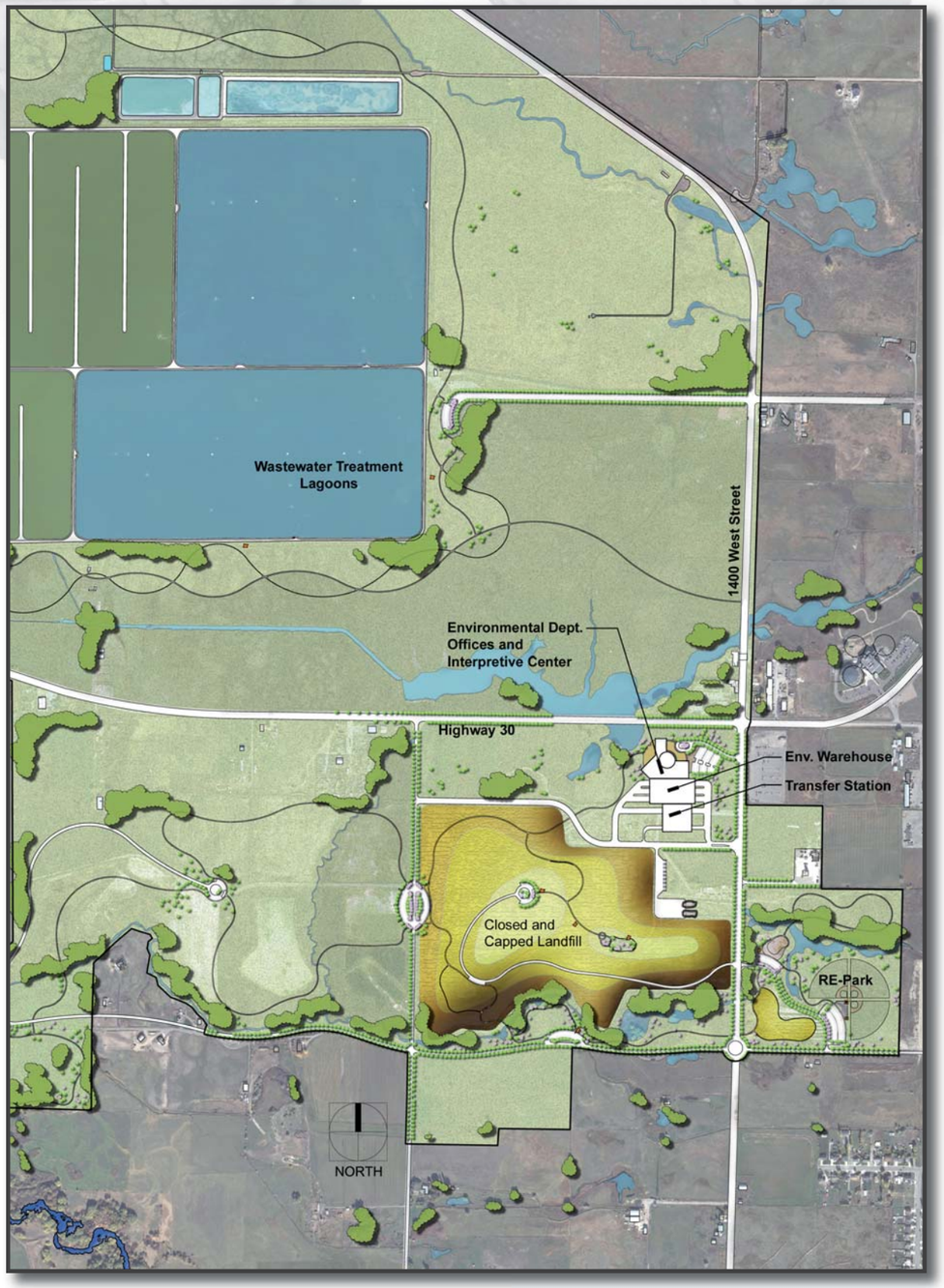


City of Logan

Integrated Municipal Waste Management Campus

February 2010

prepared for:

City of Logan
Randy Watts, Mayor

City of Logan Environmental Department
Issa Hamud, Director
issa.hamud@loganutah.org
435-716-9752
450 North 1000 West
Logan, UT 84321

City of Logan Community Development Department
City of Logan Parks and Recreation Department
City of Logan Public Works Department

Cache Valley Residents

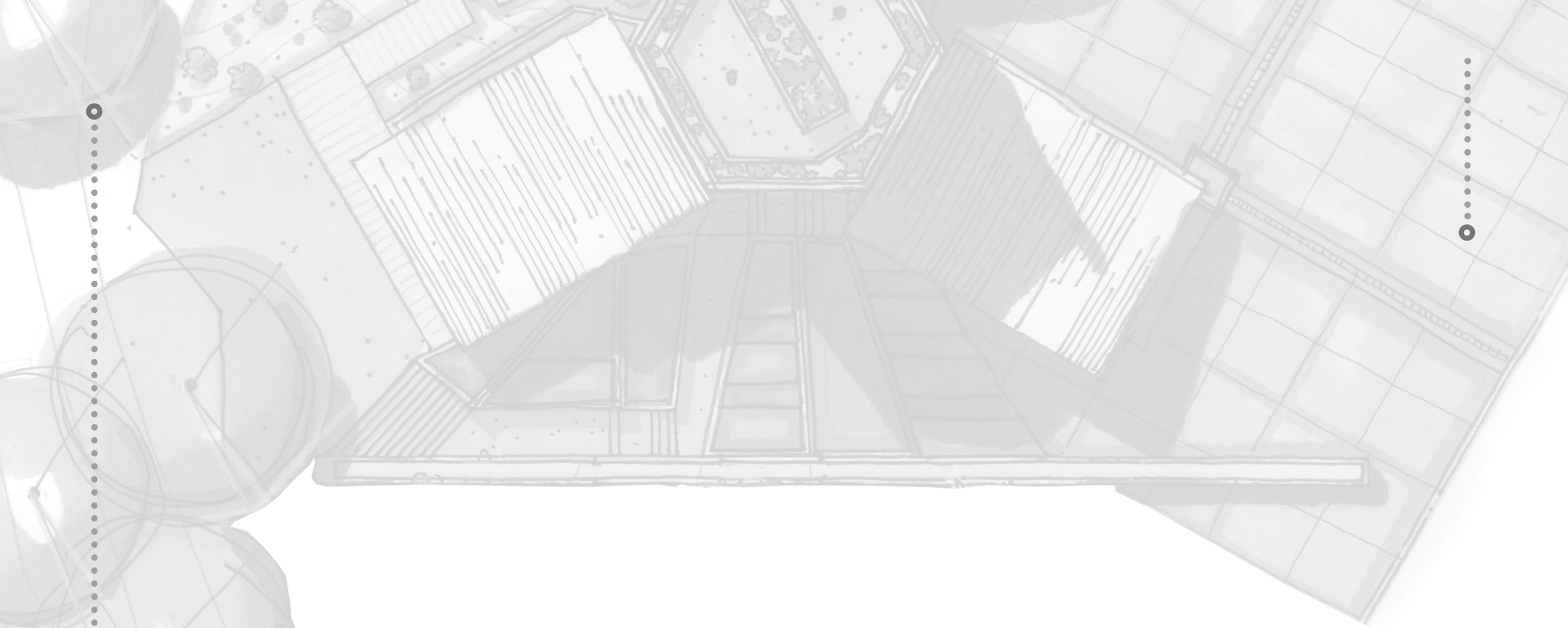
prepared by:

Cache Landmark
1011 W. 400 North
Suite 130
Logan, Utah 84321

in collaboration with:

Utah State University
Department of Biological and Irrigation Engineering
Dr. Ronald Sims

Department of Landscape Architecture and Environmental Planning
John C. Ellsworth, FASLA



Executive Summary

The existing City of Logan Environmental Department is a model framework for upholding public health and environmental quality. The current program begins with a very strong public relations and education program designed to help residents understand their responsibility in waste reduction, diversion, collection and disposal. This educational emphasis is supported by Environmental Conservation and Urban Forestry programs within the department which establish a solid foundation for environmental quality throughout the City of Logan and Cache County.

The waste management facilities are a large part of this process as well, ensuring that the waste stream is managed safely and efficiently. The current facilities consist of the solid waste landfill, household hazardous waste drop-off, green waste composting, recycling program, wastewater treatment lagoons and the tertiary treatment wetlands. The vision for these facilities is to further develop them to create an Integrated Municipal Waste Management Campus that is not only integrated within itself, but also integrated within the community and the environment. A first step toward achieving this vision is proper planning.

The City of Logan lies within one of the most beautiful and picturesque valleys of Northern Utah and the Intermountain West. It is found nestled between two beautiful mountain ranges and offers its residents a broad variety of live, work and play opportunities.

This renowned beauty brings with it a responsibility for developing a long term strategy for waste disposal that is sensitive to the regional ecosystems. Each of the sites associated with the existing waste management facilities afford an opportunity to exemplify this ideal.

The standards for safe, efficient and sensitive waste disposal are growing more stringent and more highly regulated, specifically concerning water quality discharged from existing municipal wastewater treatment facilities. Within this context a method for improving water quality and providing a resource for alternative energy has been identified by encouraging the growth of algae upon the surface waters of the wastewater treatment lagoons and harvesting the algae for biofuel production. The existing wastewater treatment facilities are planned to be retrofitted in phases to promote this new technology and to provide improved water quality and electrical power to the residents of Logan.

Additionally, the City of Logan is preparing for the closure of its solid waste landfill that has been in operation since the 1970s. This is a long-term process that has been in the planning stages for over five years. An appropriate post-closure use has been identified and the programming is underway to site a new solid waste transfer station and warehouse facility coupled with new administrative offices for the Environmental Department and an Interpretive and Education Center for the community.

Utah State University has been an integral part of the research, design and planning of each of these various facilities. It is of the utmost importance to maintain an on-going relationship with the University and to continue to provide facilities, resources and opportunities for students and faculty to continue to research the many facets of integrated municipal waste management.

This document sets forth a framework for the planning and implementation of many of the proposed changes to the existing City of Logan waste management facilites over the next ten years or more.

1.1 Table of Contents

1.2 List of Figures

1.3 Acknowledgements

Mayor Randy Watts

Mayor Randy Watts was re-elected for his second term as Mayor of Logan on November 3, 2009. Mayor Watts has lived in Logan all his life. He attended Utah State University in 1966 and then left the University to enlist in the Air Force. Upon his return he continued his education. He owns and previously operated J.R. Construction for 14 years. He was Vice-President of Cache Valley Builders for 15 years, the family-owned business.

He served on the Beaver Mountain National Ski Patrol for 21 years. He also served as Vice-President of Sunshine Terrace Board of Directors and is currently a member of the Zions Bank Advisory Board. He is Past-President of the Utah State University Alumni Association and member of the Utah State University Board of Trustees.

Mayor Watts and his wife Kathie are the parents of four children.

Brent Miller, Ph.D

Brent Miller was appointed Vice President for Research and Director of Federal Relations at Utah State University on October 1, 2001. He previously had been Interim VP for Research, and Head of the USU Department of Family and Human Development. Since being appointed VP for Research, he has focused on building Utah State University's research capacity by providing resources to recruit and retain outstanding faculty and students, by facilitating interdisciplinary research teams, and by making research support services more helpful and responsive. He has worked to establish USU research policies, and to make sure that USU research is conducted with integrity and in compliance with state and federal regulations. He recently became a member of the Board of the Association for the Accreditation of Human Research Protection Programs.

Dr. Miller completed degrees at Weber State University and Utah State University before completing a Ph.D in family sociology at the University of Minnesota. He is the author of several books and over 100 articles and chapters, and has received major research grants from federal agencies. He became a Fellow of the National Council on Family Relations in 2001, a year after USU honored him with its Outstanding Graduate Mentor Award.

Special Thanks to:

Lynn Lemon, Cache County Executive

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Lyle Shakespear, GIS specialist, Logan City GIS Department

Citizen's Advisory Committee for Logan City / Cache County landfill

Technical Advisory Committee for Logan City / Cache County landfill

Carl Francis, Logan City Environmental Department

Dr. Sridhar Viamajala

Erick Griffiths

Reese Thompson

1.4 About the Authors

Issa A. Hamud, P.E.

Issa A. Hamud, P.E. is Director of the Environmental Department for the city of Logan, Utah. He is responsible for Cache County solid waste programs, and regional wastewater treatment. Issa has been with Logan city for more than 14 years and has over 20 years engineering experience in solid waste management, wastewater treatment, and drinking water issues. Issa is a licensed professional Engineer, with a Bachelor Degree and Masters Degree in engineering from Utah State University. He has authored many technical reports in the areas of solid waste, wastewater, and drinking water. He directed recent award-winning efforts to site a new landfill in Cache County, and to develop the Master Plan for an Environmental Education Center on the site of the existing landfill. Issa is a member of SWANA (Solid Waste Association of North America) and has served as the public sector director for the local chapter. He is a certified municipal solid waste system manager, and certified waste-water treatment system operator. He was the recipient of a Utah water laboratory graduate scholarship and a World Bank fellowship. He has served as the President of the Logan Lions Club, and is former President of the Utah State University African Student Association.

Issa also works as an adjunct instructor in the Department of Biological and Irrigation Engineering at Utah State University. His emphasis is on teaching biofuels and energy recovery from waste management. In 2008, Issa was awarded the “Alumni of the Year” award from the College of Engineering

Kristofor L. Kvarfordt, *ASLA*

Mr. Kvarfordt holds a Bachelor of Landscape Architecture (BLA) degree with honors from Utah State University and has also completed his Master of Landscape Architecture degree with a specialization in project visualization and 3D design integration. Mr. Kvarfordt, a licensed landscape architect, and works as the Senior Landscape Architect for Cache Landmark, Inc specializing in large scale environmental planning, integrated storm water management and water wise planting design. Kris strives to balance functionality, life cycle maintenance and aesthetics in all of the planning and landscape architecture that he is involved with. He works closely with civil engineers and architects to create plans that are well integrated into all the various components of a project. Kris has developed significant expertise in site grading and earthwork design as well as stormwater management and erosion control. He enjoys the challenge of planning places for people that are well integrated into the existing built and natural systems. His experience has helped him to provide his clients with solutions that are creative, functional and responsive to the spirit of the place.

Mr. Kvarfordt also works as an adjunct instructor in the Department of Landscape Architecture at Utah State University. Mr. Kvarfordt has been teaching since Fall 2003, with an emphasis on site grading, drainage and construction. He enjoys working with students and bringing his professional practice expertise into the studio environment. 435.713.0099; kkvarfordt@cachelandmark.com.

Dr. Ronald C. Sims, Utah State University

Dr. Ronald Sims is currently Head of the Department of Biological and Irrigation Engineering at Utah State University, and previously served as Director of the Utah Water Research Laboratory in Logan, Utah. Professional positions outside academic include Director of the International Program in Industrial Development, Energy Engineer (Research Triangle Institute, North Carolina), and Environmental Control Laboratory Supervisor (Mobay Chemical Corporation, South Carolina). His areas of research include public health engineering related to wastewater treatment, bioenergy production, and synthetic biological engineering for microbial production of bioplastics and other bio-based products. He received the PhD Degree in Biological & Agricultural Engineering from North Carolina State University, and also earned M.S. Degrees in Environmental Engineering (Washington State University) and in Environmental Biology and Chemistry (University of North Carolina at Chapel Hill). Dr. Sims served on the state of Utah Water Quality Board, is a current member of the City of Logan Water Board, and is a recipient of the Utah Governor’s Medal for Science and Technology.

“Cache Valley is the most lovely and enchanted valley I have ever seen, a valley that makes all that has gone before fade as nothing.”

- Thomas Wolfe
from Notes on a Journey Through the West

Figure 1. Sunset over Cache Valley and the Environmental Education Center study area.
photo credit: John C. Ellsworth, FASLA

1.6 Finding Common Ground: The Mission of the Community

Cache Valley Regional Council Mission Statement

"Living in Cache Valley is a privilege that carries with it the responsibility to assure that future generations have similar opportunities. Current residents have a stewardship to preserve and enhance the Valley's natural resources, sense of community, and economic vitality. Although individuals may differ about short term solutions, our values converge as we look further into the future. We all want to breath clean air, drink pure water, continue to enjoy the beauty of Cache Valley, provide for the economic and educational needs of our families, live together as an inclusive society, and be governed wisely and efficiently."

Logan City General Plan Vision Statement

"Our vision for Logan is a progressive community which maintains its hometown atmosphere. Our vision for Logan is one where business, industry, and residential development are accomplished with enduring quality and consideration for the entire community. We should foster an atmosphere where, citizens, property owners, and developers, alike, are caught-up in the same vision for a better community. Our vision for Logan is a gathering place where all people can join together in a full range of community activities. Our vision is the best place in the world to live, Logan, Utah."

The Mission of the Utah Department of Environmental Quality

"The Utah Department of Environmental Quality's mission is to safeguard human health and quality of life by protecting and enhancing the environment."

The Mission of the United States Environmental Protection Agency

"The mission of the EPA is to protect human health and to safeguard the natural environment - air, water and land - upon which life depends. With the purpose of protecting all Americans from significant risks to human health and the environment where they live, learn and work."

Functions of the Cache County Comprehensive Plan

- *To improve the physical environment of the community as a setting for human activities.*
- *To make the physical environment more functional, beautiful, decent, healthful, interesting and efficient.*
- *To promote the public interest, the interest of the community at large, rather than the interest of individuals or special interest groups within the community.*
- *To facilitate the democratic determination and implementation of community policies on physical development.*
- *To affect political and technical coordination in community development.*
- *To inject long-range considerations into the determination of short-range actions.*
- *To bring professional and technical knowledge to bear on the making of political decisions concerning the physical development of the community.*
- *To educate the public*

Vision Statement for the City of Logan Integrated Municipal Waste Management Plan

"The vision for the City of Logan Integrated Municipal Waste Management Plan is to provide a framework for a completely integrated system for managing municipal waste products. This framework will be based upon educating the public and implementing methods that employ waste reduction, reuse, recycling and energy recovery.

Logan City Mission Statement

"The mission statement of the City of Logan is to sustain and enhance the quality of life for the citizens of Logan."

Logan City Environmental Department Mission Statement

"To serve each person in Cache County, protect the public health and environment, sustain and enhance the quality of life for the citizens of Logan and Cache County."

Figure 2. Curbside pick up for greenwaste, recycling and solid waste.

Figure 3. Existing waste water treatment lagoons.

2.1 What is Integrated Municipal Waste Management?

Integrated Municipal Waste Management is a waste management method that employs waste reduction, reuse, recycling and energy recovery.

In the most simplified sense "Integrated Municipal Waste Management" is a complete strategy that addresses each waste stream and makes accommodation for the most efficient use, handling, disposal and recovery methods.

The existing City of Logan waste management system is set within a framework that employs a strong public education program with an emphasis on waste reduction and conservation. In 2009, the curbside recycling program diverted 7,646 tons of waste to be reused in various applications. Additionally, the greenwaste program offers Cache County residents the opportunity to reuse greenwaste by purchasing landscape products and compost.

The highlights of the existing City of Logan waste management system include the following:

Countywide curbside solid waste collection and disposal

Countywide curbside recycling

Curbside green waste pick up

Household hazardous waste disposal and re-use center

Greenwaste composting and landscape products

Largest waste water treatment lagoons in the nation

Tertiary treatment facility (effluent polishing wetland)

Strong public relations, education and outreach programs

Strong community advisory boards

Environmental conservation program

Urban forestry program

Figure 4. Curbside waste pickup.

Figure 5. Greenwaste product purchasing (compost).

