
- Bonneville cutthroat trout
- Least chub and other native minnows
- Non-native species (carp, pike, white bass, walleye, others)

Land uses
(agriculture, industrial, commercial, residential)

Transportation and access

Visual resources

Cultural resources
(prehistory, history, archaeology, Native American concerns)

Fire ecology and management

Social and economic conditions

Public health and safety

PROJECT IMPLEMENTATION AND MONITORING

Once the EIS has been completed, the measures resulting from mitigation planning will be incorporated into detailed implementation plans that will be key to the plan of development that (1) guides design and engineering and (2) directs construction, environmental monitoring during construction to ensure the measures are being applied as intended, reclamation planning and restoration, post-construction monitoring to measure reclamation success and identify whether adaptive management measures are needed, and long-term monitoring of environmental health and sustainability. Detailed environmental implementation plans will include, but not be limited to, biological resources conservation; noxious weed management; water resources protection; vegetation management; historic properties treatment; erosion/dust control; fire protection; reclamation and revegetation planning, implementation, and monitoring; stormwater pollution prevention; spill prevention, containment, and countermeasures and hazardous materials management; and emergency preparedness and response.

MASTER PLANNED COMMUNITY, DESIGN, AND METHODOLOGY

Overall Design Methodology

The Utah Lake Restoration Project includes an intelligent, new master plan for a community that will be developed on the Lake. With this development, the goal will be to protect the lake ecosystem in a manner that is maintainable and sustainable. The resultant development will be guided by the objective of a lakefront community, untainted by pollution, that is uniquely planned and designed for local residents and people moving into the state.

It will include a vibrant waterfront as well as an attractive location for business, retail, arts, culture, recreation, and education. The community will offer an unprecedented quality of life in an environment that is welcoming for all those who want to live, work, and recreate on the restored Lake.

The community will be a place for families and will nurture inventiveness, health, personal development, and well-being. Districts of distinct character will be interconnected by public transit, open space, and visual amenities. Diversity of housing choices and affordability will provide comfortable homes for local residents. It will contain world-class health care, technology, and educational centers complimented by neighborhood shopping, dining, and recreation.

COMMUNITY MASTER PLAN

The community master plan is intended as an innovative conceptual blueprint for development with the understanding that it will be designed with a flexible framework to allow adaptation to public and private market changes.

The design team will implement the best practices of sustainable design to create a sophisticated, high-quality community supporting local and regional needs.

SUSTAINABILITY OBJECTIVES AND STRATEGIES

We recognize the unique nature and value of the environment within the Utah Lake Region and we recognize and embrace our responsibility to protect and improve it wherever possible.

Funding for executing the Utah Lake Restoration Project comes from using dredged material to create islands in the Lake for neighborhood and community development, recreation, and environmental control. The islands play a major role in solving some of the issues such as wave action, surface evaporation, fishery control, shoreline access, and efficient east-west transportation. The islands will be developed with state of the art, scientific environmental and conservation techniques and methods. They will be a blueprint for sustainable living.

Our vision is that environmental excellence will be a key element in the Utah Lake Restoration Project development and will enhance the quality of life for community residents.

PRINCIPLES TO GUIDE SUSTAINABLE DEVELOPMENT

The key principals which will guide the development are:

- A smart, cost-effective, easy-to-phase infrastructure that offers a platform for a high-quality 21st century community
- A vision for energy that points to emerging technologies
- A community focused on the remarkable Utah Lake and Provo Bay environment
- A community offering global excellence as a destination for live, work, education, healthcare, and tourism
- A community of transit: convenient and high quality alternatives to fossil fuel cars
- A community of smart design in everything, from buildings to neighborhoods to districts – to the community and the region
- A community that cherishes water by conservation and reuse
- A community of outdoor living recognized by its natural parks and open spaces
- A strategically phased and implemented community, focused on short-term initiatives that lead to sustained long-term growth
- A community of communities that are culturally and environmentally vibrant, which can sustain both economies and lifestyles
- A community reflecting environmental brilliance; a partnership between the community and its natural setting
- A community that not only provide "green living," but that is actually the foundation for environmental restoration of an impaired ecosystem, including removal of invasive species, restoration of native plant communities, fish, wildlife, threatened species, restored water quality, and a healthy functioning ecosystem

GOALS AND OBJECTIVES

Several project objectives will direct the design and planning activities of the Utah Lake Restoration Project:

1. Create a well-designed and balanced master planned community within a restored ecosystem that will be inherently maintainable and sustainable and built to the highest development standards.
2. Use the dredged and reclaimed material to create islands, appropriately contoured and shaped, within the structure of the Lake, which will play a major role in solving the issues of wave action, evaporation, fishery control, shoreline access, and efficient east-west transportation. The science and technology of island creation using dredged material is well proven and acknowledged as successful on projects team members have previously worked on in various parts of the world, such as:

   Palm Islands in Dubai, UAE

   Al Durrat and Diyar in Bahrain

   The Pearl in Qatar

   Al Khiran City in Kuwait
3. Create and implement development guidelines and restrictions with stringent and exacting environmental, sustainable, and conservation methods
4. Establish a sophisticated and sustainable development pattern with the overall goal of creating livable districts comprised of several distinct neighborhoods that provide diverse housing types to meet the needs of the ever-growing community. In addition, the project will have both commercial and hospitality districts. Necessary amenities such as schools, churches, parks, trails, and recreation facilities will be designed as integral parts of the districts and neighborhoods.
5. Stimulate and diversify the existing and future economic base to secure investment and development of residential, commercial, cultural, and leisure activities to broaden the interest and attraction of the diverse community. The project site seeks to increase the economic underpinning of the district and region by the direct creation of jobs and ensuring that local retailers have a location to access those opportunities and enhancing visibility and access to the waterfront.

ADDRESSING GROWTH NEEDS WITHIN UTAH COUNTY AND THE STATE

The state projects significant growth along the Wasatch Front in the future; however, available space for new construction is relatively limited, and the lack of affordable residential living along the Wasatch Front is a growing concern.

The latest federal census reveals Utah's growth among the top in the nation with Utah County being the fastest-growing county in the state. Utah's population grew by more than 40,000 people — almost 1.4 percent — from July 2013 to July 2014, with a five-year growth rate that ranks fourth in the nation, according to estimates scheduled for release by the U.S. Census Bureau. During that year, Utah added almost 14,000 new homes, with a housing growth rate of nearly 1.4 percent that was second only to North Dakota.

In the previous five years, Utah gained almost 43,000 new homes, ranking third in the nation. The greater Wasatch Front area, including Weber, Davis, Salt Lake, and Utah counties, collectively gained almost 29,000 residents that year, bringing the total to more than 2.2 million residents as of July of 2017.

Growth is a function of a variety of factors. Natural growth rate in the state is high. Between the two summers, Utah had well over 51,000 births and 15,000 deaths. The total estimated population for the state on July 1 of this year is 2,998,590, indicating the state will likely reach 3 million residents before the year 2018 is over.

On a statistical basis, Utah is considered the best state in the United States in which to retire and in every measure of retirement, Utah scored particularly well. Elderly people have strong income security and 97% of Utah residents aged 55-64 are employed. Income at a median average of $44,000 was higher than virtually all states.

The Beehive State, which claimed the number three spot in 2014 rating, scored above the national average all around, getting particularly good marks for low cost of living, comfortable weather, and good health care. Utah has the sixth-best weather in the nation, thanks to its dry climate and clear, sunny skies. It's also one of the most affordable states in the country. The state's health care system is also top-notch, ranking seventh best in the country, according to the Agency for Healthcare Research and Quality.

While the state projects significant growth along the Wasatch Front in the future, available space for new construction is relatively limited. One significant concern is the lack of affordable residential living along the Wasatch Front. "With only 23 percent of all new homes built in the last year priced under $300,000, affordability is an area for concern as buyers continue to get pushed out of the market...Affordability is going to get squeezed as prices go up." *See https://goo.gl/smqSfe*

Residential living on Utah Lake development islands will include significant affordable housing options including townhouses, multi-unit condominiums, row houses, and apartments in addition to single family units.

Current availability of these housing options is at an all-time low. "Housing inventory has fallen well behind the state's increasing needs, and now tens of thousands of Utahns are searching for homes, condos or townhouses that simply don't exist — and may not be built anytime soon." *See https://goo.gl/4boKgu*

Development strategies on Utah Lake will focus on providing more available open space, but also affordable multi-unit developments to help address Utah's housing challenges. The development islands will use this growth as an opportunity to fund conservation and restoration of Utah Lake.

DEVELOPMENT PRINCIPLES, OBJECTIVES, AND STRATEGIES

Development principles, objectives, and strategies that address community and social promotion, economics, transportation, energy, water, waste collection and treatment, use of materials, and storm water management will be incorporated into the planning, design, and development of the Utah Lake Restoration Project to create an environmentally friendly, vibrant, and sustainable community.

COMMUNITY AND SOCIAL PROMOTION

In order to achieve long term sustainability, The Utah Lake Restoration Project will be an attractive and affordable place to live and work. This can be achieved through community design and strategic development.

The following overarching principles will guide will guide community development:

- **Transport and mobility** – prioritize walking, cycling, and public transport and minimize reliance on private cars
- **Health and well-being** – enable and promote healthy lifestyles and provide opportunities for leisure and social activity, including community involvement
- **Inclusion** – provide equal opportunities for all types of people including social inclusion and access for people with mobility problems or other disabilities
- **Education** – provide educational opportunities to meet the needs of its citizens including access to schools and other educational institutions

ECONOMICS

The current regional economic climate has placed economic prudence high on the agenda. However, for truly sustainable development to be achieved through the Utah Lake Restoration Project, it will be important to consider both long-term economic gains as well as capital costs and land values.

Within this theme, the following overarching principles will be followed:

- Employment and business - the development will provide and enhance local employment opportunities and attract businesses to the area, regionally, nationally and internationally
- Building local capacity - the development will provide opportunities for local people and include skills training to enhance local capacity

Additionally, the master plan for the Utah Lake Restoration Project will address economic objectives by acknowledging the social dimension of economic development. This means focusing on cost efficiencies and flexible delivery of the development as well as establishing viable and sustainable employment opportunities throughout the development of island communities.

TRANSPORTATION

Since innovative modes of transportation are the backbone of the community, the focus will be to reduce congestion and environmental impacts, such as air pollution, while meeting transportation and mobility demand.

Strategies will focus on improving local and regional access as well as promoting efficient and diverse transportation options within the entire community itself.

Transportation objectives will be to reduce vehicle miles traveled and promote public transit and attractive transportation options.

Adverse impacts of transportation that will be minimized throughout the development are:

- Depletion of finite natural resources and fossil fuels
- Emissions of $C0_2$ that contribute to climate change
- Air pollution
- Vehicles noise
- Congestion

Aims and objectives that will govern the community design process are:

- Reduce vehicle miles traveled and trips made by personal vehicles
- Increase the efficiency of public transit and logistics
- Reduce emissions from fuels

Methodology used to achieve these aims are:

- Introduce a state of the art transportation system
- Connect to regional high speed rail
- Create a walkable street network
- Develop and manage bike-share and car-share programs
- Use the latest technology in intelligent transport systems
- Encourage solar-powered, electric, and autonomous vehicles through community design

ENERGY

Achieving an energy efficient city requires planning at the city, district, and building scale. Identifying renewable sources of energy is a critical energy strategy for modern 21st century cities and will be incorporated throughout the community planning and design process.

The strategic, climate-responsive orientation of the urban fabric and street grid can maximize efficiency through passive design. Demand reduction in buildings will be achieved by design of the building facade/envelope to minimize solar gain, the use of efficient mechanical and electrical systems, low-energy-use appliances, and natural systems (e.g. ventilation and daylight).

The overall aims and objectives for community-wide energy reduction are:

- Minimize energy demand and C02 emissions
- Maximize efficient use and distribution of energy supplies
- Maximize the efficient generation of energy supplies
- Maximize renewable energy opportunities

The strategies for achieving the energy reduction goals are:

- Use renewable energy, including waste-to-energy and large-scale solar power
- Minimize solar gain and optimize passive cooling
- Implement smart grid technology
- Promote cool roofs and other energy efficiency strategies at the building scale
- Establish building design guidelines for efficient energy, water, and waste systems and overall human comfort

The potential benefits are:

- Reduced energy consumption and waste
- Reduced system installation and operational costs
- Increased security of supply
- Air quality/environmental benefits
- Community pride/public health/well being
- Attractive marketing for the entire planned community

WATER

Fresh water is an incredibly valuable resource in Utah. Potable and wastewater networks will be designed to promote efficiency, reuse, and conservation. Water use and energy or pumping can best be reduced by undertaking full system modeling of the site-wide network. Water for irrigation and wet-system cooling of buildings will be the largest demands.

The best practices for sustainable urban water systems that will be designed into the overall community master plan and implementation strategy include:

- Efficient potable water supply and foul water treatment systems
- Promotion of consumer conservation
- Prioritize native and water-efficient plants in urban landscapes
- Avoid evaporation in irrigation systems
- Active and passive rain harvesting
- Grey and black-water reuse

The strategic aims and objectives for the community development are:

- Achieve city-wide water balance
- Conserve natural water resources
- Reduce energy consumption due to water pumping and treatment
- Prevent water quality impacts

Strategies for achieving the aims:

- Reduce demand for potable water
- Reduce demand for irrigation water
- Minimize water lost by evaporation
- Use leak-detection devices to correct leaks quickly

The significant community-wide benefits are:

- Reduced water consumption and wastage
- Reduced system installation and operational costs
- Water quality/environmental benefits
- Attractive marketing for the community

WASTE COLLECTION AND TREATMENT

Waste is best dealt with at a community-wide level. A sustainable waste strategy involves financial incentives to reduce waste sent to landfills, procurement strategies to reduce waste generated on-site, and regulation to restrict industrial and hazardous waste effluents (solid, air, and water). Throughout the master-planned community an AVAC (automatic vacuum waste collection system) will be developed and used.

The automated vacuum waste collection system, also known as pneumatic refuse collection, or automated vacuum collection (AVAC), will transport waste at high speed through underground pneumatic tubes to a collection station where it is compacted and sealed in containers. When the container is full, it will be transported away and emptied. The system helps facilitate separation and recycling of waste.

The process begins with the deposit of trash into intake hatches, called portholes, which will be specialized for waste, recycling, or compost. Portholes are located in public areas and on private property throughout the community.

The waste is then pulled through an underground pipeline by air pressure difference created by large industrial fans, in response to porthole sensors that indicate when the trash needs to be emptied and help ensure that only one kind of waste material is traveling through the pipe at a time.

The pipelines converge on a central processing facility that uses automated software to direct the waste to the proper container, from there to be trucked to its final location, such as a landfill or composting plant.

Aims and Objectives:

- Reduce waste generation and pollution
- Reuse and recycle waste
- Recover energy from waste
- Appropriate treatment and disposal of industrial effluents and hazardous waste

Strategy for achieving the aims and objectives:

- Develop a city-wide "zero waste" attitude, training and practice
- Reduce excess materials imported into the site
- Install AVAC system prior to land development
- Compost organic waste and use on-site

The potential benefits are:

- Less pollution, traffic, noise and collection bins
- Long-term reduced costs of waste disposal
- Income from waste streams
- Community pride/public health/well being

MATERIALS

Since land and community development is, primarily, a "reclamation" project, one of the most important strategies to limit its environmental and cost impact is balancing the dredged and fill used to build the site. Dredge-and-fill requirements will be planned and balanced, both for the entire city and for each development plot.

Construction materials will be selected to minimize depletion of nonrenewable sources and adverse environmental impact. This will favor materials certified as from sustainable sources, having low embodied energy, and sourced near to the development to reduce adverse transport impacts.

To ensure products and materials with defined and high recycled-content are used, a commitment will be made to assess recycled content on all construction projects.

Aims and Objectives:

- Reduce quantities of materials used
- Maximize reuse
- Reduce the generation of waste and waste sent to landfill sites

Strategy for achieving the aims:

- Use high recycled-content and certified-sustainable materials throughout the project
- Use materials with low embodied energy and emissions of Volatile Organic Compounds
- Design for reuse and recycling
- Implement Construction Environmental Management Plans and Site Waste Management Plans

The potential benefits are:

- Reduced construction costs
- Reduced costs of waste disposal
- Reduced risk of expensive pollution incidents
- Good construction practices
- Community pride/public health and well being

STORM WATER MANAGEMENT

Utah Lake lies within a large and complex watershed system that can deliver significant flows of regional storm water to the Lake and to the proposed development site. In this context, the development of a comprehensive storm water management strategy is essential to protect and properly manage the community. Maintaining the natural drainage channels and hydrological function of the region and created land masses will also be important to protect the fragile marine ecosystems.

The master planned community will integrate a city-wide green infrastructure network to manage regional flows and on-site runoff. This network will include the following best management practices:

- Naturalized drainage and storage channels to convey and slow regional flows
- Bioswales to convey on-site runoff
- Oil interceptors to collect pollutants
- City and district parks to serve as detention basins

Adverse impacts of inadequate management system:

- Flooding of developments and damage to property and infrastructure
- Polluted runoff entering marine ecosystems
- Risk to public safety
- Disruption of natural nutrient and groundwater flow to marine ecosystems

Aims and Objectives:

- Limit risk of flooding
- Protect natural hydrological character
- Limit development in floodplain
- Protect health of marine environments
- Create a robust and climate change ready storm water management strategy
- Protect important drainage ecology throughout site

Strategy to achieving the aims:

- Prioritize sustainable urban drainage systems
- Plan for climate change impacts in storm water models
- Design natural conveyance and storage system for regional flows
- Manage and treat on-site runoff before it enters marine environments

Significant Benefits:

- Create sense of place rooted in natural drainage systems
- Improve water quality
- Protect development and public safety
- Protect and enhance natural environment
- Reduce infrastructure costs of conventional pipe and treatment system

COMMUNITY-WIDE ENVIRONMENTAL DEVELOPMENT IMPLEMENTATION

Delivering sustainable and responsible development consistent with the Utah Lake Restoration Project vision and the development principles, objectives, and strategies described above at the community level will require strong leadership and commitment from the owners of each site-specific development and their development partners. It will involve taking the long-term view, considering whole life costs and best value rather than the short-term economics.

Throughout the master planning and development process the following planning objectives will be applied to ensure adherence by all to the project goals and objectives:

- Create walkable neighborhoods/districts within the natural landscape framework.
- Provide an identifiable, attractive, and fluid hierarchy of connected, narrow streets and boulevards
- Deliver an abundance of neighborhood/community parks, trails, and open space
- Develop connections, linkages, and exposure to the water environment
- Create dynamic live-work environments and vibrant commercial centers
- Provide rich diversity of housing types, superior education, commercial, and recreational opportunities

At the site-wide level, quantitative targets will be set covering a range of social and environmental issues, and developers of individual plots or buildings will be required to comply with these targets. At the building level, an environmental assessment tool, for example LEEDS or better, will be used to help ensure optimum performance is achieved.

To ensure delivery of the appropriate level of performance, developers of individual plots or buildings will be required to:

- Create a vision for the site-specific development, reflecting the vision, goals, and objects of the Utah Lake Restoration Project master plan, policy drivers, and comparisons with international paradigms
- Agree on environmental sustainability performance objectives of the Utah Lake Restoration Project
- Evaluate the cost and value of achieving expected levels of performance targets
- Agree on final performance targets

In each development case and throughout the planning and design, detailed viability testing and technical analysis will be required to demonstrate which of the proposals are deliverable relative to the final land-use mix, phasing, conditions, and design regulations.

COMPREHENSIVE DEVELOPMENT PROGRAM

The design and development team will use a collaborative approach that integrates the best sustainability practices, research driven market parameters, cost/benefit implementation strategies, and dynamic urban design and place-making strategies.

The team's extensive international experience and collaboration will allow the team to bring together local, national and international cooperating companies, providing the profession-

al resources to the community design process with experienced global practice leaders.

The master planning process will deliver a community vision and development plan that is both sustainable and responsive to market conditions, environment and region. A primary component that will prevail throughout this project will be to provide a sustainability framework for the project at every level of scale—regional, city, district, block and building.

The overarching sustainability strategies established at the outset of the comprehensive development program will be integrated into the plan and the built environment. The strategy will be crafted by the design team and will provide a basis for the overall direction of the project.

One of the most important and significant control measures used to create and ensure the development program strategies enforced are the development control regulations, zoning ordinances and land use policies created in the initial planning phases.

Given the complex and dynamic nature of the development and the fact that it will take years to achieve the ultimate build-out as envisioned, the development team recognizes and acknowledges that detailed regulations, constant monitoring and enforcement is mandatory in order for the comprehensive development plan to remain viable, realistic, and consistent with the project objectives.

In principle, the comprehensive development program is intended to be a living document, responsive to changing conditions and requirements, yet providing a sound basis for controlling long-term development. Thus, an important responsibility will be to monitor and regulate the urban development process by creating, implementing, and monitoring development control guidelines, land-use policy and zoning regulations that will include standards to be adhered to for Urban Design and Landscape Architecture.

Other specific guidelines such as urban architecture will be provided by the design team and specialized consultants will assist in the development of the project as per the established vision.

In total, these regulations will provide control guidelines for the development in the various districts including procedures to be followed that are applicable to standards for plot development, details on the land use zones, including permitted uses.

IMPLEMENTATION

RESTORATION OF PROVO BAY

By providing a smaller scale version of the much larger project, the restoration of Provo Bay will provide data and direction to more successfully implement the master plan.

The Utah Lake Restoration Project will utilize Provo Bay to initiate Lake restoration efforts. To ensure its success, careful implementation of the project will begin by transforming Provo Bay utilizing the restoration principles that will be employed on the greater Utah Lake ecosystem. The complexity of Provo Bay restoration will require the coordinated efforts from experts with varying fields of specialization.

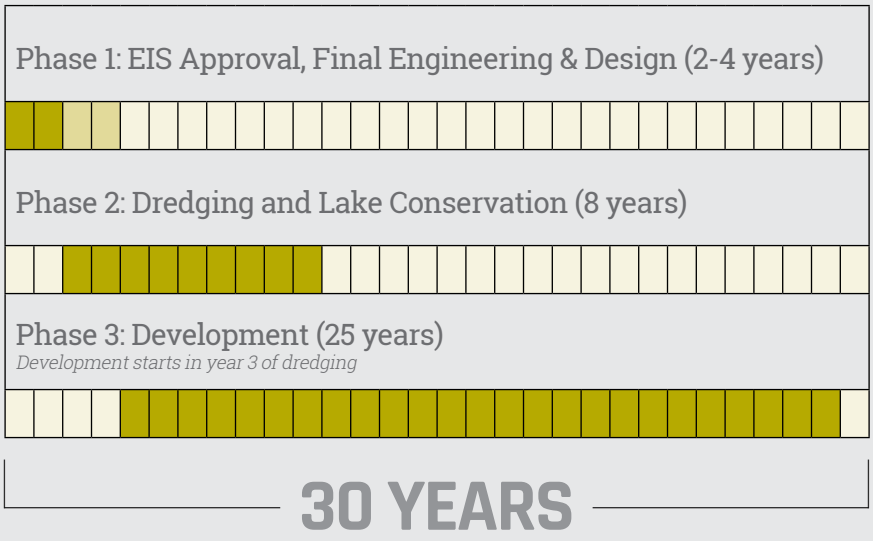
The restoration of Provo Bay will serve multiple purposes:

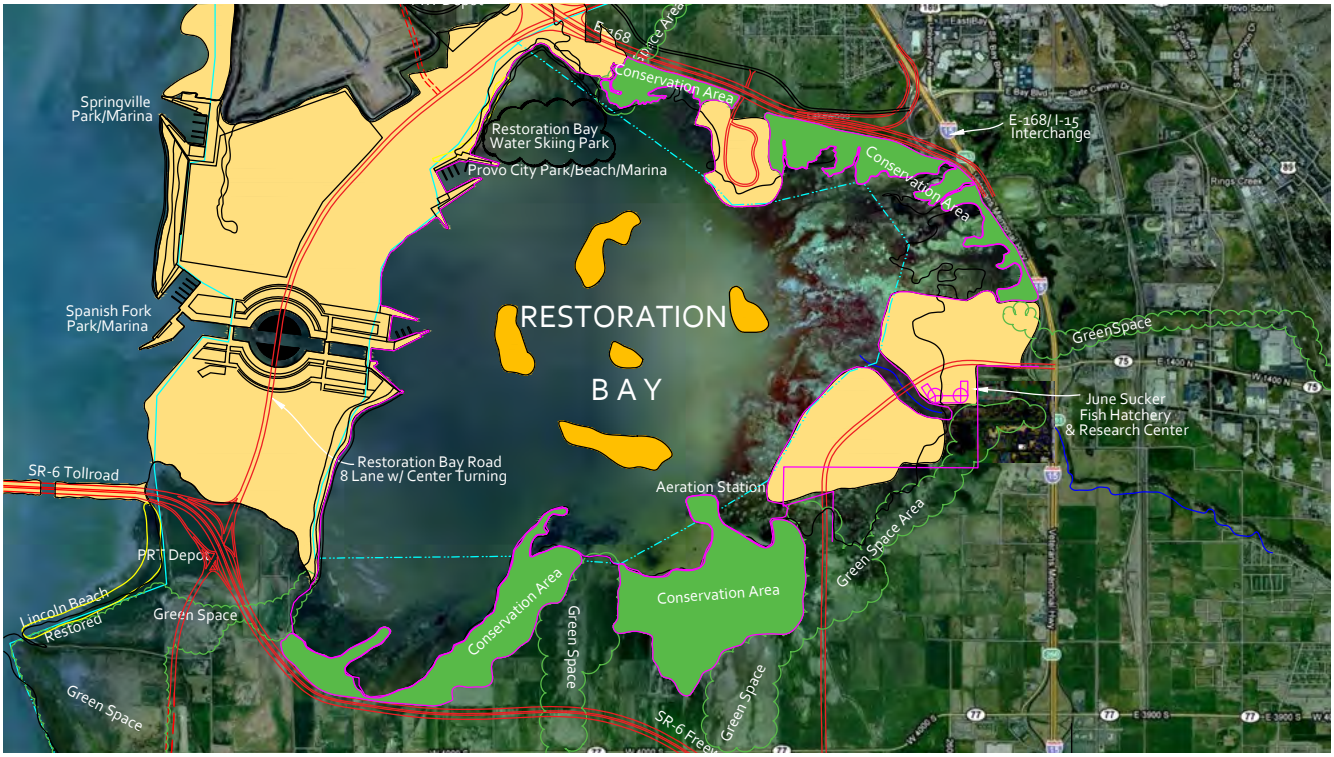
- Provide a healthy ecosystem for the recovery of the threatened June sucker
- Provide preliminary project for dredging, dewatering, compaction, and environmental reclamation implementation
- Provide a controlled environment in which to introduce, breed, and support the return of native vegetation, aquatic, and terrestrial species to the lake's ecosystem
- Provide advanced educational and scientific research opportunities
- Allow Utah residents and tourists to view and participate in conservation efforts
- Renew public interest in Utah Lake and its potential as a recreation destination

By providing a small-scale version of the much larger project, the restoration of Provo Bay will provide science, data, and direction to how our team can more successfully implement the master restoration plan for Utah Lake.

Provo Bay will illustrate the mechanisms for restoration of

UTAH LAKE RESTORATION PROJECT PHASING





Utah Lake. Here are several of the important components of Provo Bay restoration:

1. Construct a world-class fish hatchery to protect and grow June sucker populations as well as their food source, namely zooplankton
2. Upgrade wastewater treatment plants
3. Dredge, create bay islands and the causeway to isolate Provo Bay from the rest of Utah Lake
4. Net all possible June sucker from Provo Bay and its tributaries for safe keeping and controlled breeding in fish hatchery
5. Removal of invasive plants
6. Removal, both mechanical and chemical, of carp and invasive aquatic species
7. Provide support necessary for improving water quality (mechanical pumping, aeration, biofiltration, etc)
8. Restore littoral, emergent, and riparian plant communities
9. Re-introduce and advance recovery of the June sucker and zooplankton populations into Provo Bay
10. Provide infrastructure for the community outreach program and the Utah Lake Commission

HATCHERY AND JUNE SUCKER CAPTURE

The Utah Lake Restoration Project has prioritized the construction of a 140,000 square feet world-class fish hatchery on the shores of Provo Bay.

The hatchery will be the biggest in the continental United States and will also be used to re-establish not only June sucker, but also Bonneville cutthroat trout and seven minnow species.

The minnows include least chub, Bonneville redside shiner, mottled sculpin, northern and southern leatherside chub, longnose dace, and speckled dace.

The hatchery will be capable of producing 500,000 June sucker, two million Bonneville cutthroat trout a year, and eight million minnows a year. The hatchery will be based on the layout and technology used in Alaska's WJH Sport Fish Hatchery, but will also include an aquatic plant rearing facility that will provide the initial plant starts for the littoral zone plants as well as tanks for zooplankton.

Before restoration of June sucker begins, Provo Bay will be isolated from the rest of Utah Lake. Once all control measures are in place to isolate Provo Bay, systematic netting of all possible June sucker from Provo Bay and its tributaries will be completed. Placement of June sucker within the fish hatchery will be conducted in coordination with the restoration of Provo Bay.

The adjacent Community Education Center will educate visitors about the importance of the watershed, what role each plant, aquatic species, and fish play in the ecology of the Lake, and how the Lake will be preserved and restored. The hatchery will later be connected to the elevated trail system in Provo Bay which will provide opportunities for bird watching, education, leisure, and fitness.

