WETLAND RESTORATION CONCEPTUAL DESIGNS REPORT
SALTESE FLATS WETLAND RESTORATION INVESTIGATION

Spokane County, Washington

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### 1.0 INTRODUCTION

The Spokane County Division of Utilities is currently evaluating potential wetland restoration opportunities at Saltese Flats. The Saltese Flats wetland restoration project could provide a variety of benefits including:

- Delaying runoff to recharge the Spokane Valley-Rathdrum Prairie Aquifer to increase flow in the Spokane River during late summer months;
- Restoring a diverse wildlife habitat area;
- Providing a community resource for public recreation and education; and
- Allowing for possible future beneficial use of Class A reclaimed water.

This document presents and discusses a series of conceptual designs for wetland restoration options at Saltese Flats. Saltese Flats is located in Spokane County southeast of the city of Spokane Valley (Figure 1-1). The area known as Saltese Flats occupies roughly 1,200 acres of land that lies within a watershed of approximately 14,000 acres (Figure 1-2). The Flats includes land that currently functions as wetland, and also land that historically was a lake/wetland system but has been drained and used for agriculture for over one hundred years. Three wetland restoration option areas were considered during initial evaluation at Saltese Flats (Figure 1-3). Option Area A is 342 acres, Option Area B is 512 acres and Option Area C is approximately 1,200 acres. This report summarizes restoration opportunities on Option Areas A and B. These areas were determined to be sufficiently large to accommodate wetland restoration using both natural hydrology and reclaimed water (PBS&J, 2010), and directly involve only two landowners. Wetland restoration is also feasible on other lands within Option Area C and could be undertaken in coordination with efforts on Option Areas A and B, or separately over time in response to landowner interest. Option Area C includes many landowners.

This document represents the completion of the fourth phase of the Saltese Flats investigation completed by PBS&J under contract with the Spokane County Division of Utilities (Spokane County Utilities) in coordination with the WRIA 55/57 Watershed Implementation Team (WRIA 55/57 WIT), and with funding from the Washington State Department of Ecology (Ecology). Previous phases include:

1. Development of a *Scope of Work* (PBS&J, 2008a) with subsequent update upon the completion of initial tasks (PBS&J, 2008c);
2. Development of *Goals and Objectives* for the project (PBS&J, 2008b);
3. A public meeting held on October 15, 2008 to introduce the project to interested parties, and a series of meetings with the WRIA 55/57 WIT and a group known as the Wetland Panel, which was formed from a collection of stakeholders for this investigation;
4. Development of a *Quality Assurance Program Plan*, or QAPP (PBS&J, 2008c) and a *Monitoring Program Plan* (PBS&J, 2008d);
5. Completion of an evaluation and summary of existing information, including a preliminary site characterization and documentation in an *Existing Data Review* report (PBS&J, 2009);
6. Initiation of the Monitoring Program; and
Figure 1-1. Saltese Flats Location
Figure 1-2. Saltese Flats Watershed Delineation
Figure 1-3. Saltese Flats Restoration Options
1.1  Purpose and Scope

The purpose of this report is to present and describe a number of conceptual designs for potential wetland restoration scenarios at Saltese Flats. These conceptual designs are intended to provide visual perspectives and examples of how wetland restoration could appear at the Flats, and are intended to be used to determine and facilitate a final design for the site in the future. Specifically, this report includes the following:

- An overall summary of the feasibility for wetland restoration at Saltese Flats;
- Presentation of maps depicting general features for various wetland restoration scenarios;
- Presentation of photographic visualizations depicting how the restoration scenarios may appear from key locations around the Flats;
- A description of the features associated with the restoration scenarios, including alternative design components;
- A summary of the key benefits and potential description of the selected restoration scenarios with detail provided on water budgets and management alternatives; and
- An overview of potential future steps for the project.

1.2  Wetland Restoration Feasibility Overview

This section describes existing site features, wetland design components and general wetland restoration feasibility at the site. Site flexibility and future options are also described.

1.2.1 Existing Features

**Figure 1-2** illustrates the 1,200 acre Saltese Flats area within the 14,000 acre Saltese watershed. Saltese Creek exits the Flats and flows approximately 2 miles west to Shelley Lake. Shelley Lake has no surface water outlet and water leaves the lake via seepage into the SVRP aquifer. Another important feature in this area is the Steen Pit (a county-owned gravel pit) and the channel connecting it with Saltese Creek. The channel was constructed in 1948 to allow flood waters to infiltrate into the Steen Pit instead of flooding the Shelley Lake area.

**Figure 1-4** illustrates important features at Saltese Flats. A berm or dike is present at the south end of Option Areas A and B. This berm runs east to west across the Flats and allows water to be backed up south of the berm and then routed around the west border of the Flats through a bypass ditch. This bypass ditch flows into Saltese Creek at the northwest corner of the Flats. Water can be routed around the agricultural fields to dry them out for cultivation and harvest or allowed to flow into the Flats for crop irrigation. A series of other ditches are also present that can be used to route water around the Flats. These other ditches terminate at the northwest corner of the Flats where the bypass ditch enters Saltese Creek. However, the terminus of these ditches is topographically lower than Saltese Creek where it exits the Flats. During high water periods, water can flow by gravity from these ditches into Saltese Creek. However, during low water periods (most of the year) water from these other ditches must be pumped into Saltese Creek to exit as surface water. Water also exits the Flats as groundwater. A high-volume, low-head pump is present to lift water from the other ditches into the bypass ditch and Saltese Creek channel (Figure 1-4). This pump has not been used in recent years.

A large pond is located on the north border of the Flats resulting from past peat excavation. Water elevations in this pond generally reflect groundwater elevations across the northern Flats throughout the year.
Data Summaries and Feasibility Report

Existing information about Saltese Flats was initially summarized in a report titled Existing Data Review report (PBS&J, 2009). Additional information was then collected and combined with previous data to evaluate wetland restoration feasibility in a subsequent report titled Data Update and On-Site Feasibility Report (PBS&J 2010). This feasibility report included:

- Topographic surveys
- Photographic documentation
- Meteorological data
- Soil data
- Wetland delineations
- Surface and groundwater monitoring results
- Historic water management
- Water quality
- Water budgets for natural hydrology and reclaimed water scenarios
- Feasibility evaluations for each scenario

The feasibility report also identified additional data requirements needed to further quantify final design parameters.

1.2.2 General Wetland Restoration Feasibility

Wetland restoration is considered feasible with respect to this project if there is sufficient water available to maintain wetland conditions, but not in excessive quantities that may create undesirable effects. All data collection and feasibility evaluation to date suggest that wetland restoration is feasible at Saltese Flats on each of the three Option Areas A, B and C. Wetland restoration is also feasible using either natural hydrology or using reclaimed water, and under a wide variety of conceptual designs. Some of the most attractive features for wetland restoration include:

Opportunities for Hydrologic Control
Hydrology on this site can be controlled very well using the berm, bypass ditch and pump. Water levels could be lowered to facilitate construction. Water levels can be raised or lowered to maintain specific wetland conditions or to address vegetation management issues such as reed canarygrass, cattail and Eurasian water milfoil. Water levels can be manipulated to enhance habitat for desired plant and animal species.