2.2 The Place

History and Background

Cache Valley makes up most of the habitable portion of Cache County in northern Utah. The valley is located on the edge of the Rocky Mountain and the Great Basin physiographic provinces. Its first inhabitants were members of the Shoshone, Bannock, Blackfoot, and Ute Native American tribes, all of which spent seasons in the valley hunting game. The Shoshone people held the valley in such high regard that they often referred to it as "the House of the Great Spirit" (Alder 1976). Throughout the 1800's trappers and mountain men frequented the valley, and it soon became a favorite place for trappers and mountain men to host their rendezvous and trade their wares. Jim Bridger is recorded as the first European to float the Bear River from Cache Valley to the Great Salt Lake in 1825 (http://www.media.utah.ecu/UHE/b/BRIDGER,JAMES.html). In the mid-1800's Mormon pioneers were sent to settle the valley and begin industry. By 1859 there were 150 families settled in the valley, farming and working in the milling industry (Ricks 1953).

Today, Cache Valley is still held in high regard, renowned for its scenic beauty and quality of life. Cache County Chamber of Commerce proudly states, "Residents and visitors enjoy an unequaled and varied quality of life." Many residents of the county live here because of the abundance of scenic and outdoor recreation opportunities which contribute to this quality of life (Cache Chamber of Commerce 2004).

However, as the county grows many of these opportunities may be threatened by landscape change, including urban development. Former Utah State University President Kermit Hall stated, "Cache Valley is a maturing and growing metropolitan region and it can't escape both the benefits and limitations that areas associated with growth and change naturally experience." (Riggs 2004). As this growth and change continues, residents of Cache County will have an increased appreciation for open spaces and the adaptive re-use of disturbed landscapes.

Beauty of the Place

Cache Valley is renowned for the rugged beauty created when a high mountain range cradles a moist and fertile valley, creating a year-round display of astounding beauty. As the natural drainages cascade down the mountainsides, bigtooth maples dot the canyons giving brilliant fall color in contrast with the juniper scrub along the hillsides before yielding to the shrub-steppe plant communities. Majestic mountains are clothed in the brilliant pure white of fresh snow throughout the winter months, while the valley floor often displays a pleasing mosaic of patchy snow, ground, vegetation, the waters of Cutler Reservoir as well as numerous rivers and streams, and buildings. In spring and well into summer, the lingering mountain snows outline a sharp contrast to the increasing green progressing uphill from the valley floor. The green of summer often seems short-lived, as the first new mountain-top snows appear again in late summer and early fall, transitioning quickly to a raucous display of autumn reds, oranges, yellows, and browns before the winter snows once again set in. The visual mix of pristine mountains with rural and agricultural countryside adds a

Figure 6. Satelite image of Cache County.

soothing nuance to the scenic beauty of the area. Most prominent in the minds of many residents is the visual power of Logan Canyon as seen from US Highway 89. This corridor offers a great variety of vivid and striking scenes and vistas as well as the opportunity to explore a multitude of recreation activities at all scales from insect and plant study to mountaineering and extreme skiing and everything in between.

Physical Environment

In the most fundamental sense, the physical environment affects every aspect of life within a region; it dictates our most critical needs for survival and can deal out the consequences when ignored. In today's world of modern technology and luxury it sometimes seems less of a necessity to understand the physical environment and more of an academic exercise or recreational pastime. The Cache County General Plan acknowledges its impacts on "…every aspect of planned urban growth and development." Understanding the physical environment surrounding a site helps us better address the challenges and opportunities that may result from it.

Climate and Topography

Cache Valley is located in northern Utah and is bisected by the Utah-Idaho border. Approximately two-thirds of the valley is located south of the border in Utah. The valley is bounded on the East by the Bear River mountain range and on the West by the Wellsville mountain range. Generally Cache Valley is known for its cold winters, warm summers, and temperate shoulder seasons. The differences in elevation from the valley floor to the upper benches and high mountains (over 5,000 vertical feet of relief) can dramatically affect temperature and precipitation. Annual rainfall for the region is less than 20 inches, however, average annual snowfall is between 60-80 inches. Average yearly evapo-transpiration can exceed 40 inches, creating a moisture deficit in the summer months. In most of the farming areas throughout the valley the growing season ranges from 114-150 days. Maximum annual temperatures of 90 degrees F or higher occur an average of less than two days a year. Cache Valley winters can be very frigid with an average of 6-12 days with a minimum temperature below zero F, and 35-40 days with a maximum 32 degrees F or below (Cache Valley Almanac 2006).

Cache Valley is a typical "back valley" very similar to many others on the eastern side of the Wasatch front. It is situated between two physiographic provinces, the Basin and Range to the West and the Middle Rocky Mountains to the East. The elevation ranges from 4400 feet along the Bear River to nearly 10,000-feet on top of the peaks in the Eastern mountains. Several of the "benches" throughout the valley were created from wave action deposits of the ancient Lake Bonneville (elev. 5230).

Figure 7. Scenic Cache Valley "House of the Great Spirit".

Figure 8. Logan Canyon fall color, near third dam.

Plants and Wildlife

Several plant and animal communities occur within Cache Valley. The plants and animal communities listed below are a partial representation that can serve to guide the planning for proposed planting within the elevation range of the landfill area (4432'-4592' above sea level).

Aquatic Community

An association of interacting populations of aquatic organisms in a given water body or habitat (U.S. EPA Region 5).

Marsh Community

Wetlands frequently or continually inundated with water, characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions (Dept. of LAEP, 1976). Slopes 0-3%.

Wet Meadow Community

A type of marsh that commonly occurs in poorly drained areas such as shallow lake basins, low lying farmland, and the land between shallow marshes and upland areas (Dept. of LAEP, 1976). Slopes 0-5%.

Shrub-Steppe Community

Consists of a combination of sagebrush and herbacious species, often the transition zone between grasslands and desert shrubland (Johnson 1989). Slopes 0-50%.

Irrigated and Non-Irrigated Cropland Community

Include upland loam and alluvial fan soil deposits (Dept. of LAEP, 1976). Slopes 0-15% (irrigated) & 0-25% (non-irrigated).

Invasive and Noxious Weeds

Exotic and invasive plant species are threats to the native plant communities and can significantly impact the available resources through increased competition. It is critical that invasive and noxious weed monitoring and management occur for any disturbed lands.

Figure 9. Plant and animal community collage.

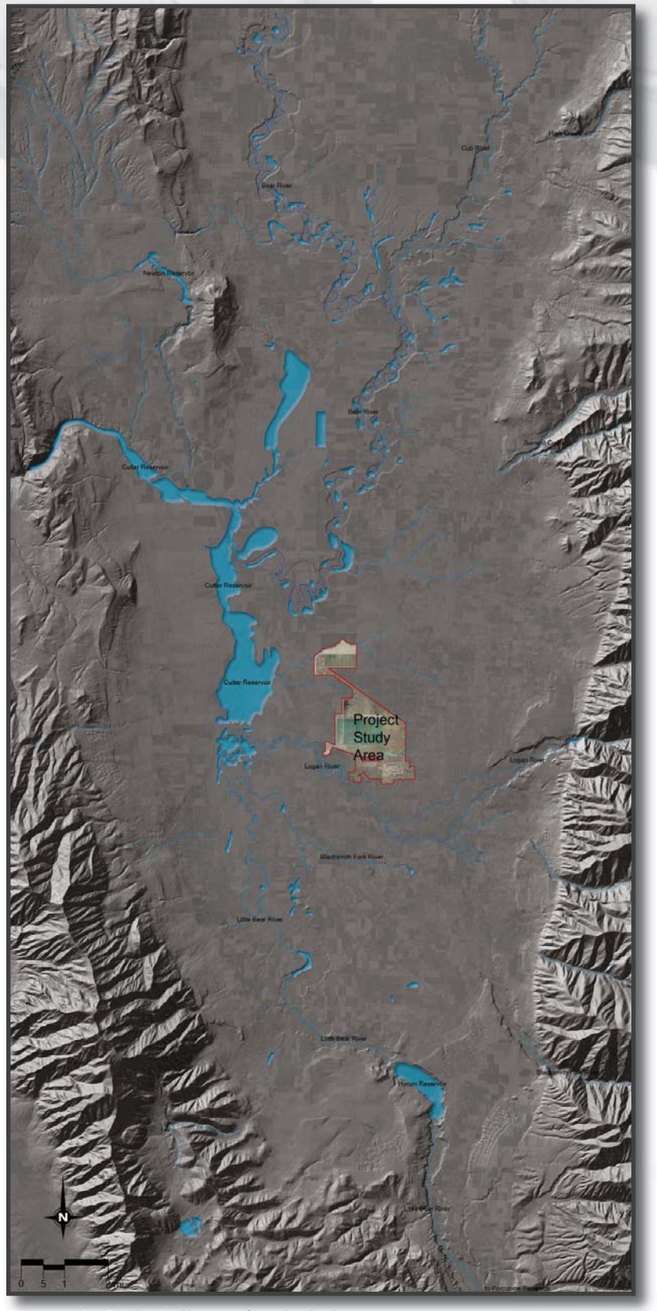

Figure 10. Cache Valley surface hydrology.

Hydrology and Water Bodies

Cache Valley serves as the drainage basin and confluence for several mountain streams and rivers. The Bear River flowing from the High Uinta Range through Wyoming and Idaho into Cache Valley en route to the Great Salt Lake is the largest river flowing through the valley. With the exception of the Bear River, all perennial streams that enter the valley originate in the Bear River Range to the East.

The following list of rivers is presented in order from highest annual flow to lowest annual flow (Cache County Comprehensive Plan 1998).

Bear River
Logan River
Blacksmith Fork River
Little Bear River
East Fork Little Bear River
Cub River
High Creek
Summit Creek

In 1927 the Cutler Dam was completed in Bear River Canyon creating what is now Cutler Reservoir. Since its creation, this water body has served as a major power source and recreational resource for northern Utah residents. Cache Valley has several smaller reservoirs that store water for agricultural irrigation.

The four largest reservoirs in the valley are listed below from largest to smallest surface area (Cache County Comprehensive Plan 1998).

Cutler Reservoir – Power Generation
Hyrum Reservoir – Irrigation
Porcupine Reservoir – Irrigation
Newton Reservoir – Irrigation

Ground water in Cache Valley can best be described as a complex, multiple aquifer system, with each basin consisting of unconsolidated fill hundreds of feet thick. The water table tends to be high in the center of the valley and up to 300 feet deep at the edges.

The bench and valley margins consist of areas of fractured and consolidated rock with high levels of percolation. The valley margins tend to serve as the primary recharge areas, with the most significant recharge occurring where streams, channels, canals, and ditches cross the valley margins. The primary source of discharge is in the center of the valley and occurs through seepage, evapotranspiration, and well water withdrawal.

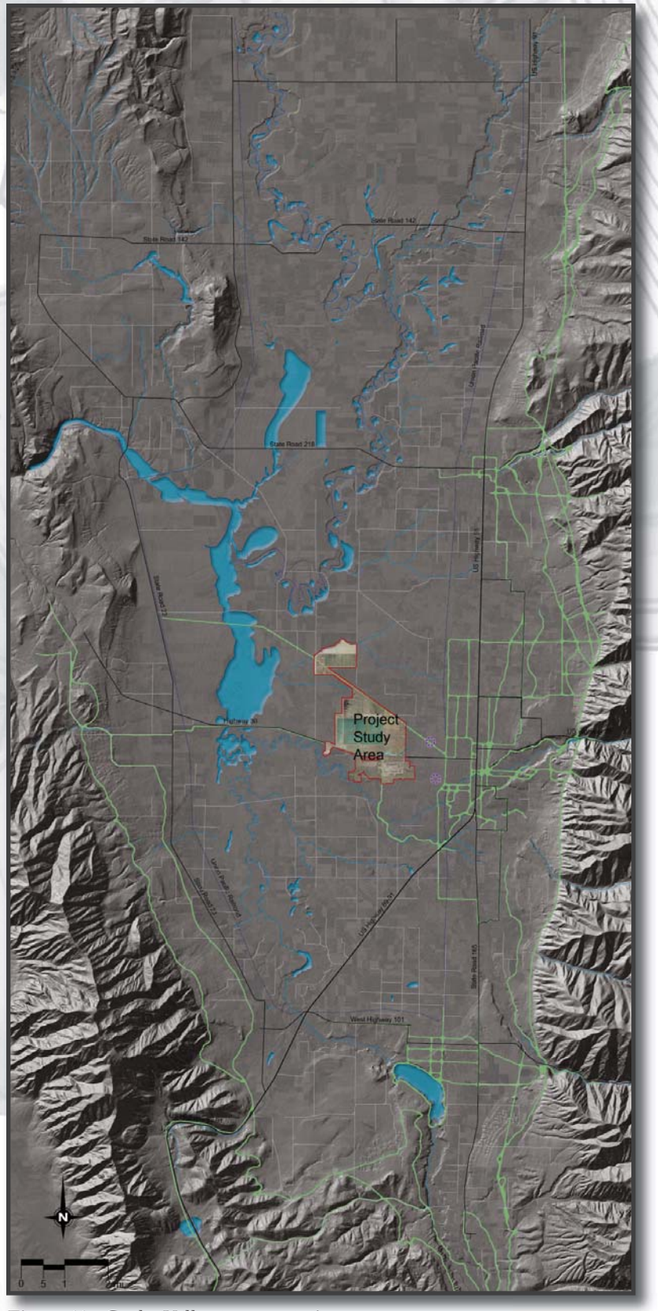

Figure 11. Cache Valley transportation systems.

Circulation Systems

Cache Valley is connected to the larger region via several highway and state road systems, however the nearest Interstate connection (I-15) is 26 miles west at Riverside, Utah via state Highway 30. US Highway 89-91 connects Cache Valley to the Great Salt Lake basin through Wellsville Canyon; US highway 89 connects Cache Valley to the Bear Lake area of southeast Idaho (Montpelier) and western Wyoming (Kemmerer) through Logan Canyon; and US Highway 91 connects Logan to southeast Idaho at Franklin.

Alternative transportation methods are of greater importance as the valley population continues to grow. Bicycle and pedestrian circulation are vital components to the long term livability of Cache Valley and need to be planned for accordingly. Cache County has identified several existing and future pedestrian access ways that have become incorporated into the county wide trail system. This system links several of the communities north to south along the bench. However, east west connections through the center of the valley are few and far between. The existing system provides only for pedestrians who are willing to walk alongside the vehicle corridors.

The Cache Valley Transit District currently offer free fares to valley residents. This transit district is regional and even offers extended service into Southeastern Idaho. It is important to plan a distinct connection to this system for expanded service to communities west of Logan and even outside of Cache Valley via Highway 30.

Outdoor Recreation

Residents and visitors enjoy a broad and diverse range of outdoor recreation opportunities throughout Cache County. Indeed, one of the main reasons many people call Cache Valley home is the ready access to high-quality, year-round outdoor recreation.

There are numerous outdoor recreation areas, ranging from wilderness to fully developed (campgrounds, picnic areas, and other recreation sites). These include federal lands such as the Wasatch-Cache National Forest with its hundreds of miles of trails and vast, relatively unspoiled natural areas suitable for mountaineering, rock climbing, photography, hiking, skiing, mountain biking, spelunking, wildlife viewing, hunting and fishing, horseback riding, OHV and motorcycle riding, snowmobiling, nordic as well as alpine skiing and snowboarding, and snow-shoeing, to name a few!

There are two state parks at Hyrum Lake and nearby at Bear Lake (not in Cache Valley). Opportunities also abound for swimming, rafting, canoeing, motorboating, wildlife viewing, and fishing in the waters of the various rivers, lakes, and reservoirs as well as tubing in the irrigation canals. Golfing can be enjoyed on four public and private courses. Bicycling and motorcycling are popular activities on the streets and highways as well as off-road. There are also numerous

city, town, and county parks as well as urban trail systems.
More exotic and in some cases expensive forms of outdoor recreation have become popular in the area recently. These include hot air ballooning, glider and powered flight, and bungee jumping from commercial apparatus.

Several organizations and agencies are committed to the enjoyment, conservation, and enhancement of outdoor recreation opportunities in Cache Valley as well as to the education of others about these opportunities. A few of these are:

- Stokes Nature Center
- Cache Valley Sun and Snow Runners
- Common Ground Outdoor Adventures
- Bridgerland Audubon Society
- American West Heritage Center
- Cache Valley Visitors Bureau
- Beaver Mountain Ski Resort
- USU Outdoor Recreation Center
- Nordic United
- Bear River Avalanche Information Center
- Wasatch-Cache National Forest
- Logan City Parks and Recreation

Population and Land Area

The population of Cache County exceeds 100,000, with over 40,000 of the county's residents living in Logan. In the 2000 census, the average population density for the county was 78 people per square mile. Cache County contains approximately 1,174 square miles of land area, and is approximately 60 miles long and 15 miles wide.

Agriculture and Industry

Cache Valley is the leading agricultural producing area of Utah and is widely known for its dairies producing milk, cheese, and other products. Cache Valley continues to be predominately rural with large expanses of agricultural fields, farms, dairies, and other open spaces throughout the valley. Historically, these agricultural operations contributed greatly to the valley's economy. Today many of these operations are still contributing to an economic base for the valley, however, several farms are giving way to residential and commercial development. This agricultural heritage still plays a significant role in planning and development throughout the valley as an idealized aesthetic that many valley residents do not want to see diminished. A major part of this historic agricultural system are the irrigation canals that extend to far-reaching parts of the valley. In many places, this canal system and easements are used as pedestrian trails and wildlife corridors.

Utah State University

Started as a land grant agricultural college in 1888, Utah State University is now a Carnegie Doctoral/Research Extensive University made up of seven colleges with 46 departments. Utah State University is Cache Valley's largest employer and enrolled 15,099 students in 2008 (http://aaa.usu.edu/FactsFigures/EnrolLevelLoc.asp December 17, 2009). This staff and student workforce

Figure 12. Volleyball players at Willow Park, City of Logan.

Figure 13. Kayaking in Cutler marsh, west of waste management facilities.

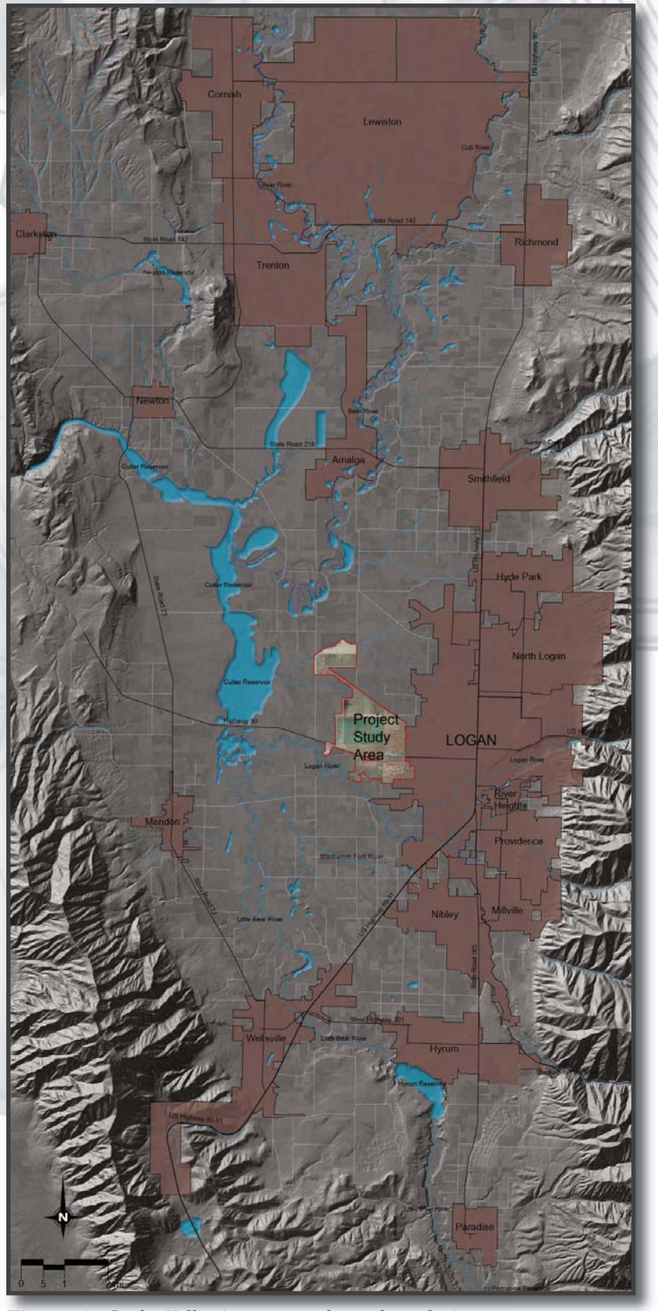

Figure 14. Cache Valley incorporated area boundaries.

contributes significantly to the economy of the valley and region. Because of the influence and opportunity created by the university, many high technology industry start-ups have their roots in Cache Valley.