DREDGING AND CREATION OF CAUSEWAY AND BAY ISLANDS

The sequence of the work involved in the Utah Lake Restoration Project will follow key milestones and subsequent timelines. Initial work to isolate Provo Bay by dredging and causeway construction will lead the construction efforts. Much of the construction equipment will be low pressure type equipment, shallow water draft skiffs and long reach excavators.

Once the fish hatchery is completed and June suckers within Provo Bay are captured for retention and breeding, the bulk of dredging inside Provo Bay will commence in parallel with efforts to remove Phragmites within the bay area. Provo Bay is nominally 3-4 feet deep and will be easily dredged in some areas to 10-12 feet deep with dredged materials being used to create a dam/causeway separating Provo Bay from the rest of the Lake.

Once the causeway fill is established and compacted, a concrete and steel weir system will be constructed. The causeway construction will incorporate a concrete reinforced channel with hydraulically operated weir gates to actively manage water levels within Provo Bay. At times, the objective may be to hold Provo Bay near compromise elevation. Maintaining the bay near compromise elevation during restoration activities will facilitate the environmental improvement of both the littoral and riparian zones. Maintaining the water depth at a more constant level is ideal for the bay to act as an initial holding ecosystem for smaller fish released from the hatchery. This system will allow water to move from Provo Bay to the Lake and will become a primary discharge for fish transport to the Lake as the project progresses. It will also allow for improvements and management of feeding, nesting, and brood rearing habitat for shore birds, migratory birds, and other wildlife species.

When the weir is operational, the environmental team will manage the treatment of Provo Bay with rotenone to eliminate carp and all invasive fish species. This will allow the restoration of the riparian, emergent, and littoral zones. Treatment will be conducted at desired times of the year and after netting of the bay to limit or eliminate impacts to desirable aquatic and fish species. Once carp and predatory invasive fish are removed from Provo Bay, tributary management and treatment will ensure that undesirable fish species do not accidentally re-enter Provo Bay.

The environmental team can then begin restoration of native plant communities by transplants of littoral zone mats and plugs, planting of seedlings and application of hydro-seeding in the riparian zones. The dredged material is very high in nitrogen and will perform well as host soil for riparian based plantings to flourish.

COMMUNITY EDUCATION CENTER

Located in Provo Bay along the Hobble Creek River, the Community Education Center will act as a public hub for updated project information and an educational center for K-12 children.

Construction of the center's open park and green space improvements will significantly add to Provo Bay's architectural content. The center will have a commanding view of Provo Bay from inside and out and will have extensive outdoor gardens reflective of the area with a variety of native flora and fauna.

The Community Education Center will be situated near the fish hatchery where it will be utilized as offices for the June sucker Restoration Team, the Utah Lake Commission, and lab space for various university studies and research teams.

The Community Education Center will also be utilized for the K-12 education program and will display Utah Lake historical models, hands-on labs and research areas, and multi-media centers for various productions. Participants will be able to take educational tours of the hatchery and along outdoor raised walkways. They will have the opportunity to participate in multi-year lab studies and research projects relating to the watershed.

Students will have the opportunity to participate in the restoration project within a class setting or on an individual basis.

The Lake Restoration Solutions team will work closely with the Utah Lake Commission and Utah County Visitors Center to create a combined Community Education Center that serves the public and the lake's associated partners with world class educational presentations.

K-12 SCHOOL EDUCATION PROGRAM

Restoring our relationship to Utah Lake and its watershed is fundamental to the vision and restoration strategy of the Lake Restoration Solutions team. Through place-based education programming and infrastructure, K-12 students in the Utah Lake Watershed will become stewards of lake restoration,.

Utah's Science with Engineering Education (SEEd) standards will be integrated into a comprehensive K-12 program that uses the natural history and phenomena of Utah Lake and its watershed as their context for learning. The three-dimensional program will support world-class science literacy and engineering design as students progress through their thirteen years of scholarship and stewardship.

Curriculum resources and professional learning will integrate all discipline areas to support teachers. Studying Utah Lake phenomena, understanding its issues, and solving related problems creates an authentic real-world education for every child.

Higher Education collaboration with Utah Valley University and Brigham Young University will provide sustainable cross benefits for research and engineering. Industry and business within the watershed will inte-

grate Utah Lake commitments that will support ecological and economic health in the region.

Communities adjacent to Utah Lake and in the watershed will thrive through enhanced recreational and educational activities for families and individuals. Healthy lake and healthy lives are intertwined. The more we do for the Lake, the more the Lake will do for us.

The infrastructure improvements circling Utah Lake will provide access points for rich experiences and destinations. Provo Bay will welcome school field trips, families, researchers, scientists, and tourists to a state-of-the-art Restoration Center and Fish Hatchery. Interactive displays and hands-on activities will engage visitors to better understand, appreciate, and care for the Lake.

Outlook sites around the Lake will highlight Utah Lake phenomena, natural and cultural history, and restoration activities. These sites will all be dynamic places of interaction that welcome recreation and play but also invite citizen science and stewardship as we look forward and back.

PROVO BAY DEVELOPMENT

Land dredging in the Provo Bay area will add 2,197 acres of project property for Utah Lake Restoration Project infrastructure buildings, warehousing, maintenance, and offices for environmental and engineering teams.

Some of the acreage will be improved and developed to generate financial resources to fund restoration of Provo Bay and construction of the Provo Bay fish hatchery. Some areas of Provo Bay are planned for smaller commercial and residential construction that will accompany the early dredging and construction efforts, further augmenting funding needed to support the hatchery and nursery facilities and conservation on Utah Lake.

A key improvement during the early works efforts is the construction of the Provo Bay dike/causeway with an integrated lock system allowing boats to move between the bay and lake during elevation differences.

Utah Lake annual elevation range is -2'- 6" to -4'- 0" in low snow years. That range will be reduced significantly after lake dredging is complete. However, during dredging of the Lake, a lock system will be required for boats traveling to the sometimes lower elevation of Utah Lake from Provo Bay.

The hydraulic weir system will incorporate all earthen dam measures for controlling, releasing, and storing water. The lock system will include solar powered water pump-back system capable of pumping water from one side of the causeway to the other helping keep water in the bay just below compromise elevation.

Master planning for these Provo Bay developments will utilize the architectural, environmental, and structural improvements to publicly share the restoration vision and sense for the large restoration project.

Constructing a causeway across the mouth of Provo Bay will be much more than just building a dam, it will expand our early development progress on Provo Bay and house commercial and residential development zones. Maintaining the compromise elevation greatly stabilizes the littoral zone in Provo Bay which optimizes the ecosystem and hatchery as excellent intermediate holding area for all species recovered within Provo Bay.

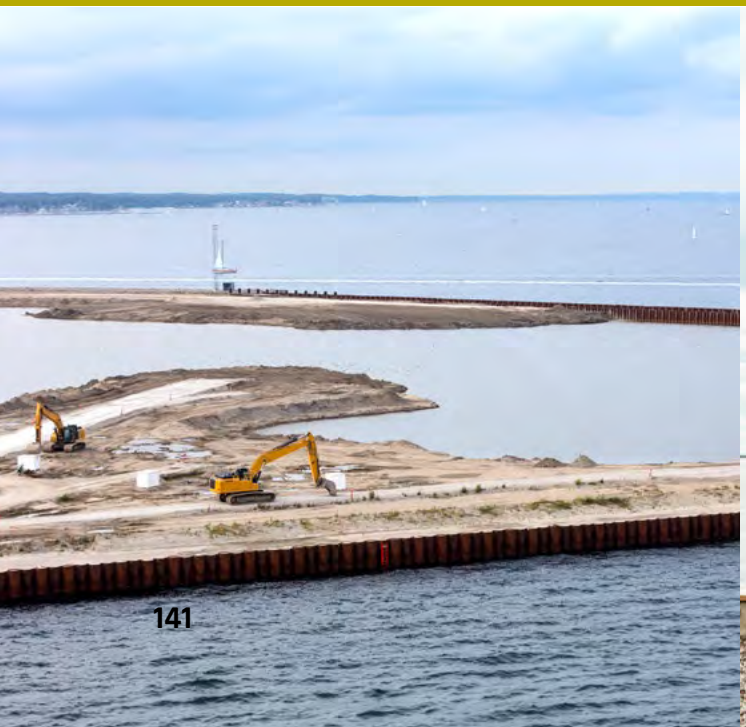
A PROJECT WORTH THE EFFORT

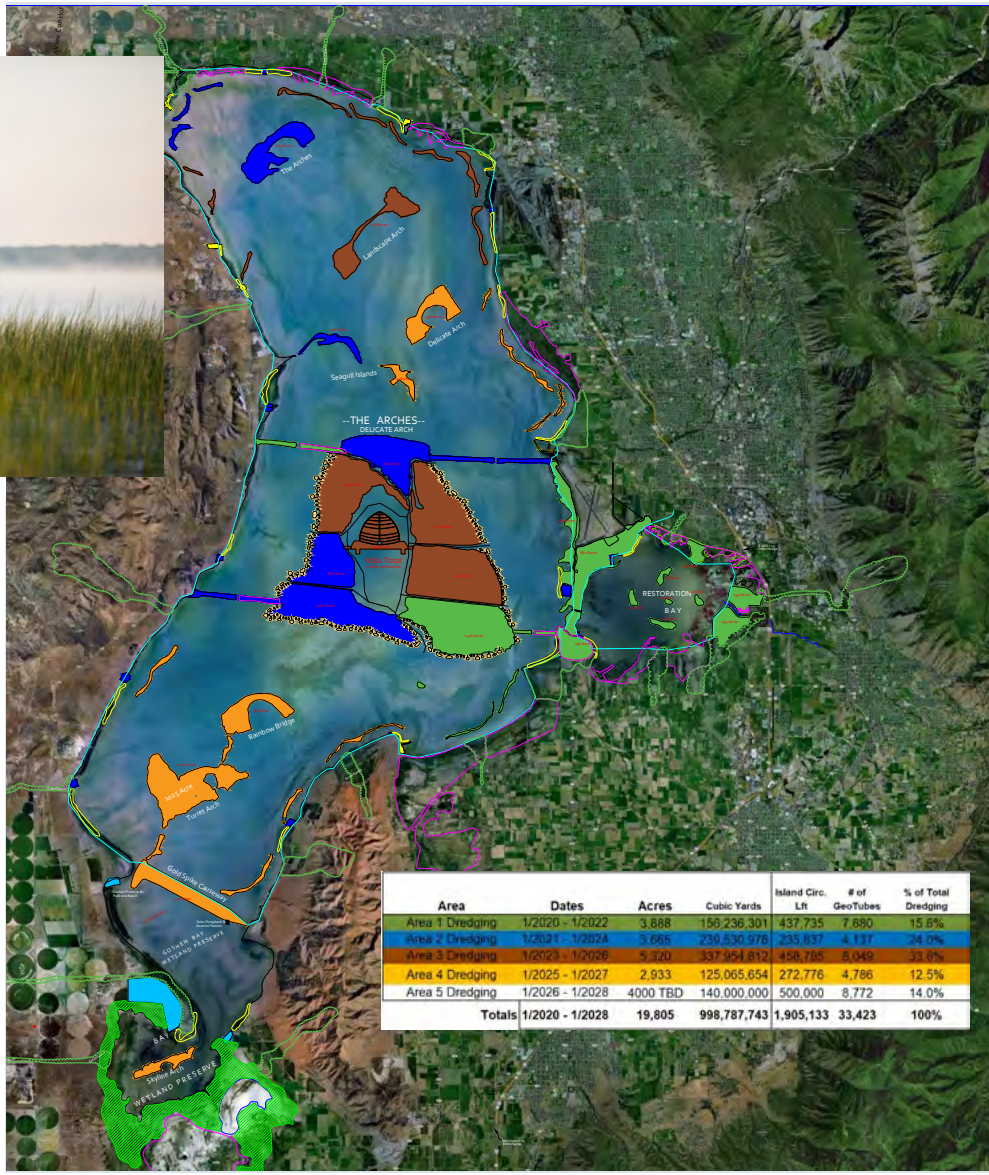
Considering the size, location, and ecological importance of Utah Lake, the promise of comprehensive restoration is an objective worthy of such monumental collaboration and investment by the State of Utah and its citizens. It will provide a vibrant crown jewel of waterfront living adding to the already tremendous natural wonders of Utah.

IMPLEMENTATION

DREDGING AND ISLAND CREATION

Dredging Utah Lake and forming islands provide the foundation for restoring the entire lake ecosystem.





Area	Dates	Acres	Cubic Yards	Island Circ. Lft	# of GeoTubes	% of Total Dredging
Area 1 Dredging	1/2020 - 1/2022	3,888	156,236,301	437,735	7,680	15.6%
Area 2 Dredging	1/2021 - 1/2024	3,665	230,530,978	235,837	4,137	24.0%
Area 3 Dredging	1/2023 - 1/2026	5,320	337,954,812	459,795	8,049	33.6%
Area 4 Dredging	1/2025 - 1/2027	2,933	125,065,654	272,776	4,786	12.5%
Area 5 Dredging	1/2026 - 1/2028	4000 TBD	140,000,000	500,000	8,772	14.0%
Totals	1/2020 - 1/2028	19,805	998,787,743	1,905,133	33,423	100%

Dredging of Utah Lake and formation of islands will provide an important foundation to the restoration of Utah Lake. As discussed in the conservation solutions section of the proposal, there is extensive modeling, engineering, and design involved with the resulting lake bottom bathymetry, island shape and placement, and desired improvements to wind and wave action, lake circulation, water quality improvements, and conservation benefits.

The conservation benefits of dredging and island creation have previously been discussed on pages 35-46. This section will outline the operational execution of phase II, including implementation of the following infrastructure improvements:

- Mapping natural springs in the lakebed
- Dredging the Lake
- Forming estuary, recreation, and development islands
- Mechanical compaction
- Planting littoral and riparian zones, including on estuary islands
- Installing lake aeration systems
- Installing lake biofiltration systems
- Rehabilitating the lake shoreline
- Completing a lake trail system
- Installing public beaches

SPRING MAPPING

Natural springs occur in Utah Lake through fissures and rock splits under the Lake. These springs represent a vital clean-water resource, and will be mapped, studied, and responsibly managed as part of the Utah Lake Restoration Project implementation. One well-known spring is in the northern region of Utah Lake,

west of the Provo river inlet. This spring forms a deeper water channel in the lakebed which is approximately 60 feet deep and is responsible for up to 6% of the water ingress to the Lake annually. Prior to dredging, the Lake Restoration Solutions team will map the springs on Utah Lake by sampling and studying the lake bottom. Water samples will be taken and tested for pH and water quality. Additionally, volume of discharge will be determined.

Many springs in the region are of a seasonal nature with flows directly correlating to the snow pack volume and resulting spring runoff. In each of these cases, further hydrology and engineering studies including cost-benefit and environmental analysis would be required to ascertain the best use of each spring. Capping and piping sub-surface water springs may be considered if the aquifer and water pressure are of a consistent magnitude through the year. Location, flows, water quality, and other data collected will be shared with relevant State of Utah agencies. The springs are not considered as a primary water source for the island residential or commercial development. Rather, springs will be monitored for potential impacts to water quality, water movement, construction of islands, lake bathymetry, water circulation, and overall conservation planning.

Possible uses of spring water include the following:

- Larger springs may be piped to the surface of islands and circulated through water features on the islands
- Springs could be piped into water storage tanks on recreational islands for use as potable water
- Captured spring water from the lake bottom can be utilized in engineering designs to further increase lake circulation and oxygenation

A possible scenario that will be analyzed as part of dredging modeling and design will be the role of springs with lake bathymetry and circulation. We will also analyze the impacts of springs on island design

and creation. Surface spring development will largely be predicated on the location of the spring. If a significant spring were located under a major island development, the water would be brought to the surface by driving a steel sleeve and pouring a concrete jacket around the spring, and installing an adequately sized HDPE nipple and piping. For such an effort, specialty divers would be sourced to bring in proper equipment, such as diving bells, to competently sleeve and pipe the spring water to the surface.

Such efforts would likely be needed if the spring poses a risk to the structural integrity of the island being constructed. We do not anticipate capping or plugging any sub-surface spring with dredge waste material, and the quality assurance/quality control ("QA/QC") program for dredging will ensure that this does not happen. Doing so would create a risk of increased aquifer pressure that could result in erosion of the structural fill, compromising the integrity of the island.

Mapping and studying naturally occurring springs is an important first step in Phase II of project implementation, and monitoring for new springs will continue during lake dredging, to ensure that these valuable water resources are responsibly utilized and contribute to improved conservation on Utah Lake.

DREDGING

During the EIS Approval stage (18-36 Months), the Utah Lake Restoration Project team will collect 520 Vibro Core Samples on the lake bottom at a minimum of 20 feet to measure existing conditions and develop data for dredging type and selection. Also a minimum of 12 deep-core drilling locations (200 Ft +) will be mapped to ascertain soil characteristics on the main development Islands where significant construction will take place.

All drill samples retracted during drilling will be analyzed for material classification and sieve analysis. All samples will be stored in core boxes and retained for the record and future scientific analysis. Using 3D modeling the Lake Restoration Solutions engineering team will create a map of the top 15 feet of sediment over the entire lake bottom. All core samples will be used by geotechnical engineers, including equipment types and volume estimates of fill types to develop the dredging plan and as required for island development.

CORE SAMPLES

Collecting core samples on the lake bottom will measure existing conditions and inform the dredging plan.

Mapping the location of rock, sand, clay, gravel, calcite and other types of soil is critical to the execution and deposition of materials during dredging, ultimately optimizing dredging and island construction.

Dredgers will all be computerized with the latest GPS and monitoring technologies so that during daily dredging operation dredging plan with GPS coordinates will display on the operator's screen and give the operator locational awareness and specific daily dredging goals. This same system will play a vital role in providing up-to-the-minute details on dredge location, pump volumes, and final quantities which will help planners plan the daily and even hourly dredging plans. All these functions will be specifically designed to ensure removal and encapsulation of fine sediments, removal of nutrient loaded sediments, deepening of the Lake, contouring of the lake bottom, creation of deep-water channels, and creation of the desired lake bathymetry.

Current estimates suggest that a fleet of 55-60 dredgers working 20 hours a day, 6 days per week will be required to complete all dredging within 8 years. The initial schedule includes two months in the winter when dredging works will likely be suspended. During the winter all dredging, pumping and heavy equipment will be processed through a detailed preventive maintenance program to provide reliable equipment readiness in the spring.

The depth of dredging will vary in different parts of the Lake based on data gleaned from core samples and on specified engineering designs. Some areas may be dredged by as little as 18 inches, while other areas may be dredged up to 90 feet to create deep-water channels. Our current engineering designs suggest that to deepen the Lake to the desired levels, upwards of one billion cubic meters of material will be dredged from the bottom of Utah Lake as part of this project. Studies, engineering, and implementation schedules will continue to be fine-tuned throughout the course of the project to ensure desired engineering and conservation outcomes.

ISLAND CREATION

Creating islands involves the following:

- Outlining island shapes with geotubes
- Infilling island outlines with engineered dredge material mixtures
- Contouring the island for natural appearance
- Compacting and dewatering the soil with dynamic compaction machines
- Completing the shoreline with riprap, sand, gravels, and soft short plants

ISLAND CREATION

Creating islands to dot the lake achieves critical ecological objectives

ISLAND OUTLINE

Initial dredging will gather and encapsulate the fine sediments from the top 12 inches of lake bottom, placing them into geofabric socks also known as geotubes. Geotubes are used to encapsulate, consolidate, and compress fine sediment.

The practice of encapsulation or capping has proven an effective method to mitigate fine sediments while adding structural integrity to the material below and above the geotubes. The geotubes that will be placed throughout Utah Lake will be used to create the outline shape of islands and are an approved technology of the Army Corps of Engineers.

Geotubes are designed to allow water to seep out of the tube, yet retain the sediments. The solids can be effectively encapsulated in a series of HDPE Socks which contribute to the structural capacity of the islands.

Once in place and filled with the finer particulate matter, these tubes will be placed by GPS per the design specification and oriented to be secured to the bottom of the Lake and to each other. The annular configuration of geotubes holds dredged material comprising the island core and above-grade structures. Initial designs indicate that islands outline will create 190 miles of island shoreline. 33,423 total tubes will be needed to create these island perimeters.

ISLAND INFILL

Once the outline of the island is completed with placed geotubes filled with sequestered dredge sediments, dredgers will infill the inside of the island with an engineered mixture of dredged materials. Lake Restoration Solutions Engineering Team will use the Vibro core samples from different areas of the lakebed,

Geotextile tube solution provided by Infrastructure Alternatives, Inc. demonstrating fine sediment encapsulation. See iaiwater.com for more information.

to determine the ideal mixture of materials to achieve desired compressive strengths. If needed, materials will be trucked in from nearby gravel mines to supplement lakebed materials. The Utah Lake Restoration Team has experience working with far less ideal substrates, including low viscosity clay, mud, sand, and other challenging soils, to create islands and other sizable infrastructure projects.

With correct soil engineering, draining, and compaction, the materials in Utah Lake are suitable for island creation and development. The final weights and heights of building will be engineered based on stability of soils and use of engineered foundation technologies.

ISLAND CONTOURING

Once island infill is completed, a long reach backhoe will dig out and berm up dredged materials around the island so another infill layer can be dredged by approximately a 4 foot to 8 foot depth. Infill of diking will be used to raise the level of the islands to desired elevation, this could reach elevations of more than 100ft on some parts of recreation islands.

Diking and infill can be utilized on any part of the islands to create desired natural contours. Once all material has been added to the island, final contouring and grading can be implemented before dynamic compaction machines compact the islands.

The islands in the Utah Lake Restoration Project are each uniquely designed in both shape and contour to meet a number of objectives, including the following: controlling wind and wave action, creating aesthetically pleasing and natural appearing islands, creating premier lakefront living opportunities, and maximizing recreation and tourism opportunities.

Completing the shoreline

A final step of island creation is completing the shoreline. The Utah Lake Restoration Project will use a variety of materials to cover the geotubes and give a natural appearance and provide variety and beauty.

As with nearly all aspects of the Project, the shoreline will be purposefully engineered to meet other functional conservation objectives. The geotubes are critical to the structural integrity of the islands and the shoreline coverings will provide protection so the tubes are not exposed to the elements. Some shorelines are more prone to exposure to wind and wave action and powerful ice flows. These elements can be mitigated by the use of estuary islands to protect residential and public spaces, and using riprap stone in strategic locations will further protect shorelines from erosive elements.

Soil compaction and dewatering

The structural capacity of islands will be engineered and designed using a combination of Geotube Synthetic Membrane[1], rip-rap stone for breakwater and engineered fill.

All considerations for full compliance to the Uniform Building Code, Utah County Seismic Zone[2], and Army Corps of Engineering standards will

[1] See TenCate Geosynthetic web site; www.geotube.com
[2] See Uniform Building Code 20XX, section page and Paragraph

PVD drain solution provided by Geosynthetic Solutions demonstrating soil dewatering and compaction. See ceteau.com for more information.

be mandatory. Construction compliance will also address needs including: seismic zones, liquefaction, wind and wave erosion, and foundation support. Engineering and geotechnical studies will be addressed in the final design phase prior to any structure development.

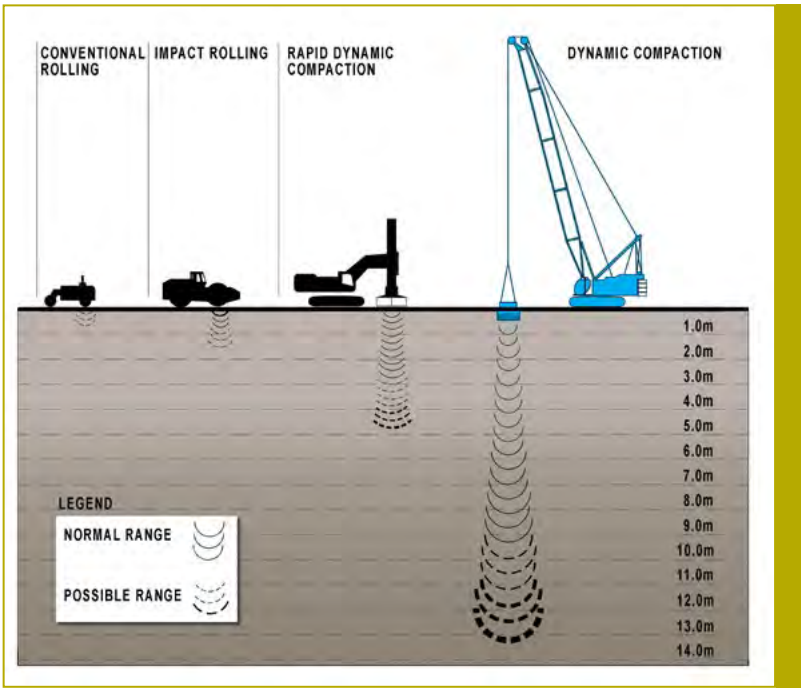
Key information to establish soils loading capacity of the proposed islands and viability of the structures will be ascertained following early preliminary boring logs and analyzing the material produced by dredging the Lake. Soil boring to depths up to 200 feet will determine the substrate topography in critical sections of the Lake. All soil boring samples will be evaluated by a licensed soils laboratory and by the Utah Lake Restoration Project engineering team. Records of all findings will be on file for audit purposes by an authorized third party to confirm findings, core sample locations, sediment gradation, geology and summary reporting content.

Structural capacity will be developed over time utilizing a number of methodologies including:

- Moisture wicking HDPE products to accelerate drainage of dredged materials
- HDPE screened fabric to retain sediment and anchor fill areas to the lake bottom
- Micro Piling, auger cast piling, H Piling, tapered screw piles, and soil piles may be utilized to optimize building foundations during construction
- Detent time drainage compaction, dynamic compaction equipment, sheep's foot compaction, vibrating plate, and heavy equipment may be utilized to optimize soil bearing capacity on all structural islands
- Soil bearing capacity and soils classification will be confirmed by conducting on site load testing and reporting results through the Quality Assurance/Quality Control (the "QA/QC") program

Compaction of dredged material is a key engineering deliverable for the Lake Restoration Solutions team. Numerous compaction methodologies are likely to be required to provide the structural capacity for commercial, multi-level structures, light industrial and residential project development.

Ground settlement, bearing capacity, liquefaction, soil heaving, moisture wicking, and substrate shear response are factors that will be remediated as compaction on the Arches Islands is completed prior to structure construction. This portion of the project is considered high-value and will be controlled using the Lake Restoration Solutions Engineering Team and QA/QC Execution Plan under the Soils Engineering organization. All findings, test results, construction reports, compaction reports, daily field reporting, soils laboratory findings, and summary reports will be retained for subsequent scientific evaluation. Critical reviews by outside third-party soils engineering professionals will be provided for verification throughout project execution.



Initial delivery of the dredged soils area on any given island being prepared for continued construction will require a separate execution plan and QA/QC plan based on construction type to follow.

The team will drain or dewater the dredged materials using a Geo Synthetic, Premanufactured Vertical Drain (PVD).

PVD media is effectively a perforated tough high-density polyethylene ("HDPE") membrane which is driven into the ground vertically at a spacing determined by soils type.

For example, sandy to granular fill areas may be one meter square pattern, with anchor drains extending to the bottom of the loose fill deposited by dredging. This may be approximately 30-40 feet of fill on Lake islands. Installation of the PVD membrane at the spacing required will optimize the timeline to allow subsequent compaction and construction 9-12 months earlier than dredged material drained using overburden alone.

Various soil compaction methodologies will be used in the project, depending on the final structures to be built and subject to actual conditions and engineering studies. Compaction methodologies will include dynamic compaction utilizing a steel impact weight weighing 15 to 25 tons. Crawler cranes drop the impact weight from a specific height and specified spacing pattern. Dynamic compaction is used to result in competent compaction depths from 30-40 feet deep depending on soil type.

Rapid Dynamic Compaction ("RDC") method is achieved by using a large excavator and a hydraulically driven, steel weight compression foot, providing effective soil densification, dewatering and compaction to 5 meters deep. The pattern for the RDC phase is integrated to the dynamic compaction plan by impact location tracked by GPS and recorded in the daily machine log.

Impact rolling is achieved by using scraper and triangular impact rollers to cover the entire surface area of the improved construction pad. This compaction methodology requires increasing of the moisture content and water trucks are utilized to maintain optimum moisture content. Effective depth of this methodology is two meters deep.

Vibration compaction equipment is used to provide final ironing of the surface area. Equipment used in this phase of construction include: Sheep's foot rollers, smooth drum rollers, D-8 bulldozers, graders and water trucks. This phase that provides final density and compaction suitable for construct to follow.

The Lake Restoration Solutions team will develop a unique execution plan following the soils engineering data collected during dredging. The

dissemination and end usage of this data, whether residential, commercial, parks, or industrial, will predicate the methodology required for compaction type(s),

Under all execution plans, the equipment will provide on board monitoring / recording devices providing a constant record of all parameters required by the execution and QA/QC plans.