Wide Variety of Wetland Designs
The site has the potential to provide a wide variety of wetland types including open water, aquatic bed, emergent, shrub/scrub and forested wetland. These types could provide habitat for a wide variety of wildlife such as shorebirds, waterfowl, raptors, small and large mammals, amphibians, reptiles, and others.

Restoration Schedule
Site hydrology and other factors are such that major restoration activities could be planned as one event at this site or could be implemented incrementally over a longer period of time. This may be important if funding is only available over a longer time period, especially using natural hydrology or if reclaimed water is not immediately available. There may not be an immediate need or opportunity for using reclaimed water at the Flats. Both Spokane County and Liberty Lake Sewer and Water District may contribute reclaimed water to the site in the future but the schedule is unknown at this time.
Future Flexibility
The site offers flexibility over time to change conditions to meet changing future needs or priorities. Hydrologic and topographic conditions could be altered in the future to provide new wetland habitats, trails, education opportunities or other desired features. These changes may be due to new recreational needs, new concerns over endangered, threatened, or sensitive species or other considerations.
Figure 1-4. Saltese Flats Existing Features
2.0 CONCEPTUAL DESIGNS OVERVIEW

This section presents an overview of important conceptual design features considered in this study. It also summarizes common components of all conceptual designs and highlights their benefits and flexibility.

2.1 Conceptual Design Areas

Conceptual designs are presented for Option Areas A and B. Both areas are feasible for wetland restoration, especially due to the control over site hydrology provided by the bypass ditch and pump. Conceptual designs on Option Area A alone would result in larger flows and volumes of water exiting the Flats due to the smaller area of wetland restoration compared with Option Area B. Option Area B provides more area for wetland restoration than A and also includes the lowest elevation portion of the Flats (northeast portion). Hydrologic control would likely entail less effort on Option Area B since it includes the topographically lowest elevation areas of those under consideration, and extra effort would be required to keep these areas dry if only Option Area A were to be restored. A second pump may be required for Option Area B designs if ditch flows are not effective at routing drain ditch water away from adjacent properties. This second pump location is shown on Option B figures in Section 3.0.

2.2 Restoration with Natural Hydrology

Natural hydrology that would be used to facilitate wetland restoration would include existing precipitation, stream surface flow, and groundwater inputs. Wetland restoration has been determined to be feasible using natural hydrology. Use of natural hydrology would result in a wetland system containing abundant water during spring runoff that would be maintained at the site for longer duration during wet years. Water levels would fluctuate with annual weather and longer-term climate fluctuations. More and longer periods of inundation would occur during wet periods and years and less during dry periods and years. Normal flooding would still occur during spring runoff and storms. The berm/bypass ditch/pump system would be effective at maintaining wetland water levels during wet periods, but not dry periods. There may be greater potential for invasive species establishment, such as reed canarygrass and cattail, with natural hydrology since water levels could not necessarily be maintained in all years that typically discourage these species. There may also be greater potential for mosquitoes with less water available to prevent shallow and stagnant water conditions that favor mosquitoes. These factors may result in higher control costs for invasive plant species and mosquito control. Under natural hydrologic conditions, flows to Shelley Lake would be increased slightly because 3 cfs would not be diverted for irrigation.

2.3 Restoration with Reclaimed Water

Spokane County Division of Utilities is considering participation in wetland restoration at Saltese Flats as a potential alternative for reclaimed water application. At this time, facilities to produce or deliver reclaimed water to Saltese Flats do not exist. The Division of Utilities is working to construct a water reclamation facility to treat wastewater from the Spokane Valley. The current plan is to discharge the reclaimed water directly to the Spokane River near the facility.

Reclaimed water is the product of highly treated wastewater and can be put to many beneficial purposes. The State of Washington does not consider reclaimed water to be wastewater and encourages its beneficial use. The Division of Utilities is planning to produce the highest quality reclaimed water, Class A, at its new water reclamation facility. One possible use of reclaimed water is wetland enhancement. A degraded wetland such as Saltese Flats could be improved with additional water. One consistent source of water is the effluent from a water reclamation facility.
The current feasibility study indicates that reclaimed water could greatly increase the quality of wetland restoration at Saltese Flats by providing a constant and dependable water source. Without reclaimed water, water levels could fluctuate dramatically by season and year-to-year. These fluctuations make it much more challenging to maintain desired wetland and habitat conditions.

For wetland restoration with reclaimed water, volumes of 8 to 14 million gallons per day in addition to natural hydrology were considered for the study. The study only considered additions of reclaimed water for seven months each year, April through October. Wetland restoration has been determined to be feasible with reclaimed water hydrology. The most significant change in using reclaimed water is the increased control over site hydrology. The reclaimed water would provide a constant dependable water supply and allow design and maintenance of wetland features throughout the dry and wet portions of the year and during dry and wet years. Less fluctuation in water levels would occur with reclaimed water use. Normal flooding would still occur during spring runoff and storms. The berm/bypass ditch/pump system should be effective at maintaining wetland water levels during wet periods and also during dry periods due to the constant reclaimed water input. There may be less potential for invasive species problems using reclaimed water since water levels could be maintained that discourage such species. There may also be less potential for mosquitoes with more water available to prevent shallow and stagnant water conditions that favor mosquitoes. These factors may result in lower control costs for invasive plant species and mosquito control. The use of reclaimed water should increase flows to Shelley Lake and may provide higher lake levels for longer durations than currently exist.

Reclaimed water use need not be incorporated into the initial design, but could be subsequently added. Another possibility is that reclaimed water could be used for a period of time and then discontinued due to changes in future needs and resource options.

Reclaimed water has the potential to contain a wide variety of residual organic compounds such as pharmaceuticals, viruses, cleaning products and others. These compounds have been found to be reduced in wetland systems and research continues to evaluate the effectiveness of wetlands in this regard. This project will continue to incorporate the latest research on residual organic compounds into final design and operation if reclaimed water is used.

2.4 Potential Restoration Components and Concerns Common to All Concepts

Potential wetland restoration components and concerns common to all conceptual designs are presented here. These include berm and shoreline designs, public access sites, trails and other features such as the Steen Road Gravel Pit. These common components are discussed further in the individual conceptual designs where appropriate.

2.4.1 Potential Berm and Shoreline Designs

Berms or dikes will be required in most conceptual designs to define wetland features, contain water at wetland features, provide hydrologic control between wetland features and prevent unwanted effects on neighboring properties. These berms can also provide habitat targeted to specific species as well as recreational and educational opportunities including trails and kiosks or points of interest.