Communities

Cache County is comprised of nineteen incorporated communities, all of which share in the splendor and resources of the valley. The communities are:

Amalga	Logan	Providence
Clarkston	Mendon	Richmond
Cornish	Millville	River Heights
Hyde Park	Nibley	Smithfield
Hyrum	North Logan	Trenton
Lewiston	Paradise	Wellsville

Current Planning

Rapid growth in Cache County has caused many residents to recognize the value of long-range planning. Several residents, councils, and agencies are working to provide comprehensive long-term plans that will benefit Cache Valley residents for years to come. Some of these are:

Bear River Association of Governments (BRAG)
Cache Metropolitan Planning Organization (CMPO)
Logan City Department of Community Development
Cache County Planning and Development Office
Cache Valley Regional Council

Waste Management

The City of Logan landfill provides solid waste disposal for all of Cache County. Disposal of waste is open to the public six days a week with provisions for greenwaste, construction debris, hazardous waste and municipal solid waste. The City of Logan currently provides weekly curbside pickup to most of the county and has recently extended the curbside recycling program to include the whole county. Curbside recycling currently diverts 7,646 tons of waste from the landfill and targets a broad range a materials including:

- Newspapers
- Mixed paper
- Phone Books
- Magazines/ Catalogs (staples okay)
- Junk mail
- Wrapping paper

Cardboard
Paperboard (cereal boxes)
Aluminum cans (coca cola)
Tin/steel cans (chili cans)
Any small metal (such as metal hangers)
Plastic with a recycle symbol #1 - # 7 (unless it is a bag or Styrofoam)
Cell phones (in a zip lock baggie)
Inkjet cartridges (in a zip lock baggie)

Curbside greenwaste pickup is available as a voluntary fee based pickup program throughout select portions of the county. These services provide the residents of Cache County a clean and organized system for solid waste disposal. The greenwaste and recycling program divert 8,801 tons of solid waste each year extending the lifespan of the landfill and providing a minimal amount of revenue for the City of Logan.

The City of Logan wastewater treatment lagoons are one of the largest lagoon facilities in the country. This facility services seven Cache County communities, including; Logan, Smithfield, Hyde Park, North Logan, River Heights, Providence, and Nibley. This system consists of 460 acres of open lagoons that process 15 million gallons of waste water each day. The lagoons are sequenced to treat organic waste prior to discharge to an effluent polishing wetland intended to further treat the water before being released into Cutler Reservoir. A recent TMDL study suggested that the reservoir's beneficial use is impaired and the pollutants of concern include low dissolved oxygen and excess total phosphorus (site source). The Logan City Wastewater Treatment Facility is subject to regulations and effluent standards set by the Utah Division of Water Quality. Currently the city needs to reduce the total phosphorus concentration of our effluent by as much as 60% or to as low as 1.0 milligram per liter in order to be compliant with the Utah Division of Water Quality's TMDL(total maximum daily load). The Wastewater Treatment Facility is compliant with nitrogen content in the effluent, but would like to prepare for more stringent nitrogen reduction requirements of the future.

Figure 15. Highway 30 eastbound entry to 1900 West (landfill in background).

Figure 16. Existing greenwaste facility, composting in process.

2.3 The Study Area

Existing Municipal Waste Management Facilities

The study area for this plan includes approximately 2200 acres (see Figure 19). Most of the project site lies within the City of Logan incorporated boundary, however some portions extend into the unincorporated areas of the county. Several existing facilities are in operation on the site. This section describes the relationship between and basic functionality of each of these existing facilities and adjacent lands.

The Wastewater Treatment Lagoons (see Figure 20)
The existing wastewater treatment system consist of 460 acres of open lagoons that service seven communities in Cache Valley. These lagoons are located northwest of the landfill across Highway 30. The wastewater treatment lagoons are bounded on the north, east and south by privately owned agricultural land with some constructed facilities and the Cache Valley Hunter Education Center in proximity to the West. Wastewater is transferred into the ponds via two 48" sewer mains that run west down the 600 North street right-of-way. Water is discharged from the lagoons on the northwest end and conveyed north to the effluent polishing wetlands through an open ditch. During the summer months the effluent discharged from the lagoons is used by local farmers for application as irrigation water.

Figure 17. Existing wastewater treatment lagoons near influent headworks.

The Effluent Polishing Wetlands - EPW (see Figure 21)
The effluent polishing wetlands make up the northern-most portion of study area and consist of approximately 362 acres. The EPW is bounded on the north, east, and south by agricultural land and on the west by 3200 West Street. The EPW can currently be accessed by a gated road extending into the site from the west. Wastewater is conveyed to the EPW from the sewage lagoons via an open ditch.

The Solid Waste Landfill (see Figure 22)
The existing landfill area and associated access roads cover approximately 129 acres. This facility provides solid waste disposal for all of Cache County and is estimated to have an operational capacity for the next twelve years. This area is bounded to the south by a natural slough which extends to 200 South and the 1400 West right-of-way. The landfill is bounded by 1900 West on the west, 200 South on the south, on the east by the green waste facility and access roads, and on the north by an agricultural plot with proximity to US Highway 30. The landfill is currently accessed by the public from 1400 West extending south from US Highway 30. There is gated access from the south as the 1400 West right-of-way extends into the property for the occasional use by large equipment owned and operated by Logan City.

Figure 18. Existing effluent polishing screw pump and pumphouse facilities.

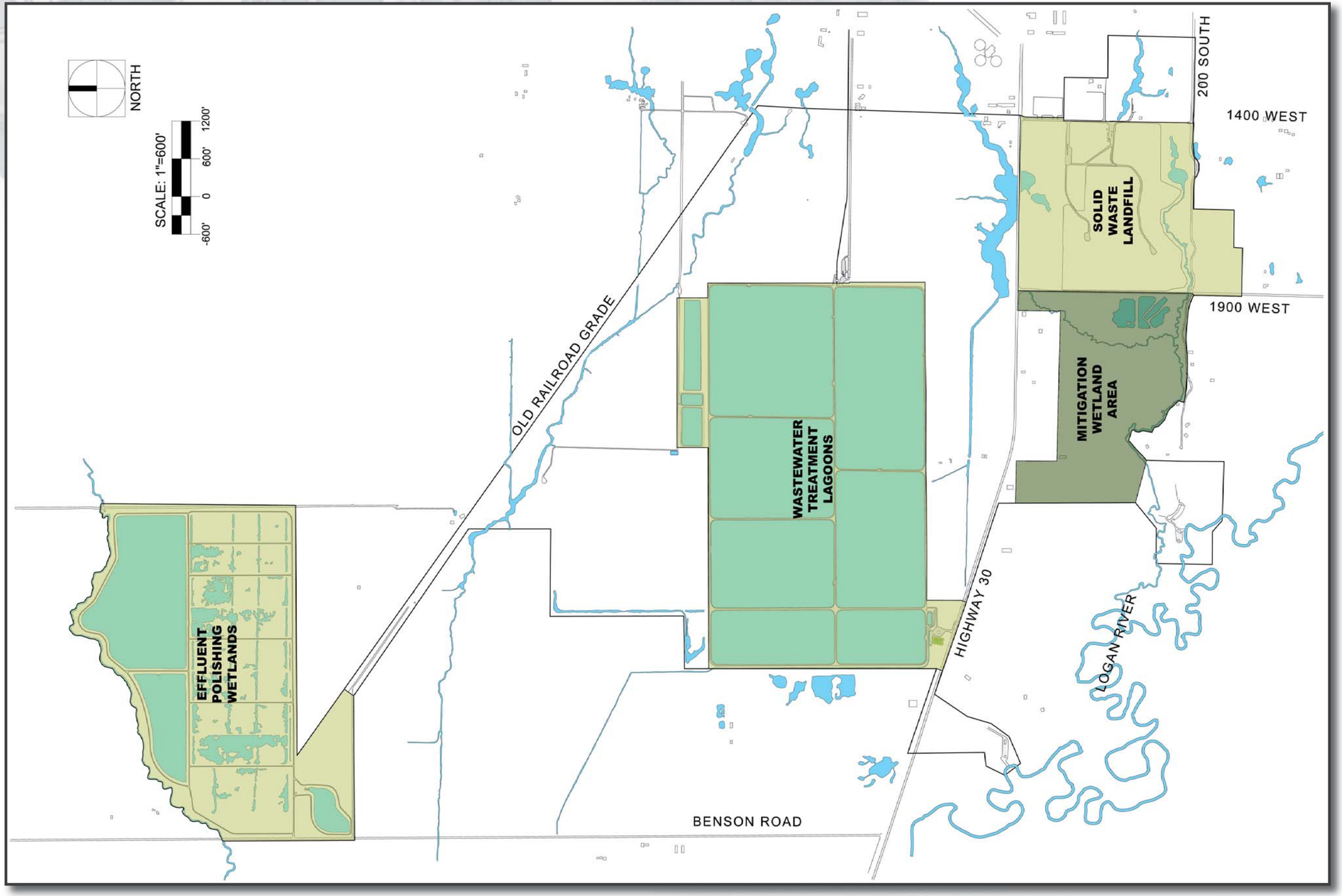

Figure 19. Existing waste management facilities (the study area).

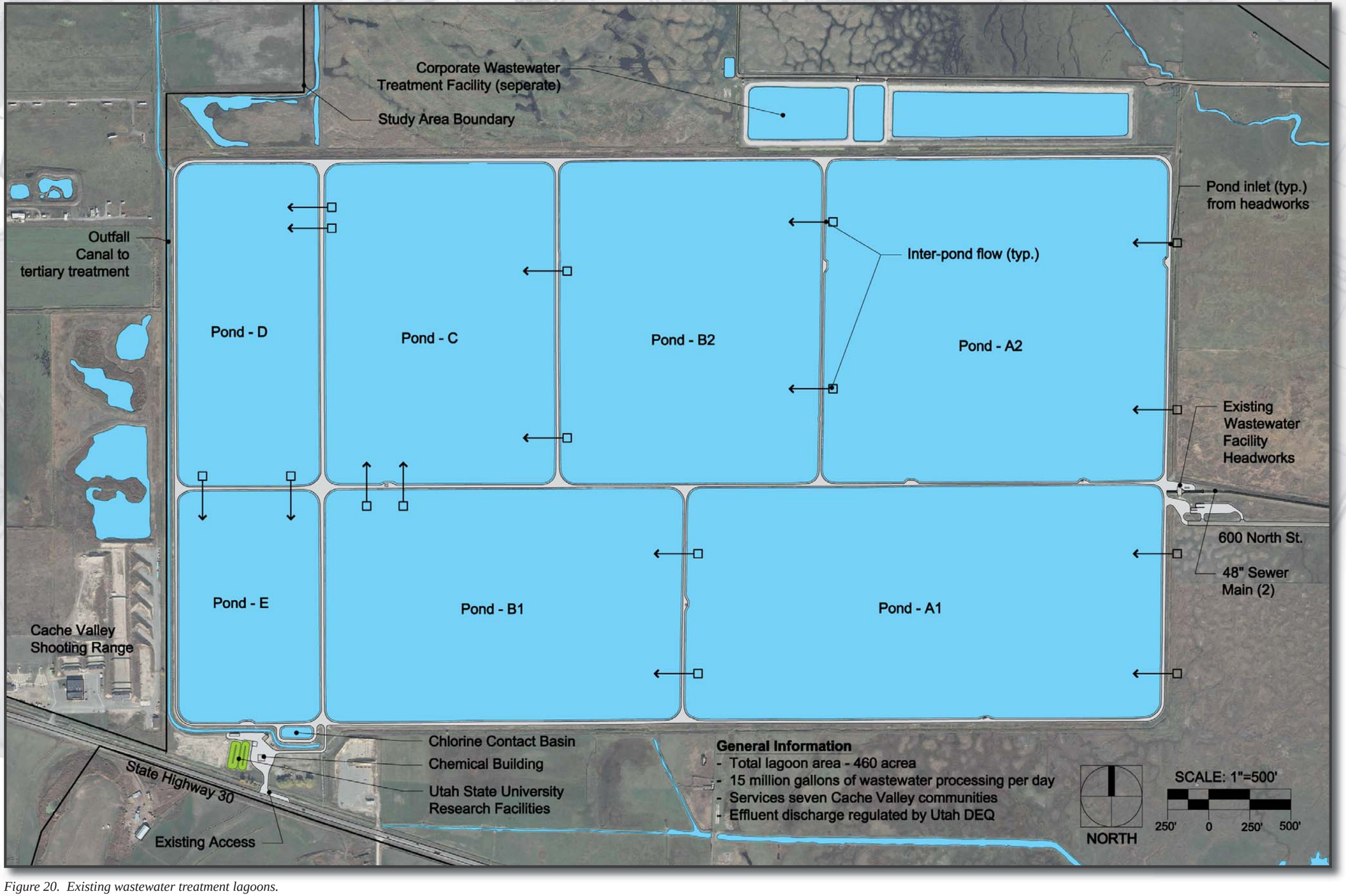

Figure 20. Existing wastewater treatment lagoons.

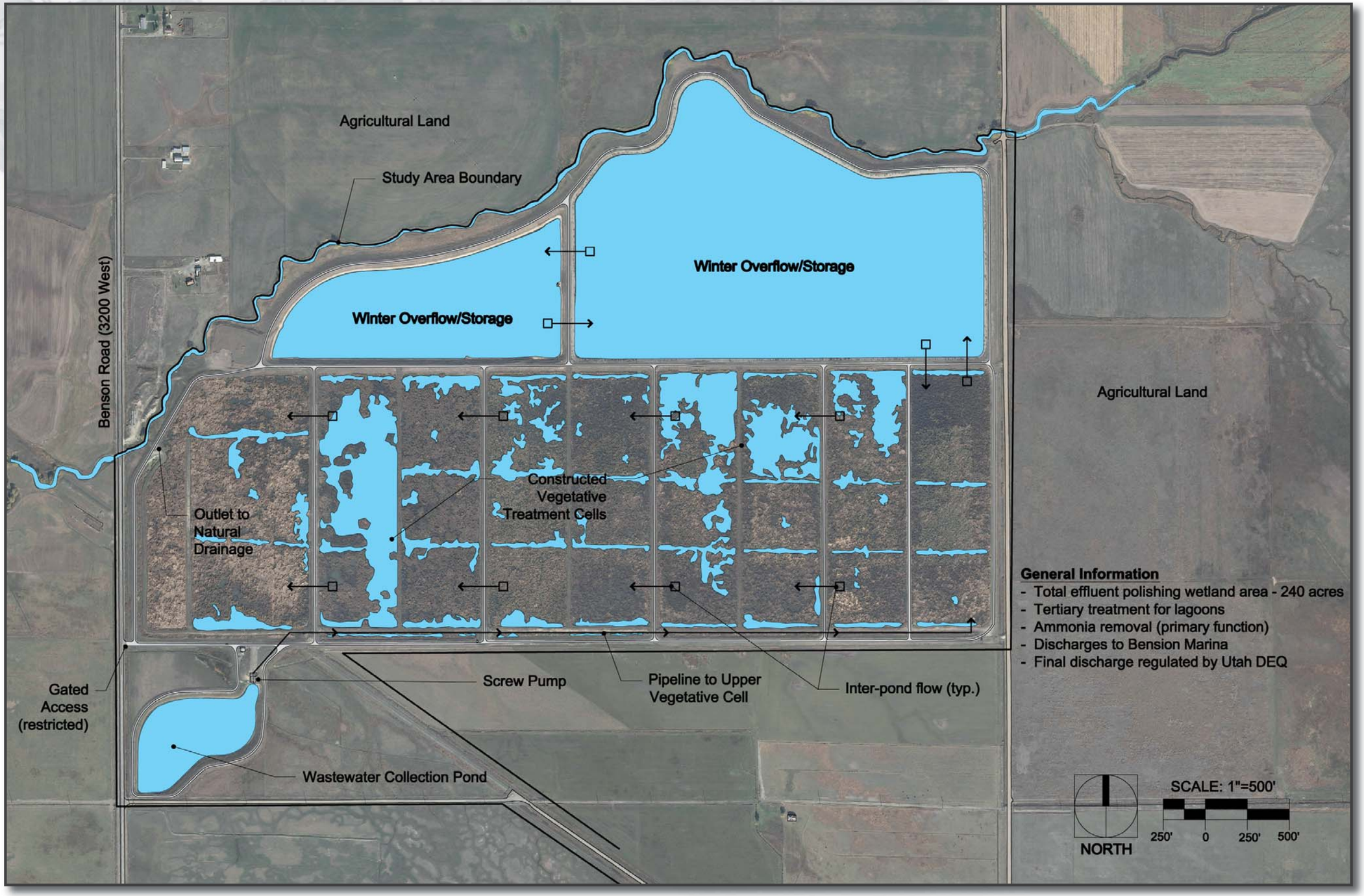

Figure 21. Existing effluent polishing wetlands (tertiary wastewater treatment).

Figure 22. Existing landfill, greenwaste, household hazardous waste and surrounding landscape.

Greenwaste Facility
The existing green waste disposal facility consists of approximately 12 acres located southeast of the existing landfill, bounded by the 200 South right-of-way to the south, agricultural fields to the east, a slough to the north, and the landfill on the west. The green waste facility is currently accessed from the north via 1400 West, same as the landfill. The scales and pay station for the landfill and the green waste facility are shared.

Composting
The current landfill operation makes use of the disposed green waste by seperating, shredding and composting the material into usable landscape products that are sold back to the residents of Cache Valley at competitive rates.

Household Hazardous Waste Disposal
Household hazardous waste disposal is available at the landfill site. The facility accepts a broad range of items at little or no charge. This facility has recently implemented a re-use program where residents may come down and take (at no charge) certain unused or partially used products that have been donated to the facility. Remaining household hazardous waste products are either recycled, reused or stored.

Figure 23. Household hazardous waste drop off and disposal.

Figure 24. Processed greenwaste stockpiles.

Existing Systems and Frameworks

Each of the existing facilities lies within a series of natural and operational systems. Understanding this context of systems is important to developing a long-term plan for the future.

The Logan River and Other Surface Hydrology

The Logan River is in close proximity to several portions of the study area (2/3 mile from the landfill). The Logan River is a primary resource for the area and a necessary component to successful integration. The Logan River is bounded by primarily agricultural and grazing lands on its northern and southern banks.

Vehicular and Pedestrian Circulation

Access to much of the study area is restricted due to current operational needs, security, and safety. Currently this system provides for all necessary access related to maintenance and observation of existing facilities. Much of the existing roadway network adjacent to the study area are limited access farm roads. Primary access to and through the study area is from 200 North (Highway 30).

Land Use

Land uses surrounding the study area are primarily agricultural, however there is rapid encroachment by residential development to the southeast. The study area is near an industrial park to the east and the Hunter Education Center to the west. Existing zoning within the study area includes public, industrial, and commercial entry.
Future Land Use Plan designations within the study area include: Gateway, Gateway (Development with Exemptions), Public, Resource Conservation Area, Recreation, Commercial, and Industrial Park.

Natural and Constructed Wetlands

Much of the land in and around the study area has been identified as wetland by the National Wetland Inventory (NWI). Much of this land is privately held and is seasonally wet, limiting agricultural operations.

