MEMORANDUM

Project No.: 140129

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Re: **Appraisal Study - Pend Oreille Interbasin Transfer for Little Spokane Water Bank Seeding**

Executive Summary

Spokane County (the County), in conjunction with Stevens and Pend Oreille County (Tri-Counties), is considering setting up a water bank to address existing and potential regulatory constraints on existing and new water use in Water Resource Inventory Area (WRIA) 55, the Little Spokane Watershed. One of the options for water bank seeding that has been discussed with the Tri-Counties and other members of the project Policy Advisory Group (PAG) is potential use of a water source from WRIA 62, the Pend Oreille River Watershed. A review of water rights decisions and Ecology regulation of the mainstem of the Pend Oreille River indicates that water is potentially available for a project of this nature, as Ecology has not closed the Pend Oreille River to further consumptive appropriations.

Aspect has conducted an appraisal-level evaluation of necessary infrastructure and potential fatal flaws associated with conveying water from the Pend Oreille River to the upper headwaters of the Little Spokane River. An interim project flow criteria has been estimated at a 10 cubic feet per second (cfs) average mitigation flow rate for a combination of bank seeding and additional instream flow mitigation, based on consideration of future water demand and preliminary estimates of stream channel capacity. Both surface water and groundwater supply options near the City of Newport may be feasible.

Consideration of Existing Conditions and Water Availability

There are several key existing conditions and water availability issues relevant to project feasibility. These include:

- The watershed boundary--and the upper headwaters of the Little Spokane River--reaches within approximately three miles of the mainstem of the Pend Oreille River, with about 110 feet of elevation difference at the topographic divide.
- Subsurface geology in the project area includes both unconsolidated aquifer materials and bedrock near the surface that will need to be considered if a groundwater source and wellfield option is pursued.
- Surface soils mapped in the project area include relatively permeable, well-drained areas where infiltration of water may be possible to support aquifer recharge and river baseflows. Site-specific field investigations would be needed to ascertain if infiltration is a feasible option for providing local recharge and associated instream flow enhancement. The alternatives discussed below focus on direct discharge to the Little Spokane River.
- Ecology has not closed the Pend Oreille River to further consumptive appropriations, but has provisioned recent water right decisions with a curtailment flow of 7,700 cfs at the Newport gage (USGS #12395500), based on a Surface Water Source Limitation (SWSL[1]) recommended by the Washington State Department of Fish and Wildlife (WDFW).
- The mainstem of the Little Spokane River has several constituents on the 303(d) list (Category 5), requiring a Total Maximum Daily Load (TMDL) to be established or other water quality improvements to be implemented. These include dissolved oxygen in the upper reaches near Scotia Road, pH, fecal coliform, and temperature further downstream, and PCBs in the lower reaches of the river. The Pend Oreille River has also been listed on the 303(d) list for temperature at Newport. PCBs have been noted as an issue by Ecology, but the listing does not occur at Newport and is further downstream at Usk. Any introduction of Pend Oreille source water into the Little Spokane watershed will need to address TMDL concerns related to the project in both rivers.
- If a groundwater source is pursued as an option, existing groundwater quality will need further evaluation. A cursory review of the potential for existing groundwater contamination was conducted. While the review did not suggest that this would be a major concern, if wellfield investigations move forward, additional investigation can be completed

[1] A SWSL is a permit-specific condition recommended by WDFW and applied by Ecology as a permit condition under the public interest test for issuing a new water right. It is not an instream flow rule. A SWSL on one water right may be applied to another water right, or a separate permit-specific SWSL may be applied, or none at all, depending on whether mitigation of instream flows is provided as a part of the project.

to support an evaluation of groundwater contamination risk based on specific test well locations proposed for further study.

Design Considerations

The feasibility of accommodating the interbasin transfer at the quantities proposed may be limited by a number of factors including:

- Available freeboard in natural downstream conveyance channel (available volume between instantaneous stream flow and ordinary high water);
- Water source-based constraints (water quality, physical water availability);
- Legal availability of water from Pend Oreille River; and
- Maximum conveyance infrastructure limitations.

An objective of this appraisal study has been to identify how these factors may be addressed through existing information, future data collection and analysis, and infrastructure improvements.

Alternatives Analysis

For purposes of evaluating feasibility and developing costs, four concept alternatives were analyzed based on two source water alternatives (a surface water supply or a groundwater supply) and two discharge locations (discharge to a large wetland in the upper headwaters and discharge to the river approximately two miles downstream). These are documented in detail in this memorandum.

Table ES-1. Concept Alternatives

	Alternative 1 (Surface Water Supply)	Alternative 2 (Groundwater Supply)
Discharge Option-A (Headwaters)	**Alternative 1A**	**Alternative 2A**
Discharge Option-B (Headwater Bypass)	**Alternative 1B**	**Alternative 2B**

Several options for source of supply, conveyance and discharge may be feasible to meet project objectives. Estimated capital and annual operations and maintenance costs for the various alternatives are provide in Table ES-2 below.

Table ES-2. Preliminary Estimated Project Cost Summary

	Total Cost		**Unit Cost[1]**	
	Capital Cost	**Annual O&M**	**Capital Cost (per ac-ft)**	**Annual O&M (per acre-foot)**
Alternative 1A	$17,725,000	$220,000	$2,450	$30
Alternative 1B	$21,475,000	$242,000	$2,970	$33
Alternative 2A	$14,965,000	$251,000	$2,070	$35
Alternative 2B	$19,841,000	$277,000	$2,740	$38

1 – Unit costs developed by dividing total costs by annual quantity of 7,240 acre-feet.

The most cost-effective solution (Alternative 2A) includes construction of a groundwater wellfield near the Pend Oreille River with surface water discharge in the uppermost headwaters of the Little Spokane River. It is anticipated that capacity-related improvements to the natural conveyance,

including replacement of several culvert crossings, may be required. These improvements have been included in the analysis. Estimated costs for this alternative are approximately $15 million with $251,000 annual operations, maintenance and replacement costs. These costs translate to roughly $2,070 per acre-foot (capital) with $35 per acre-foot annual O&M.

Other more costly alternatives considered include bypassing the uppermost reaches of the Little Spokane River with additional pipeline conveyance (Alternative 2B), or using direct surface water as source of supply (Alternative 1A), or both (Alternative 2B).

1. Introduction and Project Overview

Project Background

Spokane County (the County), in conjunction with Stevens and Pend Oreille County (Tri-Counties), is considering setting up a water bank to address existing and potential regulatory constraints on existing and new water use in Water Resource Inventory Area (WRIA) 55, the Little Spokane Watershed. A water bank is a mechanism that facilitates transfer of water rights between sellers and buyers. As part of this process, the County convened a Policy Advisory Group (PAG) to allow interagency and stakeholder coordination and evaluation of water banking in the watershed.

One of the options for water bank seeding that has been discussed with the Tri-Counties and other members of the PAG is potential use of a water source from WRIA 62, the Pend Oreille River Watershed. A unique opportunity exists to potentially withdraw groundwater or divert surface water from the Pend Oreille watershed into the upper headwaters of the Little Spokane River, near the town of Newport (Figure 1). A review of water rights decisions and Ecology regulation of the mainstem of the Pend Oreille River indicates that water is potentially available for a project of this nature, as Ecology has not closed the Pend Oreille River to further consumptive appropriations,

The watershed boundary, and the upper headwaters of the Little Spokane River, reaches within approximately three miles of the mainstem of the Pend Oreille River. According to Washington State's WRIA 55 boundary GIS layer, the drainage divide between the Little Spokane Basin and Pend Oreille Basin is approximately 110 feet higher than the Pend Oreille River shoreline, and a pipeline and pumping station would be required to convey either groundwater or surface water. Water thus conveyed could serve as water for bank seeding and instream flow enhancement in WRIA 55 after transfer.

Aspect has conducted an appraisal level evaluation of necessary infrastructure and potential fatal flaws associated with conveying water from the Pend Oreille River to the upper headwaters of the Little Spokane River. An interim project flow criteria has been estimated at a 10 cubic feet per second (cfs) average mitigation flow rate for a combination of bank seeding and additional instream flow mitigation, based on consideration of future water demand and preliminary estimates of stream channel capacity. Both surface water and groundwater supply options in the vicinity of Newport may be feasible, as discussed in this memorandum.

This memorandum will be included as an appendix to the Little Spokane Water Banking Feasibility Study, submitted to the PAG in June 2015.

Appraisal Study Objectives and Approach

This appraisal study involves characterization of permitting, construction, and other project-related considerations associated with a potential transfer of water from the Pend Oreille watershed to the Little Spokane River.

The approach of this appraisal study involved the following:

1.) Review of available maps and data;
2.) Field reconnaissance and coordination with local agencies;
3.) Estimating mitigation flow criteria;
4.) Development of concept alternatives;
5.) Characterizing permitting constraints;
6.) Evaluating water quality; and
7.) Preliminary cost estimating.

This appraisal study is organized under the following headings:

- Study Area and Existing Conditions
- Basis of Planning
- Development of Concept Alternatives
- Project Economics
- Recommendations for Additional Design and Analysis

2. Study Area and Existing Conditions

Data Sources

This study and associated analysis contained herein are based upon readily available information, limited field reconnaissance and discussion with various stakeholders. Background data includes geologic mapping, USGS topographic mapping, USGS hydrogeologic investigations, County Assessor parcel mapping, Ecology watershed boundary mapping, Ecology well log documentation, USGS streamflow information, USDA/SCS soils mapping, and Washington Department of Natural Resources geologic mapping.

Site reconnaissance was conducted in March of 2015 by members of the Aspect Project Team, personnel from Department of Ecology and Spokane County. At that time, various pipeline alignments were considered along with potential water sources locations adjacent to the Pend Oreille River at the City of Newport's waste water treatment facility. Additionally, the headwaters of the Little Spokane River including the uppermost reaches (approximately 2-miles) were observed at various locations. Photographs from site reconnaissance activities are provided in Attachment A.

Geographic Setting

The project location is generally located in the vicinity of the City of Newport (City), Pend Oreille County, Washington State. The City immediately borders the State of Idaho to the East and therefore this political boundary has been considered the eastern geographic limit of infrastructure/project planning. The apparent topographic basin divide between the Pend Oreille River and Little Spokane River is near the southwestern margin of the City (approximately 2-miles

southwest of the Pend Oreille River). Both the BNSF Railway and State Hwy 2 corridors generally bound the southern and eastern limits of the City. Downstream of the Little Spokane River side of the basin divide, these two corridors generally parallel natural drainage courses in the uppermost reaches of the watershed. The general project vicinity is shown in Figure 1.

Property Ownership

Property ownership in the project vicinity include the following:

- City of Newport
- Pend Oreille County
- Burlington Northern Santa Fe (BNSF) Railway
- State of Washington Department of Transportation (WSDOT)
- State of Washington Department of Natural Resources
- Private landowners

Topography

Based upon readily available USGS topographic quad mapping (40-foot contours), elevation differences between the Pend Oreille River and the lowest elevations at the basins divide between the Pend Oreille and Little Spokane River Basins may be as little as 110 feet (vertical) at a location approximately 1 mile southwest of the Pend Oreille River (in the general vicinity of Newport High school).

Topography on either side of the basin divide in the vicinity of the project is relatively flat with topographic gradients along drainage courses approximately 2% or less. Elevated terrain borders the topographic drainage courses along northwest and southeast representing a gradual saddle feature at the basin divide.

The uppermost headwaters of the Little Spokane River are characterized as having extremely flat gradients and are dominated by standing water and wetland complex.

Hydrogeologic and Hydrologic Considerations

Hydrogeology

Groundwater sources in WRIA 55 are derived from a combination of unconsolidated basin fill, and isolated basalt layers overlying crystalline bedrock. Figure 2 presents a surficial geology map of the project area that illustrates the combination of bedrock and unconsolidated deposits in the vicinity of the project site. Of particular note is the bedrock outcrop on the north side of the City, as this would be a preferred location for a potential groundwater wellfield, but would be limited by this occurrence. The City has a wellfield for its municipal water supply on the southeast side of town close to the mapped boarder of the Little Spokane and Pend Oreille watersheds. The City's wellfield produces from alluvial aquifer wells that are approximately 80 to 100 feet deep. Well logs on file at Ecology indicate that the aquifer is sand-dominated, but there is significant heterogeneity, with a mix of sands, clays, and gravels observed during drilling. Production rates

from the wells are on the order one hundred to several hundred gallons per minute. Well logs from Washington State Department of Ecology online database are provided in Attachment B.

Figure 3 shows the distribution of surficial bedrock and the depth of basin fill in the watershed, based on a recent USGS Study: *Hydrogeology of the Little Spokane River Basin, Spokane, Stevens, and Pend Oreille Counties, Washington* (2013). Groundwater movement in the basin generally follows surface topography, moving from high to low elevation areas. The USGS identified several key hydrogeologic units that serve as water sources, including:

- **Upper Aquifer.** This unit is unconsolidated basin fill and serves as a common water source over much of the watershed. Its distribution is widespread in the Little Spokane headwaters. Its distribution generally overlaps with the extent of basin fill on Figure 3. Some of the outlying areas of basin fill were not considered of sufficient production by the USGS to be an 'aquifer', but do, in some cases, produce water sufficient for residential use.

- **Lower Aquifer.** This unit is also unconsolidated basin fill, and is separated in some cases from the Upper Aquifer by a confining unit. The Lower Aquifer occurs in highly localized areas, generally along the mainstem of the Little Spokane River and is not significant in the upper watershed.

- **Isolated basalt units of the Columbia River Basalt Group (Wanapum and Grand Rhonde).** Basalt occurrences are generally limited to the west central portion of the basin, in the Dragoon Creek drainage, outside of the area of interest for this project.

- **Bedrock.** Crystalline bedrock underlies all of the watershed, but tends to be exposed in the upland, outlying areas of WRIA 55. Bedrock in WRIA 55 typically produces small quantities of water, but is relied upon by a number of users as a residential water source.

Basin fill thicknesses (primarily Upper Aquifer) of over several hundred feet are present across significant portions of the watershed, and may allow opportunities for aquifer recharge through surficial infiltration.

Groundwater and surface water in WRIA 55 are assumed to be hydraulically connected, and as such additional groundwater appropriations have not been authorized by Ecology since 1996, based on associated reductions of instream flows expected from newly authorized withdrawals.

A range of surficial soil types have been previously identified, as illustrated in Figure 4. Many of these soils, such as the Orwig sandy loam (Unit 97) located near Surface Discharge Option 1, are well drained, permeable soils which may allow for a surface infiltration option as a component of instream flow mitigation/seeding; however, it is also known from area well logs that clay and silt lenses are present in some areas. Site specific field investigations would be needed to ascertain if infiltration is a feasible option for providing local recharge and associated instream flow enhancement. Further discussions regarding infiltration as a potential option for discharge into the Little Spokane Basin are provided under Section 5 of this memorandum.

Hydrology and River Morphology

A review of water rights decisions and Ecology regulation of the mainstem of the Pend Oreille River indicates that water is potentially available for a project of this nature. Ecology has not closed the Pend Oreille River to further consumptive appropriations, but has provisioned recent water right decisions with a curtailment flow of 7,700 cfs at the Newport gage (USGS #12395500), based on a Surface Water Source Limitation (SWSL[2]) recommended by the Washington State Department of Fish and Wildlife (WDFW). Figure 5 presents average and minimum daily mean discharges at the Newport gage, along with the WDFW recommended Surface Water Source Limitation (SWSL) flow of 7,700 cfs. As the graph indicates, there are periods where the minimum daily discharge has fallen below 7,700 cfs in drier years in spring and late summer to early fall, but there still appears to be opportunity for significant withdrawals or diversions to take place over much of the year, given the scale of flows in the mainstem. Figure 6 provides a comparison of the frequency that the Little Spokane at Dartford and the Pend Oreille River at Newport do not meet baseflows and recommended flows, respectively. As illustrated by the figure, recommend flows are met substantially more often in the Pend Oreille River at Newport versus baseflow at the Dartford gage on the Little Spokane River.

The uppermost headwaters of the Little Spokane River are characterized as very low gradient vegetated wetlands followed by reaches with some defined channel formation coincident with an apparently losing reach of the river, with very limited flow on the order of a few cubic feet per second. Limited information on streamflows in the upper headwaters of the Little Spokane drainage is available, and additional study is recommended as discussed in Section 7 of this memorandum.

The upper reaches of the Little Spokane River likely contain both gaining and losing reaches. Observations made during field reconnaissance as part of this project (Attachment A) suggest that the uppermost headwaters of the Little Spokane may be gaining water from the groundwater system in the upper wetland areas. In contrast, review of aerial photos suggests that there are areas downstream of the initial wetlands where channel definition is diminished suggesting that a short losing reach may be present. This location is generally located approximately 2 miles downstream of the basin divide. Approximately 2.5 to 3 miles downstream of the basin divide, the stream appears to be significantly gaining water. This may be associated with surficial bedrock providing a barrier to groundwater flow that contributes to a strongly gaining reach and well-developed channel formation (Figure 3). This is a consideration for evaluating the capacity of the river to convey water, as discussed later in this memorandum. Little to no channel migration is evident in the aerial photographic record dating back to 1998.