COMPACTION QA/QC PROCESSES

Through the compaction process, numerous methodologies are required at staged intervals during compaction to achieve competent, recordable and conclusive QA/QC test results. Only through stringent execution of the QA/QC program are the compaction results provided to yield conclusive risk mitigation and competent soils capacity for construction to proceed. Compaction testing will be achieved with multiple testing methods:

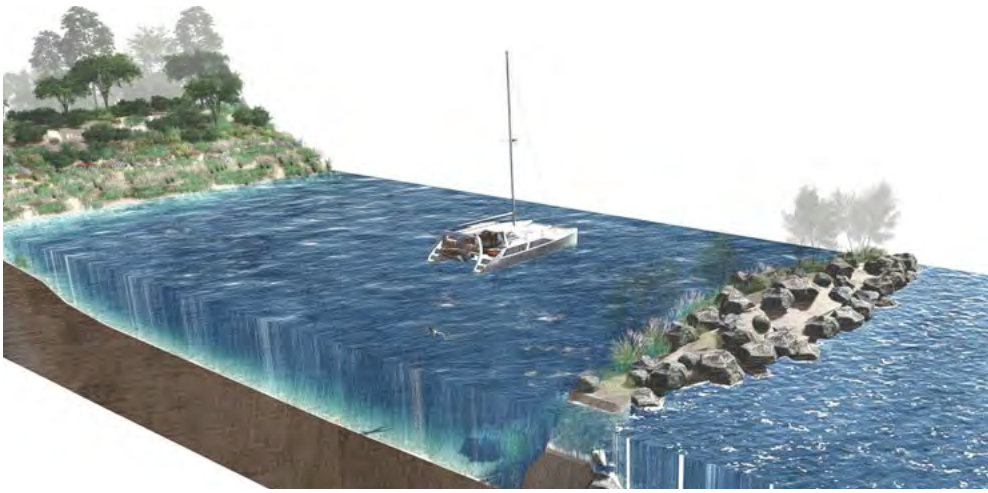
- Dynamic compaction testing is achieved with the use of vibration measurement devices, i.e. Nomis type devices, which measures soil heave and water responses during dynamic compaction.
- Other area compaction results are achieved in large areas by utilizing a Geomil Cone Penetration Testing ("CPT") mounted density analyzer which samples individual points in the field, given the spacing GPS locations, and drives to each in sequence, jacks itself up to penetrate density testing equipment into the filled area.
- The results from the CPT trucks are all logged and tracked for review and filed at the end of each shift. Any rework and compaction density non-compliant to the QA/QC plan for a given area are communicated in real time to allow remediation or alter the DC work pattern to yield the desired results as the monitoring work progresses.
- Execution philosophy for compaction and QA/QC of soils work will be unique for each Island development plan to "improve for use" quality standards.
  - The deposition of initial dredged material will be reviewed from the initial deposition logs to provide data for the execution plan and subsequent QA/QC Plan.
  - Plans are altered to provide the best soils bearing capacity for the type of construction planned in each area; Roads and Bridges, High and Low Traffic, Residential Commercial, Hi-Rise or Open Park Areas.

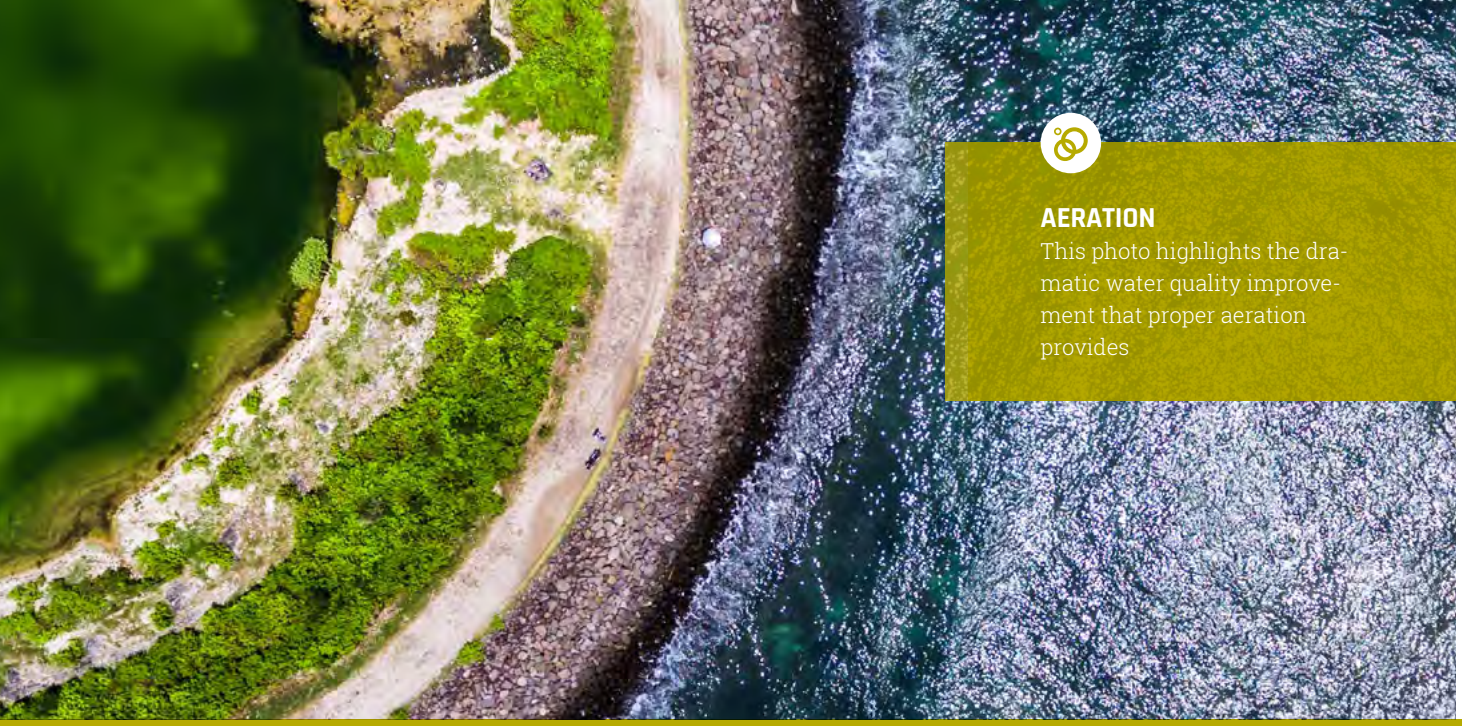
ESTUARY/BARRIER ISLANDS

Like other islands being created by the Utah Lake Restoration Project, estuary/barrier islands have been 3D modeled to provide key conservation outcomes. Estuary islands will also be formed out of sediment filled geotubes and then infilled with dredged sediments.

Estuary islands have been computer modeled and are being strategically placed to provide wind and wave shelter to the main shorelines and to give light recreationists (canoes, kayaks, paddleboards) shelter during wind events and to provide spots for these non-powered recreationists entry around most of the Lake.

The locations of the estuary islands in conjunction with placed large boulders that will populate the windward side of these islands will break up spring ice flows and large waves to protect the new littoral zone planted on the main shorelines of the Lake.





AERATION
This photo highlights the dramatic water quality improvement that proper aeration provides

IMPLEMENTATION

WATER QUALITY UPGRADES

The Utah Lake Restoration Project includes important water quality improvements

An important objective of the Utah Lake Restoration Project is restoring the Lake to a clear-water state. These efforts will improve the water quality and address sources of dangerous algal blooms. Project improvements to improve the lake's water quality include:

1. Removal and encapsulation of nutrient loaded sediments through dredging and island creation (see pages 35-46)
2. Controlling wind and wave action (see pages 47-52)
3. Removal of carp and invasive species (see pages 67-72 and 81-90)
4. Upgrades to waste water treatment facilities;
5. Installation of lake aeration systems;
6. Installation of biofiltration systems; and
7. Restoration of native plants and aquatic species.

The following section discusses important implementation of water quality improvements.

UPGRADING OF SEWAGE TREATMENT PLANTS

The Project will fund upgrades to all sewage treatment facilities surrounding Utah Lake. As discussed in "Water Quality" on pages 53-66, treated water from surrounding waste treatment facilities is the primary source from which nitrogen and phosphorous are being loaded into the Lake.

The Utah Lake Restoration Project will fund improvements to six waste treatment facilities for nitrogen and phosphorous removal. These efforts will be coordinated with water managers to initiate upgrade to their facilities. Our engineering and environmental teams will work with city engineers to provide current discharge data, subsequent engineering, system requirements, and implementation plans.

As the capital funds will be provided by the Utah Lake

UTAH COUNTY (TIER 1N) WASTEWATER TREATMENT PLANTS UPGRADES

Total Phosphorus 0.1 mg/L, Total Nitrogen 10 mg/L

Wastewater Treatment Plants	Capacity MGD	Est. Cost Upgrade	Cost per MGD
Timpanogos (TSSD)	30.000	$50,750,000	$1.69
Orem Waste Water Treat	14.000	$31,500,000	$2.25
Provo Waste Water Treat	21.000	$39,900,000	$1.90
Springville Waste Water Treat	7.700	$20,020,000	$2.60
Spanish Fork Waste Water Treat	4.900	$12,740,000	$2.60
Payson Waste Water Treat	3.000	$7,800,000	$2.60
	TOTAL COST	$162,710,000	$2.27

The cost estimates for these upgrades were taken from two studies:

- UDWQ POTW Nutrient Removal Cost Impact Study: Analysis of Timpanogos Wastewater Treatment Plant, CH2MHILL Sept 2010
- Cost Estimate of Phosphorus Removal at Wastewater Treatment Plants, Ohio EPA/Tetra Tech 2013

Restoration Project, our team will have significant input into project controls, engineering, and cost controls for upgrades to these facilities. As each city has full operational and maintenance responsibility for their respective facility, significant coordination with the city operations and engineering teams will be required for scheduling, operating systems, testing, commissioning, and turn over of upgrade operations.

The upgrade estimates are provided in the table below and will be included in the Utah Lake Restoration Project budget. Waste treatment facilities will be upgraded to a EPA Tier-1N standard which will limit outfall to 0.1mg/liter total phosphorus and 10mg/liter total nitrogen. These levels of reduction will be required to maintain and repair Utah Lake, effectively eliminating future algae blooms.

In the past, upgrades to treatment facilities have been opposed by water users due to concerns regarding the dramatic increase of costs to water users. If the capital cost for these improvements were born by the water districts, the typical water user would experience an average 48.2% increase. Because the upgrades will be paid for by the Utah Lake Restoration Project, water districts and their users will only be responsible for the ongoing maintenance of these improvements. The typical water user will only have an approximate 40-50 cent increase per month to cover the ongoing maintenance costs.

FILTERING TECHNOLOGY UPGRADES

These upgrades will be designed to specifically meet or exceed the EPA suggested standards of 0.1 mg/L for total phosphorous and 10mg/L for total nitrogen. The upgrades will utilize innovative new filtering technologies. These technologies rely on two processes for phosphorous removal at waste treatment facilities:

1. Enhanced Biological Phosphorous Removal (EBPR) which involves removal of biological uptake by biological organisms
2. Chemical Precipitation (polishing) which involves chemical addition of aluminum or iron based coagulants

Typically, EBPR is used to remove the bulk of the phosphorous. Chemical polishing follows to further reduce phosphorous levels and achieve the desired effluent concentrations. This combined approach is called EBPR+C. These nitrogen and phosphorous filtering technologies are provided by a number of companies including Nexom, Parkson Corporation, and US Filter Corporation.

Two-stage and three-stage EBPR+C filtration systems have consistently produced final effluent of phosphorous to levels near or below 0.01 mg/l, far outperforming the EPA suggested standards.

At these levels, nitrogen and other nutrients can be sustainably maintained through normal biological processes on a restored Utah Lake.

LAKE AERATION SYSTEMS

The most common method for aeration of Utah Lake will utilize sub-surface micro ceramic diffusers which will be supplied by remote compressors connected by heavy-duty small-diameter pipelines.

In later development phases during the construction of commercial properties on the islands, large above-water fountains will add architectural presence in waterways that will provide the similar aeration effects on the water column of island waterways.

Early construction efforts to introduce aeration to the Lake will start with compressors housed at infrastructure facilities, such as ranger stations or restroom facilities, on the lake trail network around the circumference of the Lake. Compressors will have power readily available at those locations, providing a logical location for equipment installation and maintenance as well as security.

Trenching to the lake edge will be required by a small gauge chain trencher and utilizing HDPE continuous roll piping from 1' to 1-1/4" diameter. From the edge of the Lake, a transition to weighted piping will be utilized for 100 yards up to 2 miles long. Pipe will route along the bottom of the Lake before terminating at a series of ceramic aeration diffusers which discharge micro bubbles of air from the bottom of the Lake.[1] As the bubbles rise through the depths of the Lake, they naturally expand, thus creating movement of solids, suspended waste, and water. This improves site-specific water circulation and water quality improvements, while also oxygenating the water.

As the project progresses, additional filtration compressors and diffusers will be engaged utilizing solar-powered motors to drive the compressors housed on recreational or special-built estuary islands. This sustained long-term approach will enhance lake clarity, oxygen levels, to improve the lake's ecosystem.

In maintaining the environmental execution philosophies of the Utah Lake Restoration Project execution, the materials used in providing the aeration effort to the Lake will be of the highest energy efficiency and piping systems will be selected to maintain environmentally safe practices.

The engineering team will specify brushless DC (BLDC) motors, which incorporate permanent magnets to generate little secondary loss from the rotor. Up to 23% less energy consumption is spent using a brushless DC magnetic rotor compared to the AC counterpart. This adds reliability and efficiency with reduced maintenance costs.

Brushless DC motor systems will be controlled with electronic-input control. The driver can be connected directly to a programmable controller. This allows the use of Supervisory Control and Data Acquisition (SCADA) technology providing continuous remote sampling, monitoring and control of the entire aeration system.

In summary, the effects of aeration across the Lake, combined with reliable equipment and long life ceramic diffusers combined with remote system monitoring, sampling and controls will result in a highly efficient system.

[1]Diffuser placement will be designed and placed in strategic locations, many will be placed along the deepest parts of the channels to help mix water and to create currents.

BIOFILTRATION SYSTEMS

As previously discussed, the Utah Lake Restoration Project will utilize biofiltration technology to help restore water quality in Utah Lake and to restore a more balanced lake ecosystem. The plan contemplates placement of approximately forty biofilter pumping stations across the Lake and on the islands. These systems pump water onto constructed streambeds in areas surrounding the Lake or on the islands of Utah Lake. Each of these pumping stations will process up to 250,000 gallons per hour. As the water flows through these specially-designed rivers, filtration media, gravels, plants and aquatic life purify the water, balancing nutrient and acidity levels and oxygenating the water before it is returned to the main body of Utah Lake. These systems will appear as natural streams coming out of rocks and running for ¼ to ½ mile before returning to the Lake. These systems will be installed during Phase II of the Utah Lake Restoration Project implementation. Further discussion of these biofiltration systems is included on pages 59-62.

IMPLEMENTATION

RESTORING NATIVE PLANT AND FISH COMMUNTIES

Removing invasive species from Utah Lake will provide a clean slate for restoring native plant and fish communities

Invasive plant and fish species compete against the native species and their removal is a key component of The Utah Lake Restoration Project. The following sections describe the process through which the invasive species will be eradicated and native species will be restored and protected.

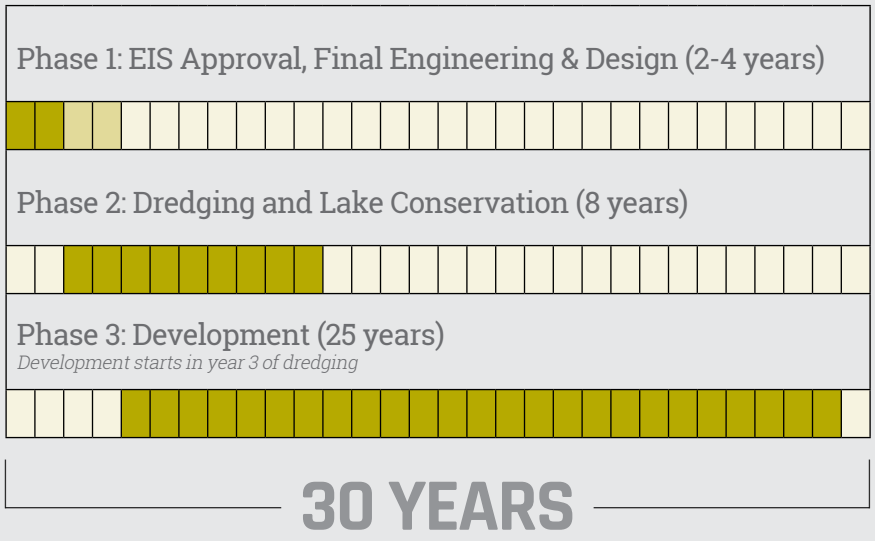
INVASIVE PLANT SPECIES ERADICATION

Invasive plant species surrounding the lake shore and lower river channels are primarily Phragmites, Tamarisks, and Russian Olive. These plants negatively impact the native environment and consuming huge quantities of water. Eradicating Phragmites, Tamarisks, and Russian Olive from Utah Lake is an important part of the restoration efforts.

Phragmites has expanded to the point that it covers a significant portion of Utah Lake's shores. Phragmites consume many times the amount of water of native Cattails and crowd out native species. The Utah Lake Restoration Project will eliminate Phragmites from Utah Lake and its surrounding areas. Removal of phragmites will take several seasons and may require ongoing maintenance to ensure new stands do not become re-established. For more information on the importance and benefits of Phragmites removal see "Solutions: Invasive Plant Species Eradication" on pages 67-72.

Tamarisks are another invasive plant species that can choke out and kill other native plants. Tamarisks produce salt laden leaves that drop to the ground and kill native plants and increase salt content in the soil. Tamarisks will be removed from the environs surrounding Utah Lake using the Tamarisk beetle, (Diorhabda carinulata) which consumes the tree leaves. Root

UTAH LAKE RESTORATION PROJECT PHASING



systems and trees will be removed and burned according to best control methodology.

Russian Olive will also be removed from Utah Lake and its surrounding areas. The presence of Russian Olive trees make it extremely difficult to restore native plant communities. Once trees and root systems have been removed, ongoing efforts will be conducted to prevent establishment by monitoring and treatment at the first appearance of new trees. Small infestations on otherwise healthy sites will be treated early, and the goal should be permanent eradication of all trees. Russian olive management requires a long-term commitment that will likely take 3 or more consecutive years of treatment followed by 1 to 2 years of monitoring for regrowth.

REMOVAL OF CARP AND PREDATORY FISH SPECIES

Removal of carp and predatory fish will be among the first steps to ensure successful restoration of littoral plants and native fish species. For several years, the State of Utah has invested significant resources in the removal of common carp through netting. While over three million pounds of carp are removed annually from Utah Lake, it is not realistic to eradicate carp or other predatory species by netting alone. To be effective, Utah Lake will be treated with Rotenone, a non-selective piscicide which has been used to remove undesirable fish in Strawberry Reservoir, Gunlock Reservoir, and other Utah lakes and rivers. Upon placement of netted June sucker in fish hatcheries, Utah Lake will be treated with Rotenone. Timing of the netting and Rotenone treatment of Utah Lake will be vital to minimize or completely avoid any presence of June sucker during treatment.

LITTORAL, EMERGENT, AND RIPARIAN ZONE RESTORATION

The environmental team will manage the placement of the littoral and emergent zones inside Utah Lake with seeds and nursery-generated aqua tierra species indigenous to Utah Lake. Aeration equipment and diffusers will be placed to increase water oxygen content and improve clarity levels.

Project schedule for riparian zone field work will commence during the dredging efforts. Wicking media may be engaged to dewater the dredged material and allow low pressure heavy equipment to shape contours, provide beach access, establish final grades and access for water fowl and people.

As the compaction and final grade is established, the environmental team will place filter fabric fencing to maintain grade and limit run off to Utah Lake while riparian zone planting is established. Much of the riparian zone will be established by utilizing hydro sprayers. The hydro sprayers will propel a pre-selected mixture of indigenous seeds to stabilize the shore lines. The mixture typically will be fully hydrated, fertilized and combined with bedding materials suitable for plants to germinate quickly.

Following the fully germinated and established hydro-seeding the environmental team will be responsible for the addition of suitable indigenous tree and shrub seedlings. These will be introduced by direct planting at densities to allow later thinning based on successful plantings. Volunteer community engagement and K-12 school aged children will have opportunity to engage and become part of the effort.

Scheduled progression of the riparian zone will last the entire dredging duration of 8 years and be progressive as we circle the Lake with estuary islands, recreational islands, trails and beaches. Permanent housing, commercial areas and open park areas will all contain riparian zone construction and environmental efforts.

RE-INTRODUCTION OF NATIVE FISH POPULATIONS

As discussed in "Restoration of Native Fishery" on pages 81-90, restoration of the threatened June sucker, Bonneville cutthroat trout, and several minnow species are included as primary objectives in the Utah Lake Restoration Project.

An important priority is to establish a wild and self-sufficient

population of approximately 50,000 June sucker in Provo Bay. Once healthy and self-sustaining populations of June sucker are confirmed in Provo Bay, systematic netting of Utah Lake will be implemented to capture and protect all possible remaining populations of June sucker from the Lake.

If conducted during spring spawning season, June sucker populations will largely be upstream in Utah Lake tributaries. It is also important to note that during the Provo Bay restoration process, systems will be put in place to ensure June sucker from Utah Lake can continue to utilize tributaries for spawning.

With these high population numbers, supplemental placement of zooplankton in Provo Bay may be necessary from the fish hatchery to adequately sustain these June sucker numbers. Zooplankton bred in the Provo Bay hatchery will be used to feed the June sucker. This will allow hatchery raised June sucker to rely on zooplankton as their natural food source when they are introduced to the wild.

By breeding both zooplankton and June sucker from natural brood stock, the project will be able to restore both native populations to long-term sustainable levels.

Upon completion of dredging, added measures to improve water quality, and littoral zone restoration, Zooplankton populations will quickly return to abundant natural levels. These conditions will also restore other important components of the natural food chain.

With restoration of healthy food sources and healthy littoral zone habitats, minnow species will be reintroduced and can thrive in the Lake. The restoration of healthy minnow and June sucker populations will support the larger native Bonneville cutthroat trout.

As the fish hatchery and nurseries generate various aquatic species, including fish, plants, mollusks, and crayfish, they will begin to be introduced to Provo Bay. This introductory period is critical for the project as a whole to test methods, measure the natural replication rates of all species and adjust production for and be fully prepared for large scale hatchery and nursery facilities to follow.

JUNE SUCKER RECOVERY PROGRAM

The Utah Lake Restoration Project will advance the objectives currently being followed by the "June Sucker Recovery Implementation Program" (JSRIP). Our team will work in tandem with state efforts to see the June sucker flourish again in the Lake. The final goal is to have the June sucker removed from the Endangered Species List.

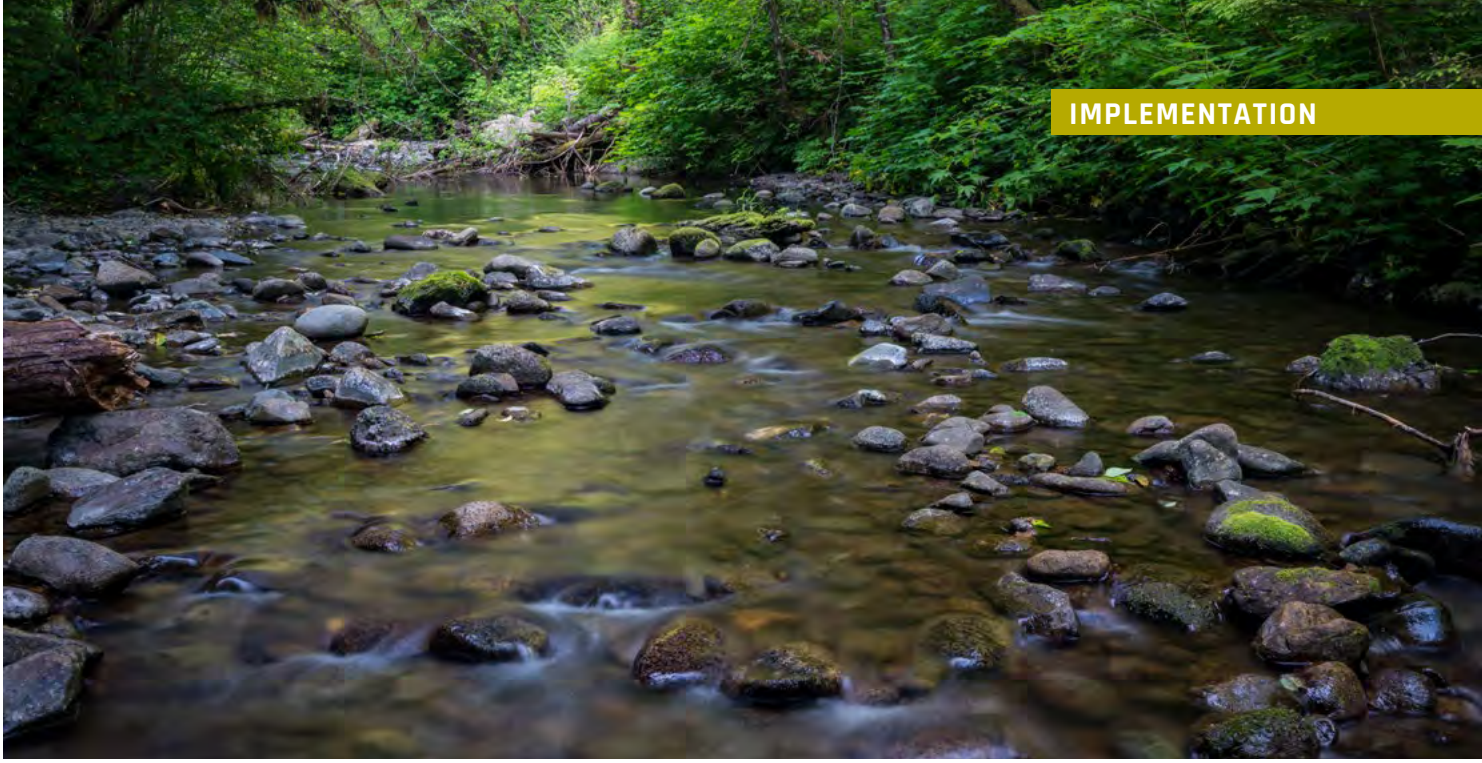
It is important to note the June sucker Recovery Implementation Program (JSRIP) effective efforts to date:

- Treated Red Butte Reservoir and established it for June sucker habitat
- Created a hatchery specifically tailored to June sucker
- Identified and upgraded Hobble Creek for spawning of the June sucker
- Continued efforts to reconstruct the Lower Provo River and the Mid-section of Hobble Creek to provide additional spawning habitat
- Implemented a program to reduce carp numbers in Utah Lake

The Utah Lake Restoration Project plan using netting alone for carp reduction.
As previously discussed, to recover littoral zone, zooplankton, and restore water quality needed to bring back the June sucker, the Utah Lake Restoration Project proposes Rotenone treatment and total eradication of carp from the Utah Lake ecosystem.

Additional project goals that help us further our goals for June sucker include:

- Construction and management of a state-of-the-art fish hatchery
- Restoration of mid-section of Hobble Creek, installing permanent fish transport systems at diversion dams. (Whoosh System)
- Remove diversion dam disturbances on the lower Provo River by using fish transport systems to take fish up and over dams
- Restore lower sections of all major rivers into Utah Lake, improving spawning access.



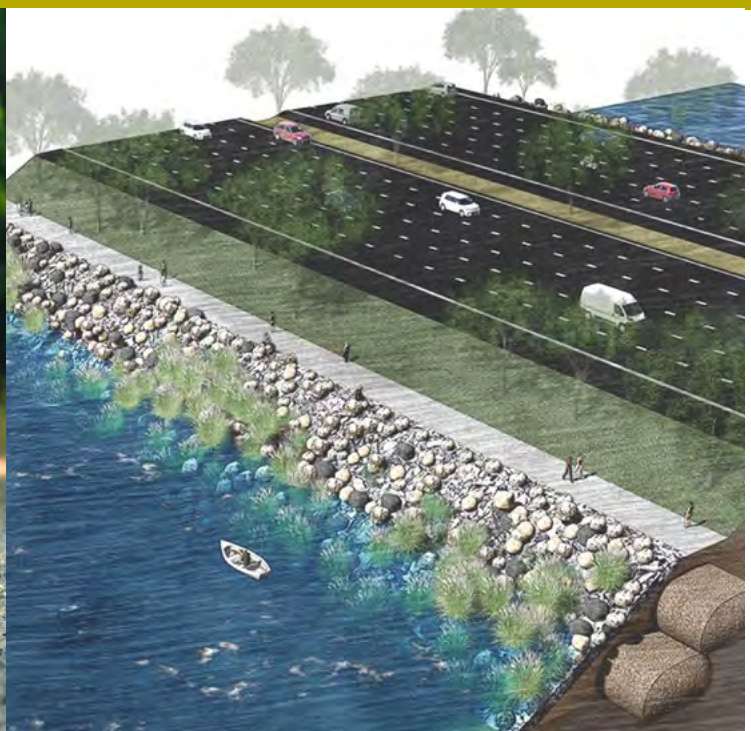
- Work with cities, irrigation companies, county, state, and federal officials to let more water come down the rivers before being pumped out for irrigation
- Remove all non-native fish from Utah Lake and restore the native fishery
- Restore the littoral zone of the Lake which directly affects zooplankton production
- Dredge the Lake to remove 30" of phosphorus and nitrogen loaded sediment
- Increase lake depth and establish natural convection currents to minimize wind turbulence and suspended sediment
- Construct permanent dike structure to control Provo Bay fish discharge to lake during breeding years
- Establish Provo Bay for hatchery and June sucker habitat during Utah Lake treatment
- Dredge the Lake to remove fine sediments reducing TDS in the Lake
- Dredge the Lake and build islands with the sediment to provide additional littoral zones to shelter fishery and improve dissolved oxygen levels in the Lake
- Fund and manage upgrades of all Water Treatment Plants that empty into the Lake to an EPA Tier 1N Level
- Provide biofiltration for all water treatment plant effluent to the Lake
- Provide biofiltration components to farms, ranches and storm water drainage to the Lake
- Improve water quality by improving flow and circulation in the Lake to decrease salinity
- Install aeration and diffusers with continuous monitoring, sampling and control to increase oxygen levels and water clarity.