Lands west of the landfill (across 1900 West) have been identified for the construction of mitigation wetlands (approx. 141 acres). Currently about 21 acres of this land has been used as a source for extracting capping material for the current landfill operations and for leachate treatment and monitoring. There are existing design proposals for developing grades and plantings more likely to attract shoreland birds that have been developed by others, but no detailed design development for a constructed wetland system has been developed in the study area.

Land Ownership

The majority of the land within the study area is owned by Logan City. However, much of this land is used to for the operational needs of each of the facilities. Land within the study area is also owned by Utah Power and Light, Utah Department of Transportation, Cache County, Pacificorp and the Bear River Water Conservancy. The remainder of the land within the study area is privately owned and access is limited (see Figure 26). Many of these parcels are seasonally wet and used primarily for agriculture.

Utilities

Several utilities occur in and near the waste management facilties. For many of the city utilities, this area is the end of the line. The sewer main terminates into the waste water treatment facility via a headworks of two 48” pipes. Culinary water is limited and will require improvement prior to significant increase in use or built structure. The primary concern is providing the volume and pressure necessary for fire suppression. Gas and power have not been located at this time. It is assumed that they are available in several locations and could be coordinated with the respective company should it become necessary.

Figure 25. Seasonally wet agricultural land northeast of wastewater treatment lagoons.

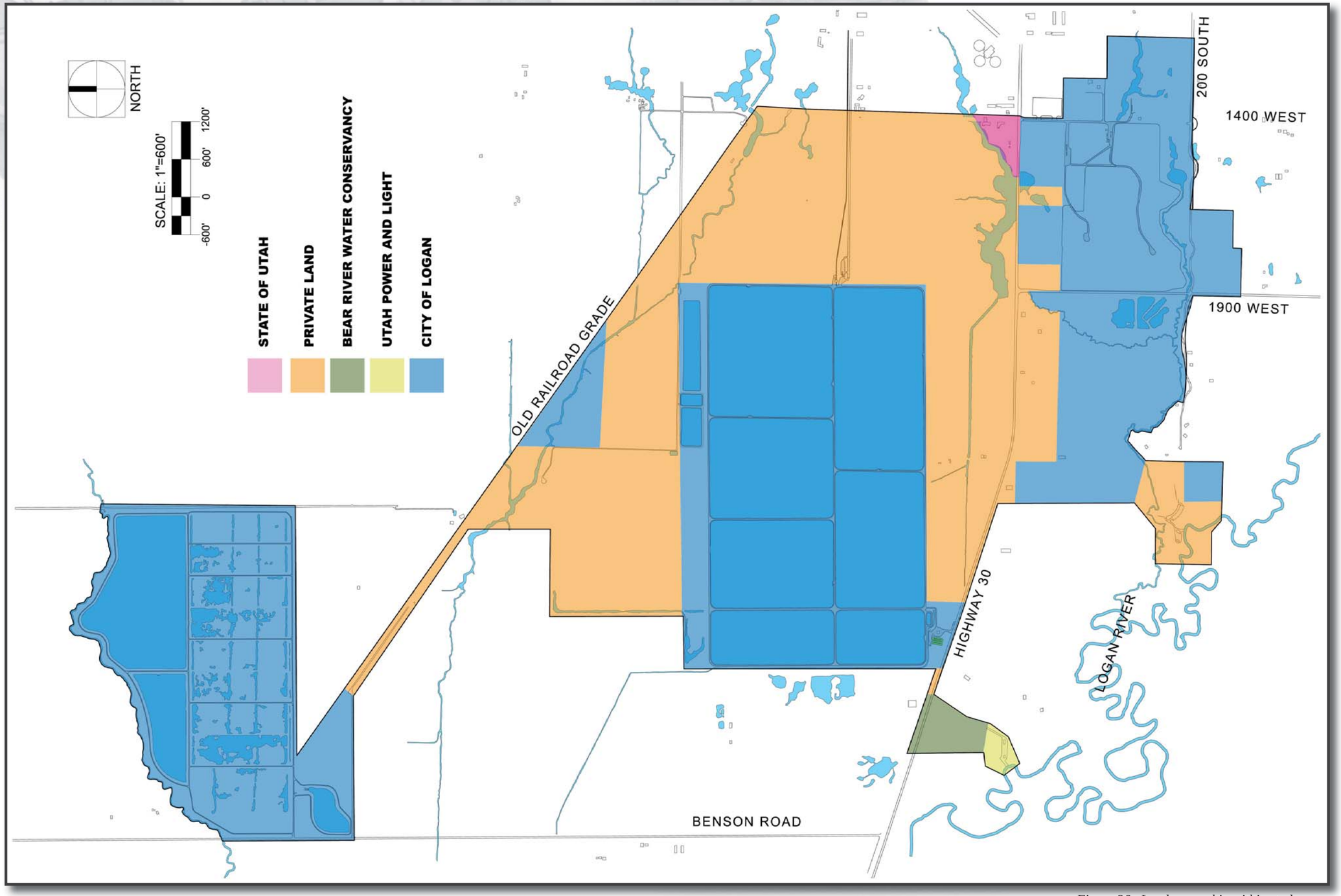

Figure 26. Land ownership within study area.

2.4 Goals for an Integrated Municipal Waste Management System

Opportunities and Constraints

The unique combination of various elements in and around the study area create an environment unlike any other in the world. This is unique quality creates many opportunities for the City of Logan and residents of Cache County. Several opportunities have been identified below:

Opportunities

1. Creation of much needed parkland on the west side of Logan City;
2. Creation of critical east-west and north-south pedestrian corridors;
3. Conservation and preservation of wildlife habitat and corridors;
4. Potential for volunteer activities;
5. Education about natural and human-made systems, and the connection of the two;
6. Creation of a good “fit’”with the Logan City and Cache County park and recreation master plans;
7. Creation of a beautiful western gateway entrance to the city of Logan for east-bound travelers on State Highway 30;
9. Development of a parkway road along 1400 West will serve as an entryway to the Integrated Municipal Waste Management Campus and future parkland;
10. Unique recreation resource for many Cache Valley residents;
11. Adaptive re-use and recovery of severely impacted landscapes (ie. the landfill, sewage lagoons, constructed, and mitigation wetlands).

Although the opportunities far outweigh the constraints, it is important to understand the challenges and limitations that may be faced during the planning and development process. Constraints include the limiting factors of the facility, its adjacencies and the socio/political obstacles encountered in a highly visible planning process. Several constraints have been identified below:

Constraints

1. Inadequate funding to design, build, and maintain all the various proposed elements;
2. Potential public misperceptions of the project, its intent, its cost, and its value;
3. Potential “unwillingness to pay” for the proposed project;
4. Potential planning paralysis caused by conflicts among stakeholders involved in the design and planning process;
5. Creation of potential pedestrian/vehicular conflict zones;
6. Increased traffic pressure on the west side of Logan city;
7. Reduced access to landfill operations near Logan.

Purpose and Need

The purpose of developing this document is to provide guidance for the implementation and transition of the existing City of Logan waste management facilities to become the City of Logan Integrated Municipal Waste Management (IMWM) Campus. There is a need for this to happen listed below:

1. The existing landfill life cycle is coming to an end, it is scheduled to close and an appropriate end-use and planning process has been identified.

2. To manage this process a solid waste transfer station must be operational as soon as possible to begin waste diversion from the existing landfill and to begin preparations for final cover and closure.

3. As the headquarters of the Integrated Municipal Waste Management Campus, the City of Logan Environmental Department is locating a new administrative building on the corner of 1400 West and Highway 30. The programming for this new building is also expected to include an Interpretive Center that will be a destination for visitors, and provide education, interpretation and information about the waste management facilities and processes.

4. The Utah Department of Environmental Quality has increased the standards for regulated phosphorus and the City of Logan waste water treatment facility is no longer in compliance. An alternative has been identified and full scale implementation of algae growth and harvesting in the waste water treatment lagoons will improve water quality to meet or exceed the new standard. The algae will then be recovered and used for energy production (biofuels) to return power to the City of Logan.

Goals and Objectives

A series of goals and objectives were developed during the early stages of this master planning process. The vast majority have been accomplished and are evident in the master plan drawings, while a few remain to be resolved when the more detailed site-scale design and planning begins.

Goal #1 - Educate the public about and promote waste reduction, reuse, recycling, and energy recovery.

Objective 1.1
Create cut-away views of the closed solid waste landfill for visitors to observe the horizons and decomposition, and guide visitors to those places along the trail system;

Objective 1.2
Create an open "viewing platform" over the sewer lines conveying sewage to the lagoons, link this element to the trail system;

Objective 1.3
Create an interactive, educational, and fun area for methane gas harvesting that would allow for controlled "flare-offs" for children and adults to experience and observe;

Objective 1.4
Create a small scale model of the process used at the Effluent Polishing Wetland;

Objective 1.5
Provide interpretive graphics and signage along the trails to interpret how waste is managed at the landfill;

Objective 1.6
Design weekend workshops, tours and events for residents to become more involved in environmental protection;

Objective 1.7
Continue to develop informative literature about waste reduction, reuse, recycling and energy recovery to be distributed through the billing process.

Winter 2010

In this issue: Your Recycle Collection schedule found on back

LOGAN CITY UNITED IN SERVICE ENVIRONMENTAL DEPARTMENT

Winter

The Garbage Gazette

City of Logan Environmental Department

Information about Recycling, Garbage Disposal, the Landfill and other Environmental issues for the citizens of Cache County

Issue number 30

Environmental Director
Issa Hamud, PE

Permits and Analysis Manager
Jim Harps

Conservation Manager
Carl Francis

Landfill Manager
John Christensen

Solid Waste Collection Manager
Steve Larsen

City Forester
Joe Archer

Dr. Garbology Recycles ... Do You?

435-716-9755
environmental.loganutah.org

TIP OF THE SEASON:
Look for phosphorous free cleaning products and detergents to help with the conservation of Cache County waterways.

The Garbage Gazette is a seasonal newsletter issued:
Winter: January
Spring: April
Summer: July
Fall: October

Second Chances for Hazardous Waste: REuse

The Logan City Environmental Department would like to announce a new program that began March 23, 2009 at the Household Hazardous Waste Facility. As many residents already know, most household hazardous waste is taken for no charge at the facility and accepted Monday-Saturday during business hours. Now, all residents can participate in a household hazardous waste REuse program. Until recently, all household hazardous waste that came into the facility was either recycled or incinerated. Any Cache County resident can now come down to the facility located at the landfill and take (at no charge) certain unused or partially used household products that have been donated to the facility. Availability will be based on whether the persons donating the waste authorized reuse of the products. Customers picking up products for reuse must fill out a liability waiver. We will be diverting items such as paint, pesticides, spa chemicals and other household cleaners, etc. out of the waste stream to be used for the purpose intended instead of being so wasteful. The Reuse shed is open year-round Monday thru Saturday from 8:00 am to 5:00 pm. Please call our Household Hazardous Waste Facility at 435-713-6686 for more information.

Phosphorous Removal could mean Renewable energy for Logan

As the economy takes a plunge, the Utah Water Quality Board (UWQB) has come up with a plan to help it stay a-float. The UWQB has awarded nearly $4 million in federal stimulus money to nine "green" water quality projects here in Utah. The Utah State University Research Foundation was granted $500,000 for a project that will help take phosphorous out of Logan's wastewater lagoons. Phosphorous is found in many consumer products today ranging from hand-soaps, toothpastes, detergents and pesticides. The problem with phosphorous is that when it is dispensed into water-bodies it aids in eutrophication or nutrient pollution which leads to excessive algae blooms. Excessive algae can cause oxygen depletion in water bodies and affect healthy fish populations. Logan City's wastewater is treated through a natural lagoon system. During the process the Wastewater goes through 460 acres of treatment lagoons, and then moves onto where it is ran through 260 acres of polishing wetlands before ending up in Cutler Reservoir. Because phosphorous is very difficult to remove from a wastewater, Logan City and Utah State University have partnered to study ways algae can be used to remove the phospherous as well as produce sustainable fuels. Through the process of anaerobic digestion, algae can be used to generate energy which in turn could help lower the consumption of fossil fuels. Researchers are quite optimistic as this endeavor has reported favorable results.

Logan City's 460 acres of wastewater treatment lagoons

Figure 27. "The Garbage Gazette" - waste processing flyer distributed to Cache County residents.

Energy Conservation
Renewable Resources
Energy Efficiency
Bright Futures
Logan City, United

Issue 1 | Volume 1 | Spring 2008

Kill-A-Watt News

ENVIRONMENTAL DEPARTMENT
LIGHT AND POWER

Alternative Energy Board Members:

Richard Anderson
Charles Ashurst
Chris Atkins
Pete Brunson
Chris Chrysostom
Justin Cooper
Robert Davies
Carl Francis
Jack Greene
Issa Hamud
Paul Jackus
Emily Malik
Jay Monson
Joe Needham
Jay Nielsen
Laraine Swenson
Paul Taylor
Garth Turley
Jeff White

LOGAN CITY UNITED IN SERVICE

Inside This Issue:

- Logan City's new solar incentive program.
- The Alternative Energy Board.
- Start a "save energy" savings account!
- Where does your power come from?

Logan City's New Solar Incentive Program

In December of 2007, Logan City Municipal Council passed a resolution authorizing a rebate for Logan City residents and business owners who install photovoltaic power systems at their homes and businesses.

The solar incentive is a $2 per watt rebate for photovoltaic systems generating up to 3 kilowatts for residential customers and up to 15 kilowatts for commercial customers. The resolution allows a $6,000 maximum rebate for residential customers and a $30,000 maximum rebate for commercial customers.

For more information about Logan City's Solar Incentive Program, contact the Logan Light and Power Department at 435-716-9700.

Have you considered solar power?

Power From The Sun

So far, one Logan City resident, Charles Ashurst, has taken advantage of the solar incentive program. He was eager to share with us his experience with solar power. Ashurst has been a resident of Logan City for 38 years now and works in the valley as an electrical engineer. This may explain a portion of Ashurst's passion for his new photovoltaic system, but there is just a bit more to his passion than his engineering background. He first turned to solar power for his home when he helped persuade the Logan Municipal Council to vote against participating in the third phase of Intermountain Power Project (a coal-fired power plant). At that point, he felt like he had to do his part to reduce electric consumption. When asked what his favorite part about having a photovoltaic system at his home is, his response was; "Sounds pretentious maybe, but the satisfaction of doing the right thing. I'll be able to look my son in the eye in 20 years."

Ashurst's photovoltaic system is grid-tied and has no storage capacity. Many people think of solar panels on roof tops or in big open fields, however Ashurst's sits on a six-foot pole in his yard. (See SOLAR pg 2)

Charles Ashurt's Photovoltaic system in Logan, Utah

Figure 28. "Kill-a-Watt News" - energy conservation flyer distributed to Cache County residents.

Goal #2 - Minimize the environmental impacts of human waste through research and application of appropriate waste management methods.

Objective 2.1
Focus on creating venues for scientific and engineering inspiration and expression to be used by individuals and the community.

Objective 2.2
Maintain an collaborative relationship with Utah State University to offer students opportunities for applied and varied research opportunities pertaining to waste management.

Objective 2.3
Foster an attitude of thinking about the waste management facilities as "outdoor laboratories" for exploration, experimentation, and discovery of new or alternative ways of addressing environmental issues related to waste;

Objective 2.4
Create a space for students and community members to explore technologies of waste disposal, management, and testing, and invite graduate students from around the world to conduct their research here;

Objective 2.5
Develop programming for innovative waste disposal technology and/or research and development (R&D) competitions, e.g. "Waste Wars", and invite competitors and provide space for demonstration of techniques;

Objective 2.6
Explain the current and potential research on waste management issues to the visiting public at the visitors center, kiosks, and pavilions;

Objective 2.7
Focus on biofuel technology and other alternative energy recovery;

Objective 2.8
Design places for methane gas harvesting practice demonstration;

Goal #3 - Recover useful resources from the waste stream whenever possible.

Objective 3.1
Provide incentives for waste management staff to stay current on latest technologies and methods of resource recovery;

Objective 3.2
Pursue funding for alternative energy production grants offered through various organizations;

Goal #4 - Create a visual and physical linkage among all the elements and features in the study area.

Objective 4.1
Design a network of trails for pedestrian, bicycle, canoeing access;

Objective 4.2
Create a grade-separated crossing of Highway 30 for pedestrians and City of Logan maintenance vehicles to create a more unified and easily accessible facility;

Objective 4.3
Use plantings, signage, and a palette of like materials to create visual unity;

Objective 4.4
Place a point of interest or other defined space/destination adjacent to each identified element and feature with interpretation as necessary;

Objective 4.5
Create interesting access points which are easily seen from appropriate distances;

Objective 4.6
Accommodate universally accessible design for all facilities throughout the campus.

Figure 29. Trailside interpretation and education at the Ogden Nature Center.

Figure 30. Algae in wastewater treatment lagoons.

Figure 31. Viewing tower and boardwalks (Shorelands Preserve).

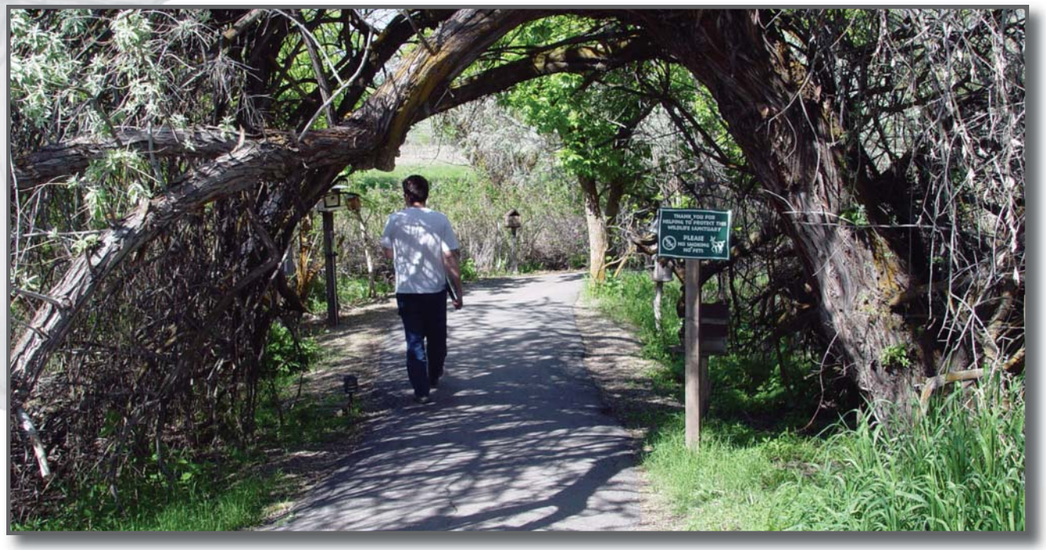

Figure 32. Trail entry at Ogden Nature Center.

Goal #5 - Create a physical open space and trail linkage between the City of Logan and the Cutler Reservoir/Bear River Corridor.

Objective 5.1
Coordinate all planning with the City of Logan Parks and Recreation Master Plan and the Cache County-wide Trail and Parkway Master Plan;

Objective 5.2
Identify specific locations within the City of Logan and at Cutler Reservoir, so the trail connections can be distinct, obvious and useable;

Objective 5.3
Create physical trail connections to any existing trail systems, including where and if possible the Bear River corridor and Cutler reservoir.

Goal #6 - Design a facility that will promote health by providing increased year-round outdoor recreation opportunities for Cache County residents and visitors.