[2] A SWSL is a permit-specific condition recommended by WDFW and applied by Ecology as a permit condition under the public interest test for issuing a new water right. It is not an instream flow rule. A SWSL on one water right may be applied to another water right, or a separate permit-specific SWSL may be applied, or none at all, depending on whether mitigation of instream flows is provided as a part of the project.

Observations made during field reconnaissance as part of this project suggest that the uppermost headwaters of the Little Spokane may be gaining water from the groundwater system in the upper wetland areas; however, the river appears to be losing surface water to groundwater at a point approximately 2 miles downstream of the basin divide. Approximately 2.5 to 3 miles downstream of the basin divide, the stream appears to be strongly gaining in conjunction with surficial bedrock contributing to a strongly gaining reach and well developed channel formation (Figure 3). This is a consideration for evaluating the capacity of the river to convey water, as discussed later in this memorandum. Little to no channel migration is evident in the aerial photographic record dating back to 1998.

Further study is required to characterize the river substrate and the potential for degradation/aggradation, which may lead to any perceptible channel migration based upon increased streamflow as a result of this project.

Water Quality

Surface Water Quality

The mainstem of the Little Spokane River has several constituents on the 303(d) list (Category 5), requiring a Total Maximum Daily Load (TMDL) to be established or other water quality improvements to be implemented. These include dissolved oxygen in the upper reaches near Scotia Road, pH, fecal coliform, and temperature further downstream, and PCBs in the lower reaches of the river. The federal Clean Water Act requires that Ecology set priorities for cleanup 303(d) listed waters by establishing a total maximum daily load (TMDL) for each constituent of concern and/or establishing a Water Quality Improvement plan.

The Pend Oreille River has also been listed on the 303(d) list for temperature at Newport. PCBs have been noted as an issue by Ecology, but the listing does not occur at Newport and is further downstream at Usk. Given the comparatively high flow of the Pend Oreille River (24,600 cfs mean flow) relative to the 10 cfs assumed to be appropriate for supporting Little Spokane water bank seeding, it is expected that water quality impacts from a surface water withdrawal or nearby groundwater withdrawal will be negligible. The more significant issue that will need to be addressed through further study focuses on mixing of a Pend Oreille surface or groundwater source with headwaters of the Little Spokane River. Any introduction of Pend Oreille source water into the Little Spokane watershed will need to address TMDL concerns related to the project in both rivers.

The project could also provide benefits in terms of upper watershed temperatures, particularly if a groundwater source is used. In addition, if a surface water source is used, measures to prevent introduction of milfoil or other invasive biota will need to be addressed.

Potential for Groundwater Contamination

If a groundwater source is pursued as an option, existing groundwater quality will need further evaluation. A cursory review of the potential for existing groundwater contamination was conducted through reviews of Ecology's Cleanup Site Search Database, Environmental Information Management (EIM) System Database, and Facility/Site Database for sites of environmental interest to Ecology. Ecology's EIM database did not have any soil or groundwater data for any sites within the City of Newport. Several cleanup sites were noted within the City of Newport. Of these cleanup sites, the Unocal Bulk Plant 0528 and Newport Industrial Park Development were the most noteworthy:

- Unocal Bulk Plant 0528 – Voluntary cleanup completed but Restrictive Covenant in place due to remaining petroleum contaminated soil above cleanup levels. Groundwater not identified as a media of concern.

- Newport Industrial Park Development – Voluntary cleanup completed and No Further Action issued in 2011 for remediation of dioxin/furan, metals, and petroleum in soil. Groundwater not identified as a media of concern.

Other sites listed above were Leaking Underground Storage Tank sites, 6 of which received No Further Actions in 2011. Only soils were identified as media of concern for these sites.

Ecology files were not reviewed for any of these sites as part of this project. Ecology's databases only list those contaminated sites that are known to Ecology and does not list those that have yet to be investigated or have not been reported to Ecology. While this review did not suggest that existing groundwater contamination would be a major concern for a new groundwater source, if wellfield investigations move forward as part of this project, additional investigation can be completed to support an evaluation of groundwater contamination risk based on specific test well locations proposed for further study.

Natural Resources

Environmental natural resources in the vicinity of the project include wildlife, fish and wildlife habitat, riparian areas and palustrine areas (wetlands). The Pend Oreille River in vicinity of Newport is listed as Critical Habitat under Endangered Species Act for Slavenlinus confluentus (bull trout), no other Critical ESA Habitat is listed in other areas of the project. Furthermore, WDFW manages Priority Habitat and Species designations which are mapped in the vicinity of much of the project improvements. This includes priority areas for regular waterfowl concentrations on the Pend Oreille River as well as for both Kokanee and Rainbow trout in the Little Spokane River. Much of the upper headwaters of the Little Spokane river is mapped as palustrine (wetlands) aquatic habitat.

3. Basis of Planning

Flow Demand Criteria

The intent of the project is to provide water supply from the Pend Oreille River into the Little Spokane River to offset consumptive beneficial uses associated with potential Little Spokane Water Bank appropriations. Based upon a water demand analysis conducted as part of the Little Spokane Water Banking Feasibility Study (Aspect, 2015), 7,240 acre feet of supply (10 cfs continuous) may be needed to facilitate water banking goals. While final water banking mitigation quantities may be subject to change during subsequent phases of study, this quantity has been used as the basis of planning for this Appraisal Study.

The feasibility of accommodating the interbasin transfer at the quantities proposed may be limited by a number of factors including:

- Available freeboard in natural downstream conveyance channel (available volume between instantaneous stream flow and ordinary high water);

- Water source-based constraints (water quality, physical water availability);

- Legal availability of water from Pend Oreille River; and
- Maximum conveyance infrastructure limitations.
- An objective of this study has been to identify how these factors may be addressed through existing information, future data collection and analysis, and infrastructure improvements.

Infrastructure Criteria

Sources of Supply

Potential sources of water supply for the project include both direct surface water from and groundwater in continuity with the Pend Oreille River. Advantages of surface water supply include relative certainty of water availability and lower pumping costs, while disadvantages may include greater consideration of water quality impacts. In contrast, groundwater supply may provide for greater certainty of high water quality and would likely be easier to permit. Relative uncertainty exists with respect to proven aquifer targets that would need to be evaluated through future study as described in Section 7 of this memorandum. Groundwater supplies would also likely require additional annual operations and maintenance costs due to the higher pumping lift (associated power cost) required to bring water to the surface.

Because the source of supply for this project is intended to mitigate for continuous beneficial uses, reliability criteria is relatively high—meaning that continuous pumping ability should be generally assured with limited interruption. Therefore it is assumed that at least one measure of redundancy (e.g., standby pump) be provided to accommodate repair/maintenance while the system is continually operating.

Groundwater

The general planning criteria for a groundwater source location includes identification of high yield alluvial aquifer targets (ideally sand and gravel deposits) in close proximity to the Pend Oreille River. A suitable groundwater source would ideally be located northeast of the basin divide and west of the Washington-Idaho border. A possible configuration for groundwater supply based upon flow and reliability criteria would likely be a wellfield consisting of three (or more) groundwater wells, each sized for roughly 1/2 the proposed project flow of 10 cfs [approximately 4,500 gallons per minute (gpm)] to provide a measure of redundancy and flexibility. It is also possible that a wellfield with more numerous, smaller capacity wells would be needed based on aquifer conditions, and this is accounted for in project contingency costs.

Surface water

The planning criteria for a suitable surface water source location includes areas within Washington along the southern bank of the Pend Oreille River. Furthermore, any surface water source must be located on shorefront properties that may ultimately be amenable to such as facility. In order to reduce pipeline conveyance and reduce costs, a surface water pumping station should be located as close to the basin divide as possible.

Because the Pend Oreille River is situated upstream of Chief Joseph Dam, fish passage to a potential point of diversion by anadromous salmonid species is not possible; however the project area is designated critical habitat for ESA-listed bull trout. While infrastructure criteria is not subject to National Marine Fisheries Services (NMFS) requirements for anadromous salmon

species, screening of surface water intake pipe would be required based upon RCW 77.57.010, and would therefore need to be designed to meet the requirements of the Washington Department of Fish and Wildlife (WDFW).

Pipeline Conveyance

Pipeline conveyance will be required from the water supply facility (either surface water or groundwater) to the proposed discharge location downstream of the basin divide.

The general criteria and considerations for pipeline alignment include consideration of:

1. Available corridors including preference for existing publicly owned right of ways or easements; and

2. Pipeline / pump station economics.

Generally, the shortest path may yield the most favorable economics; however, existing surface conditions (paved/unpaved) may yield an overriding consideration for a longer route. Furthermore, existing site encumbrances, and legal considerations such as right-of-way or easement use permits provisions are important considerations for selection of a pipeline alignment. Furthermore, limiting crossings of major developed corridors such as state highway routes, railways and surface water courses is important to optimizing economics.

Pipelines would be sized to optimize pipeline diameter and flow velocities. Generally, pipelines would be sized to limit velocities to less than 5 feet per second (fps) to limit head-loss (friction loss) and limit pipe wear.

Available pipeline materials may consist of metal (steel or ductile-iron), or plastic (PVC or HDPE). Because the pipeline would be subjected to relatively high pressures and likely be constructed through primarily urban corridor, the construction would most likely be of ductile iron which is a generally accepted standard for water distribution pipeline.

Depth of cover over pipe facilities may vary, but would likely be 4-feet minimum, which is customary for water supply pipelines in areas potentially subject to freezing. Special considerations related to increasing depth must be made within public rights of way (e.g., City of Newport (City)) in order to avoid the need for future relocation to accommodate City-owned utilities such as municipal water supply or sanitary sewer.

Discharge Location

Two major categories of discharge location exist for this project including:

1. Surface water discharge; and

2. Subsurface infiltration (or combination of the two).

Surface water discharge may include discharging into an energy dissipation structure (stilling well) with low energy overflow into the highest reaches of the basin as possible. Because the existing natural conveyance channel of the Little Spokane River may have limited conveyance capacity relative to the planned project flow criteria, considerations related to either improving existing

natural conveyance or bypassing the uppermost reaches with additional pipeline should be considered for project planning. Future study related to characterizing the conveyance capacity of natural systems associated with the Little Spokane River would be needed if this approach is pursued.

Potential impacts related to direct surface water discharge quantities may be mitigated to some extent if subsurface infiltration of a portion or all of the discharge quantity is deemed feasible through further study.

System Operation Criteria

Several system operations schemes may be employed for this project including:

1. Constant rate pumping flow regime; or
2. Variable rate pumping/adaptive management.

Under a constant flow regime, water would be pumped from the Pend Oreille River at a constant flow rate of 10 cfs. Because the natural hydrology of the system may fluctuate on a seasonal or annual basis, there may be a need for flow buffering, storage and/or infiltration in order to accommodate continuous inflow. This may potentially be accommodated in existing series of wetlands in the uppermost headwaters of the Little Spokane.

Alternatively, flow supplied to the system may be variable based on interuptiblility associated with WDFW flow recommendations for the Pend Oreille River and/or to provide variable flow to maintain Little Spokane River flow targets to potentially be established at various control points within the system.

4. Concept Alternatives

Development of Concept Alternatives

Several concept alternatives have been evaluated for purposes of evaluating feasibility, estimating costs and identification of applicable permits. Concept alternatives for this project are composed of a combination of:

1. Source of supply options; and
2. Conveyance and discharge options.

Concept alternative locations are shown on Figure 7.

Source of Supply Options

Surface Water Source

Potential sites for a surface water pump station on the Pend Oreille River within reasonable proximity to the basin divide, and within the Washington State are relatively limited. The most economical and favorable locations for surface water pumping station exist across state boundaries (in State of Idaho) and therefore were excluded from consideration. Relatively few shoreline parcels exist within reasonably close proximity to the basin divide, within Washington State; however, a shoreline parcel owned by City of Newport for their wastewater treatment facility

appears to be the most feasible location. This has been included in this appraisal analysis following discussions with the City.

For the purposes of project planning/costing, a conceptualized surface water pump station at this location was considered consisting of a single 30-foot deep wet well (sump) with submerged stainless cylindrical end of pipe intake screen extruding into the Pend Oreille River. To provide redundancy and operational flexibility, it was assumed that pumping from the wet well would be accommodated with three vertical turbine pumps each capable of providing approximately 5-cfs (2,250 gpm) at 136-feet total dynamic head (TDH). Typical operation would consist of cycling through any combination of up to two of the three pumps, alternating in sequence.

The pump station would be equipped with automated motor controls including SCADA/telemetry. Additional standard pump station appurtenances include isolation valves, check valves, flow meter, pressure switches, pressure transmitters, surge anticipation equipment, and access/maintenance provisions would be included. Depending on final system operational scheme, the pumps may be equipped with variable frequency drives to provide for matching flows in response to demands expressed by available stream flow in the Little Spokane.

Due to seasonally adverse weather (hot/cold) it is assumed that pumps/motors, electrical control equipment and other sensitive components will be housed within an insulated building structure with heating, ventilation and cooling systems.

Groundwater Source

Geologic mapping and limited well log information indicate that bedrock (granite) may be present in the immediate vicinity of City of Newport Wastewater Treatment Facility (Figure 2). However, it is known that existing production wells are utilized by City of Newport, which are located further to the south and east, as shown on Figure 2. While identification of an exact well site is outside the scope of this study, it is assumed that high yield alluvial aquifer targets consisting of sands and gravels in continuity with the Pend Oreille River may be found. For the purposes of this study, it is assumed that these are south of the City of Newport's treatment facility along a similar pipeline alignment(s) considered for surface water pump station options. Therefore, potential advantages related to pipeline economics may exist with the groundwater source option relative to surface water source option.

A groundwater source alternative for this project would include similar improvements to the surface water pump station with the exception that wet-well/sump, surface water intake and screening would be replaced with a series of three groundwater wells. It is anticipated that pumped water level may be approximately 200+ feet below ground surface at available sites. Therefore, additional pump stages including increased horsepower would be required for the groundwater source option.

Pipeline Conveyance Options

Many conveyance pipeline alignment routing options may ultimately be feasible for the project, and several specific variations were considered as part of this study including options proposed by City of Newport Staff, as well as alignments that may follow "best case" scenarios such as along BNSF railway corridors. While the identification of preferred alignment is outside the scope of this study, one pipeline alignment explored during field reconnaissance was ultimately selected for

evaluation that is relatively direct, primarily follows sparsely developed right-of-ways and represents generally the most direct route. The potential cost advantages/disadvantages to other alignments were quantified and found to be comparable in cost and within margin of error of estimating at this time. It is believed that further study including more detailed consideration of existing utilities, property ownership and topography would be required in order to better refine potential pipeline conveyance routing.

Discharge Options

Discharge options include either subsurface (infiltration) or surface discharge. Furthermore, surface discharge may occur at the uppermost reaches of the Little Spokane or several miles downstream at a point at which the natural conveyance channel may better accommodate the additional flow.

Infiltration

Infiltration within the Little Spokane drainage has the potential advantages of providing a level of flow buffering in conjunction with water quality treatment. Options for infiltration include 1) surface infiltration, 2) shallow subsurface infiltration (trenches), and 3) shallow subsurface infiltration wells (drywells). Considerations related to planning for infiltration of surface water include 1) injection water quality and potential pre-treatment needs, 2) hydraulic conductivity of receiving soils, and 3) proximity of restrictive layers such as bedrock, fine grain soils and groundwater table. Furthermore, considerations related to the location and timing of return flow into the Little Spokane River is critical to gaging the value of infiltration for this project.

Four mapped data sources were used to evaluate feasibility including topographic mapping (USGS), surficial geology (Figure 2), basin fill mapping (Figure 3), and soils mapping from USDA/NRCS (Figure 4). Also, some limited well log information was located from Department of Ecology's well log database.

Both the surficial geologic mapping and the basin fill mapping indicate that near the basin divide, there may be 100 to 300 feet of basin fill with little evidence of shallow bedrock at or near the surface. Approximately 3-miles downstream of the upper headwaters of the little Spokane River, surface water flows appear to be gaining substantially due to the presence of shallow bedrock. This potentially indicates that return flow related to infiltration may discharge to the river no further down than this location. Siting of a potential infiltration facility would need to be done in a way that ensures that return flow would not flow towards the northwest (towards the Pend Oreille River). Further study is required to establish the subsurface flow regime, as recommended later in this memorandum.

Mapped soils within reasonable proximity to the basin divide are predominantly silts and sands with some gravel. There is evidence of some relatively shallow clay layers as well as peat in some areas. Based on this information preliminary estimates of long term infiltration rates may be on the order of 1 inch per hour, provided soils with sands/gravels may be targets and clays/peats may be avoided. This estimated infiltration rate would need to be refined based on further study.