These upgrades will require billions of dollars and millions of man-hours to accomplish. However, they are the key to restoring the Utah Lake fishery, including the June sucker.

IMPLEMENTATION

SHORELINE

Lake shoreline restoration, public access, trail systems, and public beaches improve public access to and use of the restored lake.



One significant benefit to the public of the Utah Lake Restoration Project is restoration of the lake's shoreline. Currently, Phragmites dominates the vast majority of the lake's 76 mile shoreline, restricting access, choking out native plant species, and degrading the lake's natural ecosystem.

The Project will remove all Phragmites and other invasive species, restore the lake's natural shoreline and ecosystems. In addition, 120 miles of trails will be built to circle the lake and interconnect a network of 12 public beaches around the shoreline. These improvements will allow the public to enjoy Utah Lake and its restored water, wildlife, and ecosystem.

The Utah Lake Restoration Project identifies the requirement to rehabilitate the shorelines from "Compromise Elevation" (defined as the delineation of Privately Owned property and State Owned Property inside the compromise line, lake side.)

The Project will undertake improvement of the Lake by installing filtration fabric at the compromise line and progressively increasing the elevation to provide the lake trail improvements. Design height minimum is 4'-0" above compromise elevation and 2.5" above 1984 flood levels.

The shoreline restoration will provide extensive plantings for the riparian zone adding structural integrity to the shoreline, protecting and stabilizing the toe line on each side of the trail system pathways. The improvement will be similar to a tapered berm or dike wall protecting the property lines of adjacent lake ownership while also providing recreational usage for the trail system around the Lake.

The shoreline rehabilitation construction will commence during the dredging activities where work will take place around the entire lake. Rehabilitation area treatments will be scheduled sufficiently in advance and communicated through web updates for public access. Adjacent landowners will be contacted directly by a project team member.

CURRENT COST ESTIMATES FOR UTAH LAKE RESTORATION PROJECT

$2.2 billion	Dredging 900,000,000 cubic yards of sediment
$357 million	Rock/stone and boulders for islands and lake restoration
$162 million	Water treatment upgrades
$550 million	Studies, science modeling, research, and engineering
$1.2 billion	Provo Bay, tributary restoration, trail system
$900 million	Wetlands, littoral zone restoration, and water circulation
$565 million	Fish hatchery and fish restoration
$500 million	Recreation improvement projects

There will be as many as 12 types of shoreline designs that will be installed as part of the trail system. The Utah Lake Restoration Project team will work with landowners, cities, and the state to identify needs and wants for differing shorelines. Some shoreline sections will require more extensive work while other sections will require less manipulation. Where required, the project will remove invasive species, terraform, and replant with native plants to achieve the best conservation outcomes.

Sections around Provo Bay will require an elevated walkway on piers. As a result, in these areas, elevation changes will occur at the compromise zone. Similar improvements in the south end of the Lake are expected in the wetlands where the causeway construction will facilitate increased elevation to maintain the shoreline's integrity of. Detailed design and scheduled sequencing will be developed during the engineering and construction planning phase following the EIS approval.

The Utah Lake Restoration Project construction team, in collaboration with the Utah Lake Restoration Project environmental team, will coordinate dredging activity to support the lake shore restoration, trails and estuary mass fills. The use of engineered fill, HDPE fabric underlayment, geotube foundation bases and concrete improvements will be developed as required to meet structural challenges

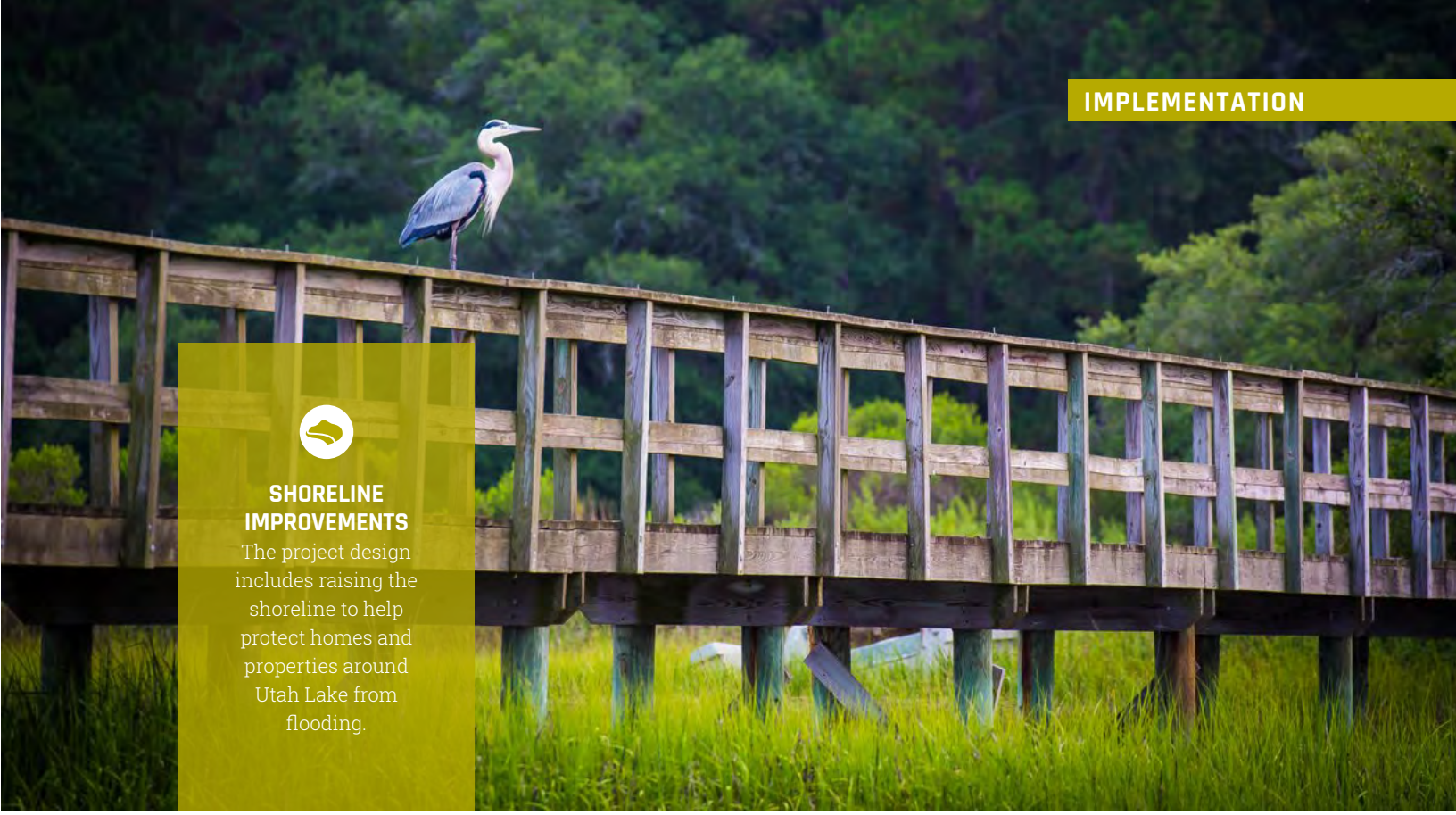
Specialized equipment including, LP (Low Pressure) excavators, shallow water dredging, long reach excavators with low pressure track systems, low pressure bulldozers, and compactors will all be required during construction.

The Team will employ QA/QC efforts to monitor compaction, assure specification requirements, deposition materials, and engineered fill will be consistent during construction.

The restoration of the shoreline from compromise elevation will be similar to the distance of the 120-mile circumference of the Trails Improvements discussed below. With the planned riparian zone, indigenous tree and shrubbery plantings, the structural integrity of the shoreline will be vastly improved during project execution. Aesthetics and ground water filtration at the lake's edge will contribute significantly to the clarity of the lake water as well.

The extension of the Littoral zone on each side of the estuary islands and the trail shoreline will increase the ability of the lake's restoration and clarity significantly. Adjacent property owners will have better utilization of their property for farming or improvements, while the filtration of any hydraulic surcharge on the dike wall will naturally occur through riparian zone filtration.

LAKE TRAILS
120 miles of public trails on the Lake and the causeways will provide a unique recreational and nature-viewing venue.



SHORELINE IMPROVEMENTS
The project design includes raising the shoreline to help protect homes and properties around Utah Lake from flooding.

LAKE TRAIL SYSTEM

A key recreation achievement of the Utah Lake Restoration Project is the installation of 120 miles of trails for public use.

The objective is to provide a unique recreational, exercise, nature-viewing venue which can also support marathon runners, bicyclists, outdoor enthusiasts, and family outings in Utah county.

The Utah Lake trail improvements will be constructed as part of the Utah Lake Restoration Project at no cost to the state or adjacent landowners.

Concurrent with the dredging scheduled in the Lake, work will also commence to develop a Utah Lake Trail system in areas adjacent to dredging work. This trail system will circumnavigate the Lake and provide 120 miles of trails for public use. This includes the entire 76-mile shoreline, lake causeways, and other areas around the Lake.

The trails system will be finished approximately the same time as the lake dredging program is completed. This will also coincide with development of recreational and estuary islands, the wetlands causeway, and other islands provided as part of the Utah Lake Restoration Project.

Completion of other aspects of the project during the dredging activities on the perimeter of Utah Lake will complement the dredging efforts providing substantial material deposition and decant time for dewatering of that material to allow construction of trail improvements as needed.

As material is deposited and drained along the shoreline, the Project will commence installation of over 120-miles of cohesive new trails around the Lake. Trail completion priority will be given to city shoreline areas where residents already reside such as Saratoga Springs, Vineyard, Lehi, Orem, and Provo.

The new Utah Lake trail system will be approximately 14 feet wide in higher use areas and reduced to approximately 8 feet wide in lower use areas. The Utah Lake Restoration Project objective will provide a unique recreational, exercise, nature-viewing opportunity which can also support marathon runners, bicyclists, and families in Utah County.

The adjacent areas to the walkways will be landscaped with indigenous plantings and ground cover and seedlings (aspen, birch, native pines, fir, grasses, and flowers) to be planted in adjacent riparian zones extending from the edge of the trail on both sides.

Main trails will be built on engineered roadways and geotextile layers to provide access to emergency response vehicles without damaging the trail surface. Materials used for the construction of the Utah Lake Trails improvements will be engineered and selected to be long life materials and improvements to minimize maintenance and replacement costs.

Construction materials will include block, brick, concrete, treated timber, engineered placement of aggregate, cementitious earth. Aesthetically pleasing architecture for overpasses, restroom facilities, benches and platforms will also be utilized in the construction of the Trails network.

Trails will offer continuous access along the lake shoreline free of bisecting roadways or intersections. Where trails and roads intersect the trail pathway will construct underpasses for safety and convenience.

The goal of the trail system is to provide unique opportunities for enthusiasts to bike, hike or walk more than 100 miles of continuous trail around the Lake.

Hosting world-class events and a variety of races, e.g. marathons, triathlons, team relay race, etc., could become commonplace around the Lake due to the safe, improved and uninterrupted quality of trails.

Bikers, joggers, and walkers utilizing the trail will find frequent rest areas providing water, shade, seating, native landscaping, and restroom facilities. The Arches team will provide the facilities and other support improvements along the trail every 1-3 miles.

Where the shoreline becomes sensitive to ground construction, such as in wetlands and conservation areas, The Project Team will provide an elevated conservation trail on piers to give unparalleled access to users (exercisers, bird watchers and naturalists alike) utilizing the trail system.

The Main Shoreline Trail will tie into Provo Canyon trail, Jordan River trail, and other city trail systems to give enhanced opportunities to visit and enjoy the Lake without needing a vehicle.

Around the lake perimeter, the Utah Lake Restoration Project will design and construct intermittent parking facilities. At these parking facilities area maps will be posted with point-to-point distances for the visitors to view at the onset of outings, to assist in planning their paths, or coordinate pick up points along the route.

The Utah Lake Restoration team will work with the Utah Lake Commission to communicate with state, local, and public stakeholders with the purpose of updating the public during construction of the Utah Lake trail system.

Numerous segmented "openings" of completed segments of the trail system will be staged during the dredging. The Project Schedule for Dredging and concurrent Trails construction is expected to steadily progress from 2020 – 2027, pending completion of permitting and other approvals.

In summary, the trails system is a key component to the Project proposal, providing a viable and unique outdoor recreational venue for people of all ages to enjoy while significantly improving habitats along, access to, and utilization of the shores of Utah Lake.

PUBLIC BEACHES

Toward the end of dredging, The Utah Lake Restoration Project will start installing public sand beaches around the shoreline of the Lake. Based on the current design, 12 beaches will be created around the shoreline in participating cities for their citizens to enjoy as part of their city park system.

Beaches will be accessible by a short trail from adjacent areas with parking lots and provided access roads. Beaches will also have direct access to the new lake shoreline trail system that circumnavigates the Lake providing unmatched access to biking, jogging, walking, and shoreline sightseeing.

Beaches will extend from the riparian zone into the water for a minimum of 150 feet and will be sloped so that drought and low lake water won't affect the usability of the beach. Public beaches will vary in length from 500 feet to 2000 feet.

Beaches will be constructed by excavating into the shoreline 8 feet and installing a geofabric liner so clay and soil can't penetrate the sand to darken the look or feel of the beach. Eight feet of sand will then be placed on top of the geofabric.

All beaches will be constructed with a specific mixture of graded manufactured sand designed to be resort-rated, i.e. soft on the feet and comfortable to walk, sit, and enjoy. Waiting to install beaches until the latter half of dredging will keep sands clear from clay and bottom resuspension spoilage.

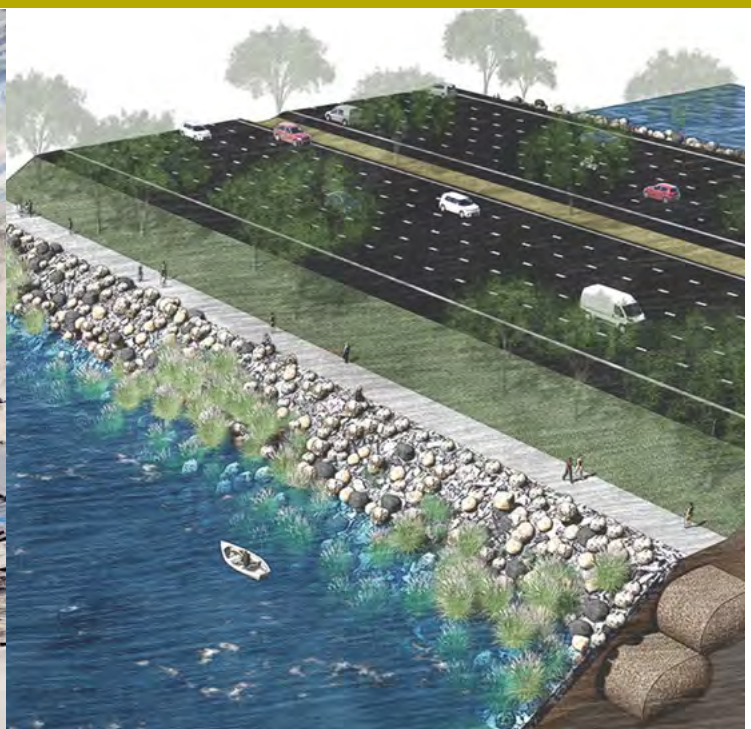
SANDY SHORES

12 beaches will be created around the shoreline for participating cities and for their residents to enjoy.

IMPLEMENTATION

TRANSPORTATION

The Utah Lake Restoration Project includes a comprehensive proposal for alleviating existing and anticipated traffic congestion in Utah County.



1

TRANSPORTATION AND ECOLOGY
Roadway systems are designed to incorporate environmentally engineered solutions to maintain the Lake's pristine nature.

2

ROADWAY DESIGN
Two main causeways anchor the island to both the east and west shorelines and provide ample room for access.

3

MASS TRANSIT ORIENTED
In addition to walkable communities, the project also incorporates forward looking mass and personal mass transit technologies.

The Utah Lake Restoration Project includes a comprehensive proposal for alleviating existing and anticipated traffic congestion in Utah County using new and expanded roadways and mass transit for island residents and visitors. Utah County is already one of the fastest growing metro areas[i] and counties in the USA.

The growth is so rapid that local news is reporting it as a "crisis"[ii]. Population increases in Utah County are expected to continue at a rate of 15,000 families per year. Such rapid increase creates significant traffic strain on highways. Increased fuel consumption, traffic jams, and pollution are some issues expected as more drivers are added to Utah County roads.

ROADWAYS

The Utah Lake Restoration Project will work with UDOT to drastically improve the way traffic flows around Utah County and the Lake, significantly improving the efficiency of transportation circulation for the population on the Lake and in Utah County.

The transportation improvements in the Utah Lake Restoration Project is to create two main causeways across Utah Lake. One causeway will cross the northern portion of the main development island. The second causeway will cross the southern portion of the main development island.

These two causeways will provide east-west access across the Lake. This access will connect I-15 with the Mountain View Corridor and link the communities on the east and west sides of the Lake, eliminating the need to travel around the entire lake to get from one side of the Lake to the other. It will also create potential additional development opportunities.

All roads on the development islands will be paid for by the Utah Lake Restoration Project.

Support at a federal level will assist the state in securing federal funding to complete highway improvements outside of the island development.

UTAH LAKE RESTORATION PROJECT PHASING

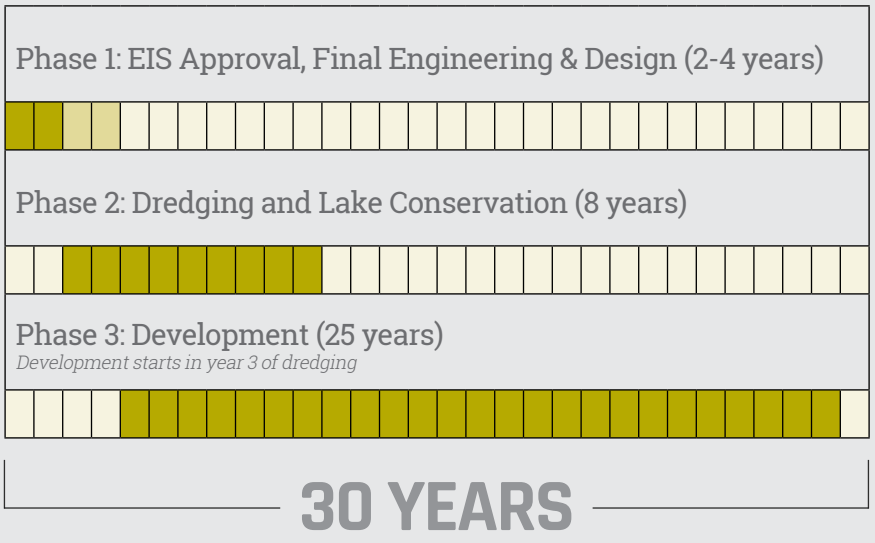


FIGURE III: UTAH LAKE RESTORATION PROJECT CORE TRANSPORTATION IMPROVEMENTS

PROJECT	LOCATION	LANES OF TRAFFIC	FUNDED BY
Mountain View Corridor (MVC)	I-80 (west of airport) along the west side of Salt Lake County and Utah Lake connecting to I-15 south of Payson. MVC will cross Utah Lake via the Golden Spike causeway at the mouth of Goshen Bay.	4 each way + Express lane	Federal and State
Northern Utah Lake Causeway	I-15 interchange at Provo East Bay to the MVC (west of the Lake).	5 each way + Express lane	Federal and State. Utah Lake Restoration Project will install and pay for all highways and roads within the lake boundary proper. This road will have a $1 toll that starts and ends at each Lake shore used for road maintenance and security.
SR-6 Bypass Highway	Spanish Fork Canyon to I-15 Interchange in Springville	3 each way	Federal and State
SR-6 Extension	I-15 Interchange (Springville) to MVC Through Southern Utah Lake Causeway	5 each way + Express lane	Federal and State. Utah Lake Restoration Project will install and pay for all highways and roads within the lake boundary proper. This road will have a $1 toll that starts and ends at each Lake shore used for road maintenance and security.
Pony Expressway Interchange	I-15 (Pleasant Grove) to Eagle Mountain Pony Expressway.	3 lane express-way similar to Pioneer Crossing but with on/off ramps at major intersections. Built as levy with gates and pump stations if required.	State
University Parkway Extension	West University Parkway south to the Northern Utah Lake Causeway freeway	3 Lanes each way built as levy with gates and pump stations if required.	State and City
Redwood Road Upgrade	Bangerter Highway South to Elberta	3 lanes each way with bicycle lanes	State
Provo Bay Causeway	Northern Causeway to Southern Causeway	3 lanes each way similar to State Street Orem	Utah Lake Restoration Project
Provo Bay Extension (West Mountain Expressway)	South continuation of Provo Bay causeway road south along Lincoln Beach and south to MVC	3 lanes each way with bicycle lanes. Built as levy with gates and pump stations if required. Expandable to 3-lane belt-route in future.	State

MASS TRANSIT

In addition to new freeways, the Project will contract with a major mass transit provider to supply mass transit connecting to major UTA bus and rail transportation systems in the Provo/Orem area. This state-of-the-art transportation system will provide all residents and visitors with easy access to transportation, with stations on the main island within a five minutes' walk of any home or business.

Major hotels, businesses, shopping centers, attractions, and event centers on the island will have direct ties to the line in the form of stations to facilitate usage from tourists and residents. A dedicated mass transit line will connect the main island to the Salt Lake International Airport along the MVC easement.

The transportation plan will serve to elevate the traffic strain and subsequent air pollution in Utah County. The execution of this plan will remediate the traffic demands while providing commuters multiple high speed transportation options on all parts of the development.

FACTS

UTAH COUNTY AIR QUALITY

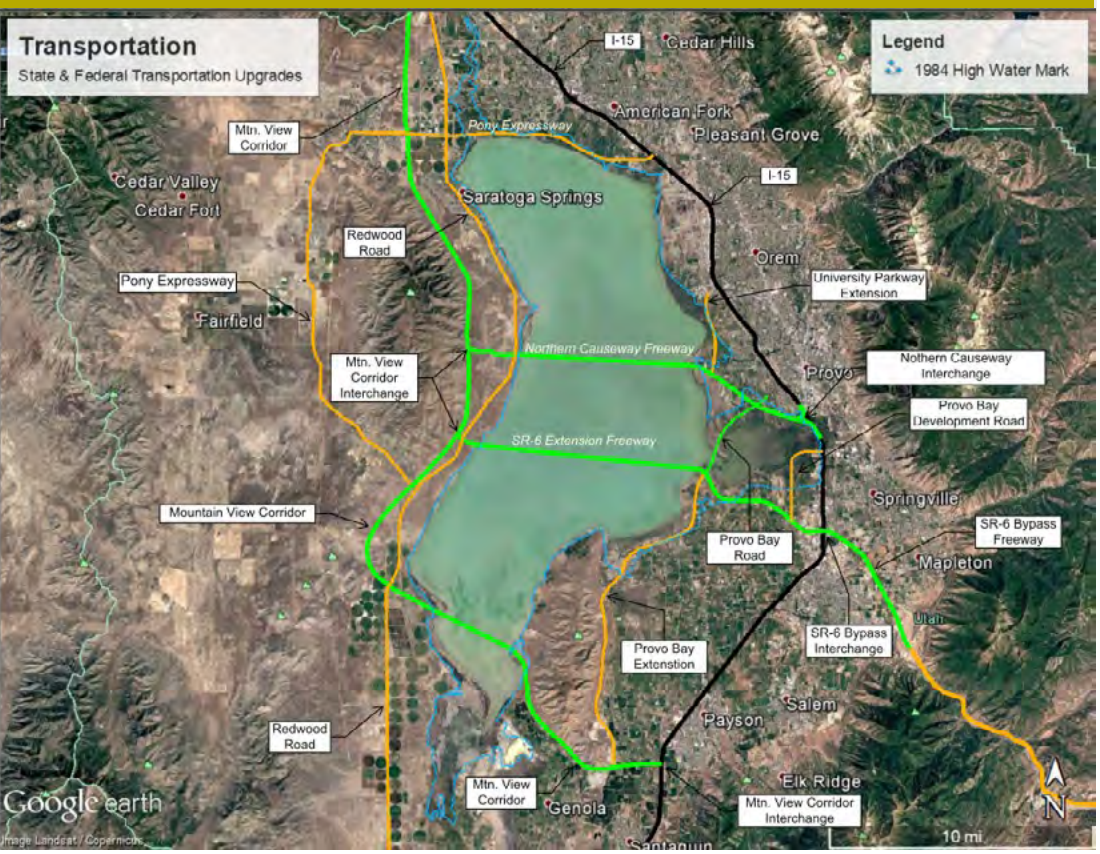
Northern Utah suffers from inversions and air quality issues during calm summer and winter months.

MASS TRANSIT INTEGRATION

To help improve air quality and help citizens we have designed a mass transit-oriented community on development islands.

PRELIMINARY TRANSPORTATION BUILDOUT SCHEDULE

- 2018 Redwood Road construction kickoff
- 2018 Mountain View Corridor construction kickoff
- 2020 Redwood Road expanded to two lanes e.w. from Saratoga Springs to south causeway (west shore)
- 2021 Mountain View Corridor connected to I-80 Salt Lake county
- 2022 SR-6 Completed from Spanish Fork Canyon to I-15
- 2024 SR-6 Completed from I-15 to south causeway (east shore)
- 2024 "Pony Express" Crossing completed (north side of the Lake)
- 2025 Mountain View Corridor to north causeway finished
- 2028 Redwood Road expanded to three lanes e.w. from Bangerter to Elberta
- 2028 Mountain View Corridor completed through Utah County (63.1 miles over 10 years; 6.3 miles a year)
- 2030 West Mountain Expressway completed (south east side of the Lake)



CONNECTING I-15 TO MOUNTAIN VIEW CORRIDOR

To help improve traffic, congestion, and local air quality, the project provides four causeways to help move traffic around the Lake and up and down Utah and Salt Lake counties.

CONCLUSION

Providing innovative, state-of-the-art transportation for the main development islands is a significant part of the Utah Lake Restoration Project.

Development of the main island focuses on providing a comprehensive, multi-faceted transportation network. Neighborhoods, commercial centers, and public facilities all provide easy pedestrian accessibility and enhanced quality of life.

Medium density and multi-family units are centered around transportation centers which will provide ready access on and off of the island. Three causeway locations will significantly improve traffic flow for the main development island and across Utah county.

IMPLEMENTATION

INFRASTRUCTURE

The Utah Lake Restoration Project contemplates large infrastructure investments to support island residents.

1

INNOVATIVE ROADS AND BRIDGES

The city's design caters to open space and connected trails. Other attributes include: smooth and utility manhole free road surfaces, futuristic self-learning stoplight system, and app-based city-wide car parking system.

2

UNDERGROUND UTILITY TUNNELS

All utilities will be run underground in utility tunnels. This improves leak protection, security, and utility longevity.

3

STATE-OF-THE-ART UTILITIES

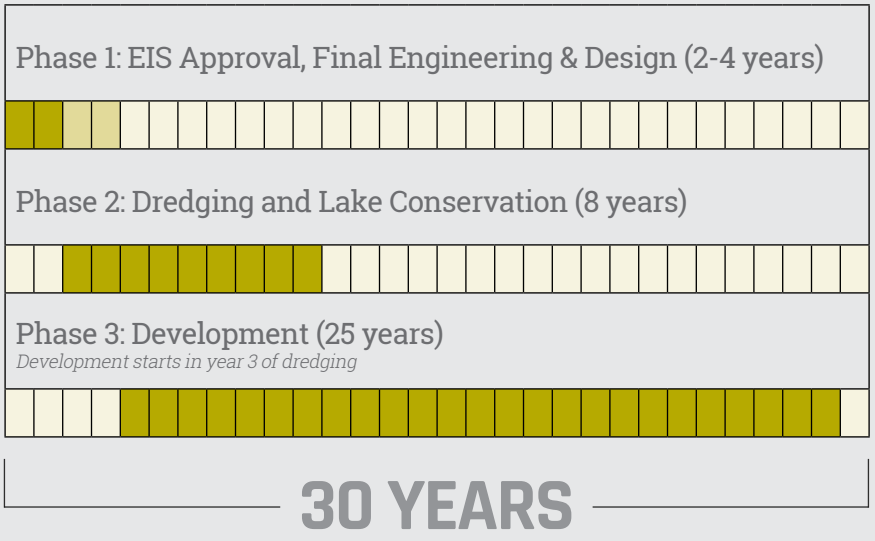
High-tech and eco-friendly services: high speed fiber, separate gray water treatment, vacuum garbage collection, city-wide gigabit wifi, high speed mass transit system, solar and wind energy, waste energy.

Infrastructure investments which utilize the latest technologies to provide clean, secure, and easy to maintain utilities to island residents. A core Utah Lake Restoration Project engineering and construction philosophy is to minimize long-term maintenance costs and convenience to the community while providing environmentally conscious engineering and construction solutions.

Another key execution initiative is to provide redundancy in delivery of all critical infrastructure services to the developed islands via the four main bridge segments.

