FHWA-ID-EIS-12-01-F

Hydrogeologic Technical Report

Final Environmental Impact Statement

US-95 Thorncreek Road to Moscow

Project No. DHP-NH-4110(156);Key No 09294

RHS Ralston Hydrologic Services, Inc.

GROUND WATER CONSULTING AND EDUCATION

1122 East B Street, Moscow, ID USA 83843

Voice 208 699 3989 FAX 208 882 3334 E-mail ralston@moscow.com

Hydrogeologic Analysis of Alternative Alignments of Highway 95 from Thorncreek to Moscow

Prepared for the Idaho Department of Transportation

Lewiston, Idaho

May, 2014

PROFESSIONAL ENGINEER REGISTERED 2004 5/2/14 STATE OF IDAHO DALE R. RALSTON

REGISTERED PROFESSIONAL GEOLOGIST DALE R. RALSTON 5/2/14 55 STATE OF IDAHO

INTRODUCTION

The purpose of this report is to describe the hydrogeologic conditions along the alternative routes for the reconstruction of U.S. Highway 95 immediately south of Moscow, Idaho. Figure 1 shows the three alternative routes that are included in the Draft Environmental Impact Statement (IDT, 2012). This report addresses possible ground-water quantity and quality impacts from highway construction and operation. This report was been prepared under a contract with the Idaho Department of Transportation.

The key to understanding ground-water conditions in any area is knowledge of the subsurface geology. Geologic information coupled with hydrogeologic knowledge from studies of similar rock types is used to formulate a hydrogeologic conceptual model. Geologic and hydrologic information obtained from well driller reports in the immediate area provide more detail for the hydrogeologic conceptual model. The finalized hydrogeologic conceptual model is used to assess potential impacts of road construction on ground water in the area.

The sections of this report follow the development of the hydrogeologic conceptual model as described above. The sections following this introduction are: 1) geologic setting, 2) hydrogeologic setting, 3) well development, 4) analysis of potential ground-water impacts on and from highway construction and 5) conclusions.

GEOLOGIC SETTING

Most of the general project area (Figure 2) is underlain by granite (Kgr) based on two geologic maps published by the Idaho Geological Survey (Bush and others, 1998; Bush and others, 2000). Basalt (Tpr) is present near the western and northern boundaries of the area and an outcrop of metaphoric rocks (pCqt) occurs in the northern portion of the area. The following is a description of the geologic units that underlie soil within the project area.

- Granite (Kgr) and metamorphic rocks (pCqt) underlie the uplands area and have similar hydrogeologic characteristics. The slight variation in the pink color for Kgr on Figure 2 occurs because the figure was constructed by combining two geologic maps. The metamorphic rocks (pCqt) outcrop in the northern portion of the project area on a feature locally known as Clyde Hill.
- The Priest Rapids member of the Wanapum Formation of the Columbia River Basalt Group (Tpr) is present near the western and northern boundaries of the project area.
- There is a small area in the west central portion of the project area where older sediments, called the sediments of Bovill (Tsb), are present.
- Younger stream-deposited sediments (Qac), shown in yellow on Figure 2, are present in valley areas throughout the project area. These valley deposits are very narrow in the upland areas and widen to the west and north within the floodplain areas.

A comparison of Figures 1 and 2 show the following for the three alternative routes for Highway 95.

- The eastern route (E2) is underlain mostly by granite (Kgr) with short sections where the roadway crosses narrow valleys underlain by alluvium/colluvium (Qac). The northern end of route E2 overlies basalt (Tpr) and alluvium/colluvium (Qac).
- The central route (C-3) is underlain mostly by granite (Kgr) but with alluvium/colluvium (Qac) along the present alignment of Highway 95 north of Reisenauer Hill and in narrow valleys. In addition, route C-3 crosses a valley which is underlain by the older sediments (Tsb).
- The western route (W-4) is underlain by granite (Kgr) and alluvium/colluvium along the present alignment of Highway 95 in the southern portion of the route, basalt (Tpr) in the central portion of the route and a combination of granite (Kgr) and metamorphic rocks (pCqt) in the northern section. The route is underlain by basalt (Tpr) and alluvium/colluvium (Qac) at the northern end just before the junction with the existing Highway 95.

HYDROGEOLOGIC SETTING

The hydrogeologic analysis is based on describing ground-water systems that are typical to each of the geologic environments and supplementing this information with data obtained from well driller reports from the immediate vicinity of the project area.

Granitic Environments

Granite is formed below the earth's crust when molten volcanic rock flows up from deep in the earth but does not reach land surface. The slow cooling of the rock below land surface results in the crystalline structure of the granite. Later erosion of the overlying material can leave the granite exposed at land surface.