Objective 6.1
Design trail systems and other opportunities to facilitate year-round use (ie. cross-country skiing, walking, day hiking, running, bicycling, skating, canoeing, fishing, photography, wildlife viewing, etc.);

Objective 6.2
Create a trail system with varying levels of difficulty to accommodate a diversity of users;

Objective 6.3
Make the trail system and other healthy recreation opportunities highly visible from the highway and to visitors on-site;

Objective 6.4
Incorporate the trail system usage into every visitor's experience (ie. provide visible trailhead and interpretive features from all access road, parking lots, etc.);

Objective 6.5
Design view points (observation towers, pavilions) for scenic viewing and wildlife watching;

Objective 6.6
Design spaces for group recreation and sporting activities (ie. play fields, boweries, etc.);

Goal #7 - Design a facility that will foster learning and understanding of natural processes through studying Cache Valley ecosystems.

Objective 7.1
Create spaces/places for interpretation of Cache Valley ecosystems, for example:

- Bear River Watershed
- Migratory Bird Routes
- Aquifer Recharge Areas
- Wildlife Habitat
- Earthquake Fault Zones
- Bonneville Shoreline
- Native Plant Communities
- River and Stream Ecology
- Floodplains
- Climate and Weather (including the effects of global warming)
- Farmstead Ecology
- Soils
- Others;

Objective 7.2
Create overlooks, viewpoints, or points of interest focused on each of the aforementioned areas;

Objective 7.3
Design programs and activities for the residents and visitors (animal tracking in winter, wilderness survival, wilderness awareness, etc.).

Figure 33. Restored wetlands and accessible walkways (Bear River Bird Refuge).

Figure 34. Demonstration wetlands and riparian plant corridor (Ogden Nature Center).

Goal #8 - Create an attractive and meaningful gateway to the City of Logan and to Cache Valley.

Objective 8.1
Develop concentrated plantings, signage, and other focal elements adjacent to Highway 30 to beautify the roadway and signify entrance to Logan;

Objective 8.2
Create a “friendly” entry road/driveway incorporating landscape design techniques such as a sinuous horizontal alignment, reveal/conceal, mystery, etc.

Objective 8.3
Create a graphic logo/symbology that will be used at the gateway and on all brochures, kiosks, websites, and all other graphics related to the campus.

Goal #9 - Create spaces for the continued operation of existing landfill elements (transfer station, green waste, etc.) that are presented to the public in an organized, accessible, understandable, and informative manner.

Figure 35. Greenwaste drop off.

Objective 9.1
Create an inviting and useable green waste recycling center, making the process as visible as possible;

Objective 9.2
Encourage the development of countywide programming and campaigning for use of these facilities and products;

Objective 9.3
Design places for recycle waste management and selling recycled products near the entrance.

Goal #10 - Create a venue for creative inspiration and expression to be used by individuals and the community.

Objective 10.1
Develop programming for community arts events, competitions, and so forth;

Objective 10.2
Develop programming for traveling outdoor art exhibits or temporary installation space and invite student/community artists to submit proposals;

Objective 10.3
Design programs such as a waste management contest, provide enough space for activities such as methane gas harvesting, waste recycling, etc.;

Objective 10.4
Provide areas suitable for renewal of the “Solid Waste Bake Sale” activity sponsored by the Environmental department some years ago.

Goal #11 - Create viable wildlife and plant community habitats that visitors can observe, move through, and appreciate.

Objective 11.1
Analyze existing, adjacent, nearby, and regional wildlife corridors, patches, edges, and matrices as well as plant communities; evaluate the campus as part of a larger network of flora and fauna habitat and continental/intercontinental (birds) migration routes; restore or create connections within this larger framework;

Objective 11.2
Create new wetlands that are appropriate for migratory bird species, mammals, fishes, and other fauna as well as native plants;

Objective 11.3
Identify and categorize all existing plant and animal habitat types and make this information available to visitors in the form of interpretive displays, brochures, guidebooks, and books;

Objective 11.4
Encourage wildlife and plant identification by providing field books and identification techniques through interpretive displays;

Goal #12 - Create "emotional analogues" for the various EEC features to encourage visitors to understand their own emotional and aesthetic connection to the landscape.

Objective 12.1
Represent the idea of "recovery" to ascribe meaning and help give form to the elements located around the sewage lagoons;

Objective 12.2
Represent "rebirth" or "repose" in the site elements and features near the Effluent Polishing Wetlands;

Objective 12.3
Represent "action" in the development of the forms and facilities for the transfer station;

Objective 12.4
Represent the idea of "giving" or "giving back" in the site elements located within the greenwaste/recycling center;

Objective 12.5
Represent "renewal of nature" or "balance" in the constructed mitigation wetlands;

Objective 12.6
Represent "life process" or "progression" with the proposed trail network as it connects all the various destinations of the campus.

Figure 36. Great Blue Heron

2.5 Illustrative Site Plan

City of Logan Integrated Municipal Waste Management (IMWM) Campus

The illustrative site plan shows the overall organization and relationship between each of the various components of the proposed integrated municipal waste management campus and the surrounding landscape.

The plan illustrates a coherent landscape and planning framework that supports the twelve primary goals for the project.

A diverse mix of uses is proposed, but the majority of the plan emphasizes reduction of waste, reuse of existing waste products, recycling, restoring natural areas and recovering useful products and energy from the existing waste stream. This emphasis was achieved while minimizing environmental impacts and developing a plan that integrates the waste management facilities into a naturalized and restored open space system.

The master plan shows a complete representation of the future integrated municipal waste management facilities together with a proposed sports park and recreational facility, a center for cultural and educational activities, alternative energy production and recovery facilities, research areas, inspirational architectural features, art, earthworks and environmental remediation all tied together with a network of trails and interpretive features. The proposed aspirations for the City of Logan Integrated Municipal Waste Management Campus are consistent with the goals of City of Logan planning, public works and parks and recreation departments, the U.S. Environmental Protection Agency, and the State of Utah Department of Environmental Quality.

Figure 37. Early visioning image depicting environmental education, a visitor's center and landfill in background.

Figure 38. Early visioning image depicting approach to new building, interpretive plaza and use of lower impact vehicles for study area circulation.

Figure 39. Illustrative Site Plan

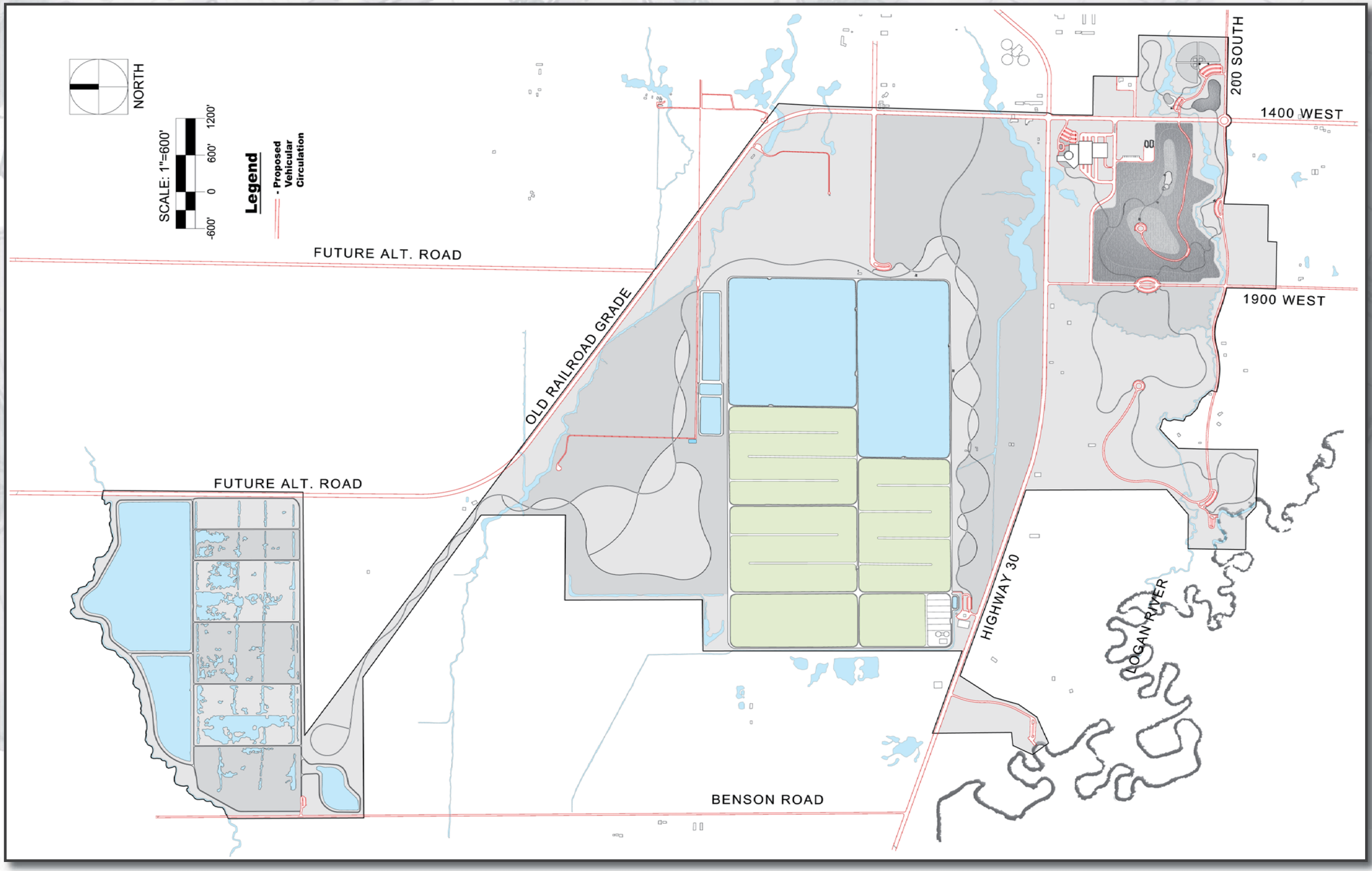

Figure 40. Vehicular Circulation Plan

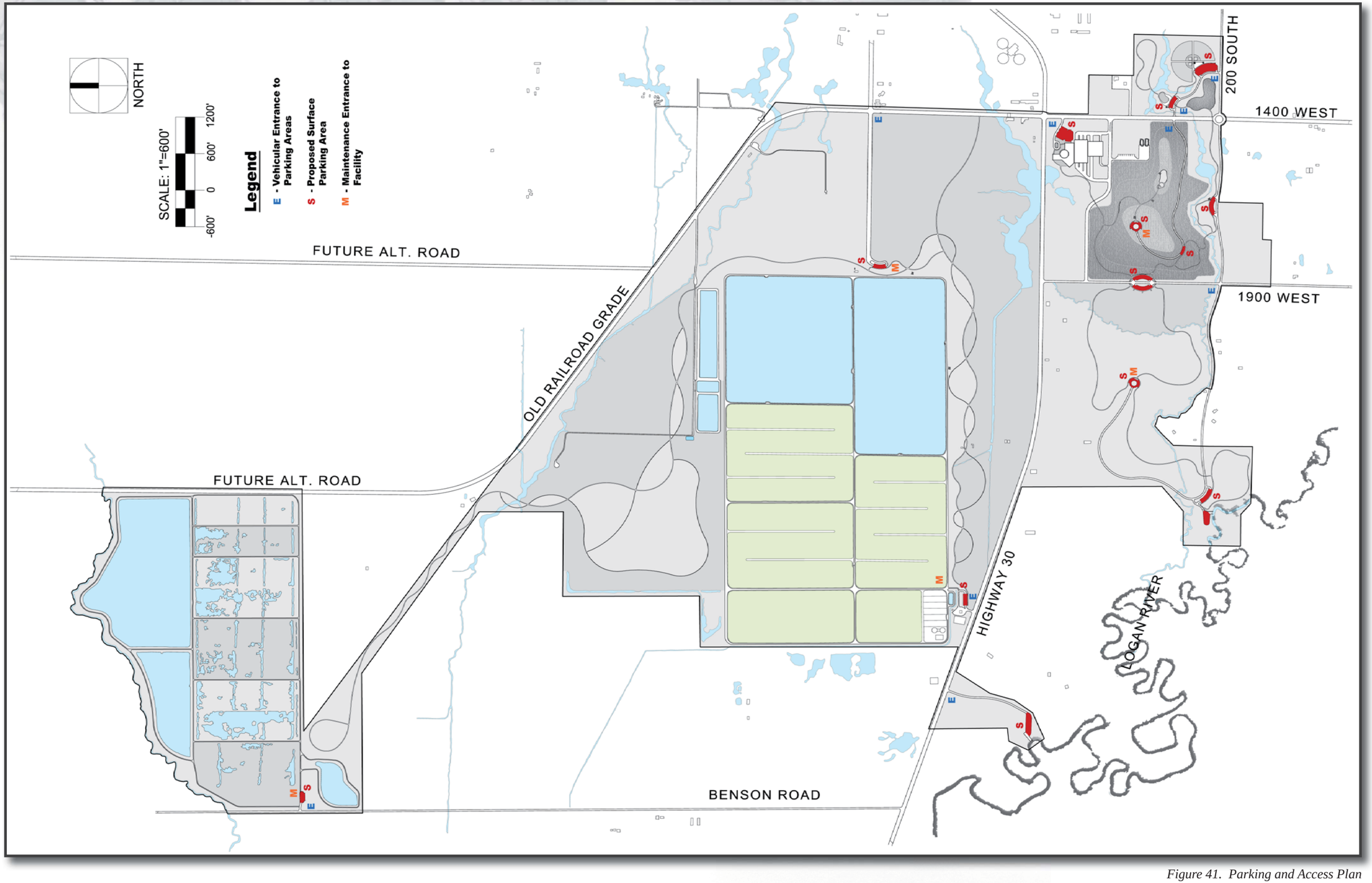

Figure 41. Parking and Access Plan

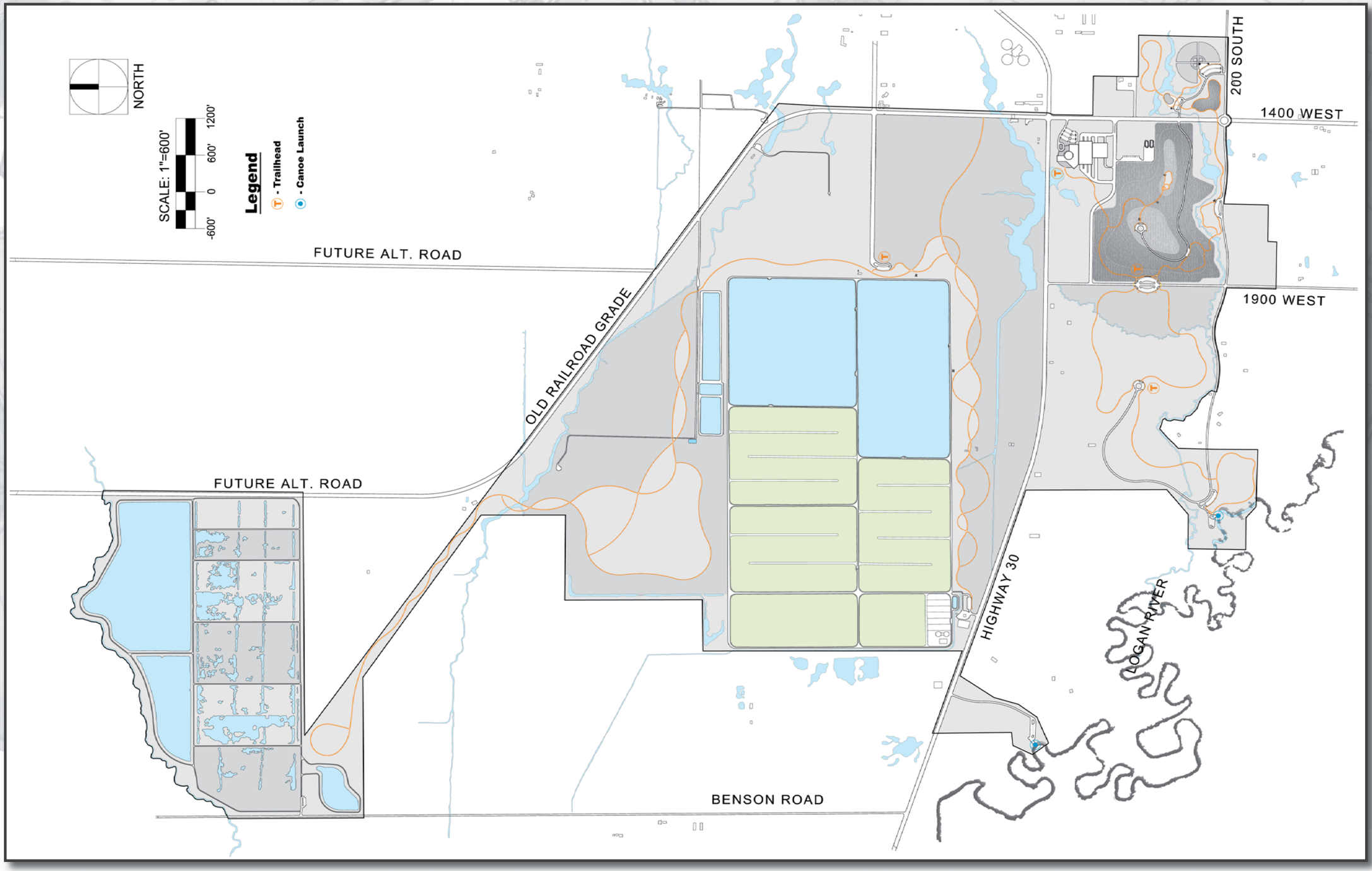

Figure 42. Non-Vehicular Circulation and Access Plan.

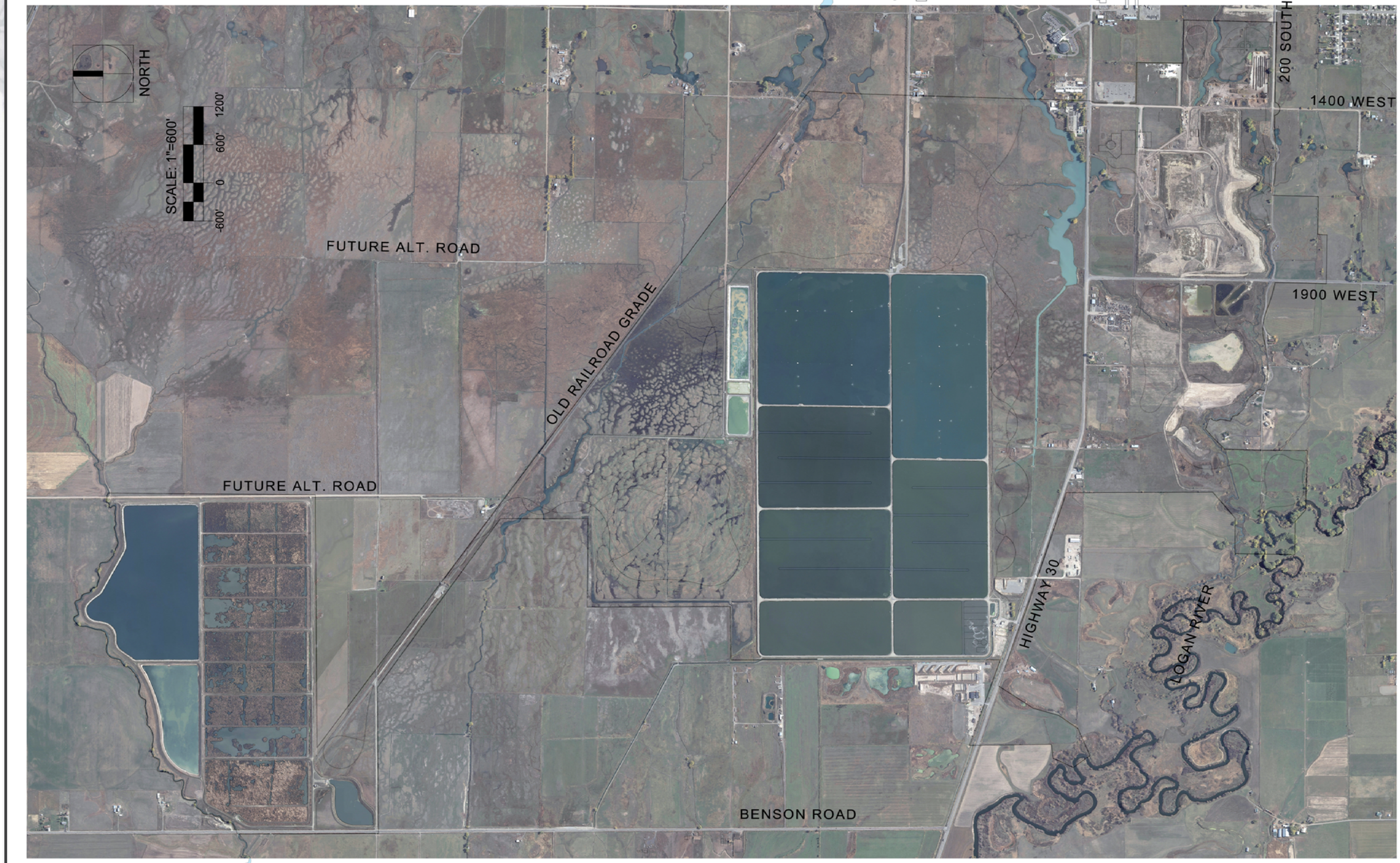

Figure 43. 2009 High Resolution Aerial Ortho-Photo of Study Area

2.6 Integrated Municipal Waste Management Zones

The extents of the Integrated Municipal Waste Management Plan can be better understood and managed by creating zones that will define uses, levels of treatment and management policies. This is a brief overview of the extents of each area, indicated anticipated levels of improvement and proposed elements. Each area of the Integrated Municipal Waste Management Campus is defined by the unique location of each zone, its context and relationship to the surroundings, the proposed land uses, and the necessary functional waste management considerations.