Furthermore, a planning criteria for pre-treatment may include detention of surface water for up to 40 hours to remove as much sediment as possible prior to infiltration (applicable to surface water

source option only). Based on these coarse scale assumptions, an infiltration facility may require 10 to 15-acres (or more) surface area to accommodate along with a pre-treatment wet pond with a capacity of 30 acre-feet (or more). In planning for a potential infiltration facility, it would be prudent to allow space for redundant infiltration galleries in the event of failure of such facility. Therefore, it is estimated that a site on the order of 30 to 40 acres may be required. While no specific site has been identified for an infiltration facility such as this, there are several undeveloped parcels in the upper limits of the Little Spokane that are either in private or corporate ownership that could be potential candidates for infiltration. These sites would need to be explored during subsequent study.

Surface Water Discharge Option-1 (At Little Spokane River Headwaters)

One option for surface water discharge is near the uppermost reaches of the little Spokane drainage at a series of wetlands adjacent to the SR 2 Hwy corridor. This alternative could allow for the shortest distances of pipeline improvement and may also provide additional storage related benefit to accommodate a level of flow buffering. Qualitative visual observations (not measured) of natural conveyance during site reconnaissance indicate that flows up to 10 cfs may not be accommodated in the uppermost drainage without modifications to culverts and dredging of existing channels. Therefore, in order to accommodate discharge this high in the basin, it is likely that in-channel conveyance improvements will be necessary to avoid inundation of land beyond the ordinary high water mark.

Surface Water Discharge Option-2 (Approximately 2-Miles Downstream of Headwaters)

An alternative to discharging at the immediate headwaters of the Little Spokane River basin would be to convey water further downstream into the Little Spokane River drainage in order to bypass potentially constraining reaches. A cursory overview of the natural conveyance indicates that the Little Spokane River expands dramatically approximately 3-miles downstream of the basin divide. Therefore, discharge Option-2 involves construction of additional 24" diameter conveyance pipeline along existing corridors including SR2, Scotia Road, and a vacated BNSF right of way.

Evaluation of Concept Alternatives

For purposes of evaluating feasibility and developing costs, four concept alternatives based on two source water alternatives (a surface water supply or a groundwater supply) and two discharge locations (discharge to a large wetland in the upper headwaters and discharge to the river approximately two miles downstream). The alternatives are shown in Table 1:

Table 1. Concept Alternatives

	Alternative 1 (Surface Water Supply)	Alternative 2 (Groundwater Supply)
Discharge Option-A (Headwaters)	**Alternative 1A**	**Alternative 2A**
Discharge Option-B (Headwater Bypass)	**Alternative 1B**	**Alternative 2B**

Hydraulics Analysis

Hydraulic analysis was performed to evaluate pipe size and to calculate pump horsepower. The Hazen-Williams formula was used to estimate friction loss using a roughness coefficient "C" of 120 to represent cement-lined ductile iron pipe. Based upon 24" pipe (nominal) diameter sizing, approximately 22-feet (water) head-loss would occur due to dynamic forces at proposed flow rate of 10 cfs (4,500 gpm). Coupled with an estimated static lift of 110 feet and an additional 4-feet of losses at the pump station, a total dynamic head (tdh) of 136 feet is calculated for the surface water pumping option. To accomplish pumping at this flow rate/pressure, approximately 190 brake horsepower (pump horsepower) is required (assuming pump efficiencies of approximately 80%).

In contrast, it is estimated that pumping head for the groundwater option may be significantly higher than for the surface water option due to well drawdown at proposed pumping rates. Assuming a pumped drawdown of 100 feet below Pend Oreille river static water levels, total dynamic head for groundwater source option may increase to 236 feet. Therefore approximately 330 brake horsepower is required using similar assumptions. This is a significant consideration, as the power costs for the groundwater source may be roughly double those of the surface water source option.

System performance curves related to both surface water and groundwater supply (variable speed operation scenario) options are provide as Figures 8 and 9.

Project Alignments, Property Ownership and Right of Way

While various options exist for pipeline alignments the alignment chosen for evaluation is the shortest and most direct (Figure 7). This alignment generates at or near the City of Newport (City) wastewater treatment facility. The City has expressed a willingness to support the project and may be a proponent of citing a surface water pump station on City property. The pipeline would most likely cross a BNSF railway right of way upon existing City of Newport's property and therefore a railway crossing permit would be required. At this point, project improvements would enter City of Newport public roadway right of way in northern extent of City Limits. Near the western/central portions of the alignment, the pipeline would ideally transect a series of public and private properties that are currently in use as parkland or otherwise sparsely developed land. A range from 15- to 20-foot wide easements from these landowners would be required, although the acquisition of these easements is not necessary for project success as alternative routes entirely on public right of way are available. The final portion of the alignment may parallel SR2 which is owned and managed by Washington State Department of Transportation.

The proposed discharge location for Alternatives 1A and 2A is at a wetland complex in the upper headwaters of the Little Spokane River. While modification of the wetland complex is not necessary for project success, there may be benefit to modification of the surface water outlet control in order to provide operational flexibility and storage which would require landowner permission/easements as well as consideration of potential biological impacts. Approximately 1-mile southwest of the discharge location for Alternatives 1A/2A the natural conveyances crosses SR2 in a culvert. This culvert is likely undersized for proposed flows and may need to be replaced necessitating coordination and permitting from WSDOT. The balance of natural conveyance downstream of this point is on private property with the exception of crossing Scotia Road which is owned by Pend Oreille County. To the extent that channel improvements are required to ensure

conveyance capacity and/or driveway culvert replacements are necessary, private landowner easements would be required.

In contrast, Alternative 1B and 2B would pipe the alignment with gravity conveyance several miles downstream of the basin divide in order to bypass flow restricting channel segments. At least one mile of this pipeline would parallel SR 2, therefore a significant utility franchise permit from WSDOT could be required. The balance of pipeline for these alternatives may follow either Pend Oreille County-owned public right of way (Scotia Road) or abandoned railway right of way.

A summary of property ownership including ownership type (right of way/parcel), brief description of improvement and magnitude (length) is provided in Tables 2 through 4 below.

Table 2. Property Ownership, Pump Station and Pipeline Improvements

Ownership	Type	Notes	Improvement	Length (ft)
City of Newport	Parcel	Wastewater Treatment Plant	Pipeline and Pump Station	1,150
BNSF	Right-of-Way/Parcel	Active Railway	Pipeline Crossing	120
City of Newport	Right-of-Way	Spokane Avenue and 2nd Street	Pipeline	4,900
City of Newport	Parcel	City Park	Pipeline	1,350
City of Newport	Right-of-Way	S. Garden Ave	Pipeline	300
Pend Oreille County	Parcel	Developed Parcel	Pipeline	640
City of Newport	Right of Way	Circle Dr. W	Pipeline	400
Private Property	Parcel	Developed Parcel	Pipeline	150
Newport School District	Parcel	Newport High School	Pipeline	1,600
Private Property	Parcel	Developed Parcel	Pipeline	350
WSDOT	Right-of-Way	State Route 2	Pipeline	1,600

Table 3. Property Ownership, Discharge Improvements (Option-1)

Ownership	Type	Notes	Improvement	Approximate Length
Private Property	Parcel	Wetland/Aquatic Land	Improved Natural Conveyance	5,280
WSDOT	Right-of-Way	State Route 2	Culvert Replacement	200
BNSF Railway	Right-of-Way/Parcel	Abandoned Railway	Improved Natural Conveyance	3,600
Pend Oreille County	Right-of-Way	Scotia Road Crossing	Culvert Replacement	100
Private Property	Parcel	Wetland/Aquatic Land	Improved Natural Conveyance	1,000
Pend Oreille County	Right-of-Way	Gray Road Crossing	Culvert Replacement	60
Private Property	Parcel	Wetland/Aquatic Land	Improved Natural Conveyance	430
Pend Oreille County	Parcel	Wetland/Aquatic Land	Improved Natural Conveyance	600
Private Property	Parcel	Wetland/Aquatic Land	Improved Natural Conveyance	4,000

Table 4. Property Ownership, Discharge Improvements (Option-2)

Ownership	Type	Notes	Improvement	Approximate Length
WSDOT	Right-of-Way	State Route 2	Pipeline	5,280
BNSF Railway	Right-of-Way/Parcel	Abandoned Railway	Pipeline	2,300
Pend Oreille County	Right-of-Way	Scotia Road Crossing	Pipeline	5,700
BNSF Railway	Right-of-Way/Parcel	Abandoned Railway	Pipeline	2,200

Environmental Review and Permitting Considerations

Permitting Framework

Permitting of the project may occur at federal, state, county local and private levels. Regulatory permitting framework has been explored for this project and the following permits may applicable to various project alternatives.

Army Corps Section 10

Under Section 10 of the Rivers and Harbors Act of 1889, 33 U.S.C. 403, restrictions on the alternation of navigable waters exist and are regulated at the Federal Level through the Army Corps of Engineers. Infrastructure improvements including construction of a surface water pumping station on the Pend Oreille River which is a navigable water and will be subject to this jurisdiction. The Little Spokane River has been adjudicated as a "non-navigable" waterway by Washington State Court decisions. Additional research is necessary to determine how this determination impacts federal jurisdiction of the Little Spokane River..

Army Corps Section 404

Section 404 of the Clean Water Act places restrictions on discharge of dredged or fill material within the limits of navigable waters. Permitting such actives are regulated by Army Corps of Engineers. Improvements related to work in either the Pend Oreille or Little Spokane River(s) may trigger this permit.

Ecology 401 WQ Certification

Section 401 of the Clean Water Act allows states to place restrictions or conditions on federal permits or licenses that may impact water quality. A 401 certification may be associated with federal permits required for this project.

WSDOT – Utility Franchise Permit

RCW 47.44 and WAC 468-34 of Washington State Law allows the Washington State Department of Transportation to issue permits and franchises to occupy state owned land with utilities such as water conveyance pipelines. Utility runs (within WSDOT right of way) shorter than 300 feet are typically issued permits, while utility runs longer than 300 feet are issued franchises. Either permits or franchise from WSDOT may be required for this project.

Washington State Department of Fish and Wildlife, Hydraulic Project Approval (HPA)

Under Chapter 77.55 RCW of Washington State Law (Hydraulic Code), the Washington State Department of Fish and Wildlife administers Hydraulic Project Approval, which serves as a permit related to most construction work within waters of the State. Any in-water work will require an HPA.

Washington State Department of Natural Resources, Aquatic Use Authorization

Washington State Department of Natural Resources (WDNR) is charged with managing uses on State owned aquatics land (e.g. stream and lake beds) consistent with RCW 79.105. Typically, use of State owned aquatics land requires a lease from the State; however, based on a Washington State Supreme Court case dating back to 1900 (Griffith v. Holman), the Little Spokane riverbed was considered non-navigable, and in addition held in private ownership. Given this, WDNR Aquatic

Use Authorizations may not apply to this waterbody. DNR Aquatic Use Authorization is clearly required however, for improvements related to work within Pend Oreille River.

ESA Section 7 Concurrence

Section 7(a)(2) of Endangered Species Act requires consultation with National Marine Fisheries regarding projects that may affect ESA listed species. Due to the presence of bull trout critical habitat on the Pend Oreille River, it is anticipated that improvements related to a surface water improvement in this waterbody would trigger ESA Section 7 concurrence from NOAA Fisheries/NMFS. Work within the Little Spokane River would not be subject to ESA Section 7 concurrence.

Tribal Reserved Water Rights

The Kalispel Tribe has unquantified water rights in the Pend Oreille watershed, as reserved by the Winters Doctrine, stemming from a 1908 U.S. Supreme Court decision (Winters v. United States). These rights are expected to be senior to most or all of the other water rights in the watershed, and would have senior priority to any water rights from the Pend Oreille permitted by Ecology to support Little Spokane water bank seeding.

County Shoreline Substantial Development Permit

Development within 200 feet of shorelines will trigger consideration of shorelines permitting per Pend Oreille County's Shoreline Management Plan. Shorelines permitting may include Shoreline Substantial Development Permit, Conditional Use Permit or Possible Exemptions.

County Floodplain Permit

Development within 100 feet of floodplains will trigger floodplain permitting through Pend Oreille County. FEMA regulations further dictate activities that may occur inside floodplain and floodway.

SEPA/NEPA

State Environmental Policy Act (SEPA), enacted by Washington State Legislature 1971 requires agencies at all levels of government (State or lower) to consider environmental impacts of projects or proposals.

National Environmental Policy Act (NEPA), enacted by US Federal Government in 1970 requires federal government agencies consider environmental impacts of proposals or actions as well as any reasonable alternatives to those action.

Water Rights Permitting

A water right(s) for either the surface or groundwater option will need to be obtained to allow beneficial use of a Pend Oreille water source. The Tri-Counties are in discussions to determine the best course of action for submitting both groundwater and surface water applications to Ecology to seek appropriate water right permits. It is anticipated that the applications would be submitted for a range of 10 to 20 cfs, equivalent to allow some flexibility in project design as detailed analysis progresses. Additionally, depending on the funding source, some flow contribution may be required to be dedicated for instream flow purposes.

Although a SWSL exists on other water right permits from the Pend Oreille River, this project would have the greatest opportunity to provide a firm supply for a WRIA 55 water bank if it were not interruptible to any Pend Oreille flow target. Since a SWSL is not the same as an instream flow rule, it is not (and cannot be) applied uniformly without jeopardy under the Administrative Procedures Act. A case specific SWSL for this project that recognizes instream flow benefit in WRIA 55 could increase the reliability of this project. Alternatively, other mitigation could be added in the Pend Oreille that addresses other limiting factors to provide mitigation, potentially eliminating the need for a SWSL.

As part of water right processing, Ecology will need to consider the Bureau of Reclamation's withdrawal of unappropriated waters of the Columbia River and its tributaries above Priest Rapids Dam, located on the Columbia River approximately 50 miles upstream of Richland (RCW 90.40.030). This withdrawal expired on December 23, 2014, but an extension request was filed with Ecology prior to expiration, and Ecology considers the withdrawal to remain in effect until the extension request is processed.

National Pollution Discharge Elimination System (NPDES)

All point source discharges into waters of the United States are controlled through the NPDES system. In Washington State, the Department of Ecology is a delegated state water pollution control agency by US Environmental Protection Agency. The project concept involves a point discharge to the Little Spokane River, which could be subject to NPDES requirements. Construction stormwater is also regulated under the NPDES program and coverage under NPDES construction general permit will be required as part of this project due to more than 1-acre of disturbance.

Cultural Resources

Washington State Governors Executive Order 05-05 requires that any Washington State funded project integrate the Department of Archaeology and Historic Preservation (DAHP) into the project planning process. Furthermore, if federally funded, National Historical Preservation Act, Section 106 permitting is required.

BNSF Railway

BNSF often accommodates utilities for crossing as well as use of their right of way corridors (for a substantive fee). BNSF issues permits, franchises and licenses for use of their right of way depending on location and use classification.

Private Landowner Easement

To the extent project improvements or uses extend beyond the limits of permitted uses within public right of ways or state owned lands, individual easements from private landowners may be necessary. Based on a Washington State Supreme Court case dating back to 1900 (Griffith v. Holman), the Little Spokane riverbed was considered non-navigable, and in addition held in private ownership. Access to conduct work on private property will require permission from landowners. Actual conveyance of any water introduced into the Little Spokane as part of this project, however, does not require easements from property owners based on RCW 90.03.030, which states in part:

> *Any person may convey any water which he or she may have a right to use along **any** of the natural streams or lakes of this state, but not so as to raise the water thereof above ordinary highwater mark, without making just compensation to persons injured thereby; but due allowance shall be made for evaporation and seepage, the amount of such seepage to be determined by the department, upon the application of any person interested.*

Given this, it does not appear that private ownership of the Little Spokane streambed, should it continue to be the case, is a fatal flaw in evaluating potential instream flow enhancement and mitigation in the river.

City of Newport Right/Pend Oreille County, Right of Way Permits

City of Newport and Pend Oreille County accommodate private and public utilities within their rights-of-way through issuance of utility franchise. These use authorizations come with special restrictions including location, depth of cover and requirements for maintenance.

Local Building, Filling and Grading Permits

Construction of structural improvements and grading within limits of City of Newport will likely trigger local building, filling and grading permits.

Environmental Approvals and Permitting Approach

Construction of project improvements and ongoing project operation represent impacts to natural resources both in the short term and long term. Short term impacts include in-water work such as dredging and filling for pump station and screening improvements in the Pend Oreille River as well as potential in-channel conveyance improvements in the Little Spokane River. Longer term impacts associated with project operation include potential impacts to wetlands and other aquatic habitat such as instream channels associated with the upper headwaters of the Little Spokane.

During construction and operation, mitigation for potential impacts must be considered including mitigation for potential water quality concerns, installation and maintenance of fish screens, re-establishment of aquatic vegetation and fish habitat and consideration of construction windows that are compatible with fisheries windows (if applicable). Furthermore, ongoing maintenance of in-channel conveyance of the upper headwaters may be required to ensure flow regime is maintained at or below ordinary high water, in conjunction with maintaining current ecological function.