A well constructed in an area underlain by granite typically intercepts the following sequence of material. After drilling through soil, the well penetrates weathered granite that is often logged as clay. The degree of weathering decreases with depth and the next notation on many well driller logs is alternating zones of soft and hard granite. The soft zones are where weathering has occurred down fracture zones. The hard zones are where few fractures are present. Hard granite generally is logged below this depth with notations where fractures are encountered. The number of fracture zones generally decrease with depth.

Wells typically obtain water from one or more of three water producing intervals that are typical of granitic environments. First, some shallow wells obtain water from near the bottom of the weathered zone where weathering has progressed to produce sand-like material rather than the end result of weathering which is clay. Second, some wells obtain water from weathering along fractured zones. The driller typically describes these areas as alternating hard and soft zones. In some areas, weathering occurs along a fracture zone approximately parallel to land surface at a depth of 100 to 200 feet. This zone may be the result of "unloading" of the weight of the material overlying the granite as erosion exposes it at land surface. Deeper wells obtain water from isolated fracture zones that have little weathering products, generally at depths greater than about 200 feet.

The yields to wells completed in granite generally are low, less than 5 gpm (gallons per minute). The well yields reported by drillers on reports submitted to the Idaho Department of Water Resources (IDWR) are, in most cases, much greater than can be produced by a pump over a long time period. Wells completed in granite that yield more than 10 gpm for extended periods of time are rare.

Metamorphic Rock Environments

The metamorphic rocks in the vicinity of the Highway 95 alternative alignments originated as sediments deposited in a shallow ocean that covered much of what is now the western United States. Over long periods of time these sediments became consolidated rocks; sand zones became sandstones and silt layers became siltstones. The temperature and pressure associated with deep burial of these sedimentary rocks caused them to become metamorphic rocks. Sandstone layers became quartzite and siltstones became gneiss or schist. Bush and others (1998) indicate that metamorphic rocks that outcrop in the general project area are mostly composed of quartzite.

The yields of wells completed in metamorphic rocks in northern Idaho are low to very low, similar to those obtained from wells completed in granitic rocks. Wells generally obtain water either from zones less than 150 feet deep where the rock has been weathered or deeper zones where fractures are intercepted by the borehole.

Basalt Environments

A large number of individual basalt flows inundated or lapped against the pre-existing topography in the Columbia Basin of Eastern Washington and northern Idaho. Individual basalt flows range in thickness from less than 50 feet to more than 200 feet. Water producing zones occur along the top of the underlying basalt flow and the bottom of the overlying basalt flow. This flow contact zone is more fractured and thus has higher hydraulic conductivity than the dense interiors of flows. The basalt flows tend to be approximately horizontal in most areas of northern Idaho and eastern Washington. Zones of sediments (sand, silt and clay) are present between some of the flows and represent stream/lake deposits in the long periods of time (thousands to millions of years) between eruptive events.

Basalt in the vicinity of the Highway 95 alternative alignments is present where it laps onto the older granitic rock along the western and northern portions of the area. The basalt shown on Figure 2 is identified as Tpr which means it is the Priest Rapids member of the Wanapum Formation of the Columbia River basalt group. The Priest Rapids flows generally are the uppermost basalt unit in the general Moscow area. Basalt of the Grande Ronde Formation underlies the Wanapum Formation in the Moscow/Pullman area. The contact between the basalt and the underlying basement rocks (granitic or metamorphic) occurs at a depth of about 1,500 feet under Moscow. The contact between the basalt and interbedded sediment and the underlying granite along the western and northern portions of the project area likely is at a depth of less than 300 feet.

The upper aquifer in the Moscow area occurs in the Wanapum Formation and the lower aquifer occurs in the Grande Ronde Formation (TerraGraphics and Ralston, 2011). The maximum yield of wells completed in the upper aquifer in the City of Moscow is about 1,000 gpm. However, most of the wells are for domestic purposes and are pumped at rates less than 30 gpm. All of the wells completed in the lower aquifer in the Moscow area are owned either by the city or the University of Idaho. The yields of these wells are large, some exceeding 2,500 gpm.

Older Sediments

The older sediments, named the sediments of Bovill, were deposited about the same time as the Priest Rapids Member of the Wanapum Formation (the uppermost basalt unit). Bush and others (1998, page 1) describe this unit as follows. "The sediments of Bovill are dominated by clays with minor lenses of silt, sand and gravel." The high clay content generally means that the hydraulic conductivity of this unit is low. Only a few wells are completed in this unit in the general Moscow area and the yields of these wells are low.