Zone A - Effluent Polishing Wetlands- 373 acres

Lightly programmed open area adjacent to constructed wetland system primarily for bird watching. North Park Trail extends into this area providing access to a rest area and lookout tower. Access to the operating cells is limited, tours may be given upon request to the City of Logan Environmental Department.

Wildlife viewing area (bird watching) - Interpretive signage - Trail loop north terminus (viewing tower, and seating)

Zone B - North Park Trail System - 461 acres

Lightly programmed open space and trail system. Some restoration plantings and improved wetland areas. Primary pedestrian and bicycle linkage to viewing areas north of Zone C. Trail improvements should provide dual purpose service access.

Wildlife viewing area (bird watching and overlook) - Interpretive signage - Trails - Resting/activity areas (benches and circuit training)

Zone C - Wastewater Treatment and Biofuel Production Center - 525 acres

Wastewater to energy production core. Retrofit existing lagoons to enhance and encourage algae growth. Construct dissolved air flotation (DAF) system for harvesting algae as well as sludge drying beds and anaerobic digesters for methane gas production. Full-time research facility as joint venture with Utah State University. Site improvements to access and parking area on southwest corner, friendly, inviting and appealling at the front door. Destination/ trailhead for trail network, improvements to include interpretation and "unveiled" glimpses into technologies associated with energy production. Limited access to lagoons and research facilities, site tours available.

Energy production improvements - Site entry and access improvements - Research facility - Interpretive elements and signage

Zone D - Gateway Park - 351 acres

Lightly programmed restoration plantings, enhancements and screening as seen from Highway 30. Trail network throughout, primary pedestrian, bicycle and service access connection from Zone G to Zone C. Viewing towers and seating areas provided along trail.

Wildlife viewing areas - Trails - Interpretive signage

Zone E - Logan River Outpost and Canoe Trail - 68 acres

Lightly programmed natural and restored riparian areas. Canoe and kayak trailhead with associated boat ramps, parking and picnic pavilions.

Boat Launch (2 - put-in and take-out) - Picnic Pavilions - Trails - Interpretive signage

Zone F - Advocet Park (Constructed Mitigation Wetlands) - 147 acres

Constructed wetland mitigation bank and habitat restoration area for shoreland birds. Trails, boardwalks and viewing blinds located throughout. Primary pedestrian and bicycle connection from Zone G to Zone E.

Wildlife viewing areas - Trails and boardwalks - Interpretive signage

Zone G - Integrated Municipal Waste Management Campus Core - 195 acres

The programmatic core of the site. Visitor information and education facility in conjunction with new home of Logan City Environmental Department offices, consolidated operational facilities for continued post landfill closure waste management. Trails throughout leading visitors on a tour of several "unveiled" depictions of past, present and future waste management methods.

Restored landfill - Environmental Department Office/Visitor Center/Warehouse - Trails - Transfer Station - Overlooks - Greenwaste/Composting Facility - Household Hazardous Waste Drop Off - Interpretive Signage and Features - Entry Features - Demonstration Areas - Outdoor Storage - Rain Celebration Plaza

Zone H - RE-Park and Sports Facility - 54 acres

Concentrated active recreation areas including sports fields and playgrounds. Programmed natural areas and restored riparian corridors. Streetscape improvements along 200 South Street.

Sports and active recreation center - Ecology and adventure playground for children - Trails - Restored natural areas - Playfields - Interpretive Signage - Entry Features

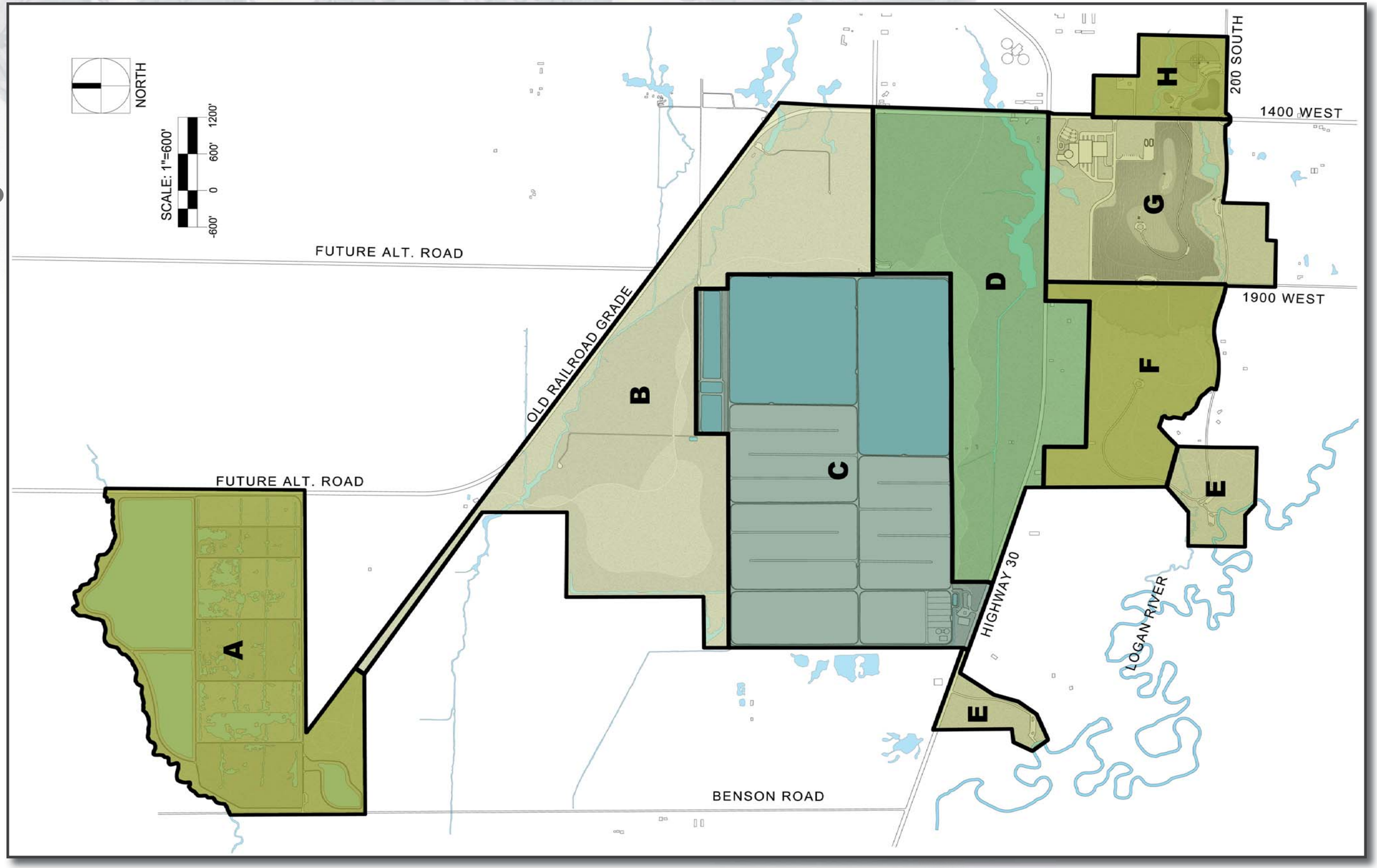

Figure 44. Management zones for the Integrated Municipal Waste Management Campus.

2.7 Integrated Municipal Waste Management Campus - Specific Plans

In order to create a more complete vision and to develop a more detailed understanding of the proposed Integrated Municipal Waste Management Campus a series of specific plans have been prepared at a more detailed scale. The locations of each of these plans relates to the existing and proposed waste management facilities and focuses on operational needs and proposed improvements.

Specific plans have been developed that organize the following areas:

Effluent Polishing Wetland and North Trail Wildlife Viewing Area
- Zone A - Effluent Polishing Wetlands
- Zone B - North Park Trail System

Wastewater Treatment and Alternative Energy Production Center
- Zone C - Wastewater Treatment and Biofuel Production Center
- Zone B - North Park Trail System
- Zone D - Gateway Park

Integrated Municipal Waste Management Campus Core and Surrounding Landscape
- Zone G - Integrated Municipal Waste Management Campus Core
- Zone F - Advocet Park (Constructed Mitigattion Wetlands)
- Zone H - RE-Park and Sports Facility

Figure 46. Existing wastewater treatment headworks.

Figure 45. Existing restricted access area at the effluent polishing wetland (screw pump in background).

Figure 47. Southwest corner of the Logan landfill.

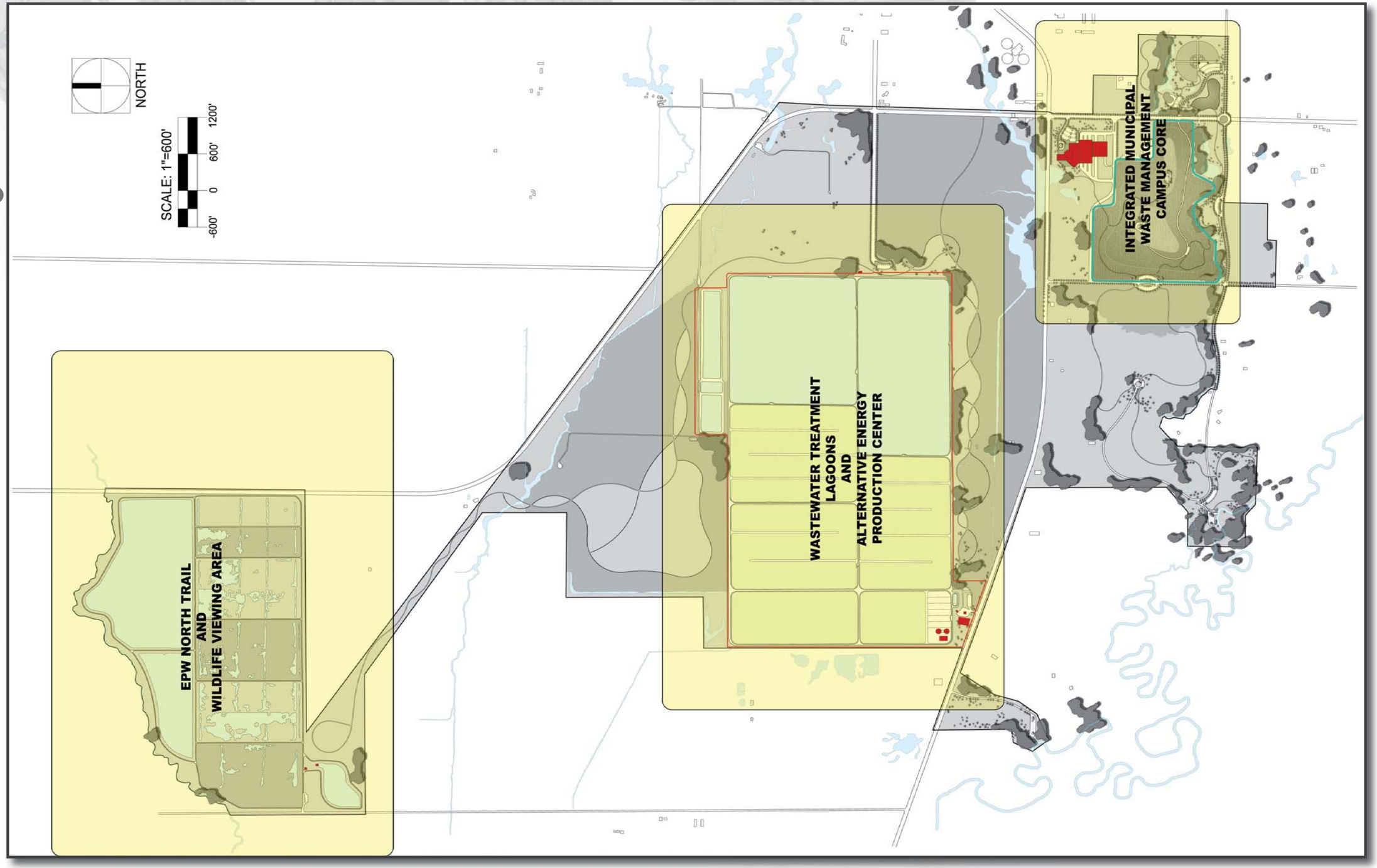

Figure 48. Key plan for specific plans.

Effluent Polishing Wetland and North Trail Wildlife Viewing Area

The specific plan for this area consists of the entire Effluent Polishing Wetland (Zone A) and the north portion of the North Park Trail System (Zone B). This area is bounded on the north, south and east side by agricultural ground and bounded on the west by Benson Road. Long-term operational needs and proposed improvements are identified below.

Operational needs:

Continued tertiary treatment of waste water
Pump maintenance
Pond cell maintenance
Regulated and restricted public access

Proposed improvements:

Change location of controlled access points (allow public parking and access to trail)
Trail improvements that extend to points adjacent to restricted access areas
Construction of elevated viewing platforms and blinds
Small destination parking area

Figure 50. Typical trail treatment and viewing area in near Effluent Polishing Wetland.

Figure 49. Photomontage depicting typical wetland interpretive seating area.

Figure 51. Elevated boardwalks may be necessary to provide access to interpretive stations in wetland areas.

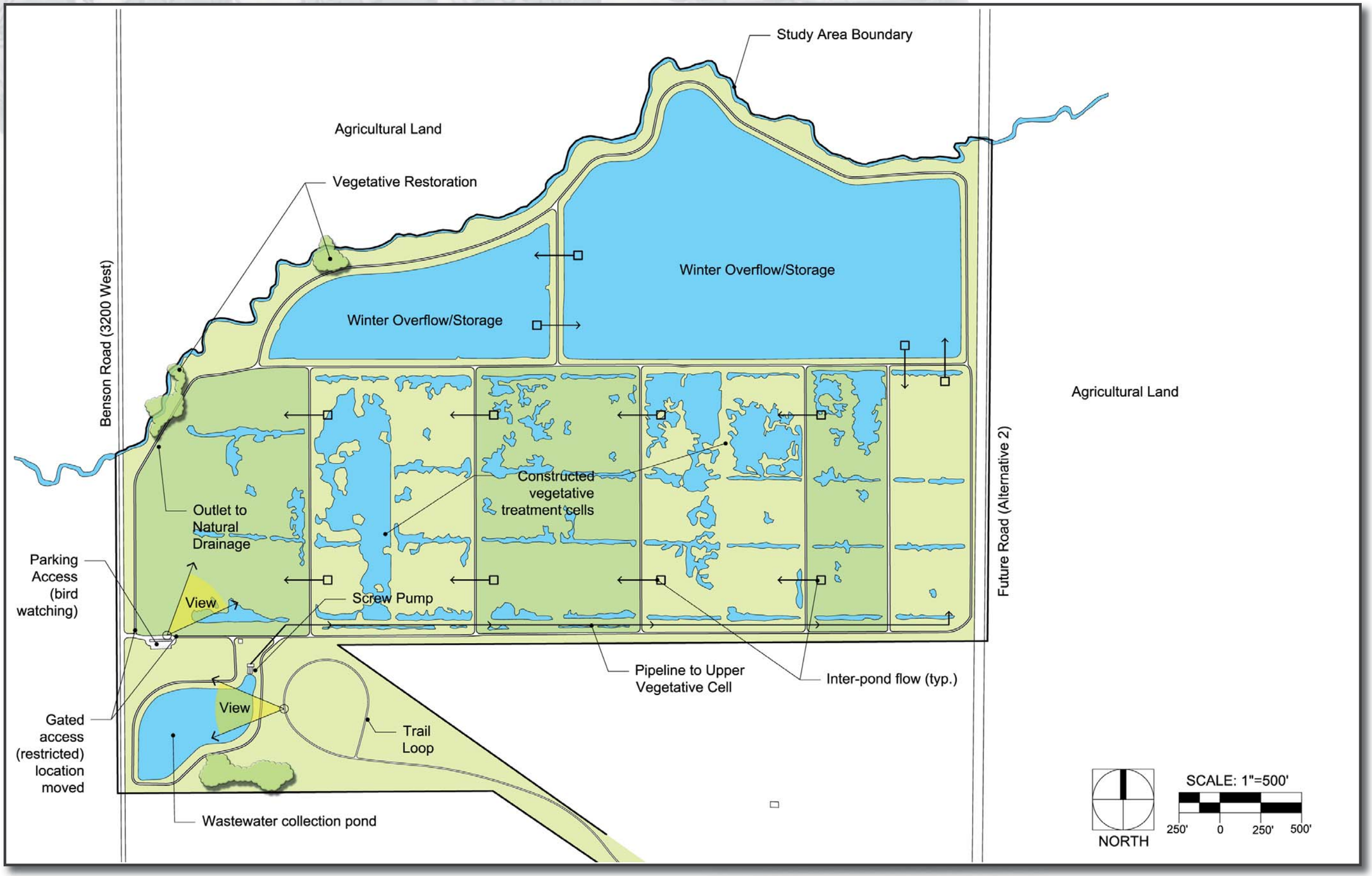

Figure 52. Effluent Polishing Wetland and North Trail Wildlife Viewing Area - Specific Plan

Wastewater Treatment and Alternative Energy Production Center

The specific plan for this area consists of the Wastewater Treatment and Biofuel Production Center (Zone C), a portion of the North Park Trail System (Zone B), and a portion of Gateway Park (Zone D).

This area has been the site of ongoing research investigating the potential to convert algae into biofuel conducted by Utah State University Department of Biological and Irrigation Engineering. The research has been completed at a variety of scales and has proven to be a viable means for producing methane gas *and* reducing the total phosphorus and nitrogen in the effluent. It is proposed that model developed in the pilot studies be followed and implemented within the existing cell structure of the waste water treatment lagoons as shown in Figure 55.

The Wastewater Treatment and Alternative Energy Production Center is the central feature of the overall Integrated Municipal Waste Management Campus. The trails adjacent to and surrounding the wastewater treatment lagoons are the primary connectors that will allow access for pedestrians, bicyclist and service vehicles between all the various interpretive sites proposed to the south, east and north of the lagoons. This trail network is proposed to be developed within a larger landscape restoration effort on the south of the lagoons that would serve as the starting point of a gateway to the City of Logan along the Highway 30 corridor.