Examples of berm and shoreline designs are shown on Figure 2-1. Figure 2-1a illustrates a simple berm design where a shallow water wetland is confined with a simple berm. A drain ditch is provided on the outside of the berm to remove water that may infiltrate through or beneath the berm. A potential trail location is illustrated on top of the berm. Figure 2-1b illustrates a more detailed berm design with a shallow water wetland bordered by a sequence of vegetation types. Each vegetation type is situated relative to its ideal range of water depths. A shelf is provided at ideal bulrush water depths (2-3 feet) adjacent to a
shelf at the water surface level conducive to shallow emergent wetland plant establishment, including rushes and sedges. Riparian shrubs are then located just above the water surface level. A drain ditch is also provided and the potential for a recreational/educational trail is illustrated.

**Figure 2-1c** illustrates a berm design with a wide surface that could range from 20 feet to hundreds of feet. The berm sides could support a variety of wetland and riparian vegetation types (emergent vegetation is illustrated). The berm top is planted with riparian and upland shrubs and trees to increase vertical vegetation diversity and provide habitat for a variety of birds and mammals. A drain ditch is provided and the potential for a recreational/educational trail is also illustrated. **Figure 2-1d** illustrates a berm design with a shallow water wetland and mudflat feature constructed along the berm. Mudflats are a special habitat created to encourage shorebirds. Note that berm examples 2-1a and 2-1d are not used along shorelines where wind may create wave erosion. This condition would be most common on the east side of open water areas due to the predominance of wind direction from west to east at Saltese Flats.

In most cases, berms would be constructed from native materials present on the Flats. Berms would be relatively low in height (<6 feet). High organic matter content and coarse mineral soil textures across portions of the Flats may be unsuitable for constructing berms with adequate structural stability and water retention. At these sites, materials may need to be excavated from lower layers or imported from other nearby locations. Alternatives at these sites also include use of geomembranes or other impermeable core reinforcements. Regardless of final construction, seepage may still occur through or beneath berms, requiring construction of drain ditches on the outside of the berm. If trails are constructed on these berms, a geotextile or other special layer may be required to prevent upward capillarity and maintain dry conditions. It is unlikely that these berms would support a hard trail surface such as pavement or concrete. The trail surface would likely consist of wood chips, pea gravel or other permeable materials.
Figure 2-1. Potential Berm and Shoreline Examples
2.4.2 Potential Public Access, Trails and Educational Features

A wetland restoration project at Saltese Flats has the potential to include tremendous public recreation and education amenities. This area could create an asset for the community far beyond its natural resource benefits, providing local, neighborhood-based exercise and recreation opportunities which enhance physical and mental health. Some of the potential recreation opportunities at this site could include:

- Hiking;
- Solo jogging and organized runs;
- Dog walking;
- Horseback riding;
- Birding and other wildlife viewing;
- Photography;
- Ice skating; and
- Limited non-motorized boating.

Figure 2-2 illustrates two examples of potential public access locations and recreational trail systems. The potential public access locations are both on private lands. One is on the west side of Saltese Flats and would be accessed from Barker Road. The other is on the northeast side of the Flats and would be accessed from Henry Road. The northeast site is adjacent to property owned by the local school district where a future school is planned. Figure 2-2 is based on Option Area B. If only Option Area A were restored, public access would likely occur from the west side.

The first example trail layout illustrates a perimeter trail surrounding the potential wetland restoration area. The second example trail layout includes interior trails constructed on berms. These berms may be constructed to define wetland features or could be constructed for trail use alone. An alternative to trail construction on berms is the use of elevated boardwalks. These have been used at other wetland sites but are significantly more expensive. A third potential public access site might be located at the eastern end of the existing berm which forms the southern boundary of the potential restoration area. This location would be accessed from Henry Road.

Educational opportunities related to wetlands, wildlife, habitats and other subjects would be another component of a Saltese Flats wetland restoration project. Potential education components include:

- On-site displays or kiosks;
- Signs about wetlands, plants, wildlife and more;
- Self-guided nature trails;
- Naturalists;
- Coordinated wetland/water quality events;
- School groups from nearby or bused from afar;
- Class projects for students at adjacent future school; and
- Research projects from pre-school to post-graduate.

A monitoring program would likely be an integral component of any restoration project and would provide opportunities to link with education programs and research projects. Potential research projects could include local concerns such as wetland relationships with reclaimed water, water quality, groundwater movement, stream flow and aquifer recharge.

To illustrate the potential for public use, a 160 acre wetland restoration project in Gilbert, Arizona has 20,500 participants in programs annually including 5,500 student visitors. The facility has four naturalists and conducts enough research such that a research institute has been created at the site. Over 20,000 people visit the site annually to fish. This restoration project is based on reclaimed water.
Figure 2-2. Public Access and Potential Trail System
2.4.3 Steen Road Gravel Pit

High Saltese Creek flows in 1948 threatened to cause flooding in the Shelley Lake area where Saltese Creek terminates. A channel was excavated at that time which routed water to a county-owned gravel pit on Steen Road (Figure 1-2). All of the proposed conceptual designs discussed in this report include using the Steen Road Pit as a “safety valve” for large flood events. Wetland restoration is unlikely to cause significantly higher flood flows and may actually help attenuate flooding downstream of Saltese Flats. However, large natural flood events will continue to occur in the future and the Steen Road Pit can provide an alternative floodwater discharge site, thereby preventing flooding of residential and commercial areas near Shelley Lake.

2.4.3 Saltese Flats High Volume Pump(s)

The pump illustrated on Figure 1-4 is a high-volume, low-head unit which can play an important role in wetland restoration at Saltese Flats. To facilitate construction and reduce costs this pump can be used to lower water table levels during construction, especially on the northern portion of the Flats. This pump also would allow a more constant design elevation to be established and maintained in the restored wetlands. The combination of the bypass ditch and pump allows control of water both entering and leaving the site. With a dependable design elevation, wetland vegetation types can be established and maintained that require specific water depths and conditions. Wetland depths can also be avoided that favor undesirable vegetation such as cattail and reed canarygrass.

A second pump may be required for Option Area B if ditch flows are not effective at routing drain ditch water away from adjacent properties. This second pump location is shown on Option B figures in Section 3.0.

2.4.4 Reclaimed Water Discharge

If reclaimed water were used in this project, it would likely be delivered to the site via pipeline along Barker Road from the north. This pipeline would continue across the Flats to a discharge point in the southern portion of the site. Figures for individual conceptual designs presented later in this report show the discharge point against the southern boundary for general location purposes. The actual discharge location may vary slightly by design but would most likely be northwest of the locations shown and not against the site boundary. The discharge point could be visible in the form of a riser pipe or surface discharge. It may also be located below the water surface of a deeper water wetland in the southern portion of the site.