Alluvium/Colluvium

The younger sediments, termed alluvium/colluvium, are present in valleys in the granitic areas and overlying basalt in the western and northern portions of the general project area. In most of the area, these sediments are thin (less than 40 feet) and are not targets for well development. The sediments tend to have high silt content and have low hydraulic conductivity.

Ground-water Flow systems

A ground-water flow system consists of a recharge area, an area where ground-water flow is dominantly horizontal and a discharge area. The recharge area typically is near a topographic high and the discharge area typically is near a topographic low.

Ground-water flow systems are categorized based on their length. Local ground-water systems exist in the loess of the Palouse hills where recharge occurs where a snowdrift is formed on a ridge and discharge occurs in the form of seeps in the adjacent valley. Tile drains have been installed in many of the farm fields to alleviate farming problems caused by these local ground-water flow systems. Small springs and seeps also discharge from local ground-water flow systems in the portions of the general project area that are underlain by granite and metamorphic rock. Most of these springs flow for a few months in the spring and then dry up. This type of discharge pattern is typical of a local ground-water flow system.

Regional ground-water flow systems have a considerable distance between the recharge area and the discharge area. The lower aquifer within the Grande Ronde Formation of the Columbia River Basalt group fits this category. Most of the recharge occurs as downward flow from the upper aquifer within the Wanapum Formation in eastern Washington and northern Idaho. The discharge from this regional ground-water flow system is believed to occur near the center of the Columbia Basin in central Washington. Springs that discharge from regional ground-water flow systems typically have near constant flow year around and often have elevated water temperature.

Intermediate ground-water flow systems include everything between local and regional systems. The distance between recharge and discharge areas can be as small as several miles and as large as tens to hundreds of miles. Springs that discharge from intermediate ground-water flow systems typically flow year around with greater discharge in the spring and early summer and lower flow in the fall and winter.

The hydrogeologic setting controls whether local, intermediate or regional ground-water flow systems are present. Local ground-water systems predominate in areas where the hydraulic conductivity of the subsurface material is low and there is considerable topography. Areas underlain by granitic and/or metamorphic rocks tend to have mostly local ground-water flow systems. Areas underlain by basalt are much more likely to have intermediate or regional ground-water flow systems mostly because the hydraulic conductivity of the rocks hundreds of feet below land surface can be high. The general project area for Highway 95 construction is underlain mostly by local ground-water flow systems with longer flow systems present only in the areas underlain by basalt.

WELL DEVELOPMENT

The IDWR website provides access to well driller reports for wells constructed in the vicinity of the general project area. Table 1 provides information on the 94 wells that have listed locations in the following sections: T38N R5W, sections 5,6,7 and 8; T38N R6W sections 1 and 12; T39N R5W, sections 19, 20, 29, 30, 31 and 32; and T39N R6W sections 24, 25 and 36. The number of wells in each section is given on Figure 3. Note that the large number of wells in section 30 of T39N R5W results from development of a subdivision n this area with one well per lot. The owner is listed as Germer for 27 wells on Table 1. Also, note that some of the well driller reports are for deepening of an existing well. Thus, the total number of wells with reports on file with IDWR in the above listed sections is less than 94. However, there likely are wells in the listed sections for which no report was filed with the state.

The following is a summary of the information gained from the well driller reports.

- The listed use of all of the wells is domestic.
- The wells range in depth from 60 to 650 feet with an average depth of 267 feet.
- About 55 percent of the wells that report casing diameter have 6-inch with the remainder reported 8-inch diameter casing. These casing diameters are typical for domestic wells.
- The reported yield ranged from less than 1 gpm to 200 gpm with the majority of wells having a reported yield of 5 gpm or less. Again, the yields reported on well driller reports are generally more than twice what can be pumped from the well for normal domestic use.

- In most cases, drilling the well was terminated when a significant water-producing interval was penetrated. Thus, the well depths are an indicator of the depth to the uppermost aquifer that supplies enough water for domestic uses.

The geologic information provided on the well driller's reports for most of the wells describes the subsurface material as granite. Except for the "Germer" wells, the geologic information provided on the well driller reports fits with the locations of the wells and the mapped geologic units. The "Germer" wells (T39N R5W section 30) should penetrate metamorphic rock (quartzite) based on the geologic map. The driller's report for all of these wells describes the material as granite.

The Priest Rapids member of the Wanapum Formation of the Columbia River Basalt Group is mapped in the subsurface in Sections 24, 25 and 36 of T39N R6W and sections 19 and 20 of T39N R5W. An examination of the well driller's reports for these sections yields the following information.