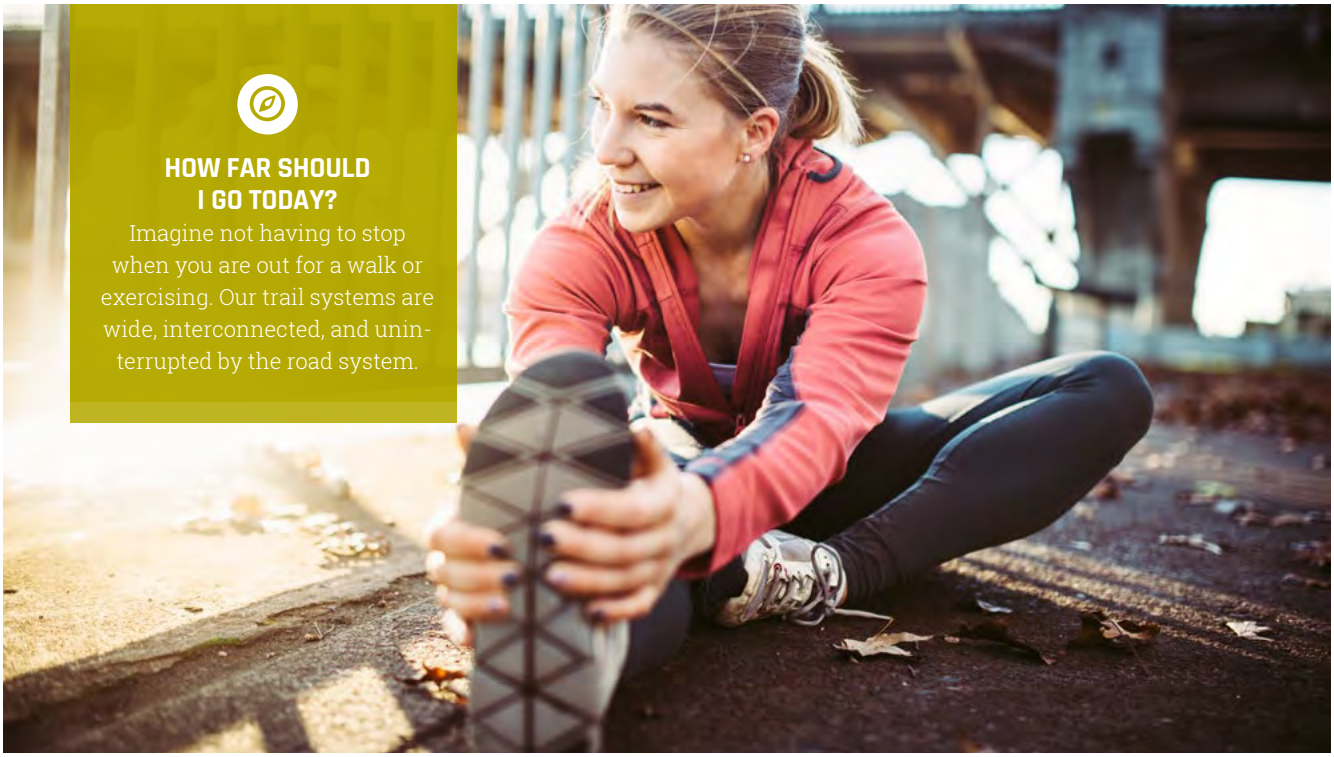
Bridges approaching from the east and west will carry the infrastructure services including sanitary water, electricity, sanitary waste, black and grey water, mass transit, as well as recreational traffic paths. All waste will be pumped off the island and lake for treatment to avoid risks of environmental contamination to the Lake. Technological monitoring and investments will assure a LEED certifiable master-planned community will continue to support conservation objectives on Utah Lake.

UTAH LAKE RESTORATION PROJECT PHASING



In this section, we'll discuss the following components:

- Roads and bridges
- Mechanical piping
- WTE facility
- Electrical
- Communications



HOW FAR SHOULD I GO TODAY?

Imagine not having to stop when you are out for a walk or exercising. Our trail systems are wide, interconnected, and uninterrupted by the road system.

ROADS AND BRIDGES

The comprehensive infrastructure of the Utah Lake Restoration Project includes access highways, interchanges, overpass and underpass bridge work, primary and secondary causeways, and primary and secondary roadways.

All bridges and causeways will incorporate separated roadways and bridges with embedded lighting in the roadways for safety and traffic control while also including space for public bicycle and walkways for the community.

The Team will design and execute the construction of all roadways, highways and bridges (within the lake boundary) to comply with or exceed State Department of Transportation (UDOT) and Federal Department of Transportation requirements for traffic load and capacity.

Bridge architectural designs will be unique, modern, and iconic, as well as functional. The bridges play a critical role in delivering utility services to the islands. Main causeways and bridges will include box girder designs with four sub-surface quadrants in a pre-cast concrete and post tensioned design.

The quadrants are areas where mechanical piping for water, communications, gas, sewage, electrical distribution, and high-volume trash vacuum system piping will be located to service the island residences and commercial properties.

The four quadrants will also provide the structural element to support the 12-lane bridges and causeways. This design will be a common execution philosophy for all four main bridges from the mainland to the islands, providing redundant feeds, easy accessibility, and low-cost maintenance to the islands for all services.

MECHANICAL PIPING

Mechanical piping will include natural gas. Companies such as Dominion Energy will be invited to expand distribution to the islands. As the causeway will be constructed well before the gas piping is to be developed, engineering staff will work with company engineers on preliminary space requirements and safety isolation requirements to be included in the causeway box girder design.

The Project Engineering Team and Central Utah Water Conservancy District (CUWCD) also include drinking water supply that will be a similar engineering and design consortium. Water storage in the islands will be minimized and any storage requirements for emergency and fire-fighting requirements will be sized accordingly. Water tanks will be constructed of cement or steel and buried at elevation to function as required.

All mechanical piping, welding, material specifications, QA/QC management, destructive testing, welding procedure specifications (WPS), material certifications, testing documentations, and welder testing documentation will be managed by the Team. In each case, the records to execution history, welder and fitters responsible for each work scope and weld number will be recorded and tracked as a part of the quality specification requirements. Structural welding will be managed by specifications in AWS Code, (Sections included; AWS D1.1, B.30, B31.1 and others associated with AWS requirements).

A welding Quality Manager will develop all project material specifications in cooperation with engineering efforts. Under the quality team management, a training and testing program will be developed to provide the manpower required to execute

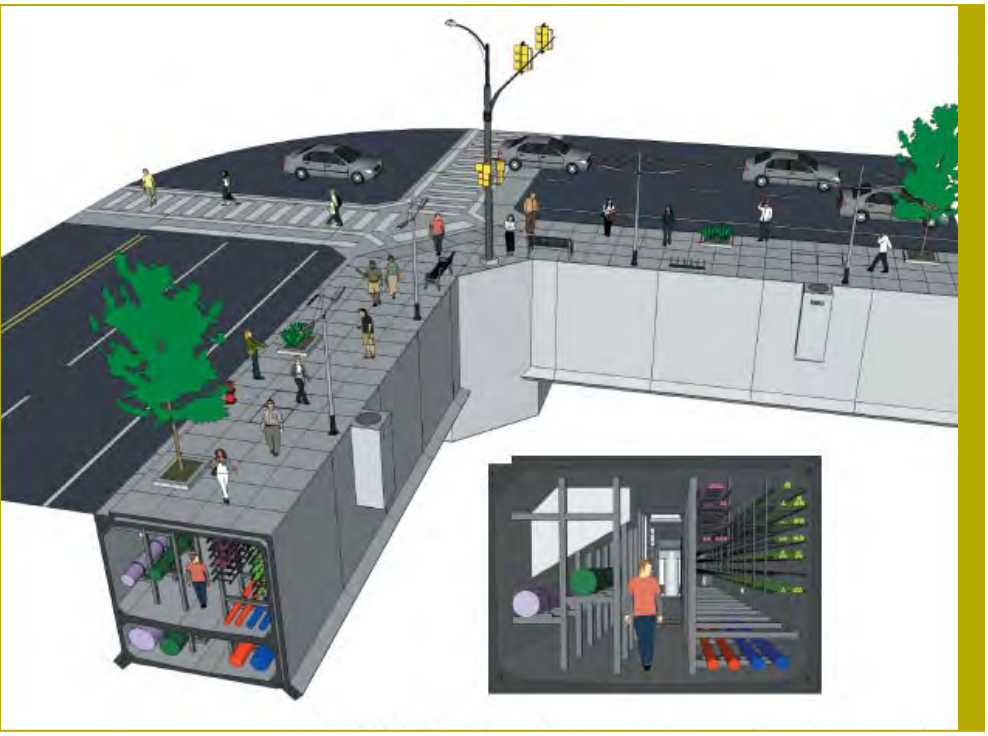
FACTS

A CITY WITHOUT UTILITY POLES

Imagine a city without utility poles and no transformer boxes.

WHY PUT UTILITIES IN TUNNELS?

Having utilities accessible for leak detection and quick and easy repair save 75% of the cost that a typical city incurs fixing underground utilities.



DESIGN SPECIFIC UTILITY TUNNEL

While upfront costs are almost double, underground utility tunnels offer substantial advantages when compared to conventional utilities.

CLEAN POWER

To help protect the local air quality and offset need for coal power, the project will fund three clean power plants that will help offset the development's carbon footprint.

Offsite waste to energy (25Mw)

Offsite solar farm (100 Mw)

Offsite wind farm (50 Mw)

the project. All WPS, testing criteria, testing procedures, training and development, welder mapping and traceability will be under the supervision of the welding Quality Manager reporting through the engineering manager to the project manager.

WASTE-TO-ENERGY FACILITY

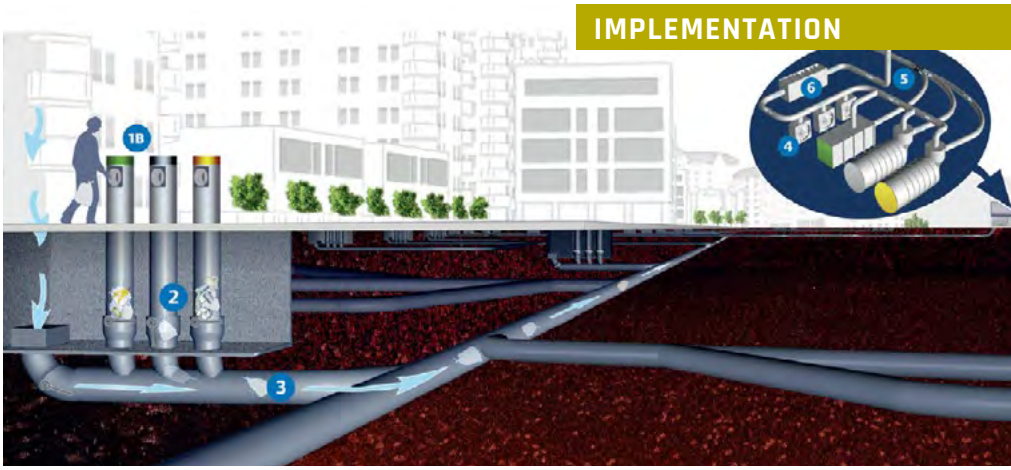
The Utah Lake Restoration Project will install a waste to energy (WTE) facility using proven clean technology to convert waste to usable energy. The WTE will be paired with an Envac trash removal system on the islands to move waste from homes, businesses, and community receptacles through large diameter pipes to the main-land WTE facility. That facility will use the waste to fuel a 25-50 MW power plant.

Preliminary investigations indicate a 25MW WTE facility would contribute significantly to the Rocky Mountain Power Grid and provide substantial power availability for the islands. The environmental cleanliness of WTE Power Plants as measured by effluent and ash waste remains one of the cleanest power production models in the world. Additional environmental benefits of this system include avoiding large landfills and sanitary waste handling by moving waste through vacuum tubes to the WTE power facility.

Subsequent expansions of the WTE facility could be completed for additional modules to allow additional MW as the feed rate of waste increases over time. The west side of the Lake is considered an ideal location for the Power Facility construction and waste handling facility.

VACUUM GARBAGE COLLECTION

Imagine no garbage trucks, no garbage cans, and no possibility of wind blowing garbage into the Lake.



ELECTRICAL

Main Electrical distribution through the box girders serving as causeways and bridges will follow the same philosophy as mechanical services, including redundancy through more than one distribution corridor. Primary electrical distribution will come from the east side of Utah Lake through one of the quadrants of the main causeways sections. Electrical distribution sub-stations will be required on the islands with subsequent electrical distribution installed as buried services. The Engineering Team will coordinate with Rocky Mountain Power or Intermountain Power on all engineering T&D corridors, sub-station installation and feed locations. The use of secondary duct banks and box girders with conduit and pull box stations for residential and commercial distribution will also be facilitated sub-surface. All electrical service will be run underground from the box girder main feed crossings.

Quality Management for Electrical services will be managed by a separate area manager skilled in the development and distribution of electrical service for development and expansion communities. In all cases the management of the Cable certifications, Load testing for primary cabling will be documented and recorded.

All supply of resistors, connectors and hardware will be in accordance with Underwriters Laboratories Requirements and in accordance with the most recent NEC (National Electrical Code).

COMMUNICATIONS

Communication distribution will include Telephone, Internet, Cable Television and WiFi based off utilizing the latest FTTH (Fiber to the Home) cabling for communications, which will support a bustling business district on the main island. Outlying island development may engage cabling on the lake bottom for distribution through sub surface piping.

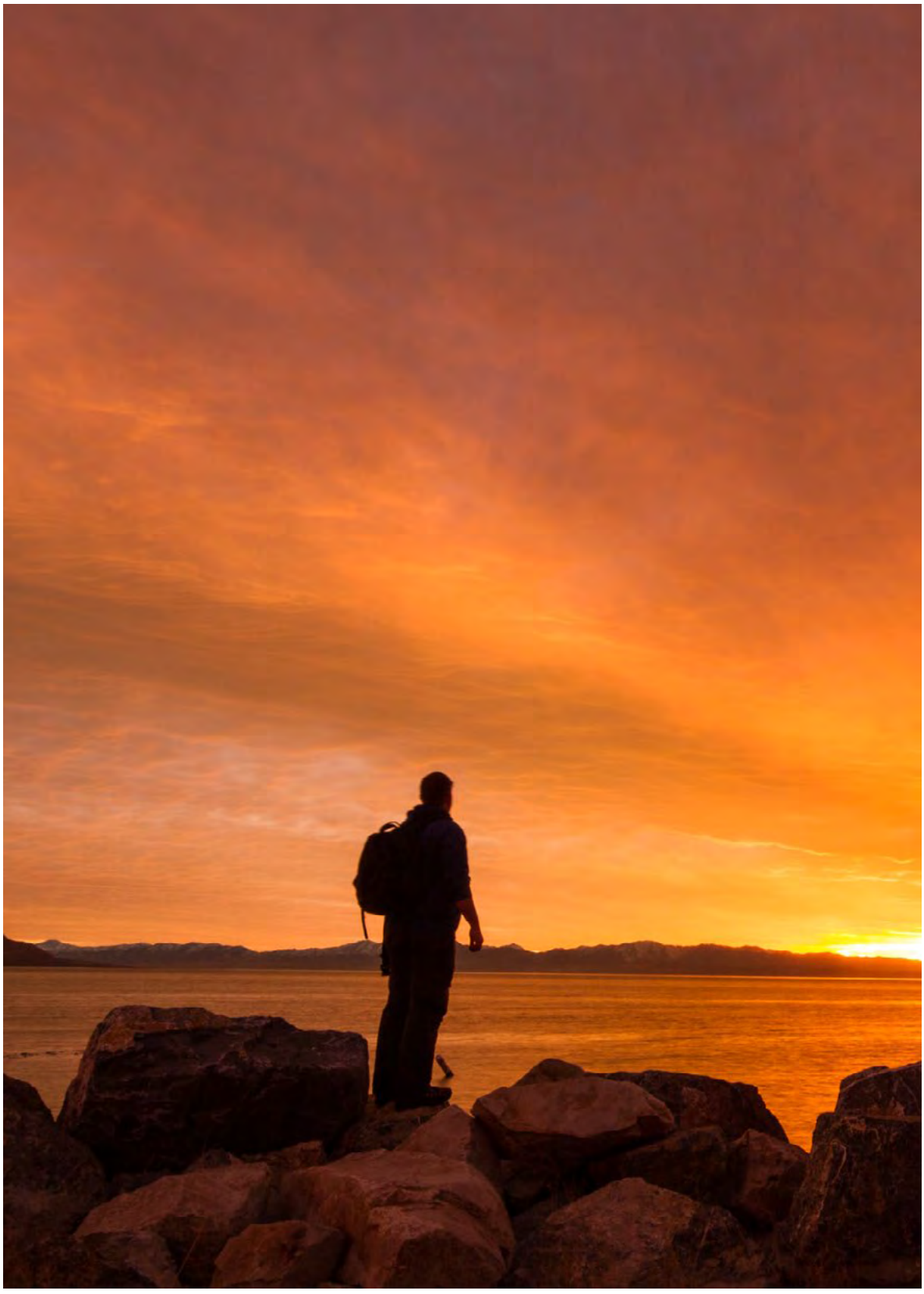
All cell service will continue to be by towers and managed by service providers currently servicing the area population.

All above-ground or above-water communications cabling will be supported and routed in NC (Non-Conductive) trays designed for expansion.

CONCLUSION

The Utah Lake Restoration Project will provide infrastructure investments which will support clean, secure, and easy to maintain utilities to island residents. Infrastructure will be designed to provide environmentally conscious engineering and construction solutions. All waste will be pumped off the island and lake for treatment to avoid risks of environmental contamination to the Lake. Bridges approaching from the east and west will carry the infrastructure services including sanitary water, electricity, sanitary waste, black and grey water as well as recreational traffic paths. Technological monitoring and investments will assure a LEED certified master-planned community that will continue to support conservation objectives on Utah Lake.

> “Fiber to the home (FTTH) connected directly to the fiber backbone.



IMPLEMENTATION

RECREATION ISLAND DEVELOPMENT

One of the crowning features of the restored Utah Lake will be the addition of recreation islands across the Lake.

1

BEACHES AND DOCKS
Boaters are welcomed by floating docks, bays, and island facilities. Beaches beckon kids of all ages to relax, play, run, and soak up sun in the middle of the Lake.

2

NATIVE VEGETATION, ANIMAL LIFE, AND ENVIRONMENTAL IMPACT
Protect island habitats while adding to the visitors' experience.

3

CABINS, CAMPSITES, AND PICNIC AREAS
Provide amenities to allow visitors to enjoy day trips or overnight stays on Utah Lake.

Recreation Islands will provide areas to boat, relax, picnic, recreate, camp, or simply to reconnect with nature. Utah is already world renowned for its world-class recreation destinations, including state and national parks, ski resorts, national monuments, mountains, and natural areas. Recreation islands on Utah Lake will add a vibrant dimension of waterfront recreation and tourism to the state. Recreation islands serve a key conservation role, will be accessible to the public, and offer a variety of low-cost opportunities to play, explore, camp, and rejuvenate.

This section addresses developing recreation islands by the addition of several important design features including contouring the island topography, completing the shoreline with beaches, the addition of docks, campsites and other amenities. This section also describes the work involved in developing these islands for their unique purpose in the Utah Lake Restoration Project, the proposed island ownership and management structure, and the environmental benefits of recreation islands.

CURRENT COST ESTIMATES FOR UTAH LAKE RESTORATION PROJECT

$2.2 billion	Dredging 900,000,000 cubic yards of sediment
$357 million	Rock/stone and boulders for islands and lake restoration
$162 million	Water treatment upgrades
$550 million	Studies, science modeling, research, and engineering
$1.2 billion	Provo Bay, tributary restoration, trail system
$900 million	Wetlands, littoral zone restoration, and water circulation
$565 million	Fish hatchery and fish restoration
$500 million	Recreation improvement projects

DETAILED DISCUSSION

Development of Utah Lake's recreation islands includes:

- Contouring the island with diverse topography
- Completing the shoreline with recreation beaches, and docks
- Introducing natural vegetation and animal life in and around the islands
- Adding recreation facilities and infrastructure
- Installing a trail system for hiking, walking, and biking
- Building cabins, campsites, and picnic areas

ISLAND CONTOURING

Like other island types, the topography of each recreation island will be designed using state-of-the-art 3D modeling to meet the conservation objectives of the Utah Lake Restoration Project, including limiting wind and wave action on the Lake, improving water clarity, and preserving restoration of lake littoral zones. Because of the unique focus of the recreation islands, the topography will be more diverse than other islands, with steeper inclines, higher elevation, rock features, and diverse terrain. This topography will support a variety of activities such as hiking, biking, bouldering, camping, and other activities.

RECREATION BEACHES AND DOCKS

Recreation island shorelines will include the addition of beautiful sand beaches and gravel beaches for public enjoyment. Beaches will be constructed by digging down into the shoreline to a depth of about eight feet.

A geofabric layer will then be placed to prevent clay and soil from penetrating up through the sand or gravel. The geofabric will then be covered with sand or rounded-gravel (<1"). Beaches will range in size from 20 feet wide to 500 feet wide. The sand will be carefully sourced and cleaned to ensure that no pollutants or undesired plant or animal life are introduced to the Lake.

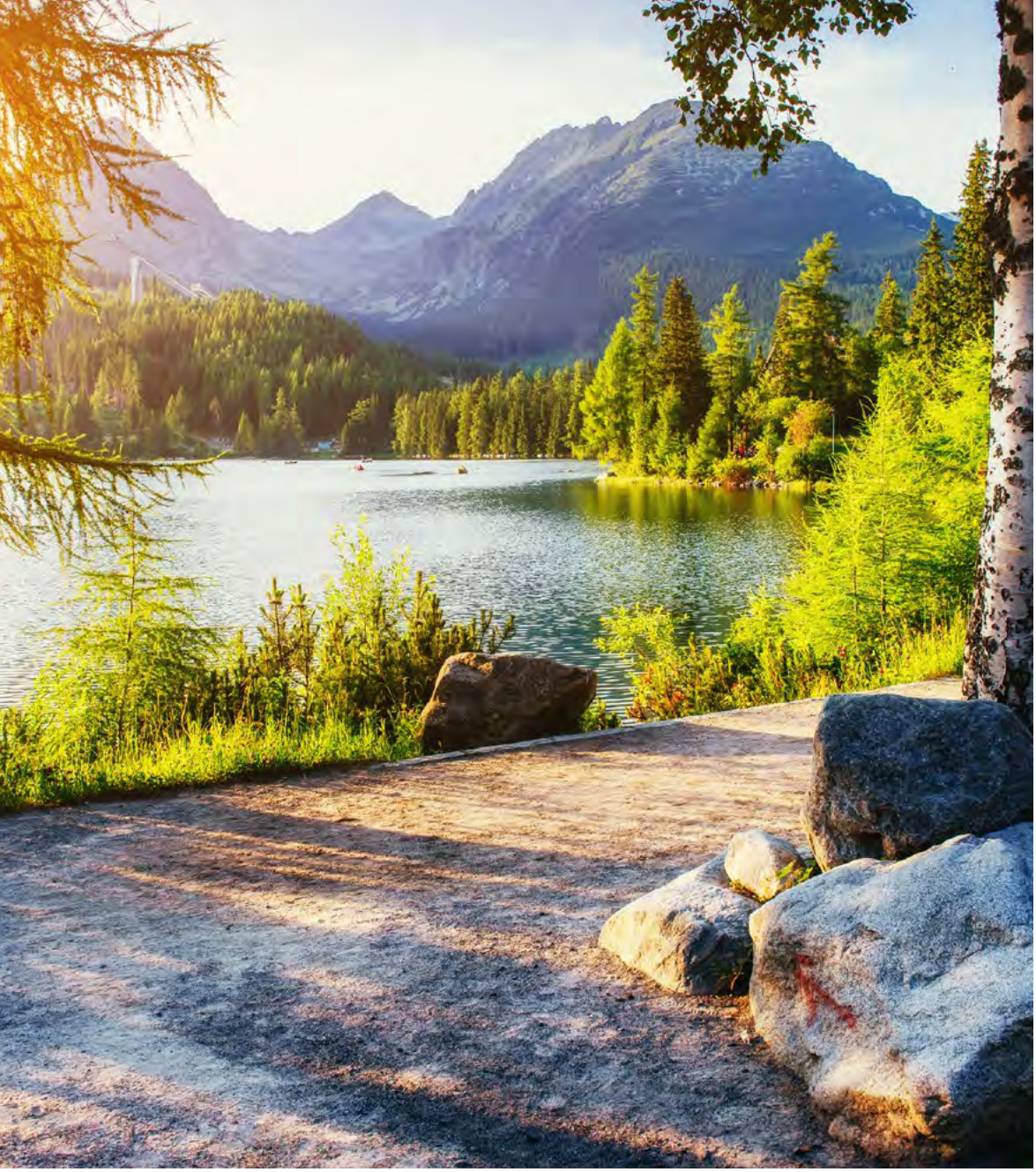
In addition to the public beaches, multiple floating docks will be constructed around each recreation island, allowing easy access to any part of the island for boaters, outdoor enthusiasts, campers, and other visitors. Docks will be free for public use and available for multiple uses including docking powered and non-powered watercraft, swimming, fishing and general access.

FACTS

BEACH CREATION
Range in width from 20 to 500 feet
Sand and natural smooth pebble

CAMPING AND PICNICKING
208 campsites
325 cabins and four-season tents
145 shade and picnic pavilions

URBAN RECREATION ISLAND PARKS
Small recreation islands provide areas where visitors can picnic, hike, rest, and dock a boat.



KNOWING YOUR ENVIRONMENT

Island shoreline doubles habitat and plant zones which are so critical to the restorative and ongoing management of the Lake. Native trees, plants, and flowers will play a crucial role in long-term island success.

2,650 acres of recreational island space

Walking Trails

Campsites

NATURAL VEGETATION AND ANIMAL LIFE

The recreation islands will be similar to native Utah mountain forest areas and will give visitors the impression the islands have always existed on the Lake. The recreation islands will be populated with native vegetation and animal life. This will include planting forests of native evergreen and deciduous trees with open meadows of grass, flowers, shrubs, indigenous ground cover, bushes, and other native vegetation which will provide visual interest and effective wind breaks on the Lake. This vegetation will not only beautify the islands, but will also protect the land from natural erosive elements. Dead fallen trees will be placed to give variety and a natural feel to the islands, as well as to give birds and mammals familiar habitat. Finally, small indigenous mammals will be introduced to the recreation islands from adjacent areas.

Islands will dramatically increase the amount of shoreline habitat available to native plant and animal species. Together with the development of barrier islands, the capacity for riparian and littoral zones around the

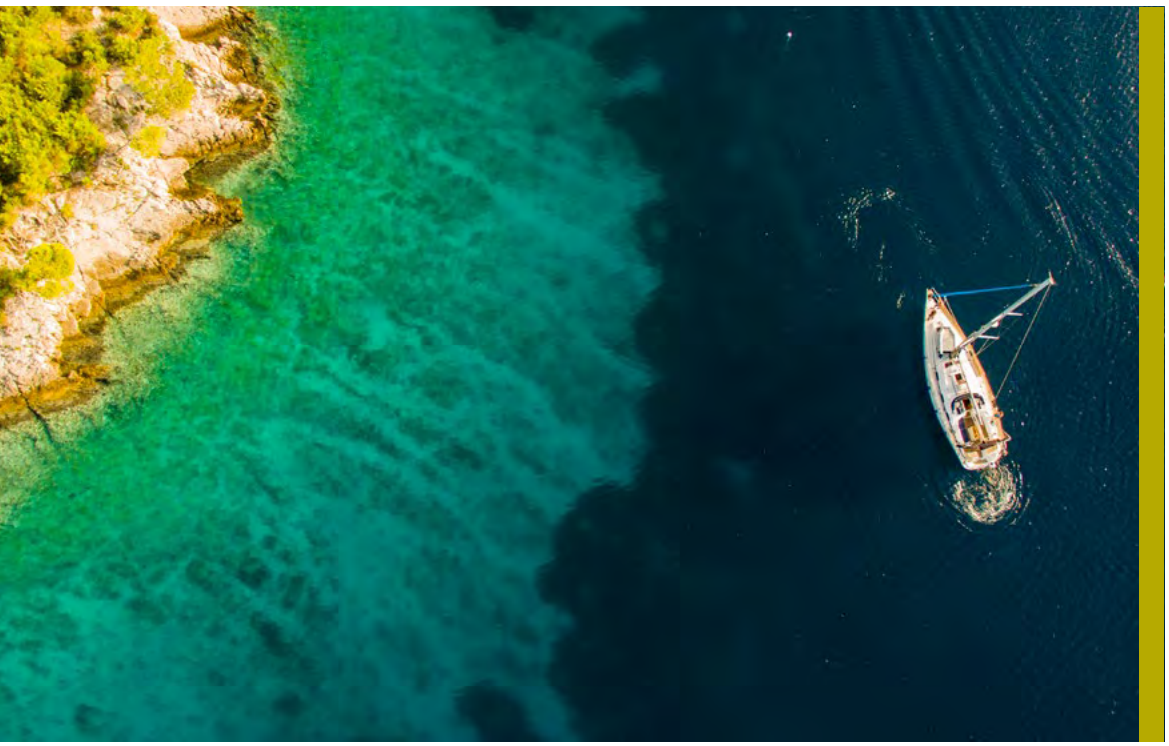
SHORELINE SECURITY

Native plants will protect the shoreline from wind and wave action as well as provide safety for fish and minnows while serving as a zooplankton breeding paradise.