2.4.5 Undesirable Vegetation

Undesirable vegetation is a common concern in wetland restoration projects. Saltese Flats currently supports two such common plant species of concern – cattail and reed canarygrass. These plants cannot be entirely eliminated, but wetlands can be designed to minimize conditions that favor them over desirable wetland plants. Cattail is most competitive where water depth is less than two feet. Water depths of less than one foot during high water periods (spring) and near the ground surface during dry periods (summer/fall) are most advantageous for cattails. Reed canarygrass is most competitive with water depths less than one foot during high water periods and near the ground surface during dry periods. The conceptual plans identified in this report minimize conditions most favorable to these undesirable plants.

Although not currently present at the Flats, it is possible that milfoil may invade the area in the future. This aquatic plant prefers shallow to moderately deep water. Should problems develop with any of these undesirable plants in the future, manipulation of water levels using the bypass ditch and pump would be the first means of control. This manipulation could also include temporarily drying out the site and re-
moving unwanted plants which has proved effective elsewhere. Use of these control methods can result in the avoidance or minimization of herbicide application.

2.4.6 Mosquitoes

Mosquitoes are often a concern in wetland restoration projects due to the perception that more wetlands equate to more mosquitoes. However, wetlands can be designed and maintained to minimize mosquito habitat and populations. Mosquitoes require shallow, stagnant water for reproduction. These conditions can be avoided with wetland designs that emphasize deeper water than mosquito larvae prefer and by maintaining flows that minimize stagnant conditions. Mosquito habitat and mosquitoes are present in the existing wetlands at Saltese Flats. Mosquitoes will continue to be present if wetland restoration is accomplished. However, the conceptual plans identified in this report minimize shallow, stagnant water conditions which favor mosquitoes.

If mosquito problems should occur in the future, there are many established control methods that could be incorporated into site management. One of the most important control methods is simple manipulation of water levels and flows through wetland areas. This would be readily achievable at the Flats due to the bypass ditch and pump system. These management options are usually preferred over pesticides. Another treatment option is the introduction of fish that specifically feed on mosquito larvae, another alternative to pesticides.

2.4.7 Water Rights

A water right for this project is important so that wetland conditions can be maintained in perpetuity without the threat of future water being appropriated and diverted. There is a high probability of obtaining a water right for this proposed project. The process is lengthy but could be accelerated since it has significant public and environmental merit.

2.4.8 Vegetation Restoration

Approaches to vegetation restoration at wetland restoration projects can vary widely. In some cases, wetland hydrology is restored without revegetation in the hope that there is a residual seed/rhizome source at the site (former wetlands) or a nearby source for wetland species to re-invade the area. In most cases, some level of effort is made to establish desirable wetland species through seeding, planting nursery stock, transplanting, or installing cuttings (mainly willows).

A small portion of Option Area B contains some residual wetland plants that may expand and provide a seed source. However, the majority of the area has been farmed for decades and is not likely to contain a viable seed/rhizome reserve. For this reason, the conceptual designs and costs presented in this report assume that wetland seeding will be required across the entire area of wetland restoration. Upland areas disturbed during construction will also require reseeding.

When budgets are limited, revegetation efforts are often the first budget item to be cut. The danger in this approach is that unless desirable species are well-established immediately when construction areas are bare, undesirable species usually invade. It is typically more difficult to control these established undesirable species than it is to prevent them from establishing initially.

It is certain that undesirable species such as cattail and reed canarygrass will continue to be components of wetland vegetation at Saltese Flats and will require future control efforts. The goal of wetland restoration with respect to these species is to limit their density and extent.

While wetland seeding can be effective at some sites, it is rarely effective alone and must be augmented with containerized nursery stock. Nursery stock includes trees, shrubs, forbs and grass-like plants including sedges, rushes and bulrush. Plant and container sizes vary up to large trees and shrubs usually in 1-5
gallon containers. The conceptual designs in this report assume a 10T container size, in which the plants are usually 6-10 inches tall with a well-established root system. Cuttings, especially willows, are also commonly used to provide additional woody vegetation and this can constitute an educational and/or community service task for school, community or other groups.

The revegetation proposed for these conceptual designs includes wetland and upland seeding across the entire construction area. Option A conceptual designs also include 100 acres of containerized plants installed on a 4x4 foot spacing. Option B conceptual designs also include 150 acres of containerized plants installed on a 4x4 foot spacing. Additional vegetation can be added over time as budgets and interest allow.
3.0 RESTORATION SCENARIOS

Conceptual designs were developed for four basic scenarios. These scenarios include the following:

- Restoration to Original Lake;
- Multiple Wetlands;
- Multiple Wetlands with Enhancements; and
- Complex Cell Wetland.

The conceptual designs for these scenarios are presented and discussed below. Each scenario includes a conceptual design under both the Option A and Option B area alternatives. Large versions of the maps are included in Appendix A. Following the sections describing the four scenarios, a series of visualizations are presented that depict how restoration may appear as viewed from two locations along the edge of the Flats.

Although the presented conceptual designs depict specific configurations for various components of the restored areas, it should be noted that there are many variations available for each of the scenarios as discussed above in Section 2.3.

3.1 Restoration to the Original Lake

Figure 3-1 illustrates simple restoration to the original shallow lake under natural hydrologic conditions. Lake waters would originate from rainfall, stream flows and groundwater sources (no reclaimed water). Flow into and out of the Flats would be returned to “natural” conditions by no longer maintaining drainage for agriculture. No water management would occur including routing water around the Flats in the bypass ditch or pumping out of the other collection ditches. The pump is shown only as an option for special purposes or emergencies.

Appearance
This design would result in restoration of a lake extending from the northeast to the southwest across the Flats. Elevation contours for 2040 and 2042 feet are shown on Figure 3-1 to illustrate the lake location under existing topographic conditions. Each year the lake area would vary, based on precipitation amounts and patterns. The area of the lake would also change throughout the year. In most years the lake would flood up to the 2042 foot elevation, and form for a major portion of the year up to 2040 feet elevation. Flooding across the entire Flats would continue to occur during high water events. Additional modeling is needed to better predict the area and timing of inundation. If reclaimed water were used to augment the natural hydrology, it would stabilize seasonal or year-to-year variations in size and depth.

Public Access/Recreation/Education
Developed potential public access sites are illustrated (Figure 3-1) on the northwest and northeast borders of the Flats. Trails could be built anywhere as desired on the site perimeter or on raised berms throughout the shallower portions of the restored lake.

Wildlife
Waterfowl would benefit most from this conceptual design due to the increased surface area of open water. Deer and other terrestrial wildlife would be displaced on those portions of the area that were flooded. Additional habitat diversity could be added by selecting appropriate shoreline and/or berm construction features.
Adjacent Landowner Effects
This option would affect all landowners with property that extends onto the northern portion of the Flats north of the east-west berm (Figure 3-1). Similar areas would be flooded as are currently flooded, but for longer periods during the spring and wet years.