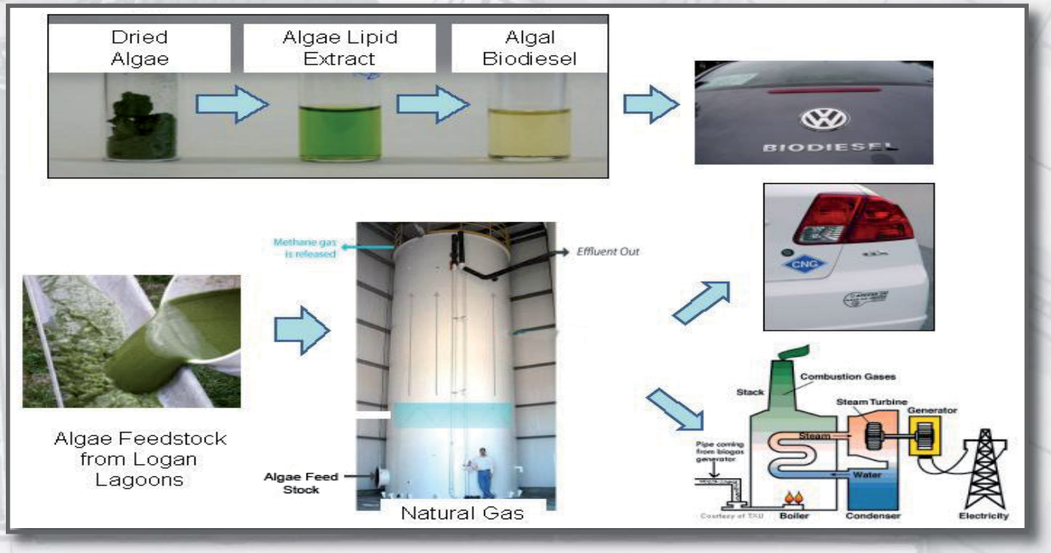

Figure 53. Algae to biofuel.

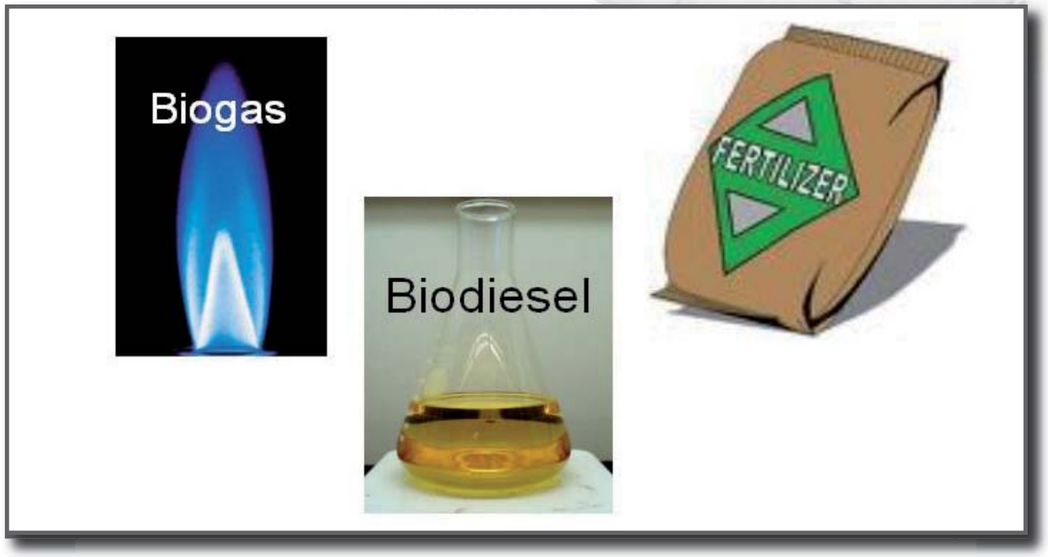

Figure 54. Products from algae feed stock.

Operational needs:

Continued primary treatment of waste water
Improved primary treatment of waste water to meet new nutrient regulations
Regulated and restricted public access
Continued access to lagoons for maintenance and upkeep

Proposed improvements:

Full scale implementation of maximum algae production
Construct Dissolved Air Floatation (DAF) system to harvest the algae (seperates the algae)
Construct an Anaerobic Digester (AD) to produce methane gas from the algae
Generate energy from the methane gas
Support USU center for research about alternative energy production (Biofuels program)
Create a small destination parking area and trailhead
Create trail improvements that extend to points adjacent to restricted access areas
Create landscape restoration and beautification south of lagoons; north of Highway 30
Construct elevated viewing platforms and blinds
Construct interpretive/educational features
Develop program for tours of facility

Figure 55. Wastewater Treatment and Alternative Energy Production Center - Specific Plan

Understanding Alternative Energy Production and Recovery

1. *Phosphorus emissions in water grow algae*
2. *High levels of phosphorus can increase algae growth*
3. *Harvesting algae can remove phosphorus*
4. *Reduced phosphorus can improve water quality*
5. *Harvested algae can be refined into biofuel or biogas*
6. *Algae sludge can be recovered and reintroduced into the system or can be used to create a high quality, nutrient rich compost material*

Estimated Algae Growth = 35 tons of algae per day (10,500 tons/yr)
(based upon pilot project modeling)
Flow = 15M gallon per day
P removal = 4 mg/L

Bio-Diesel Production
Diesel fraction derived from algal biomass = 10%
Facility operation = 300 days/yr
Total biodiesel per year = **240,000 gal (140 trucks for a year)**

Bio-Gas Production
80% of the remaining biomass is converted to methane
Energy potential of methane = 1.2 x 10^7 kWh/year
20% combustion efficiency
80% generator efficiency
Energy produced per year (Calculated Electrical Energy) = **2.8 x 10^6 kWh/yr (300 homes)**

Figure 56. Algal bloom in existing wastewater treatment lagoon (untreated).

Figure 57. Anaerobic digesters in southeast Beijing. Photo credit: http://www.wabag.com

Evaluation of Biofuel Potential Through Wastewater Treatment Using Algae

Erick Griffiths[1], Dr. Sridhar Viamajala[1]*, Reese Thompson[1], Ronald Sims[1] and Issa Hamud[2]
[1]Department of Biological and Irrigation Engineering, Utah State University, 4105 Old Main Hill, Logan, Utah 84322
[2]Logan City Environmental Department, Logan, Utah 84321
Email: erick.griffiths@aggiemail.usu.edu

Logan Wastewater Treatment Lagoons

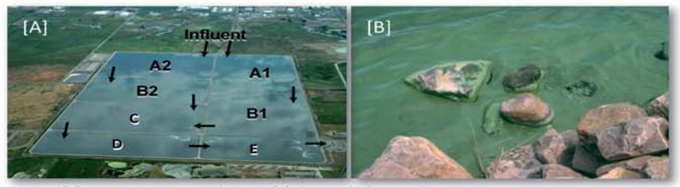

Figure 1. [A] Logan city wastewater lagoons. [B] Algae in the lagoons during summer.

The Logan City Environmental Department (Utah) operates a facility that consists of 460 acres of fairly shallow facultative lagoons (~ 5'deep) for biological wastewater treatment that meets targets for primary and secondary treatments (solids, BOD and pathogen removal). The annual average flow through the system is approximately 15 MGD.

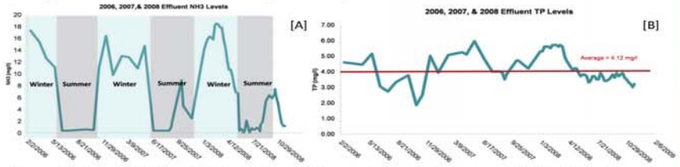

Figure 2. Historical NH_3 [A] and total phosphorus [B] concentrations in the treatment facility effluent.

Significant natural algal growth occurs in these lagoons, which improves BOD removal through oxygenation and also facilitates nitrogen (N) removal through volatilization as ammonia (NH_3) at high pH conditions created by algal growth (Figure 2A). Phosphorus (P), however, is non-volatile and stays in water and likely cycles in and out of algal cells as they grow and die in the lagoons (Figure 2B).

Table1. Logan City municipal wastewater characteristics compared to other weak domestic wastewaters

Constituent	Concentration mg/L				
	Spring	Summer	Fall	Winter	Weak Wastewater†
Total Suspended Solids (TSS)	145	105	110	130	100
BOD_5	150	175	175	135	110
COD	310	235	305	290	250
Ammonia (NH_3)	15.7	13.9	19.6	19.9	12
Phosphorus (P)	5.6	4.0	5.5	6.3	6

In the near future, the regulatory limits on P released from the Logan wastewater treatment facility are likely to become significantly lower to counter potential downstream eutrophication. Algae can uptake P during growth and managing their growth and harvest is one possible way to efficiently remove P from the wastewater.

Figure 3. Algal strains identified in the Logan lagoons.

Multiple algal strains have been identified in the Logan lagoons. The strains marked by an asterisk have been identified by others as higher lipid producing strains.

†Metcalf and Eddy Inc., 1991, *Wastewater engineering*. 3d ed. New York: McGraw-Hill

Evidence for Algae Dominated Process

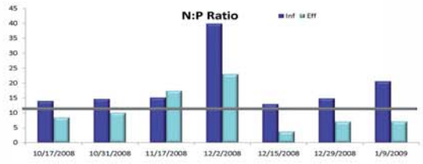

Figure 4. N:P ratio during the early winter months of 2008.

Based on the composition of algae‡ as $C_{106}H_{263}O_{110}N_{16}P_1$, algae growth requires a stoichiometric N:P ratio of 16:1 that the influent wastewater normally has (Figure 4). However, NH_3 volatilization during the summer months will require N supplementation to achieve sufficient N:P for optimal and sustained algae growth.

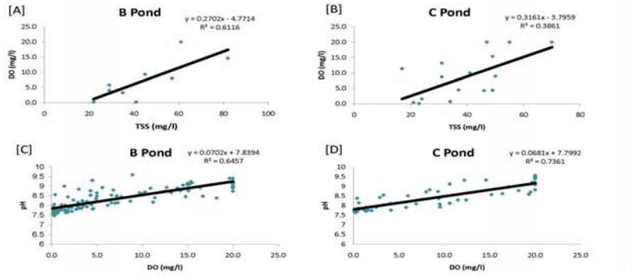

Figure 5. Correlation of (1) dissolved oxygen (DO) and TSS ([A] and [B]) and, (2) pH and DO ([C] and [D]) in B and C ponds, respectively. These data suggest that the primary biological activity in B and C is related to algal growth.

Oxygen is a product of photosynthesis. During photosynthesis, the algae sequester CO_2 resulting in an increase in pH and DO. The correlation as seen in Figure 5 [A,B] shows an increase in DO with an increase in algae biomass, reported as TSS. Figure 5 [C,D] shows the direct correlation of an increase of DO and pH, which is evidence of algae growth.

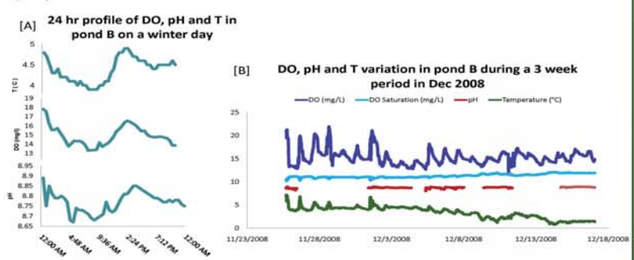

Figure 6. Variation of DO, pH, temperature in B pond during Dec 2008 [A] over 24 and [B] over 3 weeks showing evidence of sustained photosynthesis during early winter.

‡Sturm and Morgan, 1981, *Aquatic chemistry : an introduction emphasizing chemical equilibria in natural waters*. New York: Wiley

Biofuel Potential

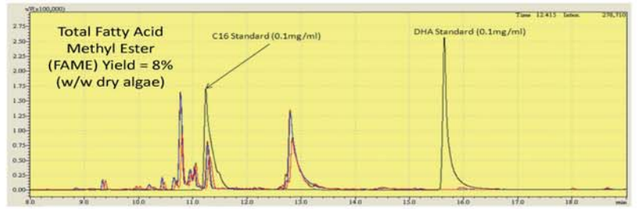

Figure 7. GC chromatogram of algae lipid analysis from B pond – Samples were collected in March 2009.

Estimated biomass production (conservative estimates)
Flow = 15 MGD
P consumption = 4 mg/L
Based on typical algae stoichiometry, biomass yields = 14 tons/day
Expected algae concentrations = 0.2 g/L

Biodiesel estimates:
Diesel fraction derived from algal biomass = 10% (w/w dry algae)
Facility operation = 300 days/yr
Total biodiesel produced per year = 240,000 *gal = fuel for* 140 *trucks for a year*

Biogas estimates:
80% of the biomass is converted to methane
20% combustion efficiency
80% generator efficiency
Energy produced per year = 2.8×10^6 *kWh = power for 300 homes*

Strategies to Improve Algae Productivity

Figure 8. 0.5 acre clay –lined raceway test ponds at the Logan wastewater treatment plant

In order to establish algae growth yields more efficiently, DO, pH, temperature, TSS, and soluble nutrients need to monitored continuously. Pilot scale raceway ponds have been built to optimize algae growth for P removal and lipid accumulation.

ACKNOWLEDGEMENTS

- Jim Harps, Tim Lindsay, and Eric Dodson - Logan City Environmental Department
- Utah Science Technology and Research (USTAR) Initiative
- Daniel Nelson, Steve Pearson, Quenten Thompson - USU

Figure 58. Biofuel potential presentation board, courtesy of Erick Griffiths.

Integrated Municipal Waste Management Campus Core and Surrounding Landscape

The specific plan for this area consists of the Integrated Municipal Waste Management Campus Core (Zone G), a portion of Advocet Park (Zone F), and RE-Park and Sports Facility (Zone H). This area provides all the services for solid waste disposal in Cache County, including solid waste landfilling, greenwaste disposal and composting, and household hazardous waste disposal.

This is the core area where many operational and community interests meet. It is vital that this area be adequately programmed and that circulation be clear and organized throughout. A critical component will be closure of the existing landfill facility and the construction of the new City of Logan Environmental Department offices, interpretive center, warehouses, and solid waste transfer station. This destination will be the point of origin for all visitors to the facility and will aid in orientation, wayfinding and interpretation of technologies. The site is accessible and visible from Highway 30 and will serve as a gateway landmark of arrival for all City of Logan residents and visitors.

The campus core also includes the landfill park and trail network that is the "hidden" gem of the entire facility. After closure, the capped and closed landfill will provide a network of trails, features and viewpoints to educate valley residents about waste management and the ecosystems and history of Cache Valley. It is proposed that many "unveiled" elements will be used to describe the landfill process, how much waste is stored and make it visible to users through a "cut-a-way" to see the efficacy of past waste management methods.

As the existing waste management facilities are consolidated and organized an new park facility will be constructed in the location of the existing greenwaste facility. This area is proposed to have sports fields and an eco-adventure playground that will allow children to experience discovery through play. With ever increasing residential development to the immediate south, the proposed park facility will be a well used destination by neighborhood and citywide visitors.

Operational needs:

Solid waste transfer station
Greenwaste operations and composting (relocated)
Environmental department warehousing and administration facility
Interpretive center
Fire training facility
Outdoor storage
Methane gas monitoring
Household hazardous waste disposal
Leachate monitoring and treatment

Proposed improvements:

New Environmental Department Interpretive Center/Warehouse/Transfer Station
Capped and Closed landfill
Road and parking improvements throughout
Entry Plaza for Rain Celebration
Demonstration Gardens
Entry Feature Monuments
RE-Park play fields
RE-Park Eco-Adventure Playground
Trail
Overlooks
Landfill Cut-aways
1900 West Pull-out and Overlook
Landfill south slough riparian corridor restoration

Figure 59. Landfill cut-away.

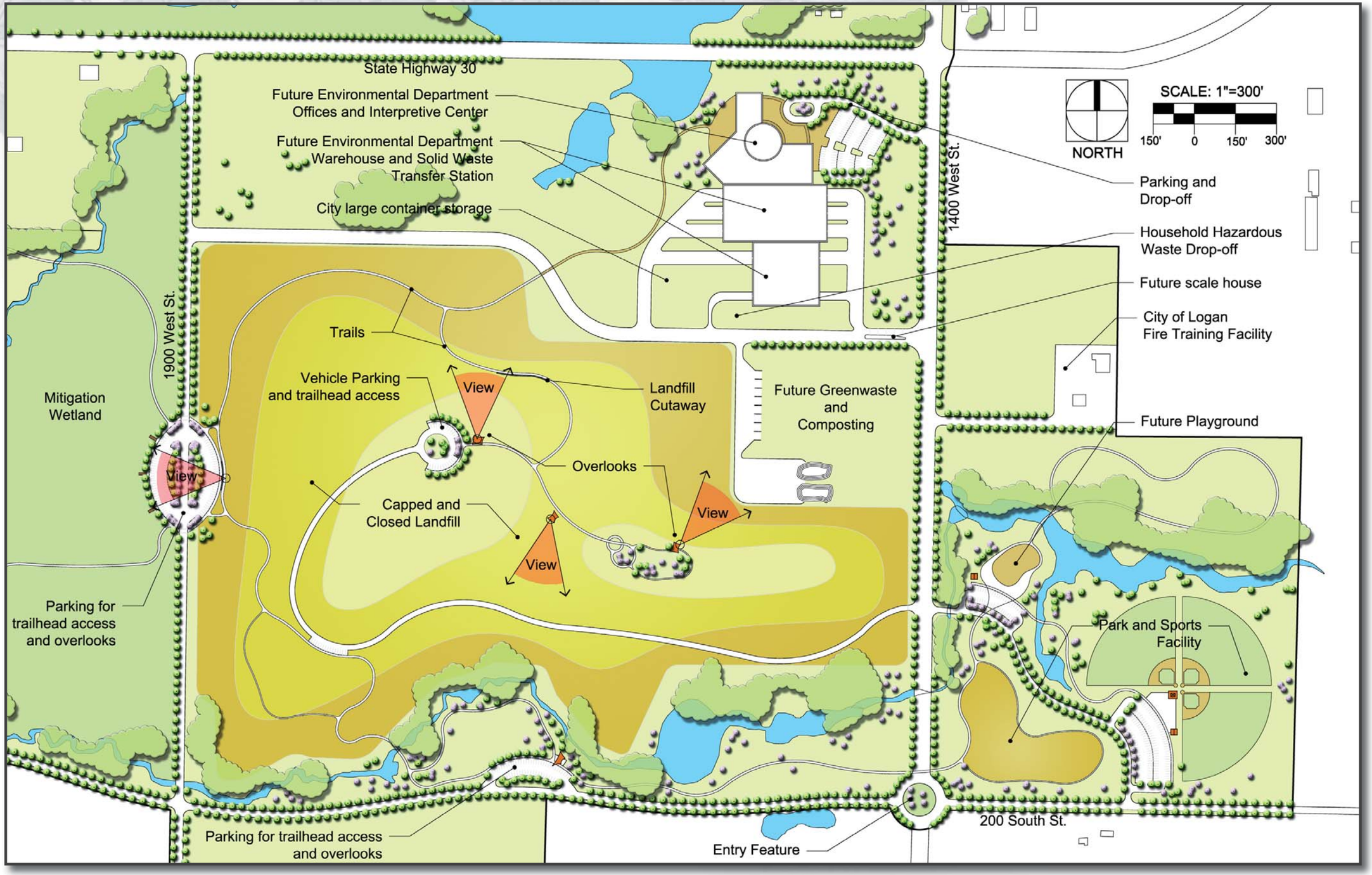

Figure 60. Integrated Municipal Waste Management Campus Core and Surrounding Landscape - Specific Plan

Rain Celebration Plaza and Demonstration Gardens
Cache Valley's climate can be described as semi-arid. When it rains it should be viewed as a celebration of life. The rain celebration plaza will showcase rainwater harvesting techniques, and fountains that will display their full splendor only during a rainstorm. Throughout the plaza one can expect to find interpretation and education about low-impact living and increasing the environmental quality of our community. One such demonstration will showcase high-yield gardening techniques, utilizing minimal space with high density plantings and productive maintenance to return the greatest yield from the smallest area of arable land. This method can be implemented in nearly all environmental conditions, including on hard paved surfaces.