All project alternatives will involve a rigorous permitting process due to the multifaceted nature of the project, spanning several major waters of the State and numerous landownerships. It is anticipated that because of potential water quality considerations, Alternatives 1A and 1B would likely represent the highest overall permitting complexity, including all permits previously mentioned including Army Corps, Section 10 (navigable waters) as well as ESA Section 7 concurrence through NOAA fisheries due to the presence of critical habitat for Bull Trout in the project vicinity at the Pend Oreille River.

Alternative 2A and 2B may potentially avoid permitting nexus associated with ESA listed species and Army Corps Section 10 due to the avoidance of in-water work associated with the Pend Oreille River. Alternative 2B is likely the simplest project to permit as this alternative is associated with the least possible impact to existing aquatic natural resources.

5. Project Economics

Opinion of Probable Cost

Project life cycle costs (opinion of probable cost) consisting of initial capital and ongoing operations and maintenance costs were developed for each of the two alternatives (1 and 2) as well as for each subset alternative (A and B).

Assumptions

The following assumptions were used in development of capital cost estimates:

- Mobilization/demobilization 10% construction subtotal;
- 25% contingency;
- 20% design engineering, surveying;
- 5% to 7% allowance for permitting (depending on complexity);
- Rock excavation assumed for 25% of excavations;
- Pipeline construction of ductile iron or steel;
- Washington State Sales Tax of 7.6% (City of Newport);
- 3% owner related management/oversight;
- 10% construction management/oversight;
- 1% allowance for property (easement) acquisition;
- Construction labor subject to Washington State Prevailing Wage; and
- 5% allowance for habitat mitigation projects.

The following assumptions were used in development of ongoing operations, maintenance and replacement costs:

- Annual Operations and Maintenance Cost for Pumps, Mechanical and Electrical Equipment assumed at 5% of capital cost per year.
- Annual Operations and Maintenance Cost for Fixed infrastructure (pipes, structures - all other construction) assumed at 1% of capital cost per year.
- Pumping power costs of $0.043 per kWh are based on Pend Oreille Public Utility District No. 1 Rate Schedule for 3-phase commercial services and are estimated based on continuous pumping.

Capital Cost

Capital cost estimates (direct and indirect costs) for two project alternatives including two variants per project alternative were developed as part of this study.

Alternative 1 consists of surface water pump station with approximately 12,600 linear feet of 24" diameter conveyance pipeline to convey surface water from the Pend Oreille River to the Little Spokane River. Surface water pump station is assumed to be located at or near City of Newport's waste water treatment facility. Alternative 1A includes discharge at the Little Spokane River headwaters in conjunction with improvement to natural surface conveyance approximately 2-miles downstream. Alternative 1B includes approximately 14,000 linear feet of additional gravity conveyance pipeline to bypass the reaches of natural channel. Opinion of probable cost estimates for alternatives 1A and 1B are $17.7M and $21.5M respectively (2015 dollars). General breakdown of capital cost estimates are provided in Table 5, and detailed breakdown is provided in Attachment C.

Table 5. Preliminary Project Cost Estimate, Alternatives 1A and 1B

		Alternative 1A	**Alternative 1B**
Item	**Description**	**Total Cost**	**Total Cost**
1.0	General	$1,190,000	$1,267,000
2.0	Site Preparation / Demo	$100,000	$15,000
3.0	Surface Water Pump Station	$1,782,000	$1,782,000
4.0	Pipeline	$3,980,000	$7,760,000
5.0	Little Spokane Channel Improvement	$1,650,000	$0
6.0	Environmental Mitigation	$450,000	$500,000
	Direct Cost		
	Construction Subtotal	$9,152,000	$11,324,000
	Contingency	$2,288,000	$2,831,000
	Washington State Sales Tax	$869,000	$1,076,000
	Direct Cost Total	$12,309,000	$15,231,000
	Indirect Cost		
	Allowance for Easement / Property Acquisition	$123,000	$152,000
	Design Engineering, Project Survey	$2,462,000	$3,046,000
	Permitting	$1,231,000	$1,066,000
	Management / Administration	$369,000	$457,000
	Construction Oversight	$1,231,000	$1,523,000
	Indirect Cost Total	$5,416,000	$6,244,000
	Total Project Capital Costs	**$17,725,000**	**$21,475,000**

Alternative 2 consist of groundwater wellfield with approximately 11,200 linear feet of 24" diameter conveyance pipeline to convey groundwater in continuity with surface water from the Pend Oreille River to the Little Spokane River. The groundwater wellfield is assumed to be located at or near City of Newport's property situated south of the waste water treatment facility. Alternative 2A includes discharge at the upper headwaters in conjunction with improvement to natural surface conveyance approximately 2-miles downstream. Alternative 2B includes

approximately 14,000 linear feet of additional gravity conveyance pipeline to bypass the upper reaches of natural channel. Opinion of probable cost estimates for alternatives 2A and 2B are $15M and $19.8M respectively (2015 dollars). General breakdown of capital cost estimates are provided in Table 6, and detailed breakdown is provided in Attachment C.

Table 6. Preliminary Project Cost Estimate, Alternatives 2A and 2B

		Alternative 2A	**Alternative 2B**
Item	**Description**	**Total Cost**	**Total Cost**
1.0	General	$934,000	$1,146,000
2.0	Site Preparation / Demo	$100,000	$5,000
3.0	Groundwater Well Source	$1,562,000	$1,562,000
4.0	Pipeline	$3,620,000	$7,400,000
5.0	Little Spokane Channel Improvement	$1,300,000	$0
6.0	Environmental Mitigation	$375,000	$500,000
	Direct Cost		
	Construction Subtotal	$7,891,000	$10,613,000
	Contingency	$1,973,000	$2,653,000
	Washington State Sales Tax	$750,000	$1,008,000
	Direct Cost Total	$10,614,000	$14,274,000
	Indirect Cost		
	Allowance for Easement / Property Acquisition	$106,000	$143,000
	Design Engineering, Project Survey	$2,123,000	$2,855,000
	Permitting	$743,000	$714,000
	Management / Administration	$318,000	$428,000
	Construction Oversight	$1,061,000	$1,427,000
	Indirect Cost Total	$4,351,000	$5,567,000
	Total Project Capital Costs	**$14,965,000**	**$19,841,000**

Operations and Maintenance Cost

Operations and Maintenance (O&M) costs consist of annual costs operating equipment, monitoring and periodic maintenance and replacement of deteriorating components throughout the life of the project. A major component of O&M cost are power consumption costs associated with water pumping. Table 7 provides a summary of estimated annual O&M costs for various project alternatives.

Table 7. Preliminary Operations and Maintenance Cost Estimate

	Mechanical / Electrical Improvements	Fixed Improvements	Electrical Costs	Total Annual O&M
Alternative 1A	$89,000	$61,000	$70,000	$220,000
Alternative 1B	$89,000	$83,000	$70,000	$242,000
Alternative 2A	$78,000	$53,000	$120,000	$251,000
Alternative 2B	$78,000	$79,000	$120,000	$277,000

Water Banking Unit Costs

It is likely that a WRIA 55 water bank will include some form of cost recovery for users relying on mitigation credits from the bank. Demand from the water bank may vary depending on the types of mitigation certificates offered (e.g. indoor use only, indoor and outdoor use), and whether mitigation is based on total use or consumptive use. Cost recovery impacts can be estimated through the following example.

Consider mitigation certificates that are based on offsetting 250 gpd of total water use (0.28 acre-feet/year). This accounts for approximately 0.0039% of the 7,240 acre-feet supplied by the project. At a cost range of $15 to $20 million for the project, a capital cost recovery on the order of $580 to $775 / house would be required. Primary factors that could lead this cost to increase include higher total water use/house, and including cost recovery for operation and maintenance. Primary factors that could lead to decreased costs include mitigation for consumptive use only (which would decrease the per home mitigation requirement) and potential state subsidy for public benefits, such as instream flows.

As criteria are established for water bank management, costs per home can be more accurately estimated. However, the costs on the order of hundreds of dollars (or even a few thousands of dollars) per home are likely affordable given the experience of water banks in other areas.

Cost Considerations/Data Gaps

Capital and O&M costs considered have been developed without the benefit of detailed design and various levels of environmental study/review. Further subsequent feasibility study will be required to refine costs based on evaluation of project elements in greater detail. Factors which may tend to dramatically impact cost include the following:

- **Little Spokane Conveyance Capacity.** The input of 10 cfs into the uppermost reaches of the natural conveyance of Little Spokane River presents a project challenge that must be addressed with further scientific study and engineering evaluation. The project flow must be accommodated below ordinary high water or otherwise within limits agreed to by various impacted landowners. Some assumption has been made as to the limit of natural conveyance that may readily handle project flows, however this limit may need to be refined, which could greatly impact cost.
- **Groundwater Well Source Option.** The siting/configuration of a potential groundwater source may have dramatic impact on cost estimates. To provide a level of conservatism, it was assumed that a groundwater source may be cited in the northern extents of City of Newport; however, locations further south may be feasible which could reduce required

pipeline lengths and reduce cost. Well construction costs may increase depending on potential well depth required. Furthermore, it is assumed that high yielding aquifer targets may be found with production capacities suitable for a wellfield configuration as described herein. It may be possible that a wellfield with more numerous quantity of smaller wells is required. However, it is anticipated that alternative configurations may be similar in aggregate cost.

- **Power Infrastructure.** Power supply to proposed water supply options has not been explored in detail. Should extensive power extension be required, cost may be impacted. Furthermore, it is assumed that reliability criteria do not dictate the need for emergency backup power supply through installation of permanent standby generator.
- **Existing Utilities.** Piped conveyance improvements with pipeline diameters on the range of 24" pose significant technical challenges with respect to installation in urban/suburban settings. Limited flexibility is available to negotiate and avoid other utilities therefore extensive relocation of existing utilities and/or deep installation of pipeline improvements may be required.
- **Surface Water Pump Station.** It is assumed that the surface water pump station may both 1) be installed on City of Newport property in the vicinity of the Waste Water Treatment Facility and 2) surface water pump station may be configured with a wetwell/piped intake with cylindrical end of pipe fish screen. Should the pump station be located on alternative property sites, estimated costs would likely increase. Furthermore, should the need arise for a platform/pump deck style pump station, costs would likely increase due to the height and distance required.

In summary, estimated capital and annual O&M costs for the various alternatives are provided in Table 8 below.

Table 8. Preliminary Estimated Project Cost Summary

	Total Cost		Unit Cost[1]	
	Capital Cost	Annual O&M	Capital Cost (per ac-ft)	Annual O&M (per acre-foot)
Alternative 1A	$17,725,000	$220,000	$2,450	$30
Alternative 1B	$21,475,000	$242,000	$2,970	$33
Alternative 2A	$14,965,000	$251,000	$2,070	$35
Alternative 2B	$19,841,000	$277,000	$2,740	$38

1 – Unit costs developed by dividing total costs by annual quantity of 7,240 acre-feet.

6. Recommendations for Additional Design and Analysis

Additional detailed engineering and environmental analysis is needed to further develop and potentially implement this work, as recommended below. Aspect and the County have worked together to develop an Implementation Plan for continued water bank development. This Implementation Plan has been incorporated into a Watershed Plan Implementation and Flow Achievement Grant application to seek funding for completion of water bank development. The grant application was submitted to Ecology on April 30, 2015 and is pending review. Additional detailed engineering and environmental analysis is needed to further develop and potentially implement use of Pend Oreille source water for bank seeding, as recommended below:

Little Spokane Headwaters

This work is intended to provide data and analysis focused on engineering and environmental issues specific to the Little Spokane headwaters. Recommended data gathering and analysis includes:

- Establishment of gaging stations;
- Stream geomorphology/hydrology/flood plain assessment, including road crossings;
- Evaluation of wetland and stream habitat enhancement opportunities;
- Water quality data review, sampling, and analysis;
- Evaluation groundwater/surface water interaction;
- Streamflow flow and temperature measurements/seepage runs;
- Installation and monitoring of near stream piezometers;
- Private/public well water level measurements;
- Isotope comparison of surface water and groundwater to evaluate hydraulic connection;
- Evaluation of surface aquifer recharge (SAR) as a mechanism to enhance stream flow; and
- Limited numerical groundwater/surface water flow modeling if deemed appropriate following further study (would also include portions of the Pend Oreille Watershed).

Pend Oreille Watershed

This work is intended to provide data and analysis focused on engineering and environmental issues specific to the Pend Oreille watershed. Recommended data gathering and analysis includes:

- Installation of a test well(s) and associated aquifer testing;
- Water quality data review, sampling, and analysis, to include development of a Quality Assurance Project Plan (QAPP);
- Evaluation groundwater/surface water interaction;
- Monitoring/water quality testing during aquifer testing;
- Review of existing well data;
- Development of a conceptual hydrogeologic model of Pend Oreille River and adjacent aquifer; and
- Limited numerical groundwater/surface water flow modeling if appropriate.

Pre-Design Evaluations

These investigations and data analyses are recommend to support an assessment of the viability and if viable, engineering design for development and use of a suitable water source and operational

system to obtain and convey water to the upper headwaters of the Little Spokane River. Recommended evaluations include:

- Update of the existing data review and data gap analysis;
- Evaluation of land access options (contact with property owners, physical limitations, right-of-way issues);
- Coordination with City of Newport and other entities as required;
- Evaluation of reclaimed water options;
- Evaluation of potential water quality impacts;
- Evaluation of potential impacts on future water allocations from the Pend Oreille River;
- Preparation of a final assessment of preferred alternative (groundwater or surface water source);
- Establishment of a conveyance approach; and
- Development of additional mitigation options (wetland enhancement, instream flow augmentation, SAR).

Preliminary Engineering Design

Recommendations for preliminary design support the assessment of the project's viability. If determined viable, future detailed engineering design for the development of a suitable Pend Oreille water source and associated operational system will be performed. Recommended preliminary design tasks include:

- Conveyance system, road crossing modifications and associated field work (surveying);
- Stream channel modifications;
- Wetland/habitat enhancement;
- Wellfield (or pump station) design; and
- Detailed cost estimates.

If preliminary design continues to support the viability of the Pend Oreille source for WRIA 55, additional detailed design and implementation approaches should be developed as part of completing preliminary design work.

Attachments

Figure 1 – Little Spokane and Pend Oreille Drainage Divide
Figure 2 – Surficial Geology
Figure 3 – Depth of Basin Fill
Figure 4 – Soils Mapping
Figure 5 – WDFW Recommended Flow vs. Gage Data (2002-2012) Pend Oreille River at Newport
Figure 6 – Frequency Below Base / Recommended Flows – Dartford and Newport

Figure 7 – Conceptual Improvements Plan
Figure 8 – System Performance Curves, Surface Water Alternatives
Figure 9 – System Performance Curves, Groundwater Alternatives

Attachment A – Photos from Site Reconnaissance
Attachment B – Well Logs
Attachment C – Detailed Cost Estimates

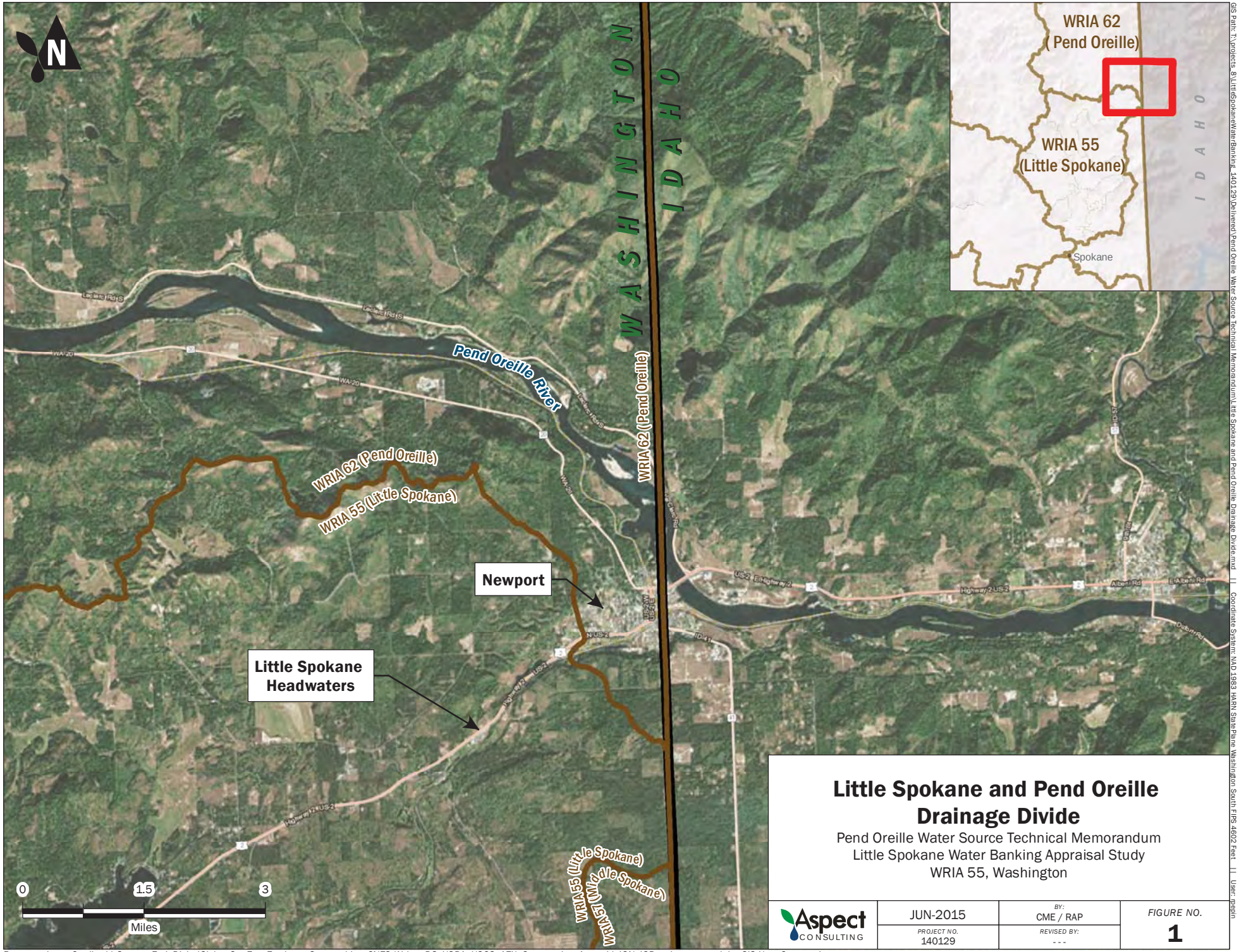
Limitations

Work for this project was performed for the Spokane County Utilities (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