Lake will increase exponentially. Native vegetation will be intentionally planted in locations where it can naturally spread and flourish. Some of the plants will be partially raised in the green house portion of the Provo Bay fish hatchery, with others planted from seed. To protect the biosphere found on the island, the use of gas powered vehicles will not be permitted on the Islands.

The Utah Lake Restoration Project environmental team will manage the staged introduction of indigenous plant and animal life, including shrubbery, grasses, trees, and small mammal and aquatic life on all islands, including estuary and recreational lands. New grasses, trees, shrubbery plantings as well as mollusks, crayfish, and aquatic plants will be grown at the Provo Bay fish hatchery preparatory to reintroduction.

Each of these elements along with the nature-inspired island topography will give the islands a feeling of natural beauty, enriching the recreation experience and further enhancing the fully restored Utah Lake ecosystem.



SAFE HARBOR

The recreation island arch design creates natural safe harbors for all boats and will allow sailboats to spend nights anchored next to the safety of island coves.

FACILITIES AND INFRASTRUCTURE

Public facilities will be installed on the islands for visitors and campers, including public restrooms and potable water. Toilets will be designed consistent with typical National Park restrooms, but will be upgraded with flushable toilets and environmentally friendly solar panels integrated in the roofing to provide electricity.

Other infrastructure improvements will include public shower facilities and electricity. All sewage will be pumped off the islands to treatment plants via offshore solar pumping.

Fresh water will be available for campers in the campgrounds and at the public facilities. Fresh water will be provided by wells, springs, or underwater pipeline. Water storage will be constructed using steel or concrete water tanks buried at elevation for use on the islands. Constant monitoring of water quality and quantity will be provided via solar powered sensors and cloud-based software to allow remote monitoring.

TRAILS

Trail systems will be built around the perimeter and interior of each of the recreation islands to allow the public to visit and explore the islands' unique topography. These trails will be perfect for hiking, biking, or trail running around or through the islands. They will be constructed using soil and crushed rock mixed with cement to help keep unwanted weeds and grass to a minimum, while preserving a natural feel to the trails and minimizing long-term maintenance costs.

CABINS, CAMPSITES, AND PICNIC AREAS

The recreation islands will provide camping sites and cabins, for one-night or multi-night family and group outings. Camping opportunities will be provided at several different cost points, varying from prepared tent sites, luxury 4-season safari-style tents, and small and large cabins. Pavilions will also be available for day use rental, and a number

of picnic areas will be available at no cost for public use. Each campsite will be secluded with at least 100 feet between tent sites, 200 feet between luxury tent sites, and 400 feet between cabins. Cabins will also vary in size, shape, building materials, and character. This will give different opportunities for hosting varying group sizes and event types, including family reunions, scout camps, church group events, and friend outings.

Campers will be able to dock their boats and jet-skis overnight close to their camping spots at convenient docks around the island.

RECREATION ISLAND OWNERSHIP AND MANAGEMENT

The recreation islands will be built at no cost to the State of Utah or its taxpayers. They will be open to Utah State residents and visitors at no charge. Reasonable fees from overnight camping or renting pavilions will cover ongoing management and maintenance expenses.

The Utah Lake Restoration Project proposal includes the fiscal budget requirements for initial construction of all islands, development, improvements, campgrounds, restroom facilities, ranger accommodations, management, rental, care, and maintenance.

The ownership of all recreational Islands will be retained by Lake Restoration Solutions for a period of 20 years. Following the twenty-year period from completion, the land, improvements, records of all maintenance, rental usage may be transferred to the State of Utah based on coordination with State leaders regarding preferred management of the recreation islands.

The primary recreation islands will have a year-round professionally-staffed ranger station, including a helicopter pad for emergency response.

ENVIRONMENTAL IMPACT

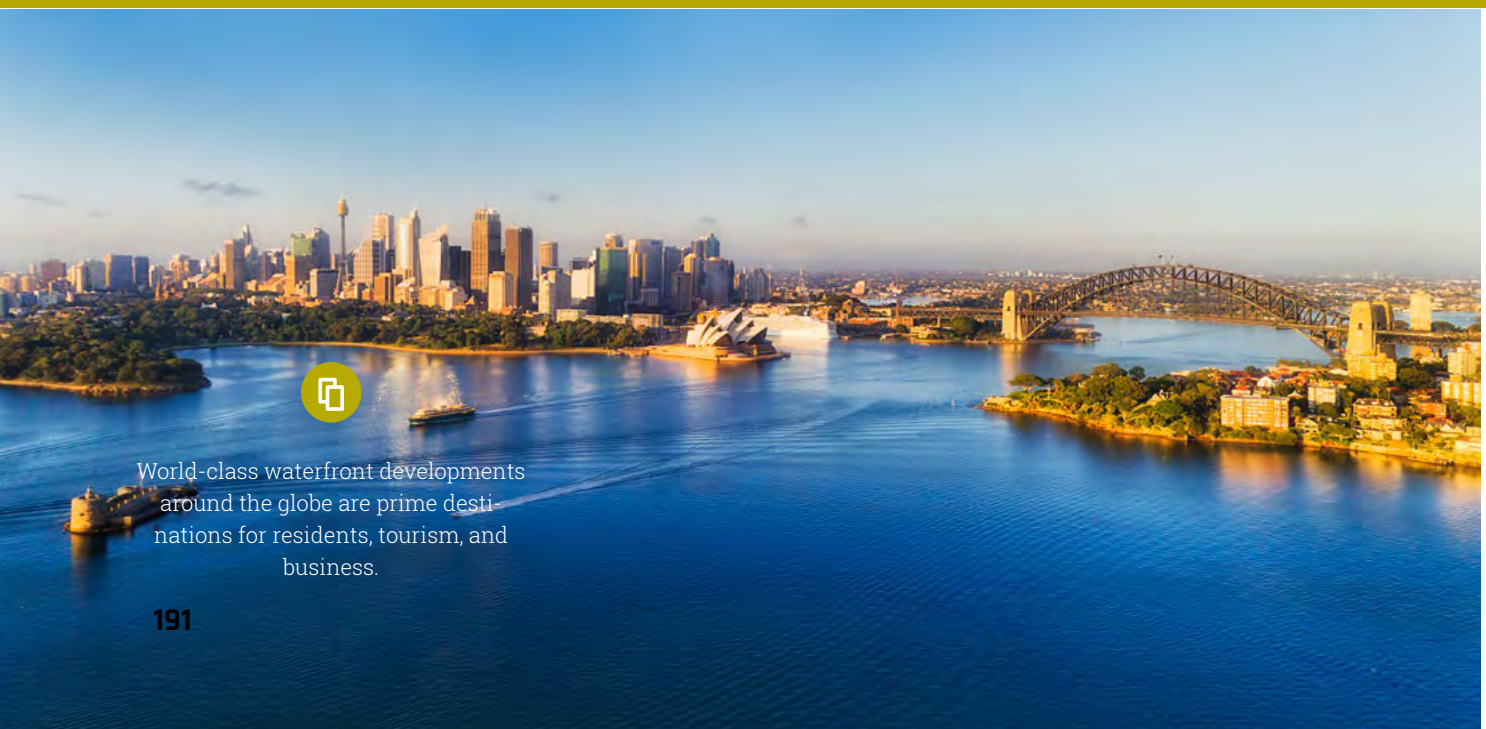
The primary goal of the Utah Lake Restoration Project is restoration of the Lake and environmental conservation. Recreation islands are an important part of the restoration plan, with their unique topography and plant life contributing to water clarity by controlling wind and wave action on the Lake, expanding riparian and littoral zones, providing water quality improvements, and creating natural habitat for various aquatic plants.

Further discussion of the islands' contribution to these goals is included in the Solutions section on pages 41-46. Recreation Islands will benefit the public and create incredible recreation opportunities in the State of Utah and on Utah Lake, while helping to ensure restoration of the Lake, its water, and its wildlife.

IMPLEMENTATION

DEVELOPMENT ISLANDS

Development islands are the economic foundation providing the billions of dollars needed to restore Utah Lake.



World-class waterfront developments around the globe are prime destinations for residents, tourism, and business.

As the first conservation project of its kind in the world, the Utah Lake Restoration Project leverages the creation and development of islands on the Lake to fund landscape level conservation investments.

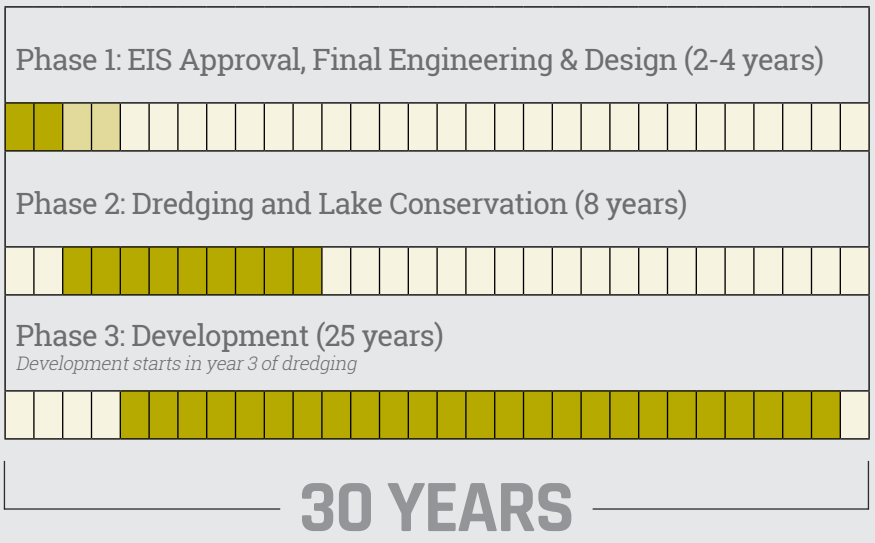
These are a powerful tool which will facilitate the dozens of projects needed to restore water quality, native plant species, fish and wildlife to the Lake.

These islands will add a special dimension of lakefront living for hundreds of thousands of Utahns and provide a living experience unlike any other in the United States.

These world-class, environmentally friendly communities will be surrounded by trails, parks, waterways, beaches, open space, and abundant water sport recreational opportunities.

They will include areas for business, shopping, entertainment, and sports. Considering Utah's other natural wonders, a fully restored lake dotted with recreation, development, and conservation islands will add to Utah's aura as the destination for lifestyle, outdoor recreation, and business.

UTAH LAKE RESTORATION PROJECT PHASING



OUR OBJECTIVE

Our objective is to implement the comprehensive solutions needed to restore the Lake. Among a few of the massive projects that the Utah Lake Comprehensive Restoration Plan will undertake are:

- Removing millions of tons of nutrient loaded sediments from the lake bottom
- Funding over one hundred and fifty million dollars in upgrades to existing water treatment facilities
- Deepening the Lake, creating deep-water channels, and improving lake bathymetry

- Controlling wind and wave action
- Improving water circulation, water temperatures, and reducing evaporation
- Restoring water clarity and water quality
- Removing invasive fish and plant species
- Restoring thousands of acres of native aquatic plants in littoral zones
- Restoring millions of June sucker, Bonneville cutthroat trout, and other native fish species

These restoration projects will cost approximately $6.4 billion. Much of this will require an upfront investment in massive dredging projects, infrastructure implementation, science, and other engineered solutions. Our team has extensive experience in engineering, science, design, planning, and implementation of multi-billion-dollar infrastructure projects of this magnitude.

A primary obstacle to restoring Utah Lake has been the lack of funding needed to undertake these massive infrastructure projects. The Utah Lake Comprehensive Restoration Plan will provide billions of dollars in private investment to fund the restoration of the Lake. Creation and development of islands on the Lake are the economic foundation that will pay for restoration of the Lake.

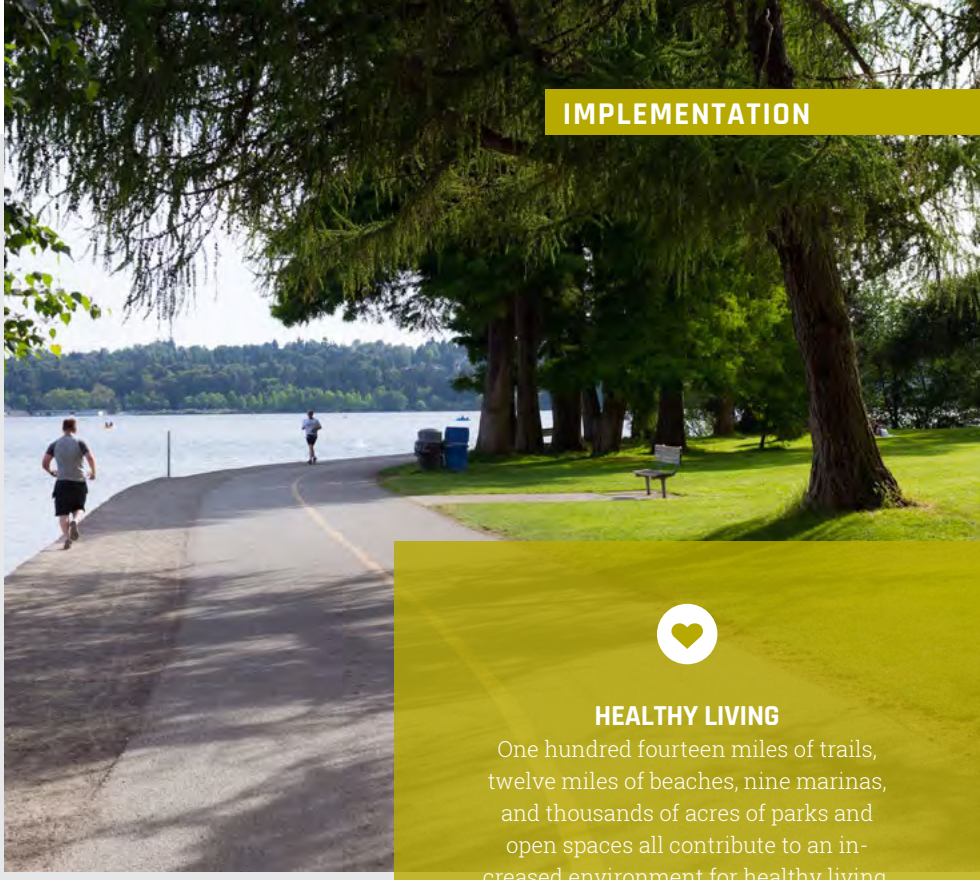
THE ECONOMIC FOUNDATION

While each of the three island types play a role in lake restoration, the vast majority of the restoration funding comes from one type of island--development islands. Development islands include six key economic drivers that work in concert to adequately fund the restoration of Utah Lake:

1. Low Density Single Family Residential Communities
2. Medium Density Single Family Residential Communities
3. Medium Density Multi-family Residential Developments
4. High Density Multi-family Residential Developments
5. Mixed-use Areas
6. Commercial Centers

The following pages include detailed market projections and analysis explaining funding levels that come from each of the six areas which are the economic drivers for restoration of Utah Lake.

> The total acreage devoted to parks, recreation, and open space accounts for 10,256 acres or 64% of areas created by island development.



64% DEDICATED OPEN SPACE

The total acreage devoted to parks, recreation, and open space accounts for 10,256 acres or 64% of areas created by island development.

HEALTHY LIVING

One hundred fourteen miles of trails, twelve miles of beaches, nine marinas, and thousands of acres of parks and open spaces all contribute to an increased environment for healthy living.

There are approximately 10,000 total acres of land on the main development island of Utah Lake. The following is a breakdown of the acreage currently planned for each category of development:

Parks, Recreation, & Open Space	1,710 acres (17.1%)
Public Facilities, Roads, Public Access	2,460 acres (24.6%)
Single Family Low and Medium Density	1,100 acres (11%)
Multi-family Medium Density	1,320 acres (13.2%)
Multi-family High Density	1,800 acres (18%)
Mixed-use Areas	1,000 acres (10%)
Business and Commercial	610 acres (6.1%)

As can be seen in the figure above, parks, recreation, open space, public facilities, roads, and public access constitute 41.7% of the acreage on the development islands. When recreational waterways through the main island are included, total parks, recreation, and open space becomes 7,370 acres or 55.8% of the main island development.

When the estuary islands, recreation islands, beaches, and recreation waterways are included, these categories account for 10,256 acres or 64% of the areas created by island development. Development for communities, business, commercial, and mixed-use areas account for the remaining 36% of acreage, or 5,830 acres, on the islands.

LAKEFRONT LIVING AT ITS FINEST

Islands will add a special dimension of lakefront living for hundreds of thousands of Utahns

DEVELOPMENT ISLANDS

SINGLE FAMILY LOW DENSITY RESIDENTIAL COMMUNITIES

Under the preliminary development plan for the main development island on Utah Lake, 420 acres are designated for low-density single family homes.

We currently project four lots per acre on average for these areas, for a total of 1680 total homes. While we estimate an average of quarter acre lots, some lots will have larger acreage, while other lots will have smaller acreage.

The single family low density areas will be spread throughout the main development island.

Some lots will be private satellite islands surrounding the main island, while some lots will be positioned more centrally in the main island. Our objective is to provide a range of home values [redacted] This will ensure affordable options as well as higher price point areas.

Much of this development will occur in years 5-20 of the project meaning potential inflationary impacts to home values.

[redacted]

FACTS

ACRES
420

UNITS PER ACRE
4

TOTAL UNITS
1680

[redacted]

YEAR ROUND ACCESS
Snowboarding in the winter, watersports, mountain biking, and backpacking in the summer--all less than an hour's drive.

SINGLE FAMILY MEDIUM DENSITY RESIDENTIAL COMMUNITIES

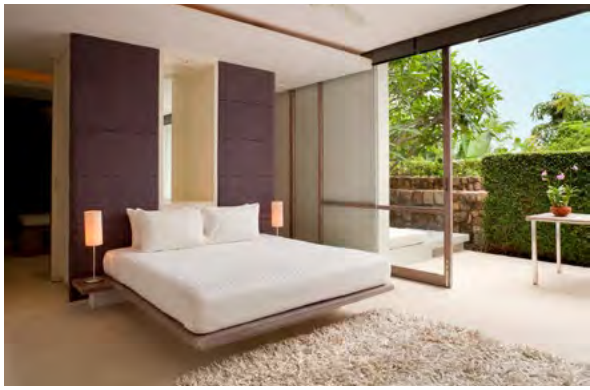
Under the preliminary plan for the main development island on Utah Lake, 680 acres are designated for medium density single family homes.

Medium density single family homes will range from 0.2 acre planned unit developments to multi-unit townhomes. We currently project an average of eight lots per acre for these areas, for a total of 5,440 total homes.

The medium density single family areas will be spread throughout the main development island. Our objective is to provide a range of home values [redacted] This will ensure affordable housing as well as higher price point luxury townhome options.

Much of this development will occur in years 5-20 of the project meaning potential inflationary impacts to home values.

[redacted]



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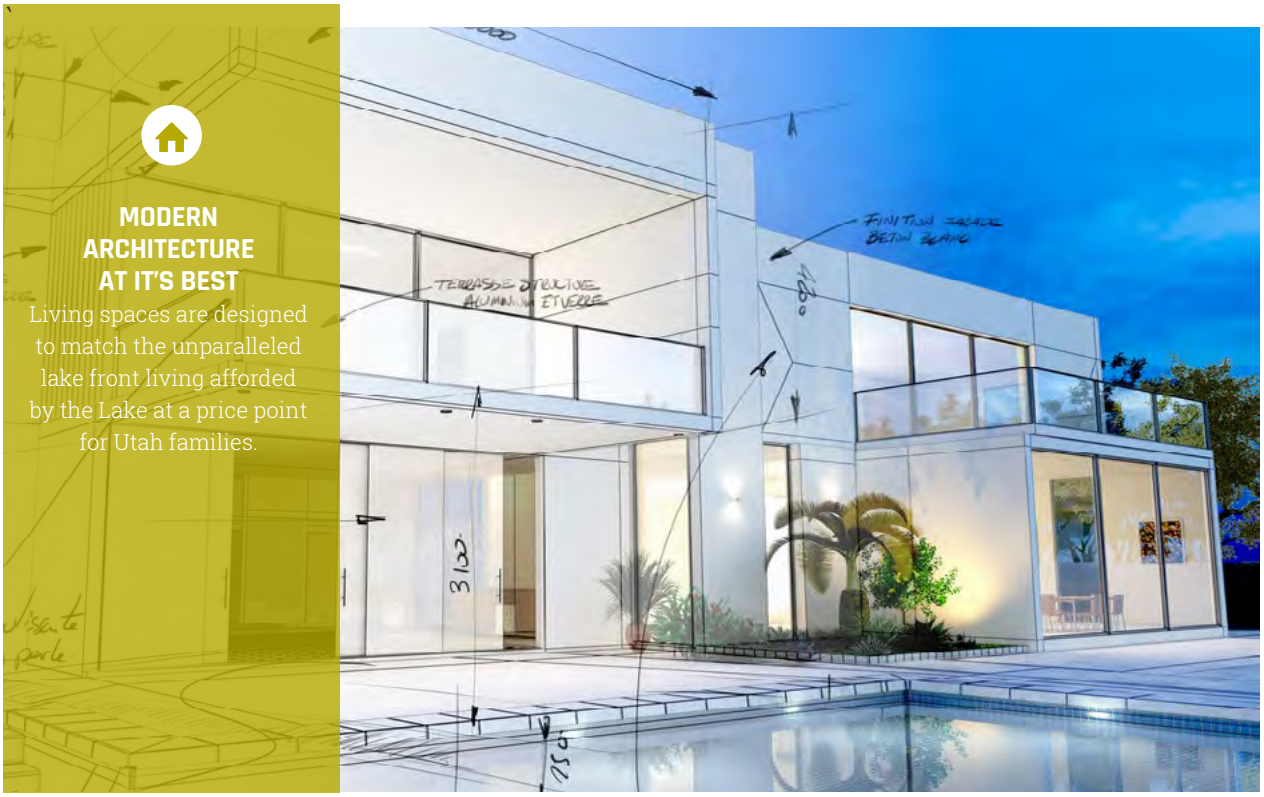


MODERN ARCHITECTURE AT IT'S BEST

Living spaces are designed to match the unparalleled lake front living afforded by the Lake at a price point for Utah families.

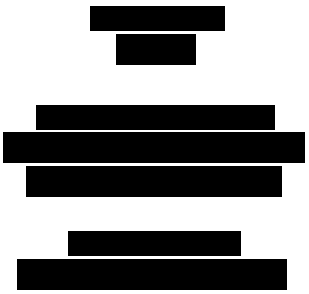
ROOFTOP GARDENS
Communities with shared spaces bring friends, families, and neighbors together in fun and creative ways.

FACTS

ACRES
680

UNITS PER ACRE
8

TOTAL UNITS
5,440



DEVELOPMENT ISLANDS

MULTI-FAMILY MEDIUM DENSITY RESIDENTIAL COMMUNITIES

Under the preliminary plan for the main development island on Utah Lake, 1,320 acres are designated for medium density multi-family condominiums.

Medium density multi-family units will range from 14 units per acre to 32 units per acre. We currently project an average of 24 units per acre, for a total of 31,680 total units. The medium density multi-family areas will be spread throughout the main development island.

Our objective is to provide a range of condominium values [redacted] This will ensure affordable housing as well as higher price point condominium options.

Much of this development will occur in years 5-20 of the project meaning potential inflationary impacts to condominium values. [redacted]

FACTS

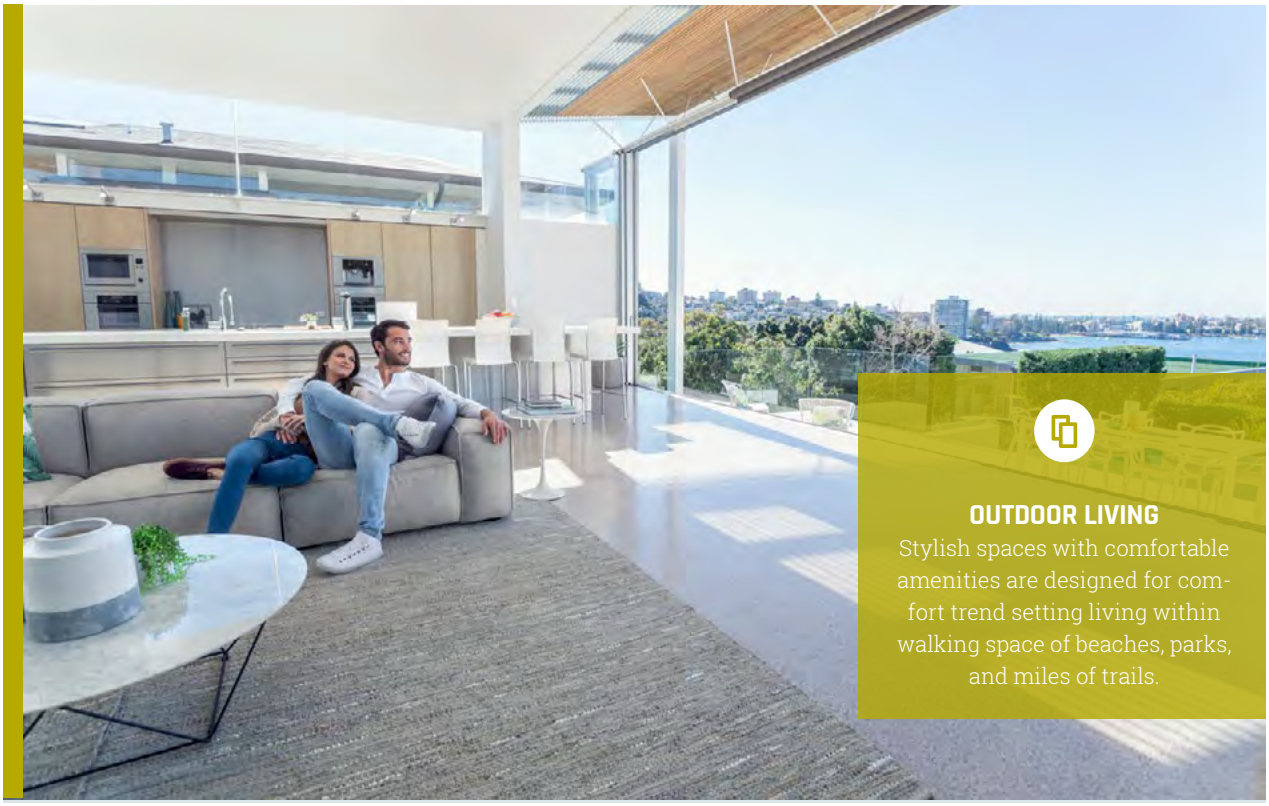
ACRES
1320

UNITS PER ACRE
24

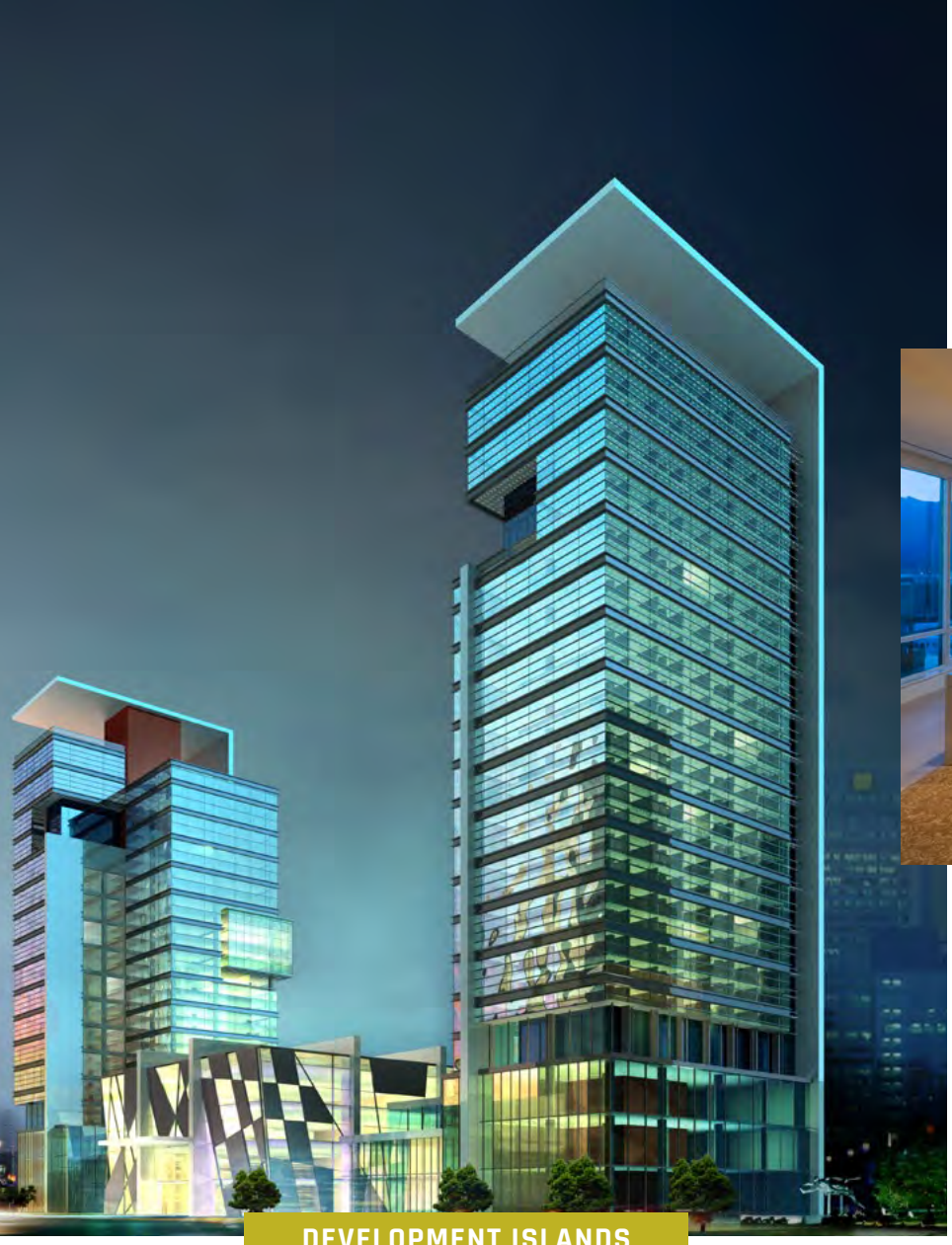
TOTAL UNITS
31,680

[redacted]

FIT FOR ALL
Affordable multi-family units provide all the benefits of lakefront lifestyle at price points that works for all Utahns.