Figure 3-1. Restoration to Original Lake
3.2 Inundated Wetlands on Option Areas A and B

Figure 3-2 illustrates restoration on Option Areas A and B to inundated wetland with three water depths. The existing topography would be maintained and water depths would decrease from north to south. This design includes a constructed berm and drain ditch around the perimeter to contain water within the restoration site.

Appearance with Natural Hydrology
Under this conceptual design and natural hydrology, the site would be inundated by a shallow lake extending from the north to the south, decreasing in depth to the south. The area and depth of the water would likely be maintained at a nearly constant elevation during the spring and early summer of most years and for longer periods during wet years. The southern portion of the site would likely be exposed during the drier portions of most years and for longer periods in dry years. When not inundated, the area would have the character and appearance of emergent wetland. Site hydrology would be maintained by controlling natural flows into the site with the bypass ditch and outflows with a pump at the northwest corner of the Flats. Flooding across the entire Flats would continue to occur during high water events as it has in the past. Additional modeling is needed to predict the area and timing of inundation for this conceptual design example.

Appearance with Reclaimed Water
If reclaimed water were used it would stabilize seasonal or year-to-year variations in area and water depth. The wetlands would remain inundated during dry periods. Flooding across the entire Flats would continue to occur during high water events. Additional modeling is needed to predict the area and timing of inundation. A reclaimed water pipeline would be installed across the Flats from the northwest corner to a discharge point near the southern boundary. The discharge location would likely be northwest of the location shown on Figure 3-2 and not immediately adjacent to the southern boundary.

Public Access/Recreation/Education
A potential developed public access site is illustrated (Figure 3-2) on the northwest border of the Flats for Option Area A. Two potential access sites are illustrated for Option Area B. Trails could be built anywhere as desired on the site perimeter or on raised berms within the site as discussed in Section 2.4.2 above.

Wildlife
Waterfowl would benefit most from this conceptual design due to the increased area of surface water. Shorebirds would benefit from fluctuating shorelines if the specific wetland cell is managed for fluctuations. Shoreline designs could also be manipulated (varied) to produce mudflats or similar special conditions that favor individual species. Deer and other terrestrial wildlife would be displaced on deeper portions of the flooded area. Amphibians and reptiles would benefit from emergent wetland and shoreline conditions. Additional habitat diversity could be added by selecting specific shoreline and/or berm construction features.

Adjacent Landowner Effects
This design option would prevent potential effects to adjacent landowners by constructing berms and drain ditches around the perimeter of the site. Flooding across the entire Flats would continue to occur during high water events in a similar manner to that which has occurred in the past.
Figure 3-2. Inundated Wetlands
3.3 Multiple Wetlands

Figure 3-3 illustrates restoration on Option Areas A and B to multiple wetland types. The existing topography would be manipulated to create inundated and emergent wetlands. This design includes a constructed berm and drain ditch around the perimeter to contain water within the restoration site.

Appearance with Natural Hydrology
Under this conceptual design and natural hydrology, the site topography would be modified to create a three-cell system with water moving from south to north both above and below ground level. A deeper inundated area (DW) would be constructed at the south end of the site. An emergent wetland (EM) dominated by sedges and rushes would be constructed just north of the deep water wetland. Water would leave the deeper water wetland under the surface and as shallow surface flow. A shallower inundated area (W) would be constructed on the northern portion of the site. The deeper inundation area would likely remain inundated most of the time. The shallower inundation area would likely be exposed during the drier portions of most years and for longer periods in dry years. When not inundated, these areas would have the character and appearance of emergent wetland. Site hydrology would be maintained by controlling natural flows into the site with the bypass ditch and outflows with a pump at the northwest corner of the Flats. Flooding across the entire Flats would continue to occur during high water events as it has in the past. Additional modeling is needed to predict the area and timing of inundation for this conceptual design example.

Appearance with Reclaimed Water
If reclaimed water were used it would stabilize seasonal or year-to-year variations in the area and depth of inundation. Inundation of the deeper and shallower water areas of would be maintained throughout dry periods and years. Flooding across the entire Flats would continue to occur during high water events. Additional modeling is needed to predict the area and timing of inundation. A reclaimed water pipeline would be installed across the Flats from the northwest corner to a discharge point near the southern boundary. The discharge location would likely be northwest of the location shown on Figure 3-3 and not immediately adjacent to the southern boundary.

Public Access/Recreation/Education
A potential developed public access site is illustrated (Figure 3-3) on the northwest border of the Flats for Option Area A. Two potential access sites are illustrated for Option Area B. Trails could be built anywhere as desired on the site perimeter or on raised berms within the site as discussed in Section 2.4.2 above.

Wildlife
This design increases potential habitat for a variety of wildlife. Waterfowl would benefit due to the increased water surface area. Shorebirds would benefit from fluctuating shorelines. Shorelines could also be manipulated (varied) to produce mudflats or other desirable conditions. Deer and other terrestrial wildlife would be displaced on deeper portions of the flooded area. Amphibians and reptiles would benefit from emergent wetland and shoreline conditions. Additional habitat diversity could be added by selecting appropriate shoreline and/or berm construction features.

Adjacent Landowner Effects
This design option would prevent potential effects to adjacent landowners by constructing berms and drain ditches around the perimeter of the site. Flooding across the entire Flats would continue to occur during high water events.
Figure 3-3. Multiple Wetlands

Legend
- Potential Public Access
- Pump
- Reclaimed Water Discharge
- Berm & Drain Ditch
- Approx. Maximum Water Depths/Types
  - DW: Deep Water, 3-5 ft
  - WS: Water, 2-3 ft
  - EM: Emergent Wetland
3.4 Multiple Wetlands with Enhancements

Figure 3-4 illustrates restoration on Option Areas A and B to multiple wetland types as described in Section 3.3 above but with added enhancements. The existing topography would be manipulated to create inundated and emergent wetlands as described above but with the addition of islands and deep water pockets. Each island would be constructed by excavating a deeper water pocket adjacent to the island. This creates two new habitats – deeper water and the riparian/upland island. These enhancements increase vegetation diversity, habitat diversity, wildlife values and visual aesthetics. The elevated islands allow riparian vegetation to survive including trees such as aspen and cottonwood, shrubs such as dogwood or willow and many other non-wetland plants. These islands also provide cover, food sources, security from predators and other wildlife values. This design includes a constructed berm and drain ditch around the perimeter to contain water within the restoration site.

These or similar enhancements can be applied to any of the conceptual designs discussed in this report. They could be included as part of initial wetland restoration efforts or could be added over time in response to further investigation, experience, interest or funding.