V:\140129 Little Spokane River Basin\Deliverables\Phase III Final FS\Appendices\Pend Oreille Interbasin Transfer Memo\Pend Oreille Inter Basin Transfer 063015.docx

FIGURES

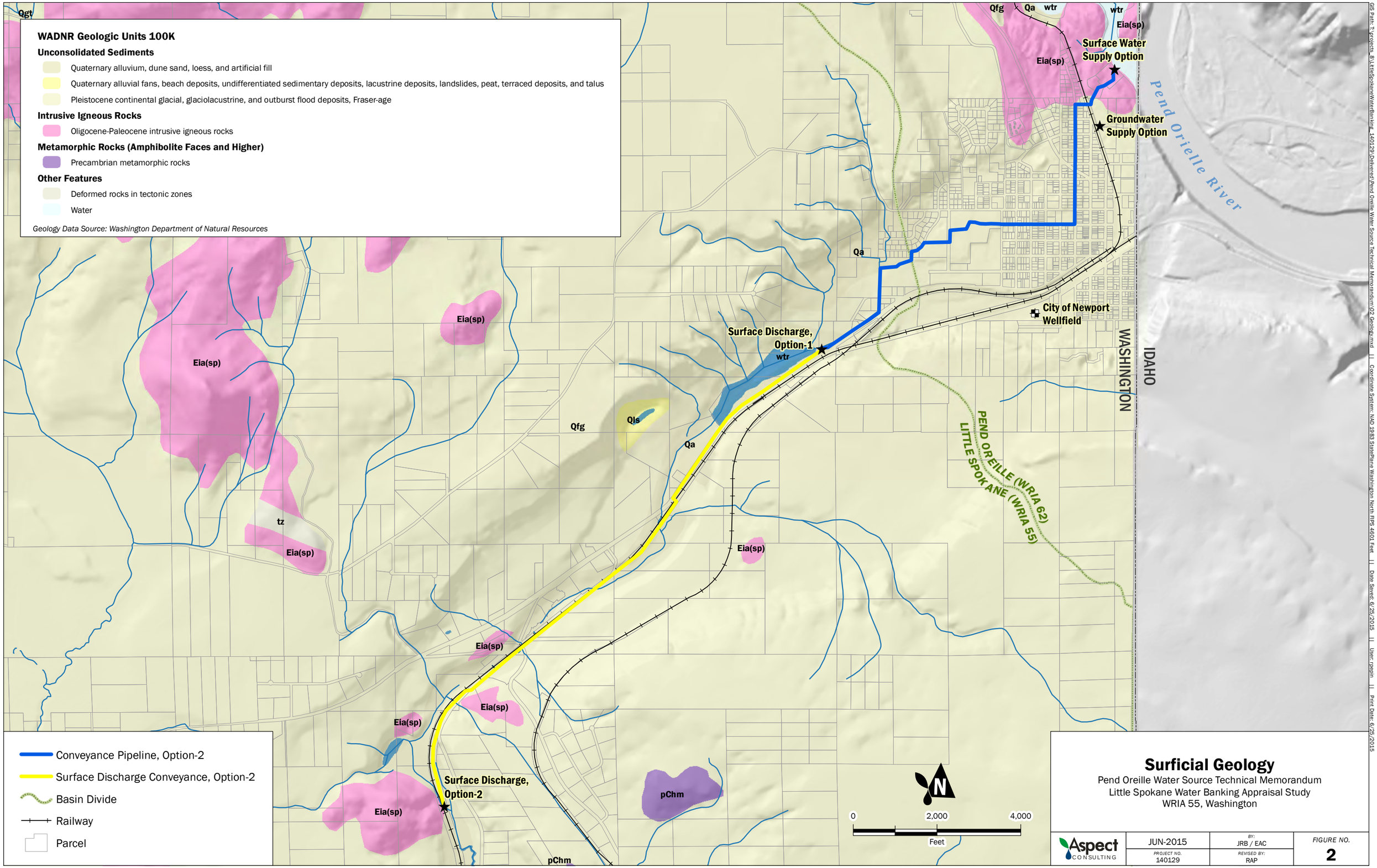


Little Spokane and Pend Oreille Drainage Divide

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect CONSULTING	JUN-2015	BY: CME / RAP	FIGURE NO. 1
	PROJECT NO. 140129	REVISED BY: ---	

GIS Path: T:\projects_8\LittleSpokaneWaterBanking_140129\Delivered\Pend Oreille Water Source Technical Memorandum\Little Spokane and Pend Oreille Drainage Divide.mxd || Coordinate System: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet || User: pepin



Surficial Geology

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect Consulting	JUN-2015	BY: JRB / EAC	FIGURE NO. 2
	PROJECT NO. 140129	REVISED BY: RAP	

GIS Path: T:\projects_8\LittleSpokaneWaterBanking_140129\Deliverect\Pend Oreille Water Source Technical Memorandum\02 Geology.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/25/2015 || User: rpeplin || Print Date: 6/25/2015

Extent and Thickness of Basin Fill (ft)

- 0 to 100
- 100.1 to 300
- 300.1 to 500
- 500.1 to 828
- Surficial Bedrock

Basin Fill and Bedrock Data Source: USGS Scientific Investigations Report 2013-5124

Surface Water Supply Option

Groundwater Supply Option

Pend Orielle River

City of Newport Wellfield

Surface Discharge, Option-1

PEND OREILLE (WRIA 62)
LITTLE SPOKANE (WRIA 55)

WASHINGTON

IDAHO

Surface Discharge, Option-2

- Conveyance Pipeline, Option-2
- Surface Discharge Conveyance, Option-2
- Basin Divide
- Railway
- Parcel

N

0 2,000 4,000
Feet

Depth of Basin Fill

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect Consulting	JUN-2015	BY: JRB / EAC	FIGURE NO. 3
	PROJECT NO. 140129	REVISED BY: RAP	

GIS Path: T:\projects_8\LittleSpokaneWaterBanking_140129\Delivered\Pend Oreille Water Source Technical Memorandum\03_BasinFill.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/25/2015 || User: mepin || Print Date: 6/25/2015

Soils (SSURGO)

- 19 *Blueslide silt loam*
- 20 *Bonner silt loam, 0 to 10 percent slopes*
- 21 *Bonner gravelly silt loam, 0 to 10 percent slopes*
- 22 *Borosaprists, ponded*
- 43 *Dufort silt loam, 0 to 15 percent slopes*
- 44 *Dufort very stony silt loam, 0 to 40 percent slopes*
- 51 *Hoodoo silt loam*
- 60 *Kaniksu sandy loam, 0 to 15 percent slopes*
- 61 *Kaniksu sandy loam, 15 to 40 percent slopes*
- 62 *Kegel loam*
- 77 *Mobate-Rock outcrop complex, 0 to 40 percent slopes*
- 78 *Mobate-Rock outcrop complex, 40 to 65 percent slopes*
- 79 *Moscow silt loam, 0 to 25 percent slopes*
- 80 *Moscow silt loam, 25 to 40 percent slopes*
- 81 *Moscow silt loam, 40 to 65 percent slopes*
- 83 *Moscow-Rock outcrop complex, 40 to 65 percent slopes*
- 97 *Orwig sandy loam, 0 to 20 percent slopes*
- 98 *Orwig sandy loam, 20 to 65 percent slopes*
- 99 *Pits*
- 109 *Rathdrum very fine sandy loam*
- 121 *Rock outcrop-Usk complex, 30 to 65 percent slopes*
- 125 *Sacheen loamy fine sand, 5 to 15 percent slopes*
- 126 *Sacheen loamy fine sand, 15 to 25 percent slopes*
- 129 *Scotia fine sandy loam, 7 to 15 percent slopes*
- 130 *Scotia fine sandy loam, 15 to 25 percent slopes*
- 134 *Skanid-Rock outcrop complex, 0 to 40 percent slopes*
- 145 *Typic Xerorthents, 30 to 65 percent slopes*
- 146 *Uncas muck*
- 148 *Usk loam, 0 to 20 percent slopes*
- 149 *Usk loam, 20 to 40 percent slopes*
- 151 *Usk stony loam, 0 to 40 percent slopes*
- 152 *Usk-Rock outcrop complex, 0 to 40 percent slopes*
- 163 *Water*

Soil Data Source: Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey Accessed June 2015.

Surface Water Supply Option

Groundwater Supply Option

Surface Discharge, Option-1

Surface Discharge, Option-2

City of Newport Wellfield

Pend Orielle River

PEND OREILLE (WRIA 62)

LITTLE SPOKANE (WRIA 55)

WASHINGTON

IDAHO

- Conveyance Pipeline, Option-2
- Surface Discharge Conveyance, Option-2
- Basin Divide
- Railway
- Parcel

N

0 2,000 4,000

Feet

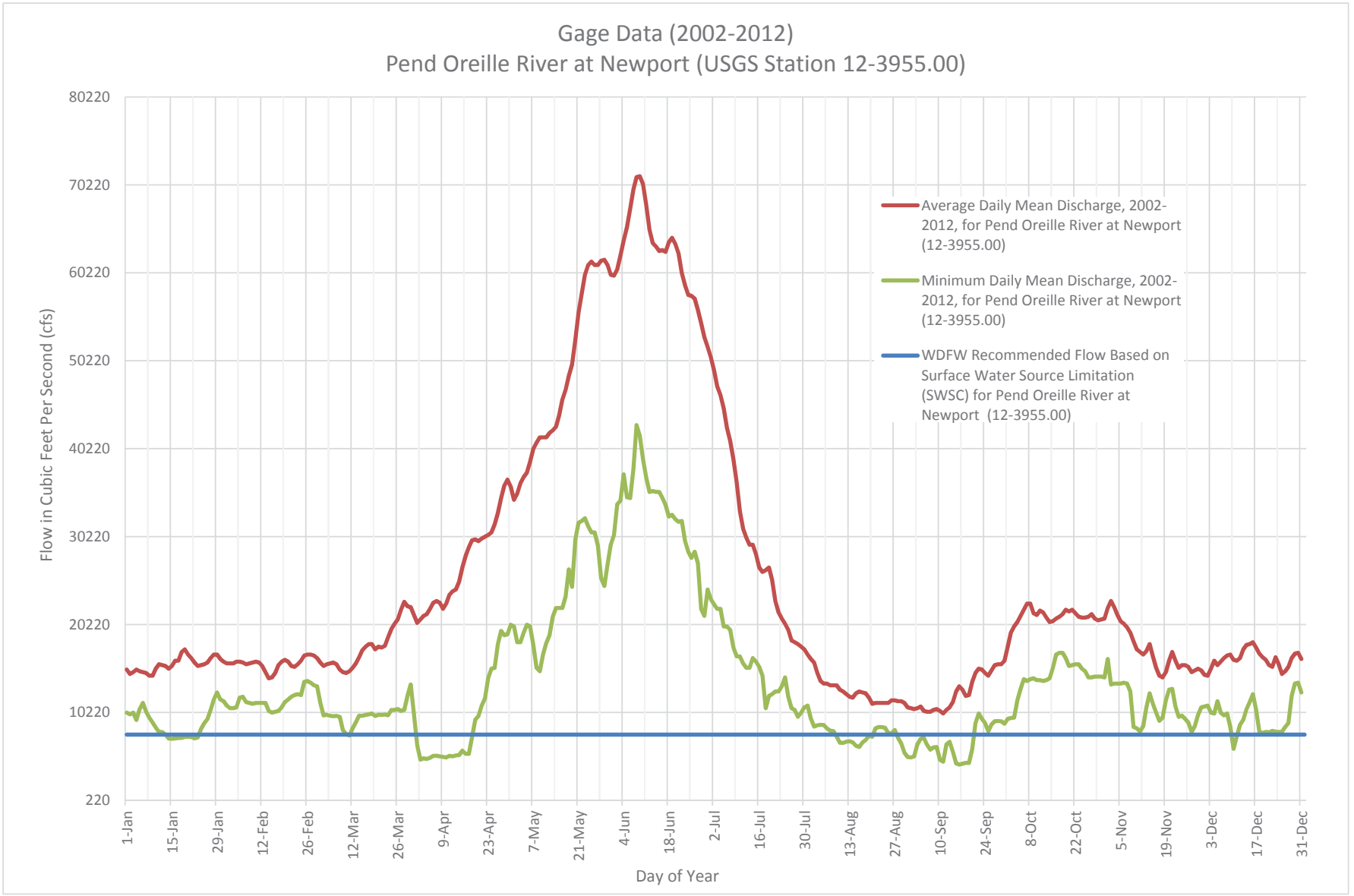
Soils

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect CONSULTING

JUN-2015	BY: JRB / EAC	FIGURE NO. 4
PROJECT NO. 140129	REVISED BY: RAP	

GIS Path: T:\projects_8\LittleSpokaneWaterBanking_140129\Delivered\Pend Oreille Water Source Technical Memorandum\04_Soils.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/25/2015 || User: rpeplin || Print Date: 6/25/2015

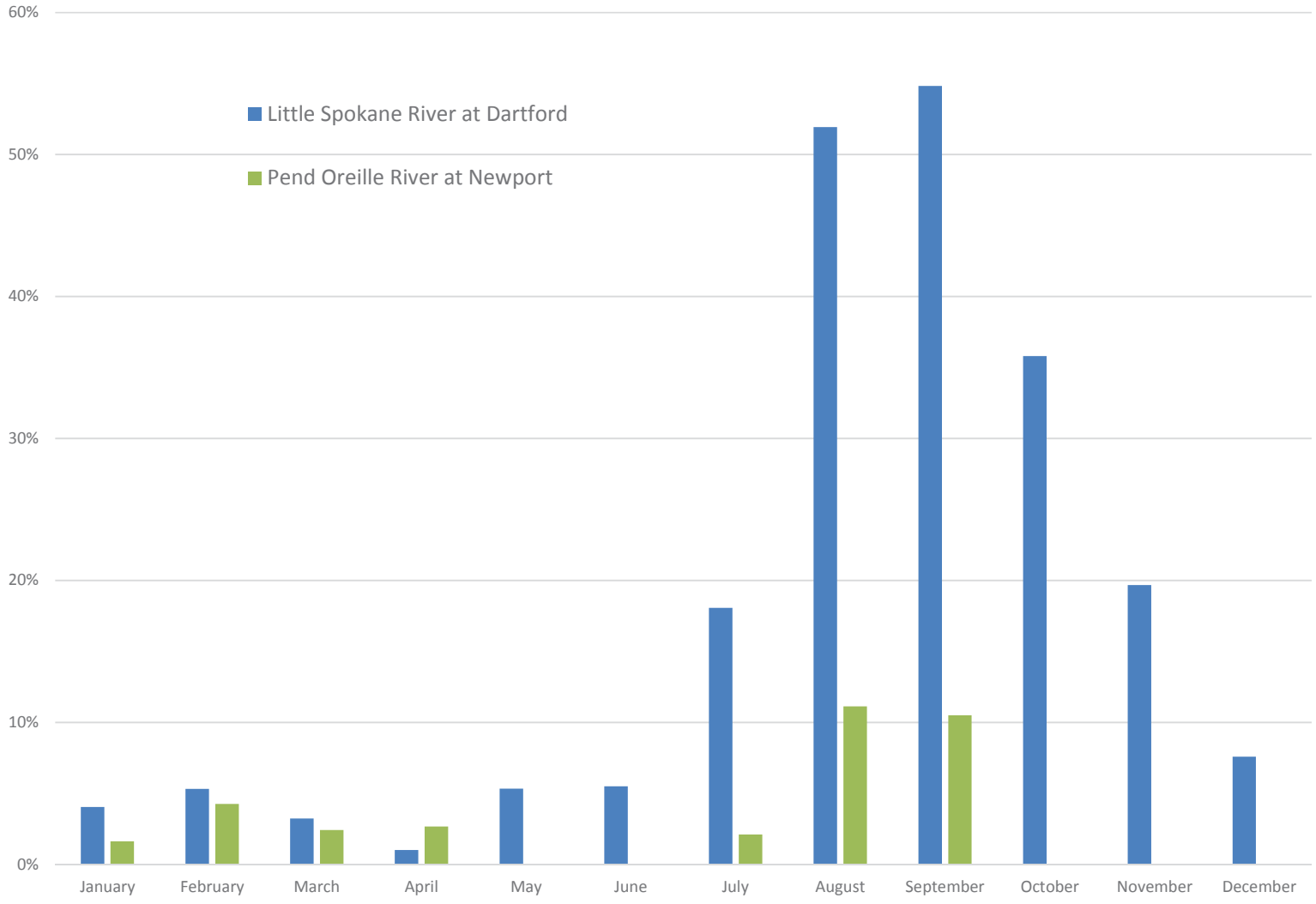


WDFW Recommended Flow vs. Gage Data (2002-2012)
Pend Oreille River at Newport

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect CONSULTING	JUN-2015	BY: CME / RAP	FIGURE NO. 5
	PROJECT NO. 140129	REVISED BY: ---	