OUTDOOR LIVING
Stylish spaces with comfortable amenities are designed for comfort trend setting living within walking space of beaches, parks, and miles of trails.



DYNAMIC LIVING
World-class, environmentally friendly communities will be surrounded by trails, parks, waterways, beaches, and open space.

DEVELOPMENT ISLANDS

MULTI-FAMILY HIGH DENSITY RESIDENTIAL COMMUNITIES

Under the preliminary plan for the main development island on Utah Lake, 1,800 acres are designated for high-density multi-family condominiums and apartments.

High-density multi-family units will range from 32 units per acre to 65 units per acre.

We currently project an average of 40 units per acre, for a total of 72,000 total units.

The high-density multi-family areas will be spread throughout the main development island with emphasis on commuter stations, major commercial centers, and adjacent to transit streets.

Our objective is to provide a range of apartment and condominium values [redacted] This will ensure affordable housing as well as higher price point options.

Much of this development will occur in years 5-20 of the project meaning potential

inflationary impacts to condominium values. [redacted] A portion of these units will likely be rental or long-term lease options [redacted]

FACTS

ACRES
1800

UNITS PER ACRE
40

TOTAL UNITS
72,000

[redacted]

DEVELOPMENT ISLANDS

MIXED-USE AREAS

Under the preliminary plan for the main development island on Utah Lake, 1,000 acres are designated for mixed-use areas. These areas will be defined by street level shopping, entertainment, restaurants and commercial areas, with multi-story living above.

Building height will range from 8-20 stories, with an average of 10 stories per building.

Mixed-use areas will range from 40 units per acre to 85 units per acre. We currently project an average of 60 units per acre, for a total of 60,000 total units.

OF BOTH WORLDS

Living in shopping, dining, and entertainment districts yet within walking distance of outdoor, recreation, and waterfront is a powerful combination.

The mixed-use areas will be spread throughout the main development island with emphasis on commuter stations, adjacent to main commercial centers, and city centers.

Our objective is to provide a range of commercial and residential values [redacted] A portion of these units will likely be rental or long-term lease options [redacted] This will ensure affordable housing as well as higher price point options in more desirable areas.

Much of this development will occur in years 5-20 of the project meaning potential inflationary impacts to apartment and condominium values. [redacted]

Areas for business, shopping, dining, and entertainment provide a vibrant energy and atmosphere.

FACTS

ACRES
1,000

UNITS PER ACRE
60

TOTAL UNITS
60,000

[redacted]

GLOBAL HUB FOR TREND SETTING CORPORATIONS

A fully restored lake dotted with recreation, development, and conservation islands will add to Utah's aura as the destination for lifestyle, outdoor recreation, and business.

DEVELOPMENT ISLANDS

BUSINESS COMMERCIAL CENTERS

Under the preliminary plan for the main development island on Utah Lake, 610 acres are designated for commercial centers. The commercial areas will be placed strategically at specific points on the island.

These areas will be defined by high rise office buildings for major corporations, sports, finance, and industry. Business and commercial centers are anchor tenants for the islands. These areas will become a magnate for international and local businesses who value quality of life and a unique water front environment for their business and their employees.

Building height will range from 8-20 stories, with an average of 15 stories per building. Commercial centers areas will range from 20 units per acre to 100 units per acre.

We currently project an average of 45 units per acre, for a total of 27,450 total units. [redacted] This will ensure

affordable options as well as higher price point options for more desirable space.

[redacted]

FACTS

ACRES
610

UNITS PER ACRE
45

TOTAL UNITS
27,450

[redacted]

PUBLIC TRUST BENEFITS

The Utah Lake Restoration Project contributes significantly to public trust values in the state of Utah.

SIGNIFICANT PUBLIC TRUST BENEFITS TO THE STATE OF UTAH AND ITS RESIDENTS

The fundamental purpose and overlying objective of the Utah Lake Restoration Project is restoration of Utah Lake, its natural ecosystem, habitats, and wildlife. As such, components of these public trust values are described throughout the entire proposal document. The following sections on the contributions to each of these public trust values will help provide a concise overview of the benefits. They will also provide cross-reference to sections within the larger proposals that will describe the substance of how the Project and Team will accomplish these objectives.

COMMERCE
Increasing tourism, economic development, and state tax revenues

PG 209

WATER
Improving water conservation, water clarity, and water quality

PG 219

ENVIRONMENTAL CONSERVATION
Restoring natural ecosystems, including native plant communities, wildlife, and endemic and endangered species

PG 225

GROWTH
Sustaining population growth along the Wasatch Front, with affordable housing, sustainable green living, and commercial/business areas

PG 229

RECREATIONAL OPPORTUNITIES
Restoring use of the Lake, and building recreation islands, open space, trail systems, docks, and public beaches

PG 231

TRANSPORTATION
Constructing causeways, public transportation, and enabling pedestrian traffic

PG 237

NAVIGATION
Increasing recreational utilization, access, and safety of the Lake

PG 239

PUBLIC TRUST

COMMERCE

The Utah Lake Restoration Project will be an incredible economic driver for Utah and its residents.

TOURISM IMPACT

The Utah Lake Restoration Project creates a tremendous tourist attraction in the state, generating $1.4 billion in travel spending each year, more than $200 million in state and local taxes annually, and more than 24,000 tourism-generated jobs. In this section, we will describe the various tourist attractions and the benefit to the state of Utah and the Utah public trust.

TOURISM APPEAL

A fully restored Utah Lake will attract visitors from around the world. These are the different tourism activities that will attract them:

- Water and related amenities
- Venues and hotels
- Conservation and educational areas
- Recreation islands

WATER AND RELATED AMENITIES

Water is the world's top tourism attractor, accounting for more tourism spending than any other public amenity. These tourism attractors include oceans, lakes, beaches, rivers, and streams. While the Great Salt Lake encompasses nearly 1,700 square miles, it is limited as a strong visitor attraction, leaving the greater Salt Lake Valley area shy in terms of public-access lakes with supporting amenities and complementary activities.

Utah Lake encompasses 96,400 acres, or just over 150 square miles. It is the third largest lake in Utah after the Great Salt Lake and Lake Powell, providing a tremendous economic opportunity which is not currently being realized due to the lake's growing challenges. A detailed discussion of these challenges is included in the background section of this proposal on pages 7-30.

West of the Wasatch Front, other large lakes include Sevier Lake and Willard Bay. Sevier Lake is primarily used for farmland irrigation and lacks the recreational and supporting development that Utah Lake can provide. Willard Bay is a popular recreational lake and encompasses just under 10,000 acres – about a tenth of the size of Utah Lake. It, and the nearby Bear River Migratory Bird Refuge, are terrific recreational and environmental attractions for Northern Utah.

A restored Utah Lake could fill a different role with a much larger capacity that would include privately-developed attractions and supporting amenities to service the Wasatch Front. The Utah Lake Restoration Project will add 200 miles of public shoreline access, which will include a substantial network of waterfront trails, boardwalks, parks, sporting facilities, marinas, and beaches. Private development will include waterfront lodging, a number of meeting and event facilities and dozens of small businesses renting and providing gear including sailboats, pontoon boats, jet skis, power-boats, stand-up paddle boards, fishing skiffs and related gear, kayak and canoe rentals, and lake excursions such as sightseeing and dinner cruises.

URBAN CENTER

The Utah Lake Restoration Project includes plans to construct a thriving population center on the main island. This will include sports and cultural venues that will further attract, on a year-round basis, spectators and participants for team sports, Olympic trials, personal achievement and team-building events, concerts, and performing arts.

The urban center will also have upscale retail and dining "downtown" districts that will attract meetings and conventions and the demand for a conference center and hotels which will also be developed. Each of these venues will be tourist attractions in their own right and will further contribute to the tourism appeal of Utah Lake.

CONSERVATION AND EDUCATIONAL AREAS

The Utah Lake Restoration Project master plan includes the creation of over 10,000 acres of new wildlife habitat, 75 miles of restored shoreline, 2,000 acres dedicated to the development of new conservation and education areas, and miles of trail systems including elevated conservation boardwalks. These additions will create an amazing educational and active visitor experience.

One of the primary components of the Project is an interactive multi-million-dollar Interpretive Center, the cost for which will be covered by future development, that showcases the history of the Lake, its challenges, and how the Utah Lake Restoration Project restored the Lake to a healthy and natural ecosystem.

This showcase center will educate the public about one of the world's largest restoration projects, further cementing Utah's international outdoor brand and reputation as a premier destination for outdoor recreation and tourism.

The interpretive center and other public conservation and recreational areas would be combined and donated to the Utah State Parks system or to another non-profit organization if the State desires, with a foundation organized to help fund ongoing operations and educational programs.

The lake restoration also includes substantial enhancements to the existing shore areas including the Rock Island Waterfowl Management Area, the Powell Slough Waterfowl Management Area and Utah Lake State Park – making these terrific destinations for visitors. Activities would include bird watching excursions, interpretive displays along lakeshore trails and parks, and boardwalk interpretive sites through some of the wetland areas. Sections of the conservation areas will be left protected and be off-limits to boaters and disruptive recreational activities, helping to maintain the restored native habitat.

> "These additions will create an amazing educational and active visitor experience.

Ultimately, the 150 square-mile surface of the Lake and its 200 miles of new shoreline will offer an outdoor recreational playground to not only Utah residents, but also attracting visitors from around the world. With convenient access to an international airport and the amenities of Salt Lake City and Provo, visitors will be enticed to the newly-restored pristine waters, and natural plants and animals of Utah Lake.

TOURISM ECONOMIC ANALYSIS

Tourism and recreation create huge economic value to the national, state and local economies. In 2016, over $990 billion in U.S. direct tourism expenditures spurred an additional $1.3 trillion in non-related industries through the multiplier effect. Travel is one of the top ten industries in 49 states, including Utah, in terms of employment and accounts for 2.7% of the U.S. Gross Domestic Product. More than $645 billion in outdoor recreation spending generates more than six million American jobs.

In Utah, tourism is an $8.4 billion industry (2016), of which $7.2 billion is spent by non-resident visitors. Tourism is the state's third largest industry, its largest export industry, and employs more than 129,000 direct tourism-related jobs. The industry generates $1.23 billion in taxes each year: $665 million to the state, and an additional $561 million in local taxes. This has been increasing by more than five percent annually. This growth creates some challenges. Many of Utah's tourist attractions are over-crowded, leaving local and State resources strained to keep up with the demand.

The number one reason people travel is to visit friends and family, and the second reason is for business. This is why Salt Lake County is the largest generator of tourism spending in Utah. For leisure visitation, the five national parks in Southern Utah and Utah's famous ski areas (10 of the state's 14 ski areas are within an hour's drive of Salt Lake City) are among the state's primary draws and the focus of its marketing efforts, rightfully so.

Utah has the most diverse landscapes and experiences in North America, which range from sites like the Bonneville Salt Flats, to high mountain forests, to the desert communities of St. George and Washington County, to the red rock canyons of Southern Utah, as well as the 70,000-acre bird refuge of Bear Lake, and America's best scenic trout fishing destinations in Flaming Gorge and Green River.

While Utah is home to dozens of stunning lakes and rivers, a restored Utah Lake will help bolster the non-ski seasons and will provide a signature recreational and conservation-oriented experience that visitors currently travel to Nevada (Lake Mead), Arizona (Lake Powell), or Idaho (Bear Lake, which is split between Utah and Idaho) to enjoy.

UTAH LAKE RESTORATION PROJECT TOURISM IMPACT

While the Utah Lake Restoration Project is focused primarily on its environmental stewardship of the Lake and creating an amazing quality of life for residents and businesses, it will add tremendously to Utah's tourism industry.

The completed project will generate, conservatively, more than $1.4 billion in increased travel spending each year (based on 2016 expenditures with no adjustments for inflation). This will generate more than $200 million annually in state and local taxes, just in visitor spending, and will create more than 24,000 new tourism-related jobs. Lodging taxes generated from overnight stays in the new destination will generate an additional $3.5 million in annual revenues to the state and local governments.

The Utah Office of Tourism has successfully developed an international brand and worldwide recognition. The value of Utah's tourism brand will accelerate awareness of the reclamation of Utah Lake, and reciprocally, tourism will benefit from a restored Utah Lake with increased visitor access and expanded amenities.

The Utah Lake Restoration Project will begin adding to the local economy as early as year three, through the initial Provo Bay restoration effort. This initial project will restore Provo Bay and create both demand and opportunities for shore side parks and beaches, recreational resources, and planned communities that appeal to vacationers and permanent residents.

Utah County's private, leisure and hospitality employment grew an impressive 28.1% between 2012 and 2016, more than any other county in Utah. That rate will increase significantly with the restoration of Utah Lake and demand for more lakeside access and amenities.

In terms of per-capita visitor spending, Utah County underperforms the state average by nearly $700 per resident. This is perhaps due to the fact that many of the state's top attractions are located in the southern, eastern, and northern parts of the State, and the Wasatch Range (including Temple Square, and downtown Salt Lake City). Nearly all of the main attractions are outside of Utah County.

The Utah Lake Restoration Project will not just increase the overall tourism revenue of the State, but will also help balance the travel spending, bringing additional spending into Utah County. With more than two-thirds of state residents living within an hour's drive of the Lake, Utah Lake will lessen the pressure on the rural counties of the state and Salt Lake City, who currently carry the load of supporting Utah's growing tourism demand, helping alleviate the crowding issues at these destinations.

The demand for new boat launch sites, marinas, provisioning stores, restaurants, recreational rentals, cottages, motels, hotels, and outdoor guides will create hundreds of opportunities for small business start-ups. In the U.S., over 84% of tourism-related businesses, are classified as small businesses and the majority of these are family-wage businesses.

Additionally, the top activities of travelers world-wide when they travel to a destination are shopping, dining and entertainment, preferably in a pedestrian-friendly, intimate setting. In fact, this is where 80% of all non-lodging tourism spending takes place. This is why downtowns such as Park City and Springdale (next to Zion National Park) do so well in terms of retail sales. The same could be said for Station Park in Farmington (near Lagoon), or City Creek in Salt Lake City. This is also why Disney developed Downtown Disney outside each of its parks.

> The restoration of Utah Lake will not just increase the overall tourism revenue of the State, but will also help balance the travel spending, bringing additional spending into Utah county.

The Utah Lake Restoration Project development designs include pedestrian-oriented retail "villages" or neighborhood shopping and dining districts featuring narrow tree-lined streets, wide sidewalks, shared parking and transit stops, and programmed plaza areas full of life 300+ days a year. Sidewalks will be home to outdoor café dining (in season) and street music.

Village centers will include performing and visual arts venues. The retail mix will be orchestrated with 70% locally owned shops and restaurants, with occasionally invited chains and locally owned franchise businesses. This local focus will create an "organic" feel to the area, important in creating a true "sense of place," or "place-making."

Americans are moving to the "European Standard," which includes shopping and dining later into the evening hours (70% of all consumer retail spending now takes place after 6:00 pm), programmed gathering areas or plazas, and pedestrian- and transit-oriented development.

The lake's developed retail villages will lead the way in this cultural shift. These zones will attract conferences, conventions, trade shows, particularly within the urban planning and environmental sciences, as well as leisure visitors looking for waterfront ambiance and water-oriented experiences combined with a variety of culinary, arts and shopping experiences.

In summary, while the Utah Lake Restoration Project is focused primarily on its environmental stewardship of the Lake and creating an amazing quality of life for the lake's residents and businesses, it will add tremendously to Utah's tourism industry. The Project will start contributing to the industry as soon as year three, and at completion, will generate more than $1.4 billion in increased travel spending each year, contributing more than $200 million annually in state and local taxes, and creating more than 24,000 new tourism-related jobs in the State.

ECONOMIC IMPACT

The Utah Lake Restoration Project will not only be one of the largest environmental restoration projects in the country, it has the opportunity to be a significant contributor to the economic and social benefit of Utah residents. Planners, designers, engineers, biologists, technicians and many other professionals will participate in the restoration of the Lake. These new jobs fit comfortably with Utah's Strategic Industry Clusters, and priority Economic Clusters.

In order to recoup the $6.4 billion private investment in restoration of the Lake, and to improve the health of the Lake, up to 16,000 acres of new upland islands will be created. A detailed discussion of the environmental benefits of island creation is included on pages 41-46 of this proposal. Of the newly formed land, more than 10,200 acres will be held for public access and conservation.

The remaining land will be used to create a new futuristic mixed-use island development that will include a mix of retail shopping, dining and entertainment options, single and multi-family housing, creative and Class A office space, educational and religious institutions, hotels and meeting/event space, sports and cultural venues, along with other amenities, both commercial and public including parks, marinas and interpretive facilities.

Upon completion, the Project will create a taxable base of $70 billion dollars, not adjusted for inflation. This will generate more than $1.9 billion in direct state and local taxes each year, including resident state income, sales and property taxes. Additional taxes will be generated from spin-off taxes, other jobs created throughout the state as a result of the Project, permitting and other fees, sales taxes tied to more than $25 billion in goods and services provided during the Project's construction period, and tax revenues generated from the 22,500 construction jobs that will be generated during the 25-year build-out period.

DETAILED DISCUSSION

Environmental conservation and restoration of the Lake are the primary objectives of the Project and the Utah Lake Restoration Project Team is fully committed to secure the resources to achieve these aims. Development of a portion of the created islands will be the economic driver to attract the private capital needed to fund the Project.

The private sector will not only restore Utah Lake with $6.4 billion in private funding, but will also build transportation infrastructure (including roads, sidewalks, greenbelts, parking areas, transit portals and hubs, and landscaped medians), utilities (including water, waste, sewer, storm drainage, etc.), and public amenities (including local parks, trail systems, boardwalks, marinas, restrooms, sports and recreational facilities).

Jobs

The projected $6.4 billion private investment in the Utah Lake Restoration Project will require high-tech employees for Project planning and execution. The multiplier effect of each high-tech job in the U.S. creates five additional skilled and unskilled jobs in the service economy according to economist Enrico Moretti[ii]. The state will benefit from the global development investment in professional consultants, both home grown and non-resident technical experts who will move to the state for this multi-decade project.

New discoveries and technical innovations from the project will be available for export around the world. Planners, designers, engineers, biologists, technicians and many other professionals will participate in the restoration of the Lake. These new jobs fit comfortably with Utah's Strategic Industry Clusters, and priority Economic Clusters.

Construction requirements and the need for skilled workers will be massive with an island development timeline stretching out more than 25 years. The LEED Diamond Development Program requirements for commercial, residential and recreational construction will establish Utah as a world center for innovative design and construction. This in turn will attract technology, engineering, information and architect firms and academic research to the region.

The restoration and subject private-sector development will employ an average of 22,500 full-time construction jobs, each year, over the 25-year build out.

For the first time in U.S. history, quality of life is leading economic development. In fact, the Urban Land Institute, the Wall Street Journal and other sources have stated that jobs are now going where the talent is, or where the talent wants to live and work.

Tourism is the front door to non-tourism economic development efforts because it promotes the recreational and environmental activities and amenities offered locally. Combine those assets and amenities with the new-urban transit-oriented development that is core to the project, and island development will become the showcase for the future of American city development and revitalization.

Utah's frequent ranking as the Best State for Business, its young, educated workforce, fiscally responsible local governments, and a lower than national average cost of doing business, combined with newly developed premier business districts and lakefront residential living will attract new businesses to the State, creating thousands of new employment opportunities.

> For the first time in U.S. history, quality of life is leading economic development.

[ii] Enrico Moretti, MITSloan Management Review, June, 6, 2012

Tax Revenues and Housing

The new development will be large enough to generate substantial economic impact in a state region that is experiencing sustained demand for new housing, skilled jobs, and a healthy retirement population. Island development will include business and commercial districts, resort destinations, schools, recreation parks and trails, and social and religious facilities.

Located on and around a restored Utah Lake, this type of lifestyle community will attract thousands of employers, employee families and retirees. Economic value will be created continuously throughout the length of the project, from value added initial investments of buildable land, and real estate appreciation.

A successful destination brand of the new community development and surrounding recreational lake attractions will be accelerated through built-in energy efficiency technology and transportation innovations as well as pedestrian-scale and neighborhood-focused urban design. Utah Lake can enhance the Utah "natural" brand with environmental successes and cutting-edge technology.

The new developments on the project will help alleviate the housing shortages of Utah County, by creating lake destination living at multiple price points, including single and multi-family low, medium, and high density housing within walking distance to work, public transit, shopping, and entertainment.

Upon completion, the Project will create a taxable base of $70 billion dollars, not adjusted for inflation. This will generate more than $1.9 billion in direct state and local taxes each year, including resident state income, sales and property taxes.

Additional taxes will be generated from spin-off taxes, other jobs created throughout the state as result of the Project, permitting and other fees, sales taxes tied to more than $25 billion in goods and services provided during the Project construction period, and tax revenues generated from the 22,500 construction jobs that will be generated during the 25-year build-out period.

ECONOMICS SUMMARY

The Utah Lake Restoration Project will be the largest restoration and development undertaking in Utah State history, and perhaps in the country, and will create an international model for impaired lake restoration.

The Project will add billions of dollars in state and local taxes to the economy each year, will create tens of thousands of new full-time family-wage jobs, and will help fill the inventory needs of housing, which has been, increasingly, in short supply.

All of this will be achieved with the private-sector carrying the substantial cost of restoration and development for a new international restoration and development model. In the process, it will elevate the greater Salt Lake City/Provo metropolitan area as one of the nation's highest-ranking destination for jobs, investment, quality of life, and tourism.

PUBLIC TRUST

WATER CONSERVATION

Utah Lake Restoration Project will contribute billions of gallons of clean water to the public trust.

WATER

One of the primary public trust benefits of the Utah Lake Restoration Project is contributing billions of gallons of clean water to the public trust. The project will save 30-34 billion gallons of water from evaporation and water conservation saving annually. This is enough water to support over 600,000 state residents annually. Given the scarcity of water in the state of Utah, this is one of the most important public trust contributions of the Utah Lake Restoration Project. Saving water from evaporation plays an important role not only in water conservation, but also in restoration of the Lake.

DETAILED DISCUSSION

Water Needs

Water is a precious resource along the Wasatch Front and for the state of Utah. As one of the fastest growing states in the country, providing water for new Utah residents is a significant concern. Population projections for the Wasatch front predict upwards of 2 million new residents in the next several decades. Utah County is projected to experience the highest population growth of any county in the state. The Utah Lake Restoration Project will help address water needs along the Wasatch front.

Envision Utah (envisionutah.org) estimates that by the year 2050, 2.4 million additional people will be living in Utah. Most of those people will likely live along the Wasatch front. One of the most immediate concerns this will create is a lack of water to support the growing population. There are several state initiatives to address this pressing issue, including Slow the Flow and the Central Utah Project. The Utah Lake Restoration Project will further address the potential water challenges in the state of Utah.

Water Savings

Utah Lake undergoes significant fluctuations in its water level every year. While the Lake has always experienced some natural fluctuations in lake level, the degree of fluctuation today is not a natural condition of the Lake. Irrigation, culinary water use, increased evaporation, invasive plant species, and diversion of water from Utah Lake tributaries means significantly less water reaches the Lake than before settlement of the Wasatch Front.

As a result, water levels on Utah Lake can fluctuate by as much as 4 feet during the year.[i] This results in the exposure of as much as several hundred yards of the lakebed during the year. This kills littoral zone plants, leads to proliferation of Phragmites, and degrades habitat for both aquatic and terrestrial wildlife species. High evaporation rates also increase salinity of the lake water and total dissolved solid concentrations, exacerbating water quality challenges in Utah Lake.

By reducing evaporation on Utah Lake and implementing conservation measures planned as part of the Utah Lake Restoration Project, many, if not all of these challenges can be ameliorated. Four facets of the Utah Lake Restoration Project are designed to reduce evaporation on Utah Lake:

1. Island creation to reduce surface area of Utah Lake;
2. Improved water clarity and increased lake depth which reduces temperatures on the lake surface;
3. Improved circulation within the water column which further reduces water temperatures on the lake surface;
4. Removing invasive Phragmites

The following factors influence evaporation rates of Utah: the greatest is lake surface area, also included are average depth, water temperature, water circulation, and total suspended solids ("TSS"). In each of these factors, Utah Lake is substantially impaired. Utah Lake has a large surface area at 96,400 acres, but is relatively shallow with an average depth of only about 9 feet. Utah Lake's TSS impairment comes from multiple sources, primarily high sediment levels at the bottom of the Lake and Phragmites decomposition.

TSS loaded sediments are stirred by frequent wind and wave action. A detailed discussion of the impact of wind and wave action is covered on pages 47-52. Utah Lake is relatively warm compared to

other lakes in Utah, which is another factor affecting evaporation and high TSS concentrations.

The total volume of water in the Lake is estimated at over 294 billion gallons of water. According to multiple studies, Utah Lake currently loses between 47-51% of its water annually to evaporation, which is between 138 and 150 billion gallons of annual evaporation loss.

> Utah Lake currently loses between 47-51% of its water annually to evaporation.

[i] "Utah Lake": A Few Considerations" LaVere B. Merritt; May 2016; Page 2

[ii] Utah Lake Comprehensive Management Plan Resource Document, Dr. Daniel Horns, UVU Department of Earth Science 2005 p.6

One of the most significant public trust benefits of the Utah Lake Restoration Project is reducing water evaporation by reducing surface area of the Lake while also increasing the depth and total water holding capacity of the Lake. This means that a greater volume of water can be contained within a smaller surface area. The project will reduce the surface area by 16-20%, which is the ideal range to achieve the desired evaporation savings and environmental benefits without inhibiting public access to water-based recreation. Evaporation savings alone will conserve 22.5 – 30 billion gallons of water annually.

Other factors which will also further reduce water evaporation are improved water clarity, a deepened and re-contoured lake bathymetry, and improved water circulation within the water column, all of which will lead to lower surface temperatures and will further reduce evaporation. These topics are addressed in depth on pages 35-66.

Removing 8,000+ acres of invasive Phragmites and replacing them with native species saves even more water, up to 9.1 billion gallons annually as discussed in depth on pages 67-72.

These improvements will save 30-34 billion gallons of water from evaporation every year. Saving water from evaporation plays an important role not only in water conservation, but also in restoration of the Lake itself. Stabilizing the shoreline will protect littoral zone plants and help control the spread of invasive plant species like Phragmites. A stable shoreline with minimal fluctuations will protect long-term economic value and recreation interests on the islands and lake perimeter.

Water quality

The Utah Lake Restoration Project will transform Utah Lake from its turbid hypereutrophic state to a clean, clear water state. In its current state, the water of Utah Lake can't even be used as a potable water source. During algae bloom season, not only is Utah Lake closed to public recreating for extended periods, but the water quality is so poor that reservoirs downstream of Utah Lake are closed as well. Increasing the holding capacity and saving water wouldn't be nearly as beneficial if not for restoring the water quality to a clean, clear state. The Utah Lake Project will attain both of these objectives.

Dredging of Utah Lake, including removing fine sediments, nutrient loaded sediments and deepening of the Lake; creation of islands; and controlling wind and wave action will create a foundation for cleaner, clearer water. The Project will create a long-term naturally sustainable ecosystem for maintaining high water quality by addressing high nutrient inflows, removing invasive plant and fish species, and restoring native plant populations. Littoral and emergent zone plants will anchor the lake bottom and play a fundamental role in restoring the clear water state of Utah Lake. Riparian zones will help filter water before it enters Utah Lake.

Additional water quality improvements include the addition of 40 biofiltration systems around the Lake, capturing and treating storm water and surface waters entering the Lake, upgrades to water treatment facilities and aeration systems, and improving lake circulation. Restoring the biodiversity and providing these infrastructure improvements will help naturally restore and maintain water quality and water clarity on the Lake. These solutions are addressed at length in the Water Quality Solutions section on pages 53-66.

WATER CONSERVATION SUMMARY

In summary, the Utah Lake Restoration Project will vastly improve the water quality of the lake's 294 billion gallons, will increase its holding capacity by deepening the Lake, will save 30-34 billion gallons of water each year, and will stabilize the shoreline from fluctuating water levels. Infrastructure improvements and restoring the lake's natural ecosystem will improve water clarity and water quality. This will benefit the public by providing cleaner, clearer, and more usable water reservoirs for as many as 600,000 residents which will be critical to support the State's growing population.

PUBLIC TRUST

CONSERVATION

The primary objective of the Utah Lake Restoration Project is to restore Utah Lake as a viable and self-sustaining ecosystem.

CONSERVE THE ENVIRONMENT

The Utah Lake Restoration Project will meet each of the objectives of Resolution H.C.R. 26, sponsored by Representative Mike McKell and Senator Deidre Henderson. Comprehensive restoration includes restoring natural ecosystems, including native plant communities, wildlife, and endemic and endangered species. This restoration will be a significant contribution to the Utah public trust.