Avocet Park Boardwalks
Foot travel through the mitigation wetlands will be accommodated by a boardwalk and self-guided interpretive trail. Visitors will enjoy a broad range of views of Cache Valley while learning about wildlife that inhabit and visit these wetlands, the mitigation function of these wetlands, and their role in environmental health and "clean-up".

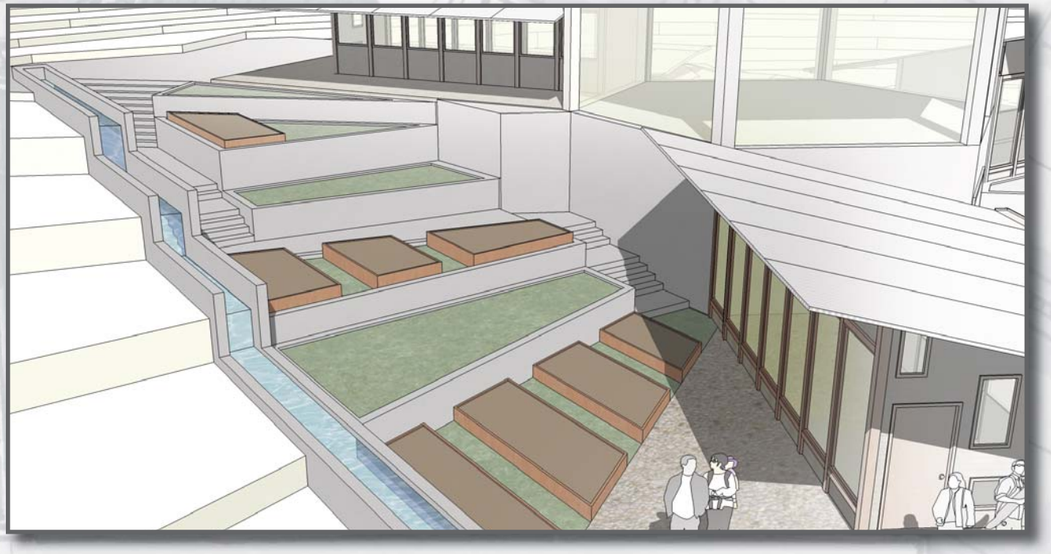

Figure 62. Vision of a terraced demonstration garden and rain celebration feature.

Figure 61. Demonstration/Interpretive scale algae raceways (pilot project).

Figure 63. Boardwalks are envisioned throughout the constructed wetland area to provide access.

Avocet Park Overlook (West)
This overlook is adjacent to, and on the west side of, the 1900 West pull-out. The view is to the west, overlooking the mitigation wetlands, Logan River, and Cutler Reservoir. Development will be minimal, with a rest bench and interpretive panel on an observation platform.

Greenwaste Center Overlook
The Greenwaste Center is located to the northeast of the entry monument and round-about, the central node of vehicular circulation. This location is convenient for the citizen dropping off or picking up, with a great view of the Visitors Center thereby enticing the Greenwaste Center visitor to investigate more of the Landfill Learning Center. Likewise, those intending to spend time at the Visitors Center may be attracted to explore the Greenwaste Center. The Greenwaste Center Overlook will provide the visitor an opportunity to enjoy the panoramic view of the east side of Cache Valley with the Greenwaste Center in full view.

South Slough Overlook
The view towards the south of the landfill is spectacular, with the broad valley floor enframed and enclosed by the Wellsville and Bear River ranges. The view over South Slough also encompasses the rapidly developing residential areas of west Logan, therefore offering an excellent opportunity for interpretation and discussion of the land-use changes underway in Cache Valley. The landfill is the visual and physical manifestation of this and other development over the years. This overlook will describe the relationship of people, development, and solid waste in a way that "connects the environmental dots" for the visitor.

North Overlook
Near the summit of the high point on the landfill's northwest side will be an area of modest interpretive development. It will feature a rustic pavilion with rest benches and viewing platforms as well as covered space for outdoor classroom use. It will incorporate interpretive displays and signage as well as directional indicators pointing to the sewage lagoons and effluent polishing wetlands in the distance, as well as the major natural features and human communities in the north end of Cache Valley.

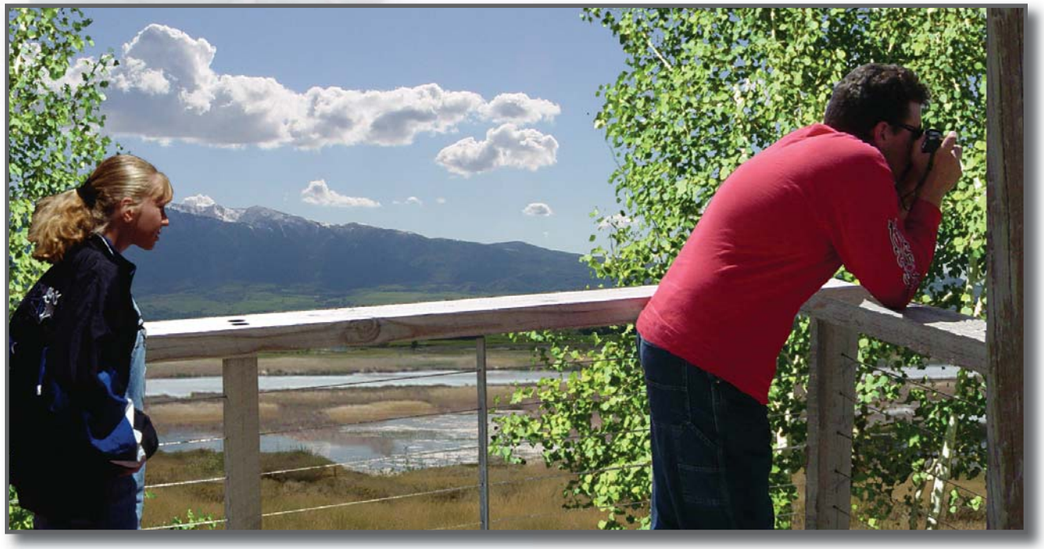

Figure 64. West overlook from capped and closed landfill.

Figure 65. South overlook from capped and closed landfill.

1900 West Pull-Out

It is proposed that there will be pull-outs to access parking on both sides of 1900 West street. The east side pull-out will follow along the base of one of the landfill cut-aways, providing views of the mitigation wetlands and Cutler reservoir/Logan river to the west as well as the landfill and cut-away to the east. The west side pull-out will provide a more intimate viewing experience of the mitigation wetlands and immediate surrounding area.

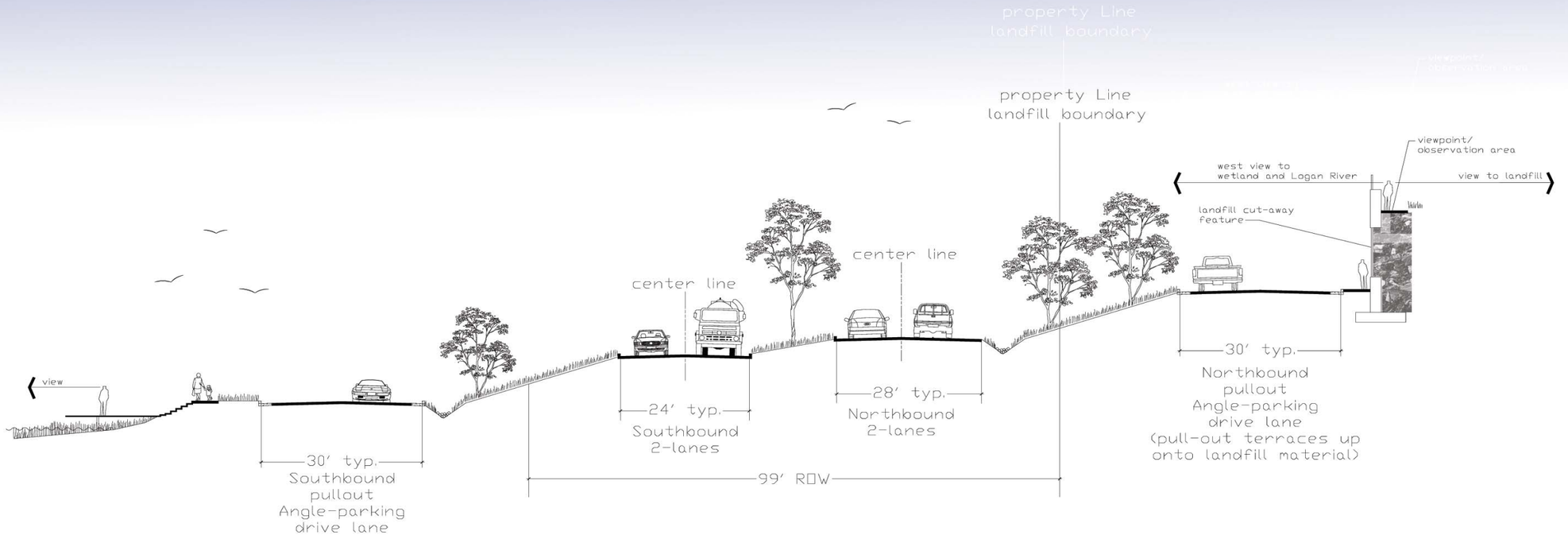

Figure 66. Cross-section of 1900 West (looking north), including pullout areas, landfill cut-away, and Avocet Park overlook. Not to scale.

Flameworks

Methane gas is a common by-product of landfill material decomposition. When the landfill is large enough, this gas can be harvested in a commercially viable fashion. The Logan City/Cache County landfill, although too small for commercial methane gas harvesting, should produce sufficient gas to provide some power for the Interpretive Center. However the real potential lies in the FlameWorks demonstration. The methane gas will be captured in a series of sub-surface pipes and carried to a central point, near the interpretive center. A series of "organ pipes" will be constructed with safe ignition systems for igniting the gas on command as it is released from the top of the pipes. This ignition and its timing will be controlled from an oversize piano-style "keyboard" which children (as well as their parents and other un-inhibited adults) can dance upon and thereby "play" the methane organ. Musical notes will emit from nearby concealed speakers while the individual methane organ pipes ignite, emit flame, and extinguish on command. "Playing the methane" will add fun and novelty to a valuable learning experience.

RE-Park and Eco-Adventure Playground

The site of the existing greenwaste facility is proposed to move and be replaced with a park. The vision of this park is one constructed entirely of recyled and/or renewable materials, including entry drives, signage and sports facilities. This park is planned to have several playing fields and a looped nature trail through the adjacent riparian corridor that will be restored and improved. Along with these facilities it is planned to have a playground like no other, the Eco-Adventure Playground will provide an experience of active learning through discovery and play.

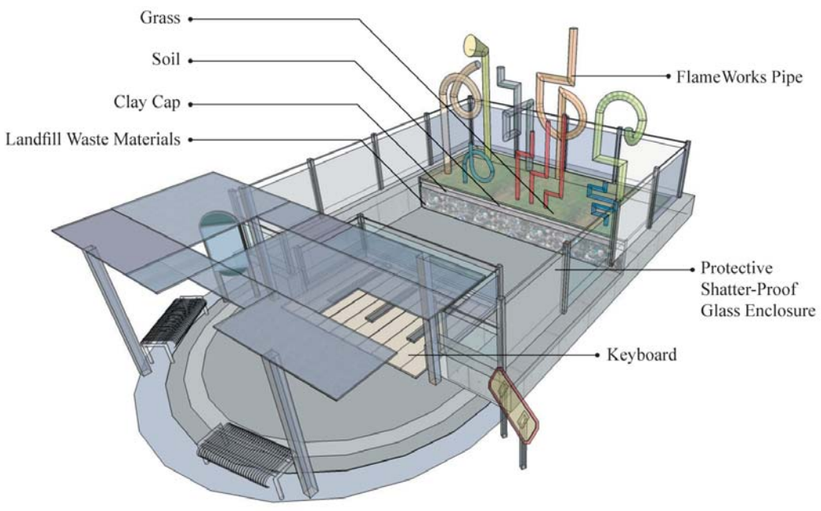

Figure 67. Vision of "flameworks" facility.

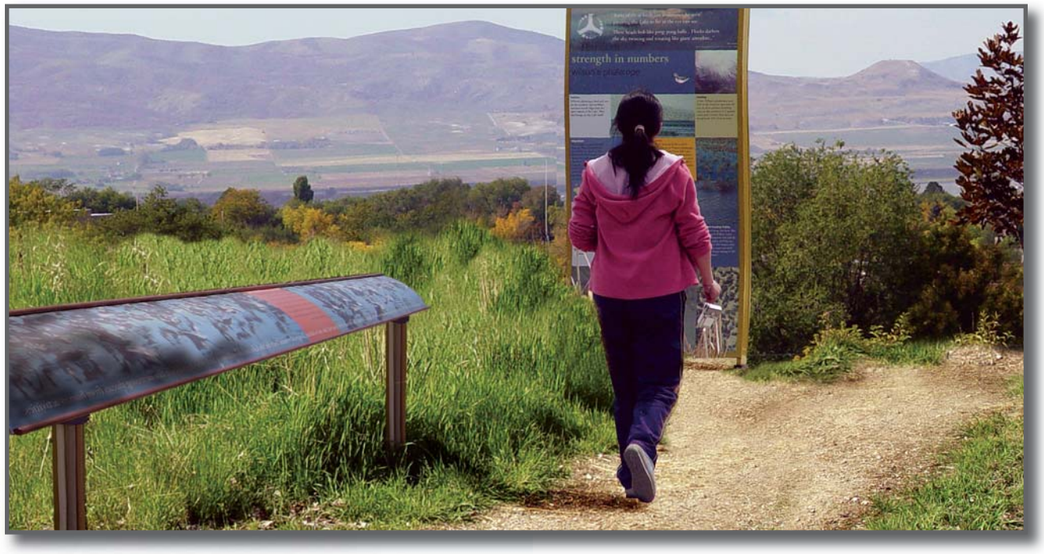

Figure 68. Vision of a nature trail and interpretive signage on the capped and closed landfill.

3.0 Site Structure Programming Guidelines

Several structures and other built elements are proposed throughout the study area. These built structures should relate to their surroundings and not contribute to environmental degredation. A series of guidelines have been developed to guide the intent behind future construction. These guidelines are intended to be followed for operational facilities, public education and amenities.

Conservation Programming Guidelines

Utah is one of the driest states in the nation, so water conservation is a primary concern for any improvments within the IMWMC. These guidelines have been developed for any proposed structures and landscape improvements throughout the site.

- Where possible collect rainwater from all roofs structures and detain it in a buried water cistern for flushing toilets and irrigating landscaping;
- Employ gravity flush techniques to reduce use of toilet water;
- Use 3/8” cross-linked polyethylene pipes and manifold to save water by increasing pressure and restricting the flow of water;
- Select drought-tolerant and native plants for the landscape design;
- Use mulch in the garden and around the building to reduce evaporation;
- Use limited grass and turf in the landscape design to reduce water consumption;
- Plant trees around the building to provide shade and reduce water evaporation.

Environmentally Friendly Programming Guidelines (Green-Building Materials and Features)

The programming and design of the new Environmental Department building should be guided by the concepts of use, reuse, and recycle. A great deal of recycled and green material are available for nearly every application and can reduce the impact to the natural environment and make the new structures environmentally friendly.

- Employ recycled concrete as a primary building material
- Use concrete amended with recycled fly ash (which makes the concrete harder) to build the central hub;
- Use lumber harvested from sustainable forests;
- Use metal roofing which will last more than 50 years;
- Use Oriented Strand Board (OSB) on the roof (use smaller trees and parts of the tree that were not previously used for wood products);
- Use blown-in cellulose made from recycled newspapers and cotton made from recycled blue jeans for insulation materials;
- Use salvaged road signs to build railings of the decks;
- Use permeable materials for pedestrian and vehicle circulation (to reduce on-site run-off and pollution to the existing water system, also to recharge the ground water table);
- Use recycled carpet;
- Use recycled glass material for windowsills and counter-tops in bathrooms;
- Use renewable natural cork for bulletin boards;
- Minimize the use of electricity for indoor lights and use natural light as much as possible for illumination;
- Use recycled shipping containers to create a series of vegetated ponds to clean run-off water from the landfill before it flows into the existing water system;
- Create a demonstration green roof to reduce on-site run-off and improve microclimate.

Energy Efficiency Programming Guidelines

Energy efficiency is one of the most important factors in sustainable development design. The following guidelines are intended to be employed throughout the IMWMC.

- Use renewable energy resources to generate electricity for the building and surrounding landscape, including:
  - photovoltaic (PV);
  - wind turbines;
  - methane
- Use a solar hot water system to generate hot water for the building;
- Use natural light as much as possible, through windows and clerestory windows to reduce the need for and expense of artificial lighting;
- Use compact fluorescent lighting (CFL) instead of incandescent light bulbs;
- Increase insulation levels in walls and roofs to reduce energy loss;
- Use green roof technology to improve thermal insulation efficiency;
- Utilize passive solar energy design with thermal mass on the south-facing rooms to heat the building;
- Minimize windows on the west side of the building;
- Carefully design windows and clerestory windows to achieve natural ventilation and reduce the need for air-conditioning in warm months;
- Design roof overhangs to admit winter sunlight and block summer sunlight;
- Plant deciduous trees and shrubs on the south side of the building to admit winter sunlight and block summer sunlight;
- Use energy-efficient windows covered with a high performance coating which can minimize energy loss and UV infiltration;
- Use Energy Star appliances throughout;
- Use energy-efficient gas fireplace;

- Use solar outdoor lighting;
- Use motion sensors on outdoor solar lighting, and motion detecting switches in the bathrooms;
- Double insulate exterior doors and roofs to reduce energy loss.

Indoor Health Programming Guidelines

Human health is critical to the success of any facility, the following strategies can create a healthier indoor environment:

- Use low VOC’s (volatile organic compound) interior materials for paint, carpet, etc.;
- Install a carbon monoxide detector in each building sector;
- Detach the parking area as distant as practical from the building to reduce exhaust fumes in and near the building, and utilize smart car technology where practical for site circulation

4.0 Benefits and Outcomes of the Integrated Municipal Waste Management Campus

The IMWM Campus and its varied purposes, operations, and products will provide a number of benefits to both Logan City and Cache County residents. The benefits and outcomes are listed below:

- *Provide compliance with the DEQ waste water pollutant limit requirements*
- *Provide clean (ie. phosphorus, nitrogen, and algae free), reusable effluent to downstream farmers*
- *Ensures the ecosystems like that at Cutler Reservoir are improved and preserved for wildlife, fishing, boating, and other activities*
- *Create jobs in a slow economy*
- *Reduce fossil fuel use by providing supplemental heat, electricity, and biofuels*
- *Help Logan achieve its renewable energy goal of zero growth of coal fired electricity purchase*
- *Reduce greenhouse gas emissions from the lagoons; especially methane emissions;*
- *Help reduce winter inversion particulate matter pollution*
- *Provide community educational benefits*
- *Be replicable in other parts of the country*
- *Preserve a well-planned and low impact location for the operation of Logan City waste management (and related) facilities into the future*
- *Create a visual and physical linkage among all the elements and features of the City's waste management operations and wetlands*
- *Create and preserve wildlife habitat*
- *Provide a visually preferred gateway to Logan City*
- *Preserve open space*
- *Create a variety of opportunities for community education regarding natural processes, wild life habitats and plant communities*
- *Create a place where people can experience nature, art and physical activity*
- *Create an excellent venue to educate the public about waste and some of the hidden technologies and processes involved in waste management*

ENVIRONMENTAL DEPARTMENT