Appearance with Natural Hydrology or Reclaimed Water

Appearances of these restoration concepts would be similar to those described above in Section 3.3 for Multiple Wetlands but with the addition of islands. The addition of islands with riparian shrubs and trees adds visual diversity as well as other values. Water levels would fluctuate in dry periods and dry years under natural hydrology and would be more stable with reclaimed water.

Public Access/Recreation/Education

These issues would be similar to those described in Section 3.3. Trails could be built anywhere as desired on the site perimeter or on raised berms within the site as discussed in Section 2.4.2 above.

Wildlife

This design further increases vegetation diversity and potential habitat for a variety of wildlife. Waterfowl would benefit due to the increased security on islands, especially during nesting. Shorebirds would benefit from fluctuating shorelines. Shorelines could also be manipulated (varied) to produce mudflats or other desirable conditions. Deer and other terrestrial wildlife would be displaced on deeper portions of the flooded area, but islands may provide additional habitat for those species able to access them. Amphibians and reptiles would benefit from emergent wetland and shoreline conditions. Additional habitat diversity could be added by creating appropriate island, shoreline and/or berm construction features.

Adjacent Landowner Effects

This design option would prevent potential effects on adjacent landowners by constructing berms and drain ditches around the perimeter of the site. Flooding across the entire Flats would continue to occur during high water events.
Figure 3-4. Multiple Wetlands With Enhancements
3.5 Wetland/Crop Combination

Figure 3-5 illustrates a restoration idea developed from landowner comment that includes wetland restoration and an adjacent area of cropland. This concept is shown for Option Area B but could also be used for restoration on Option Area A. Figure 3-5 illustrates topographic manipulation to create inundated wetlands with multiple water depths. Also included are a constructed berm and a drain ditch around the perimeter to contain water within the restoration site. This restoration concept provides greater separation between wetland features and adjacent landowners as well as a potential food source for wildlife (crop).

Appearance with Natural Hydrology
Under this conceptual design and natural hydrology, the site topography would be modified to create inundated wetland separated from adjacent landowners by berms and crop area. Deeper inundated areas (DW) are illustrated in the southwestern and northeastern portions of the site. Shallower inundation is shown in the remaining wetland restoration area. The deeper inundation area would likely remain inundated most of the time. The shallower inundation area would likely be exposed during the drier portions of most years and for longer periods in dry years. When not inundated, these shallower inundation areas would have the character and appearance of emergent wetland. Site hydrology would be maintained by controlling natural flows into the site with the bypass ditch and outflows with a pump at the northwest corner of the Flats. Flooding across the entire Flats would continue to occur during high water events as it has in the past. Additional modeling is needed to predict the area and timing of inundation for this conceptual design example. The crop area would be planted with a species or mix that would provide food and cover for target wildlife. This crop could be an annual, such as oats or peas. Annual crops would require cultivation, seeding, weed control (herbicides) and other manipulation. Perennial crops may also be considered that provide similar benefits without annual cultivation and other maintenance efforts.

Appearance with Reclaimed Water
If reclaimed water were used it would stabilize seasonal or year-to-year variations in the area and depth of inundation. Inundation of the deeper and shallower water areas would be maintained throughout dry periods and years. Flooding across the entire Flats would continue to occur during high water events. Additional modeling is needed to predict the area and timing of inundation. A reclaimed water pipeline would be installed across the Flats from the northwest corner to a discharge point near the southern boundary. The discharge location would likely be northwest of the location shown on Figure 3-5 and not immediately adjacent to the southern boundary.

Public Access/Recreation/Education
Two potential developed public access sites are illustrated (Figure 3-3) on the northwest border of the Flats for Option Area B. Trails could be built anywhere as desired on the site perimeter or on raised berms within the site as discussed in Section 2.4.2 above.

Wildlife
This design increases potential habitat for a variety of wildlife. Waterfowl would benefit due to the increased water surface area. Shorebirds would benefit from fluctuating shorelines. Shorelines could also be manipulated (varied) to produce mudflats or other desirable conditions. Deer and other terrestrial wildlife would be displaced on deeper portions of the flooded area. Amphibians and reptiles would benefit from emergent wetland and shoreline conditions. Additional habitat diversity could be added by selecting appropriate shoreline and/or berm construction features. Wildlife habitat would be further enhanced by the adjacent cropland, especially if planted to crops that benefit specific wildlife. This crop area could provide both food and cover for upland as well as wetland animal species.
Adjacent Landowner Effects
This design option would prevent potential effects to adjacent landowners by constructing berms and drain ditches around the perimeter of the site. Flooding across the entire Flats would continue to occur during high water events. Adjacent landowners would be further insulated from potential effects due to the increased distance from wetland restoration areas.

Figure 3-5. Wetland/Crop Option
3.6 Visualizations

Visualizations representing the possible appearances of wetland restoration options at Saltese Flats were
developed based on two viewpoints. Viewpoint 1 is located on the southwest side of the Flats along Sal-
tese Flats Road (Figure 3-5). Viewpoint 2 is located on the east side of the Flats along Henry Road.
Figures 3-6 and 3-7 illustrate wetland restoration on Option Area A. Figures 3-8 and 3-9 illustrate wet-
land restoration on Option Area B.

Note that these visualizations show wetlands at their full inundation (design elevation). Under natural
hydrology (no reclaimed water input) the inundated areas would decrease significantly during dry seasons
and dry years. The inundated wetland view is relatively uniform compared with the more complex mo-
saic of the multiple wetland design.

Figure 3-6 compares current conditions on Option Area A with inundated wetlands and multiple wetlands
as they appear from Viewpoint 1. Note that these visualizations show wetlands at their full inundation
(design elevation). Under natural hydrology (no reclaimed water input) the inundated area would de-
crease significantly during dry seasons and dry years. The view from this location would change dramat-
ically with wetland restoration since the viewpoint is elevated above the Flats at this point and is adjacent
to the restored area. The inundated wetland view is relatively uniform compared with the more complex
mosaic of the multiple wetland design.

Figure 3-7 compares current conditions on Option Area A with inundated wetlands and multiple wetlands
as they appear from Viewpoint 2. Note that these visualizations show wetlands at their full inundation
(design elevation). Under natural hydrology (no reclaimed water input) the inundated area would de-
crease significantly during dry seasons and dry years. The view from this location would not change sig-
ificantly with wetland restoration since the viewpoint is not elevated much above the Flats and the
restored area is quite distant (>3,000 feet).

Figure 3-8 compares current conditions on Option Area B with inundated wetlands and multiple wetlands
as they appear from Viewpoint 1. This view would change in a similar manner to that depicted in Figure
3-6. The difference is that Option Area B extends farther into the distance, so wetland features would
extend farther as well. However, since most of Option Area B is over 5,000 feet from Viewpoint A, the
difference in views would be minor between wetland restoration on Option A versus B. The view from
this location would change dramatically with wetland restoration on both Option A and B since the view-
point is elevated above the Flats at this point and is adjacent to the restored area.