The solutions and methodologies for the restoration have been thoroughly discussed throughout this proposal. These are the environmental public trust benefits the state of Utah and its residents will enjoy as a result of implementing the Utah Lake Restoration Project:

- Dredging the Lake will remove one billion tons of nutrient loaded sediments from the lakebed
- Upgrading waste treatment facilities and installing biofiltration in and around the Lake will stop the cycle of adding more nutrients than the Lake can naturally process
- Removing carp and other invasive fish species will put an end to the destruction of valuable littoral zone plants. Breeding/growing and re-introducing natural plant and animal life to the Lake that can naturally filter the nitrogen and phosphorus flowing into the Lake will ensure that through natural processes the Lake avoids eutrophic relapse long-term
- Replacing invasive plant species like Phragmites with native littoral and riparian plant species will create ideal breeding and living habitat for aquatic and terrestrial animal life, including endemic and endangered species, and will naturally filter the water

UTAH H.C.R. 26

1. WILDLIFE RESTORATION
Restore a vibrant fishery, including the Bonneville cutthroat trout population and recovering the June sucker, while improving habitat for waterfowl and other wildlife species.

2. PLANT RESTORATION
Accelerate solutions to remove invasive plant species, restore littoral zone plant communities, and restore native plant species on Utah Lake's shoreline.

3. RECREATIONAL ACCESS
Maximize and ensure recreational access and opportunities on Utah Lake, while also improving lake use for Utah and its citizens.

- Deepening the Lake and changing the lake bathymetry with deep underwater channels will limit wind and wave action on the surface and exponentially reduce lakebed disturbing forces from these events. This process will also improve circulation on the Lake creating a more sustainable environment for native plant and animal life
- Forming islands will store the dredged material, limit wind and wave action to protect Littoral zone plants and improve lake safety.

Implementing the Utah Lake Restoration Project will lead to a clean clear-water lake with abundant aquatic and terrestrial animal life and thriving Littoral and Riparian zones surrounding the Lake and its islands.

It will also mean restoring abundant populations of a wide variety of wildlife species, including but not limited to, waterfowl, upland bird, shore birds, mammalian, aquatic, and amphibian species.

These species rely on the Lake, its shoreline, and tributaries for habitat and as a food source. Many of the animal species that utilize the Lake have been adversely affected by the diminished water quality on the Lake, loss of native plant and animal species, algal blooms, and fluctuating levels.

Our goal is not only to make the Lake and its surrounding better for wildlife, but to also return the flocks of waterfowl, pelicans, mammals, abundant fisheries, and aquatic species that once dominated the Lake.

The Utah Lake Comprehensive Conservation Project is a landscape-level conservation effort designed to benefit the wildlife on the Lake. As we restore the clarity of the water and repopulate native plant species and millions of native fish to the Lake, dependent species will return and flourish.

The ultimate objective of these efforts is to produce conditions on Utah Lake to restore the natural systems, food chain, and reproductive ability for self-sustaining fish and aquatic species of Utah Lake.

> The ultimate objective is to restore the natural systems, food chain, and reproductive ability for self-sustaining fish and aquatic species

PUBLIC TRUST

GROWTH

. The Utah Lake Restoration Project benefits the state and its citizens by helping manage growth.

SUSTAINABLE GROWTH

The state of Utah, and Utah County in particular, are among the fastest growing states and counties in the country. Utah's economic and political climate continue to attract new businesses and residents. This tremendous growth presents numerous opportunities as well as challenges.

The Utah Lake Restoration Project benefits the state and its citizens by helping manage this growth by creating affordable lakefront housing opportunities, promoting and enabling sustainable living, and creating new commercial and business areas to attract new business to the state.

The islands will add a special dimension of lakefront living for hundreds of thousands of Utahns and provide a living experience unlike any other in the United States. These world-class, environmentally friendly communities will be surrounded by trails, parks, waterways, beaches, open space, and abundant water sport recreational opportunities.

They will include areas for business, shopping, entertainment, and sports. Considering Utah's other natural wonders, a fully restored lake dotted with recreation, development, and conservation islands will add to Utah's aura as the destination for lifestyle, outdoor recreation, and business.

Because the Utah Lake Restoration Project is first an environmental conservation project, all elements of island development will be executed with the environment in the forefront. For example, LEED certified construction will deploy environmental best practices and construct with the most environmentally conscious materials. Every detail of the buildings, utilities, landscaping, and transportation will be designed and built to minimize the short and long-term environmental impact, both to Utah Lake and to the state of Utah.

Finally, the Project will create new commercial and business districts with high-speed internet and infrastructure to attract new businesses and professional-level talent, accommodate job growth, and create tremendous economic opportunity for the State. Each of these accomplishments will further position the state of Utah for future economic, job, and population growth.

PUBLIC TRUST

RECREATION

The Utah Lake Restoration Project will invest billions in making Utah Lake a recreation destination.

TRAVEL/ ADVENTURE

Outdoor Recreation is a $2.4 billion industry in the state of Utah. With five national parks, world-class skiing, backpacking, hiking, and mountain biking, Utah has become a destination not only for tourists, but also companies who value quality of life for their employees.

Restoring Utah Lake will add a special dimension of lakefront living and abundant water recreation opportunity for millions of Utahns and visitors. Considering Utah's other natural wonders, this Project would add Utah Lake to Utah's aura as the destination for lifestyle, outdoor recreation, and business.

Utah Lake is currently a significant and underutilized recreation resource along the Wasatch front. More than half of the state's population, over 1.5 million people, live within a one-hour drive of Utah Lake. However, algal blooms, water quality, wave action, and a lack of native wildlife mean relatively few visitors utilize the Lake.

Restoring the Lake and its surrounding areas provides prime recreational opportunities for Utah's citizens and visitors. Restoring Utah Lake as a recreation destination is one of the core objectives of the Utah Lake Restoration Project.

DETAILED DISCUSSION

Restoring Utah Lake not only means returning the Lake to a more natural state, our comprehensive solutions are also designed to provide more recreational opportunities in and around the Lake. Here are five key components for making Utah Lake a world-class destination for recreation:

1. Restoring the water clarity and water quality
2. Recreation Islands with docks, beaches, campsites, cabins, and facilities for affordable recreation on the Lake
3. Open space including parks, waterways, and natural open space
4. A 120-mile interconnected lake trail system
5. Adding beaches and increased waterfront access on the Lake
6. Controlling wind and wave action to increase lake safety

Watersports

Utahns and visitors love water sports recreational activities. Utah's freshwater lakes are often crowded during the summer months. Whether it is sailing, canoeing, waterskiing, wake boarding, rowing, or paddle boarding, people love to spend time on the water.

At about 150 square miles, Utah Lake is one of the largest natural freshwater lakes west of the Mississippi River. However, weeks-long closures of the Lake, poor water quality, and other considerations mean that Utah Lake averaged between 10-30 boats per day during the summer of 2017. Considering that more than 1.5 million residents that live within an hour drive of Utah Lake, this is significant underutilization of a freshwater lake of this size.

The Utah Lake Restoration Project will restore the water clarity, water quality, and address algal blooms, high sediment levels, and other sources of water degradation on the Lake. Restoring water quality, water clarity, and controlling wind and wave action create conditions on the Lake favored by water sports enthusiasts, fishermen, sailors, and other water recreationists. Our objective is to attract people to enjoy the beauty of Utah Lake and reconnect with its natural wonders.

Recreation Islands

One of the crowning features of the restored Utah Lake will be recreation islands dotting the Lake. Families and individuals from around the state, and visitors will gather to enjoy the beauties of nature and reconnect with each other.

Recreation islands serve key conservation roles, and will be accessible to the public, offering multiple free and low-cost opportunities to play, explore, camp, and rejuvenate. The topography

will support a variety of activities such as hiking, biking, bouldering, camping, and other activities. Recreation island shorelines will include sand beaches and gravel beaches for public enjoyment.

In addition to public beaches, floating docks will be constructed around each recreation island, allowing easy boat access to any part of the island for boaters, outdoor enthusiasts, campers, and other visitors. Docks will be free for public use and available for multiple uses including docking powered and non-powered watercraft, swimming access, and fishing. Recreation islands will be completed with tent camping sites, numerous pavilions, picnic benches, RV camping spots, and cabins. These amenities will support day use, one-night, multi-night, or group outings.

Open Space

In addition to the open space and recreational opportunities provided by recreation islands, development islands and estuary islands will provide significant open space and recreational opportunities. Development islands will provide world-class, environmentally friendly communities. These communities will be surrounded by trails, parks, waterways, beaches, open space, and abundant water sport recreational activities. They will include areas for business, shopping, entertainment, and sports.

Parks, recreation, open space, public facilities, roads, and public access constitute more than 40% of the acreage on the development islands. When recreational waterways through the main island are included, total parks, recreation, and open space becomes more than 7,300 acres or more than 55% of the island land by the Project.

When estuary islands, recreation islands, beaches, and recreation waterways are included, these categories account for more than 10,200 acres or 64% of the acreage created by island development.

In contrast, development for communities, business, commercial, and mixed areas account for the remaining 36% of acreage, or 5,830 acres[1]. This shows the commitment and investment in open space on development, recreation, and estuary islands on Utah Lake.

[1] There will also be some development areas surrounding Provo Bay.

Trail Systems
A key component of the recreational investments of the Utah Lake Restoration Project is the 120 miles of trails for public use. The Project trails will circumnavigate the 76 miles of Utah Lake and cross both causeways.

The objective is to provide unique recreational, exercise, and nature-viewing venues which can also support marathon runners, bicyclists, outdoor enthusiasts, and family outings.

The trail system will be approximately 14-feet-wide in high use areas and reduced to approximately 8 feet wide in lower use areas. The areas adjacent to walkways will be landscaped with indigenous plantings and ground cover and seedlings (aspen, birch, native pines, fir, grasses, and flowers) to be planted in adjacent riparian zones extending from the edge of the trail on both sides. The Project will construct underpasses for safety and convenience when trails and roads intersect.

Bikers, joggers, and walkers utilizing the trail will find frequent rest areas providing water, shade, seating, native landscaping, and restroom facilities. Facilities and other support improvements will be provided along the trail every 1-3 miles.

On portions of the trail sensitive to ground construction, such as wetlands and conservation areas, the Project will provide an elevated conservation trail on piers to give unparalleled access to users (exercisers, bird watchers, and naturalists) utilizing the trail system.

Beaches
Twelve beaches will be created around the shoreline of Utah Lake and on lake islands. Beaches will be sandy beaches or gravel beaches depending on local needs and conservation design. They will be accessible by a short trail from adjacent areas, provided parking lots, and access roads and will have direct access to the new lake trail system that circumnavigates the Lake.

The beaches will extend from riparian areas into the water for a minimum of 150 feet and be sloped so that drought and low lake water won't affect the usability of the beach. Public beaches will vary in length from 500 feet to 2,000 feet.

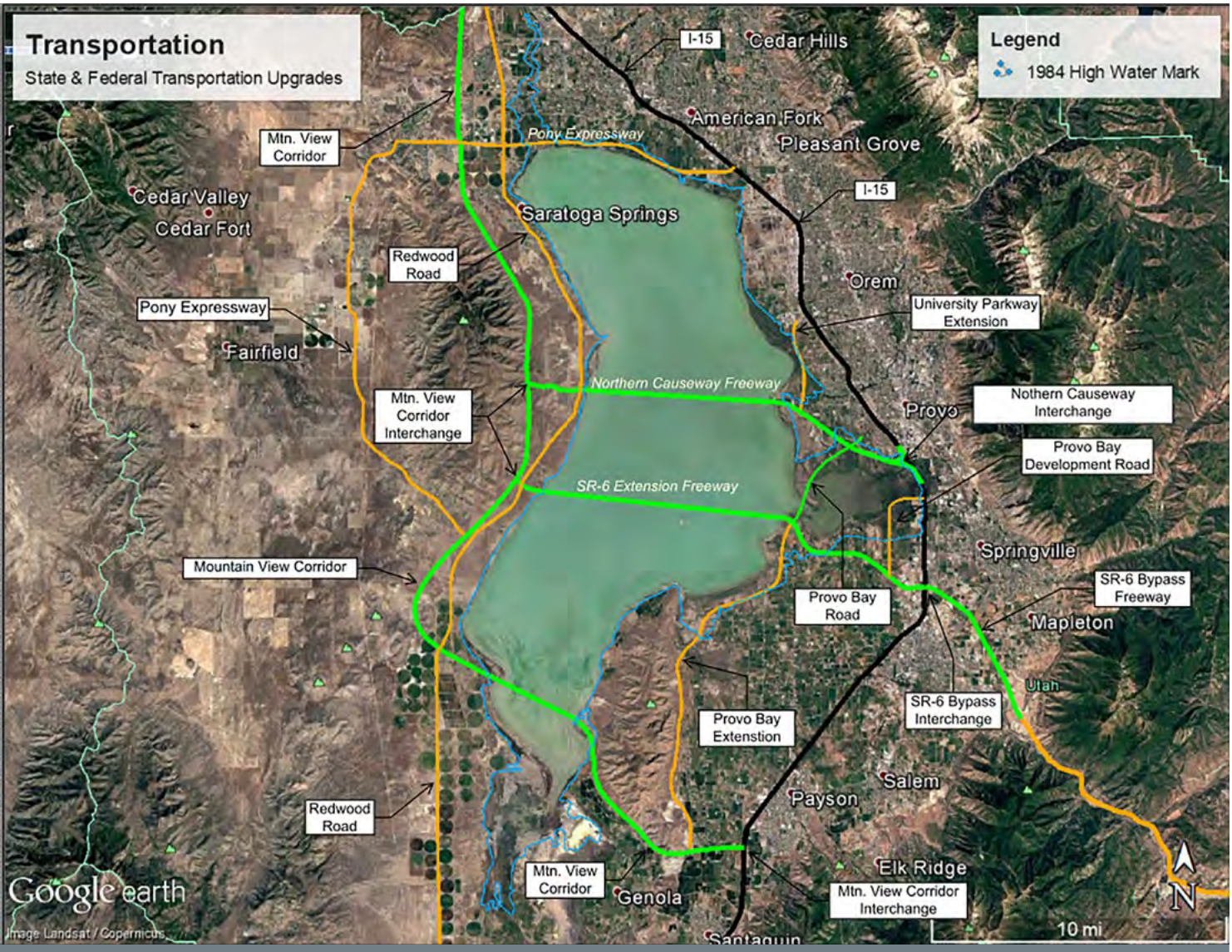
All sand beaches will be approximately 8 feet deep of sand and constructed with a specific mixture of graded manufactured sand designed to be resort rated, i.e. soft on the feet and comfortable to walk on, sit on, and enjoy.

Fish and Wildlife

Restoring the millions of Bonneville cutthroat trout and other fish, pelicans, bald eagles, osprey, and migratory species is a core objective of the Utah Lake Restoration Project. To accomplish these objectives, the Project will include over 10,000 acres of recreation and wildlife viewing habitats.

Not only will these conservation actions benefit indigenous wildlife, they will become the ecological driver for conservation and restoration of many important sensitive and endangered species.

These benefit Utah's wildlife species and contribute to the enjoyment of the public who interact with these wildlife species. Restoring native species to the Lake will not only increase the public's use and enjoyment of the Lake's natural environs, but will also expand opportunities for bird watching, fishing, water fowl hunting, and for other outdoor and wildlife pursuits.



PUBLIC TRUST

TRANSPORTATION

The Utah Lake Restoration Project will drastically improve the way traffic flows around Utah County and the Lake

TRANSPORT OPTIONS

One of the public trust benefits of the Utah Lake Restoration Project is improving the public transportation system in Utah County and easing traffic congestion on I-15 and other roads.

The Utah Lake Restoration Project will drastically improve the way traffic flows around Utah County and the Lake, significantly improving the efficiency of transportation access for the population. The Project includes a comprehensive proposal for alleviating existing traffic congestion and planning for future population growth.

Causeways are the key feature of the transportation plan. Building causeways across the Lake at strategic locations opens up many options for alleviating the traffic congestion on Utah County roads. Adding new highways and roads and expanding a few existing roads will open up Mountain View Corridor as a legitimate second option for moving north – south along the Wasatch Front.

In addition to improved automotive transportation throughout Utah County, the comprehensive transportation plan and mixed-use development design vastly reduces reliance on personal automobiles. With so many amenities within walking distance of island residences and businesses, and convenient mass transit options intra-island and to mainland, the traffic load will be further mitigated.

MASS TRANSIT

In addition to new freeways, the Project will contract with a major mass transit provider to supply mass transit connecting to major UTA bus and rail transportation systems in the Provo/Orem area. This state-of-the-art transportation system will provide all residents and visitors with easy access to transportation, with stations on the main island within a five minutes walk of any home or business. Major hotels, businesses, shopping centers, attractions, and event centers on the island will have direct ties to the line in the form of stations to facilitate usage from tourists and residents. A dedicated mass transit line will connect the main island to the Salt Lake International Airport along the MVC easement.

The transportation plan will serve to rectify the traffic strain and subsequent air pollution in Utah County. The execution of this plan will remediate the traffic demands while providing commuters multiple high-speed options on all parts of the Lake. More information on transportation improvements are outlined on pages 169-174 of the proposal.

CONCLUSION

Providing world-class transportation is an important part of the Utah Lake Restoration Project. Development of the main development island is centered around transportation hubs. Neighborhoods, commercial centers, and public facilities all enable pedestrian accessibility and quality of life. Medium density and multi-family units are centered around transportation centers which will provide ready access onto and off of the island. Two causeway locations will significantly improve traffic flow for the main development island and across Utah County.

PUBLIC TRUST

NAVIGATION

Improving navigation includes increasing recreational utilization, lake access, and safety

SAFER WATERS

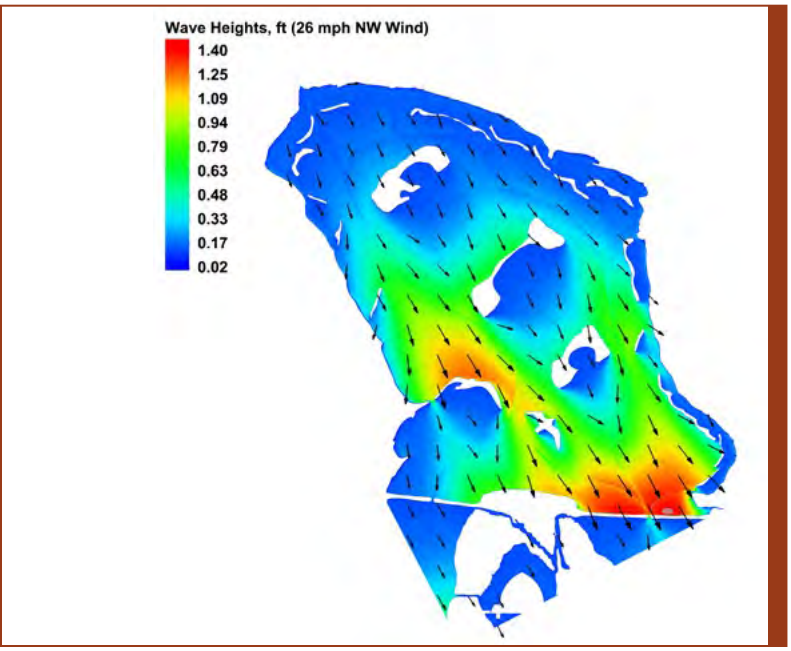
Improving navigability of the Lake is another public trust benefit the Utah Lake Restoration Project brings to the state of Utah. Essentially all navigation on Utah Lake is for recreation. Improving navigation includes increasing recreational utilization, lake access, and safety on the Lake.

Utah Lake has become significantly underutilized as a recreational destination, despite more than two-thirds of state residents living within an hour's drive of the Lake. During the summer months, water quality degradation, including significant algal blooms and e-coli outbreaks, has led to closure of the Lake lasting for weeks at a time.

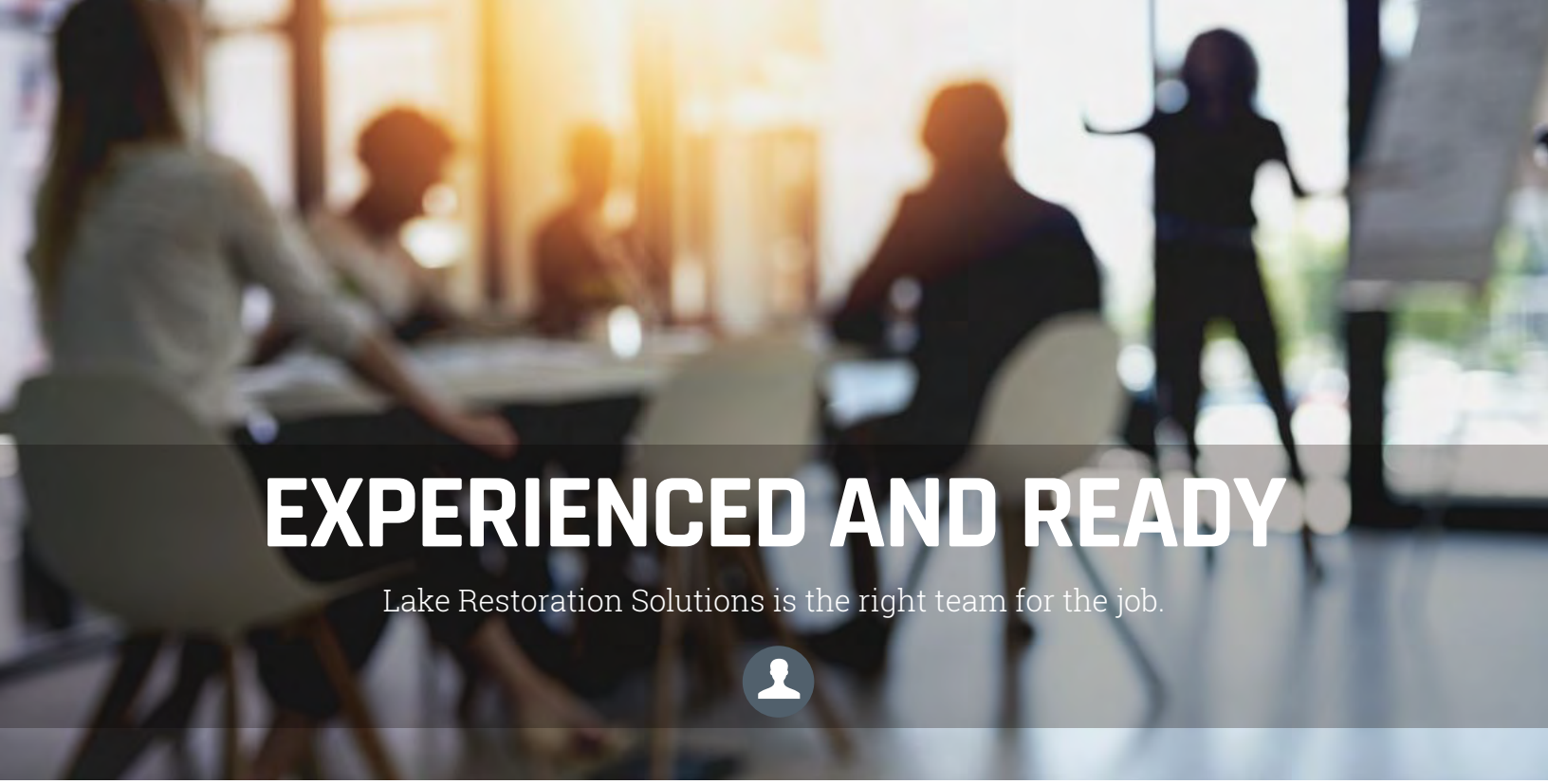
This past year, during the prime recreational summer months, there were only between 10 and 30 boats on the Lake most days. By transforming Utah Lake from its turbid hypereutrophic state to a clean clear-water state, the Utah Lake Restoration Project will greatly improve the recreational utilization of the Lake.

Today, getting caught on the Lake during a wind and wave event can be catastrophic, even deadly. After dredging and island formation is complete, Utah Lake will be much safer for boating, fishing, and other water activities.

The Project will dramatically expand lake access by constructing public marinas, beaches, and docks around the Lake and on the islands. Islands and dredged deep channels will reduce wind and wave action on the lake. Islands also create safe harbors at numerous locations around the Lake.



WIND SHELTER
Recreation islands bays provide protection from waves during wind events.



EXPERIENCED AND READY

Lake Restoration Solutions is the right team for the job.

BEN PARKER - Founder/Project Director

Working half of his professional career overseas as construction manager and 2IC of multi-billion dollar projects, Ben brings with him a unique understanding of construction management and environmental engineering solutions. Project history includes working in Madagascar, Mongolia, Zambia, and Panama.

As a native of Utah County, Ben spent his early years living and recreating on Utah Lake. Witnessing firsthand the degradation of the Lake has lead him to invest the last ten years in research and collaboration for the Utah Lake Restoration Project.

ROBERT SCOTT - Chief Design Director

As a senior urban designer for large-scale public and private sector oriented projects, Bob excels in land-use planning, site design, and master planning for cities, land developers, and state organizations. His 40 years of experience have taken him to the United Arab Emirates, Saudi Arabia, United States, and Canada. He lived in Dubai for 10 years as the lead design manager for the Palm Deira.

RANDY FINDLAY - Senior Project Manager

Randy is a seasoned and mature Project Manager and Engineer with over 30 years of experience in numerous relevant industries, such as Mining, Mass Earthworks, Soils Engineering, and Dam Construction including remote deployments around the world. He has completed $40.3 billion in projects during his career. Randy has been involved in the early development of the proposal including constructibility, feasibility studies, preliminary engineering, budgeting and technical writings to support Project execution.

CINDY SMITH - EIS Management Director

With more than 40 years of experience in environmental consulting throughout the western United States, Cindy has a strong understanding of federal land planning and associated laws, regulations, and policies. Her experience ranges from inter-disciplinary environmental project management, resource management planning, resource inventory and impact assessment, mitigation planning, and National Environmental Policy Act (NEPA) preparation.

DAVID HARRIS Chief Landscape Designer

Dave has over 27 years of experience in landscape architecture, urban design, and planning services. During his employment with EDAW/AECOM he managed and lead multi-disciplinary projects and master planned communities in the US, Dubai, Abu Dhabi and the Kingdom of Bahrain. He has managed and directed sustainable projects, such as LEED Platinum certified facilities, and is experienced in developing sustainable, low-impact developments.

TODD J. PARKER - Co-Founder, CIO

Backed by over 20 years of experience in information systems and technology, Todd brings a broad range of skills to the project. His focus with clients has been on federal, state, and local compliance to regulatory laws and business policy through automated business rules. He was project lead for the largest Oracle project in the world ($300m) in 2001-2003 for the Great Atlantic and Pacific Tea Company. Past clients include Harvard, Rockefeller, Barrick Gold Corporation, Intermountain Healthcare, as well as U.S. Departments of Energy, Interior, and Defense.

SCOTT PETERS - Senior Landscape Architect

Scott is a Professional Landscape Architect with 23 years of experience on over 200 projects globally with extensive experience collaborating with interdisciplinary teams of architects, engineers, planners, biologists, archaeologists, and other resource specialists on a wide range of projects to develop thriving and sustainable communities while protecting and restoring the environment.

RYAN BENSON - Counsel

Ryan advises the team on legal, political, planning, and conservation issues. He is a Harvard educated attorney with 17 years experience working on a wide variety of complex legal issues. He has extensive experience with important conservation and political issues, including endangered species, at the state and federal level.

ROGER BROOKS - Project Marketing Strategist

Roger brings 36 years of experience working with nearly a thousand communities, as well as many states, provinces, national parks, and countries in their branding, marketing, and product development. He is the go-to expert for anyone with ties to the travel industry or in downtown development.

ALBERTO CASAS - Project Environmental Director

Alberto brings significant experience in engineering, construction and management of structural, environmental and civil projects globally. Experience directly managing, all communications and reporting of compliance issues for First Quantum Minerals, Cobre Panama project from 2011 into 2018. VP of Latin America for MWH for 16 years in Brazil with fiscal P&L responsibility.

DR. ALAN WATT - Risk Management and Financial Affairs Director

Alan is Head of Internal Audit at High Speed 2 Ltd, the $75 billion project to build a new high-speed railway between London and the north of England. Before joining High Speed 2 Alan worked as Head of Internal Audit and Risk for First Quantum Minerals Ltd. ('FQML') between 2010 and 2015, where he had worldwide responsibility for audit and risk on FQML's entire portfolio of projects, including the $6.5-billion Cobre Panama Copper Mining Project, the $2 billion Zambian Trident copper project and the $2 billion revenue Kansanshi copper mine in Zambia.

JOHN RAPKOCH - Principal Engineer

John brings 27 years of process and project engineering experience to the Utah Lake Restoration Project Team. Experienced in Power Services, LNG, Petrochemical facility design and construction through commissioning. John has global experience in the processing and optimization of ongoing operations and provides seasoned, mature asset with excellent leadership and analytical prowess.

ERIC T. ALLRED - Project Safety Manager

Eric has 20 year's of experience in professional occupational safety and health including work for large organizations including: Northrop Grumman, Bechtel Nevada (Maintenance and Operation Government Contract), CH2M Hill (design build), Rio Tinto (US and International), and the National Nuclear Security Administration within the United States Department of Energy. Mr. Allred has covered all aspects of the comprehensive practice of occupational safety and health with experience in heavy construction, mining, and manufacturing.

Lake Restoration Solutions, Inc.

UTAH LAKE
RESTORATION PROJECT