GIS Path: T:\projects_8\Little&SpokaneWaterBanking_140129\Delivered\Pend Oreille Water Source Technical Memorandum\5 Curtailment Flow vs Gage Data.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || User: rpepin



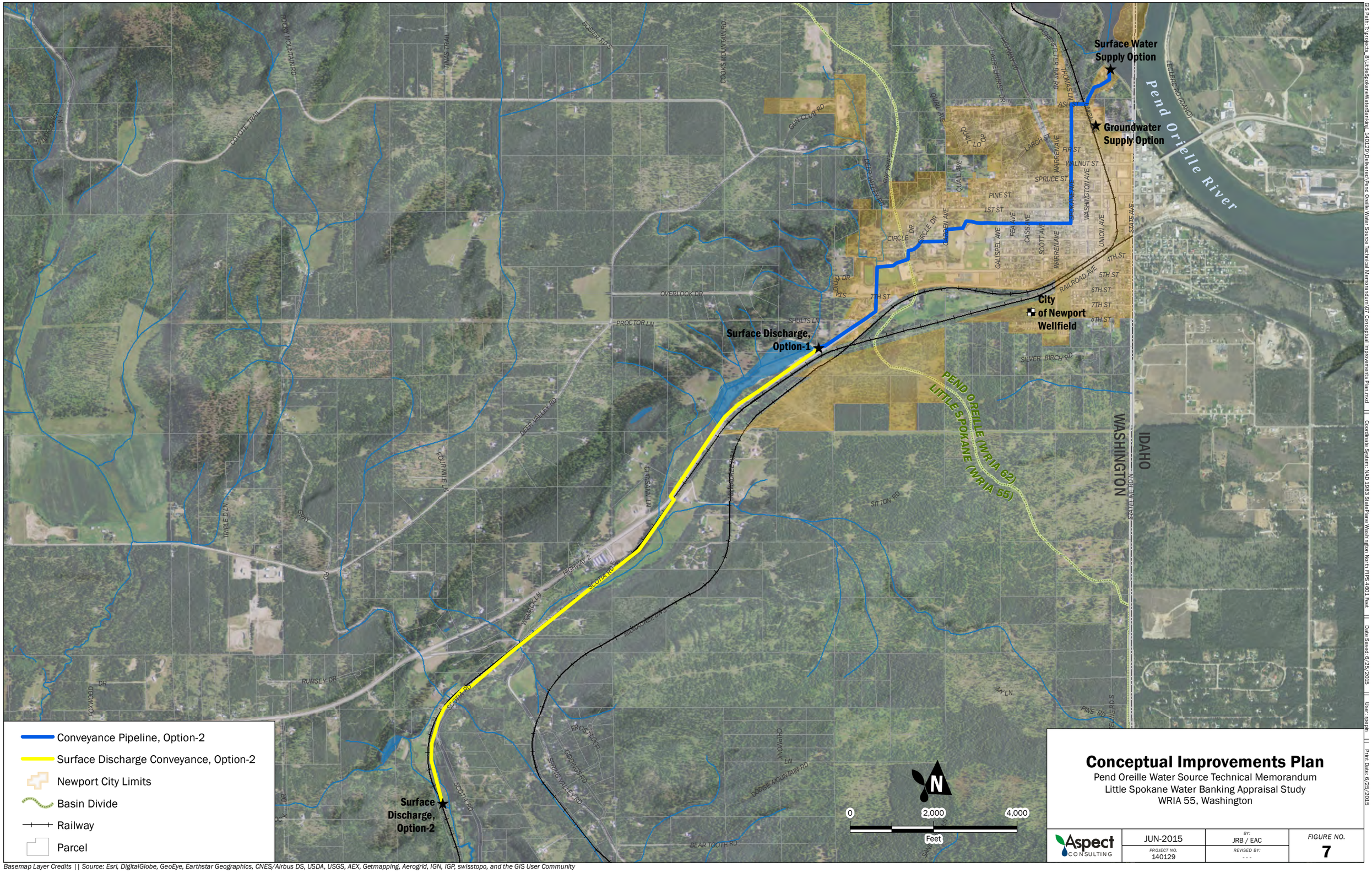
-Minimum instream flow range Little Spokane at Dartford = 115 to 250 cfs
-WDFW recommendation (SWSL) for Pend Oreille at Newport = 7,700 cfs

Note: Graph shows percentage of days in which a 7-day moving average of mean daily flow did not meet base flow/curtailment flow, 1993-2013

Frequency Below Base/Recommended Flows - Dartford and Newport

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect CONSULTING	JUN-2015	BY: CME / RAP	FIGURE NO. 6
	PROJECT NO. 140129	REVISED BY: ---	



Conceptual Improvements Plan

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect Consulting	JUN-2015	BY: JRB / EAC	FIGURE NO. 7
	PROJECT NO. 140129	REVISED BY: ---	

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

GIS Path: T:\projects_8\LittleSpokaneWaterBanking_140129\Deliverech\Pend Oreille Water Source Technical Memorandum\07 Conceptual Improvements Plan.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/25/2015 || User: rjeglin || Print Date: 6/25/2015

Figure 8 - System Performance Curves, Surface Water Alternatives

Project No. 140129, Pend Oreille Appraisal Study

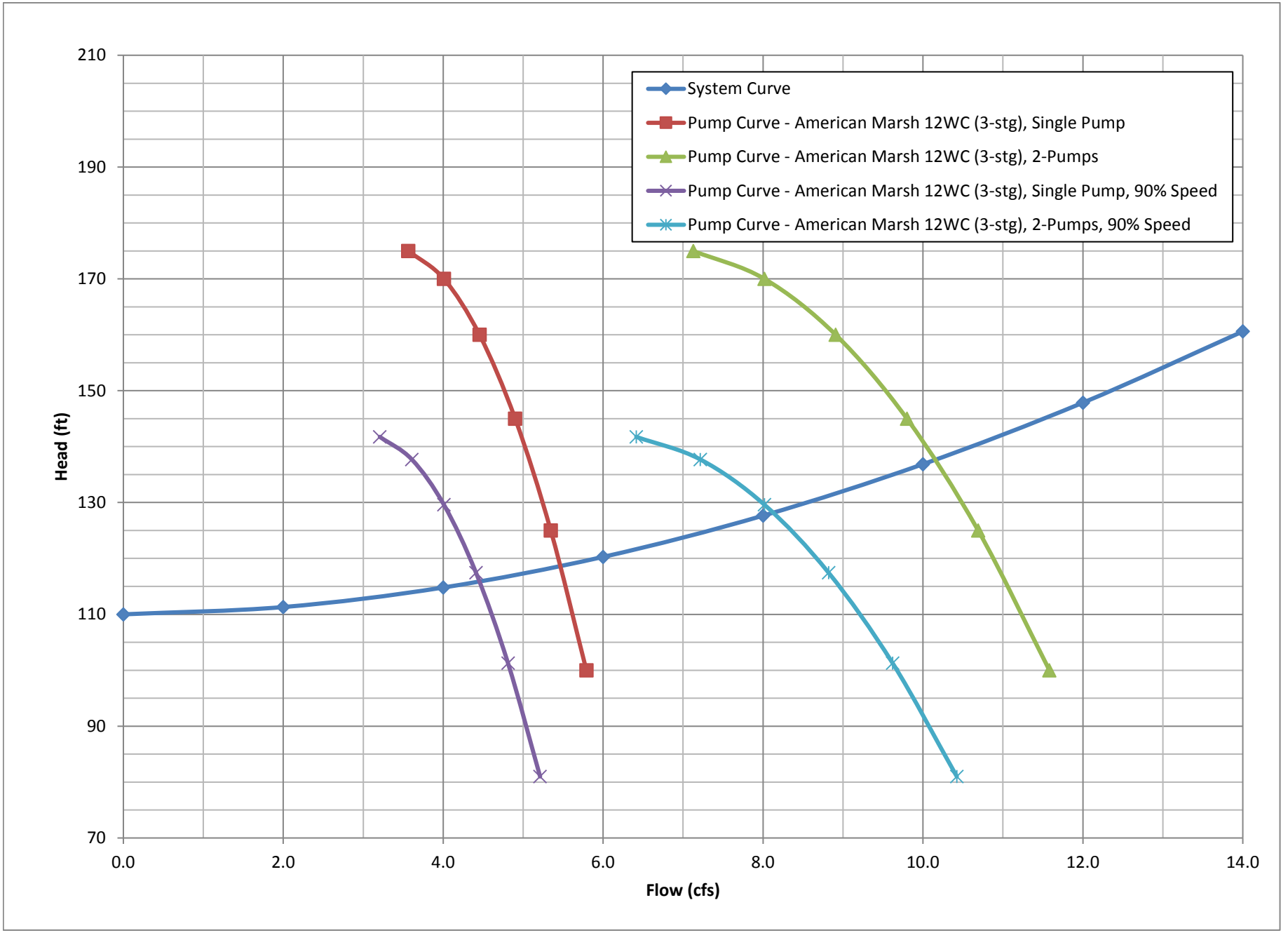
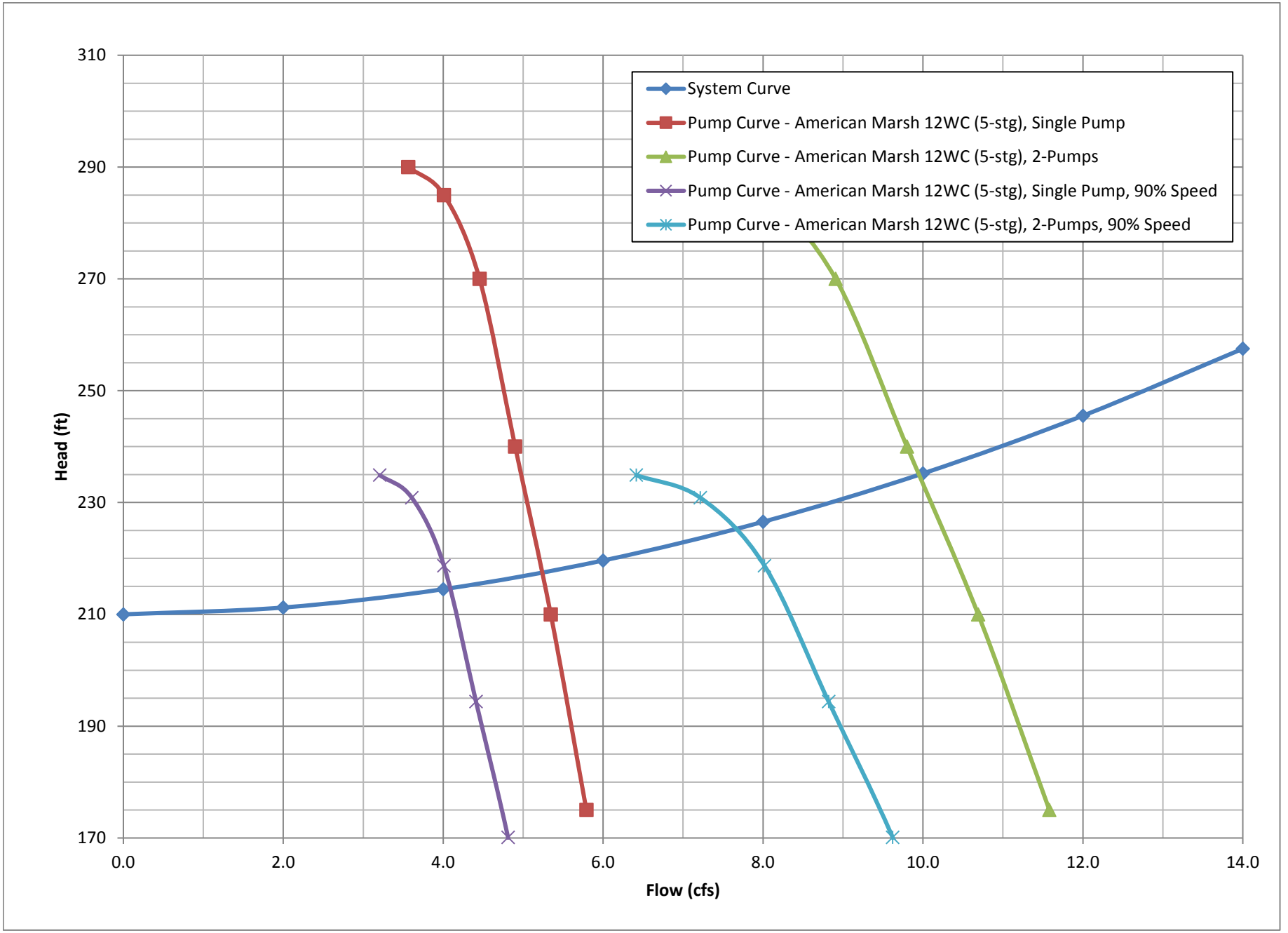


Figure 9 - System Performance Curves, Groundwater Alternatives

Project No. 140129, Pend Oreille Appraisal Study



Aspect Consulting

06/15/15

S:\Little Spokane Water Bank 140129\Report Drafts\Pend Oreille Inter Basin Transfer - Appraisal\Figures\Draft\Figures 8 and 9 - Pump Station Hydraulics.xlsx

Figure 9

System Performance Curves, Groundwater Alternatives

Attachment A

Site Photographs

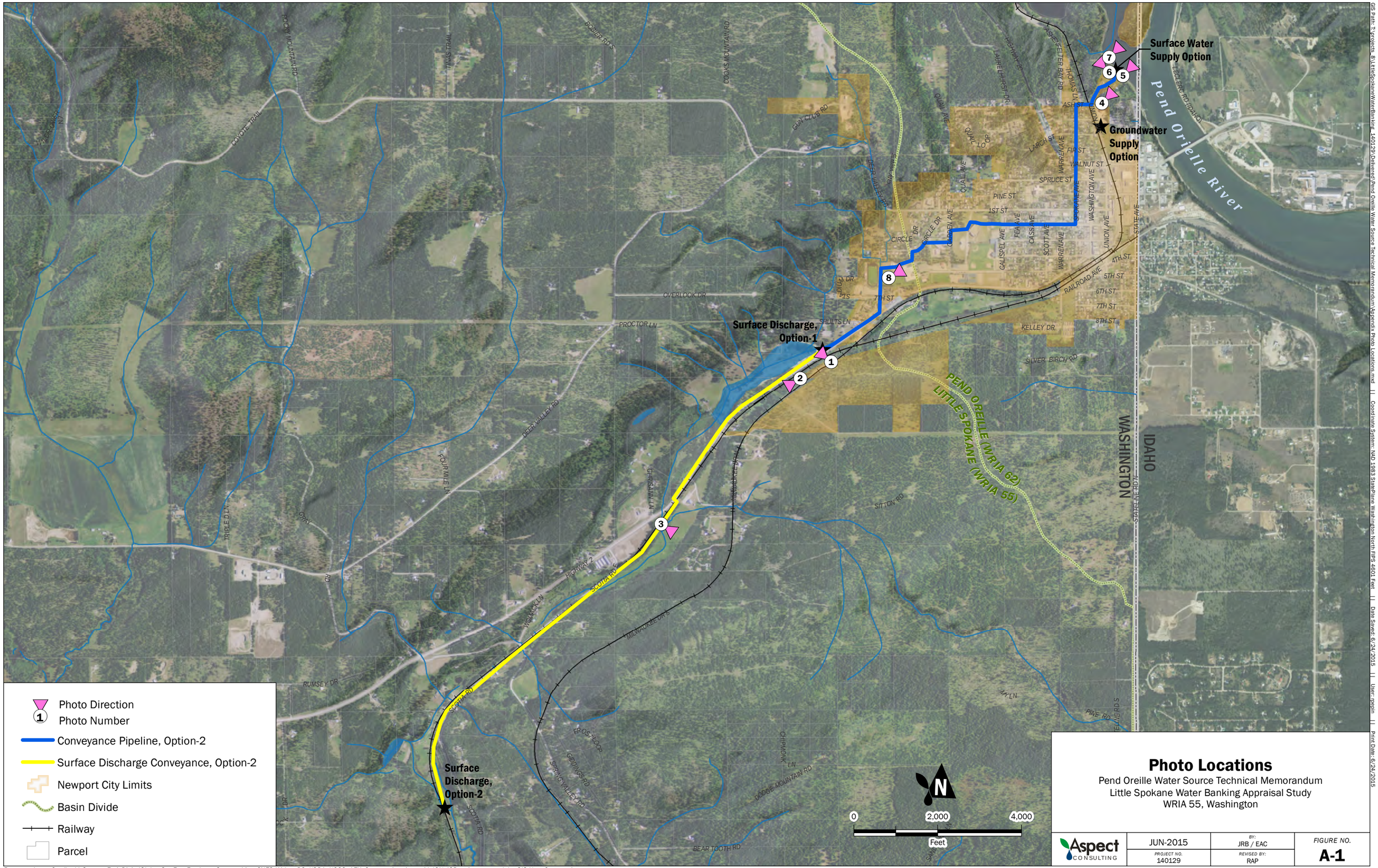


Photo Direction
Photo Number
Conveyance Pipeline, Option-2
Surface Discharge Conveyance, Option-2
Newport City Limits
Basin Divide
Railway
Parcel