Figure 3-9 compares current conditions on Option Area B with inundated wetlands and multiple wetlands
as they appear from Viewpoint 2. Note that these visualizations show wetlands at their full inundation
(design elevation). Under natural hydrology (no reclaimed water input) the inundated area would de-
crease significantly during dry seasons and dry years. The view from this location would change dramat-
ically since the restored wetland comes to within 500 feet of this viewpoint.
Option A Area Visualizations

Current Conditions

Inundated Wetland when completely inundated. Inundated area would decrease with natural hydrology during dry seasons and years.

Multiple Wetlands with Enhancements when completely inundated. Inundated area would decrease with natural hydrology during dry seasons and years.

Figure 3-6. Option A Area Scenarios From Viewpoint 1
Option A Area Visualizations

1. Current Conditions

2. Inundated Wetland

3. Multiple Wetlands with Enhancements

Figure 3-7. Option A Area Scenarios From Viewpoint 2
Option B Area Visualizations

Current Conditions

Inundated Wetland when completely inundated. Inundated area would decrease with natural hydrology during dry seasons and years.

Multiple Wetlands with Enhancements when completely inundated. Inundated area would decrease with natural hydrology during dry seasons and years.

Figure 3-8. Option B Area Scenarios From Viewpoint 1
Option B Area Visualizations

Current Conditions

Inundated Wetland when completely inundated. Inundated area would decrease with natural hydrology during dry seasons and years.

Multiple Wetlands with Enhancements when completely inundated. Inundated area would decrease with natural hydrology during dry seasons and years.

Figure 3-9. Option B Area Scenarios From Viewpoint 2
4.0 COSTS AND FUNDING

4.1 Costs

Tables 4-1 and 4-2 summarize cost estimates for the various wetland conceptual designs discussed earlier in this report. Table 4-1 shows cost estimates for designs using natural hydrology and Table 4-2 shows cost estimates for designs using reclaimed water. These cost estimates include additional investigations, final design, permitting, NEPA/SEPA documents and construction. Also included are costs for annual maintenance and monitoring. Appendix A lists assumptions used to develop cost estimates.

These cost estimates should be considered preliminary and require refinement based on final design. They are provided here as a general guide for comparing conceptual design options and evaluating the components of these designs and their influence on costs.

Table 4-3 lists potential permits and SEPA/NEPA analysis needed for completion of the project. Estimated costs for these permit processes are generally based on similar projects. These costs may be lower than estimated if one group completes all permitting, since the information and submittal documents are similar for many of these permits. The most expensive permit listed is for correcting the recent FEMA floodplain designation, which requires hydrologic/topographic modeling and completion of a Letter of Map Revision process. The environmental review will require SEPA analysis or NEPA analysis if significant federal funds are used.

Table 4-4 lists preliminary cost estimates for wetland construction on Option Area A. Some of these costs must be incurred immediately and others may be incorporated over time or not at all such as public access and enhancements. One of the larger costs - Berm Reinforcement - may or may not be required based on further study at the site. Berm excavation and additional excavation costs will vary depending on final design. Table 4-5 lists the same costs for Option Area B.

Table 4-6 summarizes maintenance and monitoring costs for Option Area A. Maintenance costs were estimated for water control, weed control, crop production (where applicable), trail mowing, litter removal and kiosk maintenance activities. Some of these items may not be required initially and additional maintenance may be needed depending on final design. Maintenance could be performed by a variety of county and contracted resources or by creating a specific position for this purpose. Maintenance requirements will likely be greatest during the first 5 years and then may be reduced as the site becomes stable and vegetated. It is likely that regular water control will be required initially and that this effort will also be subsequently reduced over time. A separate maintenance table was not developed for Option Area B. Most maintenance costs listed in Tables 4-1 and 4-2 for Option Area B were estimated at 1.5 times the cost for Option Area A.

Monitoring requirements would be negotiated with regulatory agencies during the permitting and environmental review processes. Detailed wetland monitoring is generally required (Army Corps/Washington Ecology) for a minimum period of 5 years. Wetland monitoring can be reduced to track critical wetland features at that point including wetland distribution, composition, invasive species concerns, etc. Regulatory agencies will likely require water quality monitoring for this project with additional monitoring if reclaimed water is used.
### Table 4-1. Saltese Flats Restoration: Natural Hydrology Cost Estimates

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### Table 4-2. Saltese Flats Restoration: Reclaimed Water Cost Estimates

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1 These permits may also be required depending on final design.
Table 4-4. Saltese Flats Restoration: Construction-Option Area A

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<th>INUNDATED WETLAND</th>
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### Table 4-6. Saltese Flats Restoration: Maintenance & Monitoring-Option Area A

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</table>

| **MULTIPLE WETLANDS**            | **INUNDATED WETLAND**           |
| $20,000                          | $20,000                          |
| $20,000                          | $20,000                          |
| $20,000                          | $20,000                          |
| $16,000                          | $16,000                          |
| $20,000                          | $20,000                          |
| $10,000                          | $10,000                          |
| $5,000                           | $5,000                           |
| **TOTAL**                         | $91,000                          |

| **WL+CROP**                       | **INUNDATED WETLAND**           |
| $20,000                          | $20,000                          |
| $20,000                          | $20,000                          |
| $20,000                          | $20,000                          |
| $10,000                          | $10,000                          |
| $10,000                          | $10,000                          |
| $5,000                           | $5,000                           |
| $5,000                           | $5,000                           |
| **TOTAL**                         | $101,000                         |

| **MONITORING**                    | **RECLAIMED WATER**             |
| $50,000                          | $50,000                          |
| $50,000                          | $50,000                          |
| $50,000                          | $50,000                          |
| **TOTAL**                         | $150,000                         |

4.2 Funding

This project would likely be funded by a variety of sources. A separate document has been developed in conjunction with this project that summarizes funding sources for wetland restoration projects. Additional funding sources will likely be identified for such components as public access and recreation, wildlife enhancement and education. If use of reclaimed water is ultimately approved and incorporated into project design, significant project funding would likely be provided by the Spokane Department of Utilities.
5.0 NEXT STEPS

Continued pursuit of a wetland restoration project at Saltese Flats would likely require proceeding through a series of steps over the next 2-3 years prior to construction implementation. A project including all components discussed in this report could be constructed initially or a basic wetland could be constructed with other features added later such as vegetation enhancements and public access amenities. The likely path forward would include:

- Additional investigations
- Land purchase
- Final wetland design
- Permitting and environmental documentation
- Construction
- Monitoring and maintenance
- Future enhancements

Opportunities for public comment and project refinements will continue as the project proceeds.