Photo Locations

Pend Oreille Water Source Technical Memorandum
Little Spokane Water Banking Appraisal Study
WRIA 55, Washington

Aspect Consulting	JUN-2015	BY: JRB / EAC	FIGURE NO. A-1
	PROJECT NO. 140129	REVISED BY: RAP	

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

GIS Path: T:\projects_8\LittleSpokaneWaterBanking_140129\Delivered\Pend Oreille Water Source Technical Memorandum\Appendix Photo Locations.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/24/2015 || User: mepjn || Print Date: 6/24/2015

Photo 1- Wetland near Headwaters of Little Spokane River

Photo 2- View Looking Southwest along SR2 near Little Spokane Headwaters

Photo 3- Little Spokane River, South of US2 near Headwaters

Photo 4- City of Newport Wastewater Treatment Facility

Photo 5- Pend Oreille River at Proposed Surface Water Pump Station (Option)

Photo 6- Pend Oreille River at Proposed Surface Water Pump Station (View Looking Northwest)

Photo 7- Pend Oreille River at Proposed Surface Water Pump Station (View Looking Northwest)

Photo 8- View along Proposed Pipeline Alignment Near City of Newport Fairgrounds / Park

ATTACHMENT B

Ecology Well Logs

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No
Permit No.

(1) **OWNER:** Name Mr. Bing Bowerman Address Lazy Acres Trailer Court Box 351

(2) **LOCATION OF WELL:** County Pend Creille — NE ¼ SE ¼ Sec. 24 T. 31 N., R 45E W.M.

Bearing and distance from section or subdivision corner

(3) **PROPOSED USE:** Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (if more than one)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 8 inch inches.
Drilled 64 ft. Depth of completed well 61 ft.

(6) **CONSTRUCTION DETAILS:**

Casing installed: 8 " Diam. from plus2 ft. to 51 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson well screens
Type Stainless steel Model No.
Diam. 8 Slot size .040 from 51 ft. to 61 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) **PUMP:** Manufacturer's Name
Type: H.P.

(8) **WATER LEVELS:** Land-surface elevation above mean sea level 2200 ft.
Static level 12 ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: 150 gal./min. with Unk. ft. drawdown after hrs.
" Air Test " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 6/12/78
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) **WELL LOG:**

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Top Soil	0	3
Sandy clay W/some gravel & sand	3	19
Very course brown sand w/water	19	64
Alot of water at 35 feet		
200 150 Gallons Per Minute		

RECEIVED
JUL 12 1978
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started June 8, 19 78. Completed June 12, 19 78

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Uhlenkott Well Drilling (Person, firm, or corporation) (Type or print)

Address Route 1, Box 20, Fenn, Idhao 83531

[Signed] Ray Uhlenkott (Well Driller)

License No. (0768) Date July 3, 19 78

7/13/78 Newport 7½

USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No G3 26830

Permit No.

(1) OWNER: Name Mr. Bing Bowerman Address Lazy Acres Trailer Court Box 351

(2) LOCATION OF WELL: County Pend Oreille NE ¼ SE ¼ Sec 24 T 31 N, R 45E W.M.

Bearing and distance from section or subdivision corner WELL SOLD TO CITY BY BOWERMAN

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐
Irrigation XX Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (If more than one)
New well XX Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary XX Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 80 ft. Depth of completed well 67 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8 " Diam. from plus2 ft. to 56 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded XX " Diam. from ft. to ft.

Perforations: Yes ☐ No XX
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes XX No ☐
Manufacturer's Name Johnson Well Screen
Type Stainless Steel Model No
Diam. 8 Slot size .050 from 7.57 ft. to 67 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No XX Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes XX No ☐ To what depth? 20 ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No XX
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 2200 ft.
Static level 16 ft. below top of well Date 6/6/78
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No XX If yes, by whom?
Yield: 200 gal./min. with Unk. ft. drawdown after hrs.
" Air test " " "
" " " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 6/6/78
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No XX

(10) WELL LOG: WELL #d

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil (soft)	0	3
Sandy clay W/ some gravel	3	24
Grayish rock and sand (soft)	24	28
Very course sand W/some gravel	28	81
alot of water at the depth of 41 feet on. 200 G. P. M.		

RECEIVED
JUL 1 ; 1978
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started June 2, 1978 Completed June 6, 1978

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Uhlenkott Well Drilling (Person, firm, or corporation) (Type or print)

Address Route 1, Box 20 Fenn, Idaho 83533

[Signed] Roy Uhlenkott (Well Driller)

License No. 767 Date July 3, 1978

7/13/78 Newport 7½

(USE ADDITIONAL SHEETS IF NECESSARY)

Well #1 06173 UJ061831

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. [redacted]
UNIQUE WELL I.D. # ACC 601
Water Right Permit No.

(1) OWNER: Name City of Newport Address

(2) LOCATION OF WELL: County Pend Oreille NW 1/4 SE 1/4 Sec 24 T. 31 N., R 45E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address)

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☒ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☒ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8" inches. Drilled 85' feet. Depth of completed well 85' ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 8" Diam. from +1 ft. to 85 ft.
Welded ☒ Liner installed ☐ Threaded ☐ " Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Sand Gravel Clay	0	20
Sand clay layers	20	25
Sand clay layers	25	35
Sand + Clay	35	50
Clay + Sand	50	58
brown Sand, clay layers	58	85
No Water		

Work Started 7-2-95 19 Completed 7-7 19 95

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME [redacted] (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address [redacted]
(Signed) [redacted] (WELL DRILLER) License No. 393
Contractor's Registration No. [redacted] Date 7-22 19 95

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93)

11 #2

00156

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W067402

UNIQUE WELL I.D. # ACC602

Water Right Permit No. _____

(1) OWNER: Name City of Newport Address S 2nd Washington

(2) LOCATION OF WELL: County Pend Oreille NE 1/4 SE 1/4 Sec 24 T. 31 N., R. 45 E.W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) _____

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ ☒ Municipal
☐ Irrigation ☐ Test Well ☐ Other ☐
☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) _____
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8" inches.
Drilled 80 feet. Depth of completed well 80 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 8" Diam. from +1 ft. to 70' ft.
Welded ☒ _____ Diam. from _____ ft. to _____ ft.
Liner installed ☐ _____ Diam. from _____ ft. to _____ ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Telescoping Model No. _____
Diam. 8" Slot size 40 from 70 ft. to 75 ft.
Diam. 8" Slot size 40 from 75 ft. to 80 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
Type: _____ H.P. _____

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 21 ft. below top of well Date 7-18-95
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? _____
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

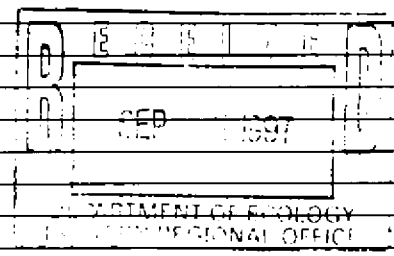
Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Sand, boulder	0	20
Sand Grayish Fine	21	28
Sand Brown	28	35
Sand coarse Brown	35	45
Sand Dirty Brown Fine	45	55
Sand brown clean	55	65
Sand Dirty	65	70
Sand Brown - clean	70	75
Sand Brown - Clean	75	80



Work Started 7-7 19. Completed 7-18 19 95

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Cascade Pump & Well (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address P.O. Box 145 Chattaroy Wash.

(Signed) _____ (WELL DRILLER) License No. 0393

Contractor's Registration No. CASCAPS052L Date 7-20 19 95

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * 1

Well "F"

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 95635

Water Right Permit No. _____

(1) OWNER: Name City of Newport Address S. 200 Washington Ave Newport WA.

(2) LOCATION OF WELL: County Pend Oreille NE ¼ SE ¼ Sec. 24 T. 31 N. R. 45 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) _____

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐ DeWater ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) Well "F"
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☒ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches. Drilled 82 feet. Depth of completed well 80 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 8" Diam from +1 ft. to 70 ft.
Welded ☒ Liner installed ☐ Threaded ☐ _____" Diam. from _____ ft. to _____ ft.
_____" Diam. from _____ ft. to _____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☒ No ☐ Manufacturer's Name Johnson
Type Telescope Model No. _____
Diam. 8" Slot size 60 from 70 ft. to 75 ft.
Diam. 8" Slot size 40 from 75 ft. to 80 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal _____
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name Berkley Pump Co.
Type: 733H 2STG Submersible Turbine H.P. 25

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 19 ft. below top of well Date 6-20-90
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? H2O Well Service
Yield: 75 gal./min. with 46.5 ft. drawdown after 4 hrs.
" " " " " " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

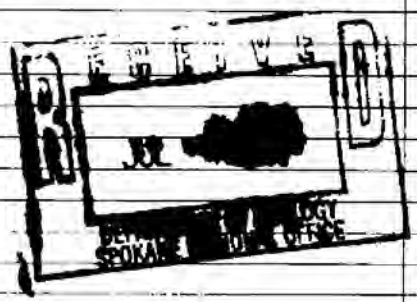
Time	Water Level	Time	Water Level	Time	Water Level
0	65'6"	3 MIN	24'	6 MIN	20'
1 MIN	38'	4 MIN	21'6"	7 MIN	20'
2 MIN	28'	5 MIN	20'	8 MIN	20'

Date of test 6/20/90
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water Cold Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown Sandy Soil	0	1
Brown Sand	1	20
Brown Sand & Gravel	20	45
Brown Sand Coarse	45	47
Brown Sand & Silt	47	70
Brown Sand Coarse	70	75
Brown Sand	75	80



Work started 6-11-90, 19. Completed 6-22, 1990

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME H2O Well Service Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 582 W Hayden Ave Hayden Id

(Signed) _____ (WELL DRILLER) License No. 0393

Contractor's Registration No. H2OWES158KB Date 6-22, 1990

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 060-1-20 (10/87) -1329-

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 9563

Water Right Permit No. _____

(1) **OWNER:** Name City of Newport Wa Address 5200 Washington St.

(2) **LOCATION OF WELL:** County Pondarille NE ¼ SE ¼ Sec 24 T. 31 N., R. 45 W.M.

(2a) **STREET ADDDRESS OF WELL** (or nearest address) _____

(3) **PROPOSED USE:** ☒ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) **TYPE OF WORK:** Owner's number of well (if more than one) Well "F"

Abandoned ☐ New well ☐ Method: Dug ☐ Bored ☐
Deepened ☒ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 8" inches.
Drilled 120 feet. Depth of completed well 80 ft.

(6) **CONSTRUCTION DETAILS:**

Casing installed: 8" Diam. from +3 ft. to 70 ft.
Welded ☒
Liner installed ☐ _____" Diam. from _____ ft. to _____ ft.
Threaded ☐ _____" Diam. from _____ ft. to _____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Telescope Model No. _____
Diam. 8" Slot size 60 from 70 ft. to 75 ft.
Diam. 8" Slot size 40 from 75 ft. to 80 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) **PUMP:** Manufacturer's Name —
Type: _____ H.P. _____

(8) **WATER LEVELS:** Land-surface elevation above mean sea level _____ ft.
Static level 19 ft. below top of well Date _____
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.))

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? _____
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes ☐ No ☐

(10) **WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION**

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Pulled Screen from	80'	70'
Redrilled 70 to 80		
Brown Sand	80	105
Decomposed Granite	105	120
Casing Pulled back		
to 80' and Screen		
Reset from 70'-80'		

RECEIVED
BY [redacted]
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE
Sept 28, 1990

Work started Aug 25, 1990 completed Aug 31, 1990

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME H2O well Service Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 582 W Hayden ave Hayden Idaho

(Signed) Earl Potts (WELL DRILLER) License No. 0393

Contractor's Registration No. H2OWCS158KB Date 9-20, 1990

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329- 3

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

al and First Copy with
nt of Ecology
Copy — Owner's Copy
Copy — Driller's Copy

#59350 DNS

WATER WELL REPORT

CITY OF NEWPORT STATE OF WASHINGTON

Application No. G3-26830
Permit No. ....

(1) OWNER: Name Mr. Bing Bowerman Address Lazy Acres Trailer Court Box 351

(2) LOCATION OF WELL: County Pend Oreille NE ¼ SE ¼ Sec. 24 T. 31 N., R. 45E W.M.

Bearing and distance from section or subdivision corner WELL SOLD TO CITY BY BOWERMAN

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 80 ft. Depth of completed well 67 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8 " Diam. from plus2 ft. to 56 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson Well Screen
Type Stainless Steel Model No.
Diam. 8 Slot size .050 from 7 57 ft. to 67 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 2200 ft.
Static level 16 ft. below top of well Date 6/6/78
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: 200 gal./min. with Unk. ft. drawdown after hrs.
" Air test " " "
" " " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 6/6/78
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG: WELL #d

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil (soft)	0	3
Sandy clay W/ some gravel	3	24
Grayish rock and sand (soft)	24	28
Very course sand W/some gravel	28	81
alot of water at the depth of 41 feet on. 200 G. P. M.		

RECEIVED
JUL 10
DEPT. OF ECOLOGY

NEWPORT, CITY OF PWS: 59350 SRC: 05
PEND OREILLE Long: -117.05234 Lat: 48.173216
Well Tag: AHC030

Work started June 2, 19 78 Completed June 6, 19 78

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Uhlenkott Well Drilling (Person, firm, or corporation) (Type or print)

Address Route 1, Box 20 Fenn, Idaho 83538

[Signed] (Well Driller)

License No. 767 Date July 3, 19 78

7/13/78 Newport T/c

USE ADDITIONAL SHEETS IF NECESSARY)

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 003425

Water Right Permit No. _____

(1) OWNER: Name City of Newport Address 5. 200 Washington Ave

(2) LOCATION OF WELL: County Pend Oreille NE ¼ SE ¼ Sec 24 T. 31 N. R. 45 E. W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) _____

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater ☐ Industrial ☐ Test Well ☑ Municipal ☐ Other

(4) TYPE OF WORK: Owner's number of well (if more than one) _____

Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10" inches.
Drilled 110 feet. Depth of completed well 105 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 10 " Diam. from +3 ft. to ~~105~~ 90 ft.
Welded ☒
Liner installed ☐ _____ " Diam. from _____ ft. to _____ ft.
Threaded ☐ _____ " Diam. from _____ ft. to _____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Telescope Model No Hi Q
Diam. 10" Slot size 30 from 90 ft. to 105 ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement + Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name Berkeley
Type: Submersible Turbine H.P. 25

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 21 ft. below top of well Date 1-17-90
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? H20
Yield: 123 gal./min. with 61 ft. drawdown after 5 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 1/23/90

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Gravel - Fill	0	1
Gray Clay	1	3
Brown Sand	3	10
Gray Sand & Clay	10	35
Brown Sand	35	110

RECEIVED
MAR - 6 1990
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 1-2-90 Completed 1-17 19 90

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME H20 well Service Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 502 W/ Hayden Ave Hayden Idaho

(Signed) Carl Putta (WELL DRILLER) License No 0393

Contractor's Registration No. H20wes158KB Date 1-22- 19 90

(USE ADDITIONAL SHEETS IF NECESSARY)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

ECY 050-1-20 (10/87) -1329- 3

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No
Permit No

(1) **OWNER:** Name John R. Posk Address General Delivery, Newport, WA 99156

(2) **LOCATION OF WELL:** County PEND OREILLE W½, E½ NW ¼ SE ¼ Sec. 24 T. 31 N., R. 45E W.M.
Bearing and distance from section or subdivision corner

(3) **PROPOSED USE:** Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (if more than one)....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 6 inches.
Drilled 190 ft. Depth of completed well 165 ft.

(6) **CONSTRUCTION DETAILS:**
Casing installed: 6 " Diam. from +1 ft. to 162 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type stainless steel Model No.
Diam. 5 Slot size .8 from 160 ft. to 165 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 40 ft.
Material used in seal bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) **PUMP:** Manufacturer's Name
Type: H.P.

(8) **WATER LEVELS:** Land-surface elevation above mean sea level.... ft.
Static level 130 ft. below top of well Date 9/24/85
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: 2½-3 gal./min. with ft. drawdown after hrs.
" ESTIMATED AIRLIFT " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Baller test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) **WELL LOG:**
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Sand & brown clay	0	35
Sand & cemented gravel	35	79
Clay, gray, hard	79	99
Clay, tan, hard	99	126
Sand, tan clay	126	160
Sand & gravel	160	190
NO PVC Liner Installed		
6" Drive shoe installed		

RECEIVED
OCT 3 1985
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 9/19, 19 85 Completed 9/24/, 19 85

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME PONDEROSA DRILLING & DEVELOPMENT INC.
(Person, firm, or corporation) (Type or print)

Address E. 6010 Broadway, Spokane, WA 99212

[Signed]
W. Scott Barratt (Well Driller)

License No. 0996 Date 9/24/, 19 85

10/3/85

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

WATER WELL REPORT

State of Washington Date Printed: **05-Feb-2007** Log No. **54906**

Construction / Decommission: Original Construction Notice of Intent #: 252943

Construction

PROPOSED USE: **DOMESTIC**

TYPE OF WORK: Owners's Well Number: (If more than one well) **1**

DEEPENED Method: **ROTARY**

DIMENSIONS: Diameter of well: **6** inches

Drilled **220** ft. Depth of completed well **220** ft.

CONSTRUCTION DETAILS:

Liner installed: **CASING**

5 " Dia from **210** ft. to **215** ft.

Casing installed **WELDED**

6 " Dia from **+2** ft. to **215** ft.

" Dia from ft. to ft.

" Dia from ft. to ft.

Perforations: **No** Used In:

Type of perforator used

SIZE of perforations in. by in.

Perforations from ft. to ft.

Perforations from ft. to ft.

Perforations from ft. to ft.

Screens: **Yes** K-Pac Location: 209

Manufacture's Name JOHNSON

Type: **SLOTTED** Model No **STAINLESS**

Diam. **5** slot size: **14** from **215** ft. to **220** ft.

Diam. slot size: from ft. to ft.

Gravel/Filter packed: **No** Size of Gravel

Material placed from ft. to ft.

Surface seal: **No** To what depth ft.

Seal method: Material used in seal **EXISTING**

Did any strata contain unusable water **No**

Type of water Depth of strata

Method of sealing strata off

PUMP: Manufacture's name

Type: H.P. **0**

WATER LEVELS: Land-surface elevation above mean sea level: **0** ft.

Static level **150** ft. below top of well Date **11/14/2006**

Artesian Pressure lbs per square inch Date

Artesian water controlled by

WELL TESTS: Drawdown is amount water level is lowered below static level.

Was a pump test made? **No** If yes, by whom

Yield: gal/min with ft drawdown after

Yield: gal/min with ft drawdown after

Yield: gal/min with ft drawdown after

Recovery data (time taken as zero when pump turned off)(water level measured from well top to water level

Time:	Water Level	Time:	Water Level	Time:	Water Level

Date of test:

Bailer test gal/min ft drawdown after hrs.

Air test **15** gal/min w/ stem set at **210** ft. for **1** hours

Artesian flow gpm Date

Temperature of water Was a chemical analysis made **No**

CURRENT

Notice of Intent No.: **W233950**

Unique Ecology Well I.D. No **APC728**

Water Right Permit Number:

OWNER: **POSK, JOHN**

OWNER ADD **P.O. BOX 556**

NEWPORT, WA 99156

Well Add: **406 SILVERBIRCH RD.**

City: **Newport, WA 99156** County: **Pend Oreille**

Location: **NW** 1/4 **SE** 1/4 Sec **24** T **31** R **45E** EW

Lat/Long: (s, t, r still REQUIRED) Lat Deg Lat Min/Sec

Long Deg Long Min/Se

Tax Parcel No.:

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure. Show thickness of aquifiers and the kind and nature of the material in each stratum penetrated. Show at least one entry for each change in formation.

Material	From	To
EXISTING WELL	**0**	**162**
COARSE SAND W/some GRAVEL W/WATER	**162**	**200**

RECEIVED
FEB 15 2007
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

Notes:

Work started **11/07/2006** Complete **11/14/2006**

WELL CONSTRUCTION CERTIFICATION:

I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Materials used and the information reported are true to my best knowledge and belief.

☑ Driller ☐ Engineer ☐ Trainee

Name: **FORREST TENNANT II** License No.: **2687**

Signature: 1933

If trainee, Licensed driller is: License No.:

Licensed Driller Signature

Drilling Company:

NAME: **FOGLE PUMP & SUPPLY, INC.** Shop: **AIRWAY HEI**

ADDRESS: **PO BOX 1450**

Airway Heights, WA 99001

Phone: **(509) 244-0846** Toll Free: **(888) 343-9355**

E-Mail: **andrea@foglepump.com**

FAX: **(509) 244-2875** WEB Site: **WWW.FOGLEPUMP.COM**

Contractor's Registration No.: **FOGLEPS095L4** Date Log Created: **12/20/200**

Attachment C

Detailed Cost Estimates

Table C1 - Preliminary Cost Estimate Summary

Project No 140129, Pend Oreille Diversion Appraisal Study, Newport WA

	Total Cost		Unit Cost	
	Capital Cost	**Annual O&M**	**Capital Cost (per ac-ft)**	**Annual O&M (per acre-foot)**
Alternative 1A	$17,725,000	$220,000	$2,450	$30
Alternative 1B	$21,475,000	$242,000	$2,970	$33
Alternative 2A	$14,965,000	$251,000	$2,070	$35
Alternative 2B	$19,841,000	$277,000	$2,740	$38

Table C2 - Preliminary Cost Estimate, Surface Water Pumping Alternatives

Project No 140129, Pend Oreille Diversion Appraisal Study, Newport WA

				Alternative 1A		Alternative 1B	
Item	**Description**	**Unit**	**Unit Cost**	**QTY**	**Total Cost**	**QTY**	**Total Cost**
1.0	**General**				**$1,190,000**		**$1,267,000**
1.1	Mobilization	LS	(variable)	1	$915,000	1	$1,132,000
1.2	TESC	LS	(variable)	1	$200,000	1	$35,000
1.3	Temporary Traffic Control	LS	$50,000	1	$75,000	1	$100,000
2.0	**Site Preparation / Demo**				**$100,000**		**$15,000**
2.1	Clearing and grubbing	AC	$5,000	20	$100,000	3	$15,000
3.0	**Surface Water Pump Station**				**$1,782,000**		**$1,782,000**
3.1	Structure Excavation, Export Offsite	CY	$50	500	$25,000	500	$25,000
3.2	Structure Excavation, Rock	CY	$100	100	$10,000	100	$10,000
3.3	Structure Excavation, Stockpile Onsite	CY	$40	200	$8,000	200	$8,000
3.4	Shoring / Trench Safety	SF	$20	2500	$50,000	2500	$50,000
3.5	Construction Dewatering	LS	$250,000	1	$250,000	1	$250,000
3.6	Import Bedding Material, Placement and Compaction	CY	$50	50	$2,500	50	$2,500
3.7	Backfill Material, Placement and Compaction	CY	$30	150	$4,500	150	$4,500
3.9	Wetwell Structural Concrete	CY	$1,500	50	$75,000	50	$75,000
3.10	Wetwell Appurtenances (Access Hatch, Ladder)	LS	$15,000	1	$15,000	1	$15,000
3.11	Check Valve	EA	$15,000	3	$45,000	3	$45,000
3.12	Intake Pipe	LF	$400	150	$60,000	150	$60,000
3.13	Screened intake	LS	$200,000	1	$200,000	1	$200,000
3.14	Screen Purge System	LS	$75,000	1	$75,000	1	$75,000
3.15	Internal Piping / Plumbing, Isolation Valves	LS	$120,000	1	$120,000	1	$120,000
3.16	Pumps	LS	$50,000	3	$150,000	3	$150,000
3.17	Floats, Switches, Automated Control	LS	$250,000	1	$250,000	1	$250,000
3.18	Flow Meter	LS	$8,000	1	$8,000	1	$8,000
3.19	Surge anticipator valve station	LS	$50,000	1	$50,000	1	$50,000
3.20	Electrical / Power Supply	LS	$250,000	1	$250,000	1	$250,000
3.21	Building Structure	SF	$250	180	$45,000	180	$45,000
3.22	24" Steel Discharge Pipe	LF	$300	100	$30,000	100	$30,000
3.23	Miscellaneous Appurtenances	LS	$50,000	1	$50,000	1	$50,000
3.24	Surface Restoration - Topsoil	CY	$35	200	$7,000	200	$7,000
3.25	Surface Restoration - Hydroseeding	SY	$1	1000	$1,000	1000	$1,000
3.26	Surface Restoration - Gravel Access	SY	$10	100	$1,000	100	$1,000
4.0	**Pipeline**				**$3,980,000**		**$7,760,000**
4.1	24" DI Pipeline - Unimproved Surface Restoration	LF	$240	5,500	$1,320,000	5,500	$1,320,000
4.2	24" DI Pipeline - Urban Roadway Corridor	LF	$270	6,000	$1,620,000	20,000	$5,400,000
4.3	24" DI Pipeline - Trenchless Construction	LF	$1,500	150	$225,000	150	$225,000
4.4	24" DI Pipeline - Gravel Surface Restoration	LF	$240	1,000	$240,000	1,000	$240,000
4.5	Relocation of Existing Utilities	LS	$500,000	1	$500,000	1	$500,000
4.6	Pipeline Appurtenances (Air-Valves, Blow-Offs, Etc.)	LS	$50,000	1	$50,000	1	$50,000
4.7	Stilling Well - Discharge Structure	LS	$25,000	1	$25,000	1	$25,000
5.0	**Little Spokane Channel Improvement**				**$1,650,000**		**$0**
5.1	Diversion and Care of Water	LS	$200,000	1	$200,000	0	$0
5.2	Culvert Replacement (SR2)	EA	$300,000	1	$300,000	0	$0
5.3	Culvert Replacement (Minor)	EA	$50,000	5	$250,000	0	$0
5.4	Excavate and Stabilize Channel	LF	$40	10,000	$400,000	0	$0
5.5	Project Headwater Flow Control and Automation	LS	$500,000	1	$500,000	0	$0
6.0	**Environmental Mitigation**				**$450,000**		**$500,000**
6.1	Habitat Improvements / Mitigation (5% Construction Cost)	LS	(variable)	1	$450,000	0	$500,000
	Direct Cost						
	Construction Subtotal				$9,152,000		$11,324,000
	Contingency			25%	$2,288,000	25%	$2,831,000
	Washington State Sales Tax			7.6%	$869,000	7.6%	$1,076,000
	Direct Cost Total				**$12,309,000**		**$15,231,000**
	Indirect Cost						
	Allowance for Easement / Property Acquisition			1%	$123,000	1%	$152,000
	Design Engineering, Project Survey			20%	$2,462,000	20%	$3,046,000
	Permitting			10%	$1,231,000	7%	$1,066,000
	Management / Administration			3%	$369,000	3%	$457,000
	Construction Oversight			10%	$1,231,000	10%	$1,523,000
	Indirect Cost Total				**$5,416,000**		**$6,244,000**
	Total Project Capital Costs				**$17,725,000**		**$21,475,000**

Table C3 - Preliminary Cost Estimate, Groundwater Pumping Alternative

Project No 140129, Pend Oreille Diversion Appraisal Study, Newport WA

				Alternative 2A		Alternative 2B	
Item	**Description**	**Unit**	**Unit Cost**	**QTY**	**Total Cost**	**QTY**	**Total Cost**
1.0	**General**				**$934,000**		**$1,146,000**
1.1	Mobilization	LS	(variable)	1	$789,000	1	$1,061,000
1.2	TESC	LS	(variable)	1	$95,000	1	$10,000
1.3	Temporary Traffic Control	LS	$50,000	1	$50,000	1	$75,000
2.0	**Site Preparation / Demo**				**$100,000**		**$5,000**
2.1	Clearing and grubbing	AC	$5,000	20	$100,000	1	$5,000
3.0	**Groundwater Well Source**				**$1,562,000**		**$1,562,000**
3.1	Drill Well (3-Wells, 500 ft each)	LF	$300	1500	$450,000	1500	$450,000
3.2	Well Casing	LF	$80	1500	$120,000	1500	$120,000
3.3	Install Telescoping Screen	LF	$300	300	$90,000	300	$90,000
3.4	Well Development, Disinfection, Pump Testing	LS	$10,000	1	$10,000	1	$10,000
3.5	Check Valve	EA	$15,000	3	$45,000	3	$45,000
3.6	Internal Piping / Plumbing, Isolation Valves	LS	$120,000	1	$120,000	1	$120,000
3.7	Pumps	EA	$45,000	3	$135,000	3	$135,000
3.8	Switches, Automated Control	LS	$250,000	1	$250,000	1	$250,000
3.9	Flow Meter	LS	$8,000	1	$8,000	1	$8,000
3.10	Electrical / Power Supply	LS	$200,000	1	$200,000	1	$200,000
3.11	Building Structure	SF	$250	180	$45,000	180	$45,000
3.12	24" Steel Discharge Pipe	LF	$300	100	$30,000	100	$30,000
3.13	Miscellaneous Appurtenances	LS	$50,000	1	$50,000	1	$50,000
3.14	Surface Restoration - Topsoil	CY	$35	200	$7,000	200	$7,000
3.15	Surface Restoration - Hydroseeding	SY	$1	1000	$1,000	1000	$1,000
3.16	Surface Restoration - Gravel Access	SY	$10	100	$1,000	100	$1,000
4.0	**Pipeline**				**$3,620,000**		**$7,400,000**
4.1	24" DI Pipeline - Unimproved Surface Restoration	LF	$240	4,000	$960,000	4,000	$960,000
4.2	24" DI Pipeline - Urban Roadway Corridor	LF	$270	6,000	$1,620,000	20,000	$5,400,000
4.3	24" DI Pipeline - Trenchless Construction	LF	$1,500	150	$225,000	150	$225,000
4.4	24" DI Pipeline - Gravel Surface Restoration	LF	$240	1,000	$240,000	1,000	$240,000
4.5	Relocation of Existing Utilities	LS	$500,000	1	$500,000	1	$500,000
4.6	Pipeline Appurtenances (Air-Valves, Blow-Offs, Etc.)	LS	$50,000	1	$50,000	1	$50,000
4.7	Stilling Well - Discharge Structure	LS	$25,000	1	$25,000	1	$25,000
5.0	**Little Spokane Channel Improvement**				**$1,300,000**		**$0**
5.1	Diversion and Care of Water	LS	$200,000	1	$200,000	0	$0
5.2	Culvert Replacement (SR2)	EA	$150,000	1	$150,000	0	$0
5.3	Culvert Replacement (Minor)	EA	$50,000	5	$250,000	0	$0
5.4	Excavate and Stabilize Channel	LF	$40	10,000	$400,000	0	$0
5.5	Project Headwater Flow Control and Automation	LS	$300,000	1	$300,000	0	$0
6.0	**Environmental Mitigation**				**$375,000**		**$500,000**
6.1	Habitat Improvements / Mitigation (5% Construction Cost)	LS	(variable)	1	$375,000	0	$500,000
	Direct Cost						
	Construction Subtotal				$7,891,000		$10,613,000
	Contingency			25%	$1,973,000	25%	$2,653,000
	Washington State Sales Tax			7.6%	$750,000	7.6%	$1,008,000
	Direct Cost Total				**$10,614,000**		**$14,274,000**
	Indirect Cost						
	Allowance for Easement / Property Acquisition			1%	$106,000	1%	$143,000
	Design Engineering, Project Survey			20%	$2,123,000	20%	$2,855,000
	Permitting			7%	$743,000	5%	$714,000
	Management / Administration			3%	$318,000	3%	$428,000
	Construction Oversight			10%	$1,061,000	10%	$1,427,000
	Indirect Cost Total				**$4,351,000**		**$5,567,000**
	Total Project Capital Costs				**$14,965,000**		**$19,841,000**

Table C4 - Preliminary Operations and Maintenance Estimate

Project No 140129, Pend Oreille Diversion Appraisal Study, Newport WA

	Mech / Elec Improvements	Fixed Improvements	Electrical Costs	Total Annual O&M
Alternative 1A	$89,000	$61,000	$70,000	$220,000
Alternative 1B	$89,000	$83,000	$70,000	$242,000
Alternative 2A	$78,000	$53,000	$120,000	$251,000
Alternative 2B	$78,000	$79,000	$120,000	$277,000