6.0 SUMMARY AND CONCLUSIONS

This report identifies a range of conceptual designs and design components that could be incorporated into a final wetland restoration project at Saltese Flats. Additional studies, public input and agency review could be used to refine these concepts and achieve the best result. These designs reveal the substantive potential of this site to provide a wide variety of public benefits including water quality, streamflow augmentation, reclaimed water use, recreation / education opportunities, and wildlife habitat enhancement. Additionally, the site appears conducive to flexible site management options such that future alterations could accommodate changing needs or conditions.
7.0 INFORMATION SOURCES

Indiana Department of Natural Resources. 2009. Did You Know?...Healthy Wetlands Devour Mosquitoes. IDNR Fact Sheet. 1p.


Appendix A
Cost Estimate Assumptions
COST ESTIMATE ASSUMPTIONS

BERM EXCAVATION
Based on berm construction 5 feet high and 10 feet wide at the top with 3:1 sideslopes. Option A has a berm length of 17,000 feet and Option B 23,000 feet. Excavation cost is estimated at $6/yd\(^3\). This estimate assumes that berm material will come from adjacent areas excavated as deeper water. Costs may be lower due to the large volume and if the site can be dried out (dewatered) effectively during construction to allow larger equipment operation.

BERM REINFORCEMENT
Additional investigation has been proposed to evaluate the permeability of Saltese Flats soils. If permeabilities are too high, berm reinforcement may be required to reduce seepage through the berms. Options for berm reinforcement include:

- excavating and moving appropriate materials from elsewhere on the Flats or nearby if available,
- installing a geomembrane barrier
- installing a vertical barrier (several material options available)
- grouting

This example assumes that 50% of the berm length would need reinforcement, likely the eastern and northern portions. It incorporates material and installation cost estimates for a 10 foot vertical barrier from GSE Lining Technologies.

ADDITIONAL EXCAVATION
Additional excavation required for the inundated wetland designs was estimated at $100,000. The multiple wetland design would require more excavation, especially for deeper water areas, and an estimate of $500,000 was used. The Crop/Wetland design additional excavation was estimated at $250,000. Further evaluation of the existing dike along the southern border of the project may reveal needs for reinforcement requiring additional excavation/fill which is not included here.

DITCH STRUCTURES
New ditch control structures would be required at the inlet and outlet of the bypass ditch; a wide range of design options are available from simple to remote control. These have been estimated at $25,000 each.

WETLAND CELL STRUCTURES
Depending on final design, control structures may be required between major wetland cells and were estimated at $15,000 each. These are not required for the inundated wetland options. The multiple wetland designs would require two structures and the wetland/crop designs would require one.

PLANTING STOCK
Planting stock includes trees, shrubs, forbs, bulrush and sedges and was estimated at $3/plant (installed). Half of the cost is for materials and half for planting. Vegetation costs are often one of the greatest variables in wetland construction.

WETLAND SEED
Wetland seeding costs were estimated at $400/acre and upland seeding costs at $200/acre. Option Area A seeding includes 300 acres of wetland seeding and 142 acres of upland seeding. Options Area B includes 400 acres of wetland seeding and 112 acres of upland seeding. Vegetation costs are often one of the greatest variables in wetland construction.
CROP PREPARATION AND SEEDING
Crop site preparation (plow/disk/herbicide) and seeding for the Wetland/Crop options was estimated at $100/acre for the 160 acre crop area.

PUMPING SYSTEM(S)
Both Option Area A and B would require a pump at the northwest corner of the Flats, which was estimated at $50,000 since power is present. Option B may require an additional pump which was estimated at $75,000 since power is not present. Both estimates include a pump, pump house and piping.

BMPS
Estimate for installation and maintenance of Erosion Control Measures (BMPs) during construction.

EXCAVATION ENHANCEMENTS
Estimate is for additional excavation to create islands and deeper water areas as described in the report. The estimate is based on 25 acres of islands and adjacent excavated deeper water areas approximately 5 feet deeper than surroundings with an excavation cost of $6/yd³.

VEGETATION ENHANCEMENTS
Estimate is for additional vegetation including seeding entire islands with riparian/upland species and planting 25% of their area with a 4x4 foot spacing of riparian trees and shrubs. Adjacent deeper water areas would be planted to a 10x10 foot spacing of bulrush. The estimate is based on 25 acres of islands and adjacent deeper water areas.

RECLAIMED WATER DISCHARGE STRUCTURE
Estimate for a discharge structure in the southern portion of the project area. Cost will depend on design details.

RECLAIMED WATER FLATS PIPING
Estimate for a piping system from the delivery point at the northwest corner of the Flats to the discharge site in the southern portion of the project area.

RECLAIMED WATER DELIVERY SYSTEM
Spokane County provided the estimate of $40,000,000 for a delivery system to Saltese Flats based on previous studies.

PUBLIC ACCESS – PARKING LOT, TRAILS, KIOSKS
Public access features have not been addressed in detail for the purposes of this report. Examples of potential features have been discussed including access points, trails and informational kiosks. This report lists example costs for these features but could vary widely depending on the level of interest and funding available. Public access components could be included in the initial effort or added in the future as funding becomes available.

LAND PURCHASE
Costs for land purchase have not been included in this cost estimate.

MAINTENANCE

Water Control
Assumes 200 hours at $100/hour to monitor/manage water inlets and outlets to the Flats as well as water movement within the Flats. Assumes more of an effort in the first few years, which should decrease over time.
Reclaimed Water Controls
Provides additional time to monitor/manage water inlets and movement through wetlands due to reclaimed water use. Assumes more of an effort in the first few years, which should decrease over time.

Weed Control
Assumes weed control efforts will be needed on upland portions of the project, especially berms, islands and perimeter areas. Assumes efforts will be greater with natural hydrology during dry periods and dry years.

Crop Production
Assumes crop production costs for 160 acres of cropped area including tillage, herbicides and re-seeding. The listed construction cost estimates $200/acre for the initial site preparation and crop, then drops to $100/acre for annual crop costs. Perennial crops may be an alternative if annual cropping is not feasible.

Trail Maintenance/Litter Removal/Kiosk Maintenance
Assumes mowing and minor maintenance on trails, trash removal, and informational kiosk maintenance. Estimates are general and would depend on the final design and extent of public access features.

MONITORING

Wetland Monitoring
Detailed wetland monitoring is generally required by regulatory agencies (Army Corps/Washington Ecology) for a period of 5 years. Wetland monitoring can be reduced to critical features at that point including wetland distribution, composition, invasive species concerns, etc.

Water Quality Monitoring
Regulatory agencies will likely require water quality monitoring for this project with additional monitoring if reclaimed water is used. The extent of this monitoring would be determined during permitting.

PERMITS AND NEPA/SEPA

Environmental review will be required and may constitute either a SEPA or NEPA analysis depending on whether federal dollars comprise a significant component of project funding.

Permit costs have been generally estimated based on our experience with other projects. The largest permit cost listed is for the floodplain permit process which includes completion of a FEMA Letter of Map Revision. The recent FEMA map revision is flawed and requires correction for the project to proceed.