- Several of the wells in section T39N R6W section 25 penetrated basalt. One well penetrates basalt in the depth range of 34 to 186 feet but was completed to obtain water from an underlying sand layer. A second well penetrated basalt from 21 to the bottom of the well at 125 feet and obtained water from the basalt. The remaining two wells in section 25 and the one well is section 36 of T39N R6W did not penetrate basalt.
- As would be expected, some of the wells drilled in the upper tier of sections (T39N R5W sections 19 and 20 and T39N R6W section 24) shown on figure 3 penetrate basalt. Four of the five wells in section 24 penetrated basalt in the depth range of 94 to 143 feet, 8 to 74 feet, 16 to 58 feet and 9 to 96 feet. Water was obtained from basalt in two of these wells. All of the wells in section 19 penetrated basalt. The depth ranges of basalt are 38 to 105 feet, 56 to 103 feet, 19 to 80 feet, 57 to 60 feet, 58 to 78 feet and 55 to 85 feet. The basalt was the source of water for all of these wells.

None of the wells for which well driller's reports are available were completed to obtain water from either the younger sediments (alluvium/colluvium) or the older sediments of Bovill. The shallow wells (less than 100 feet) were completed to obtain water from either basalt in the northern tier of sections or from granite near the southern end of the project.

ANALYSIS OF THE POTENTIAL FOR GROUND-WATER IMPACTS ASSOCIATED WITH HIGHWAY CONSTRUCTION

Construction of Highway 95 along any of the three alternative alignments has the potential to impact ground-water resources in two ways: 1) altering recharge areas and the quantity and/or quality of water that is recharged; and 2) altering discharge areas and the quantity and/or quality of the water that is discharged. Highway construction activities will not extend deep enough to alter lateral ground-water flow within any of the consolidated rock units (basalt, granite or metamorphic rocks) or sedimentary material layered within these units.

The local ground-water flow systems in granitic and metamorphic likely receive recharge from snow melt and direct precipitation over the outcrop area. The highest rate of recharge probably occurs in snow drift areas and along stream channels. Ground-water recharge occurs only when the amount of water infiltrated exceeds the soil moisture storage capacity. Thus, a summer rainfall event likely will not result in ground-water recharge whereas a spring snowmelt event likely will result in recharge to the ground-water system.

Construction of Highway 95 along any of the three proposed alignments will result in essentially no infiltration and ground-water recharge in the paved area but runoff from the pavement will result in an enhanced potential for recharge along the edge of the pavement. Snow accumulations along the edge of the pavement from plowing will also create an enhanced potential for recharge. The magnitude of changes in ground-water recharge caused by construction of the highway will be non-detectable because the impacted area is only a small percentage of the total recharge area. I do not believe there will be any ground-water quality impacts associated with runoff from the pavement for two reasons: 1) the amount of recharge from pavement runoff will be very small because the pavement is only a small percentage of the total recharge area; and 2) the aquifers generally are more than 100 feet below land surface and have very limited hydraulic connection with land surface along the roadway. Recharge from channels of intermittent streams will not be significantly impacted because the streams would be routed under the highway either in culverts or under bridges. The length of the culverts would be a very small percentage of the length of the stream channel.

Construction of Highway 95 along any of the three proposed alignments has very little potential to impact ground-water discharge areas. Most of the three road alignments are underlain by granitic or metamorphic rocks. Discharge areas for local ground-water flow systems that occur in these rock types typically occur in topographically low areas. The highway in these areas would be elevated above present topography. The construction of the highway on fill over a local ground-water discharge area would have no impact except possibly moving the seep or wet areas from under the fill to adjacent to the toe of the fill. This would not result in a change in the quantity or quality of the water that is discharged. I conclude that the construction of the highway on fill and/or bridges in valleys would have non-detectable impacts on the discharge from local ground-water flow systems in the underlying sediment (Qal or Tsb) or underlying bedrock. Highway cuts should not impact ground-water discharge because the cuts would occur on topographic highs.

CONCLUSIONS

Granite underlies most of the length of the proposed alternative routes of Highway 95 south of Moscow. The western alignment alternative (W-4) has the greatest length of roadway that overlies basalt. All three alternatives overlie basalt at the northern end of the project.

Most of the existing wells in the area are completed to obtain water from local ground-water flow systems in granitic or metamorphic rock. Most of these wells exceed 100 feet in depth and obtain water from a producing zone at the bottom of the well. Wells that are completed in basalt are located mostly at the north end of the project. These wells obtain water from the Wanapum Formation which hosts the upper aquifer in the Moscow area.

The potential for highway construction along any of the three alignments to impact ground-water flow systems in either recharge and discharge areas is very low. Highway construction has the potential to increase recharge to shallow ground-water because of runoff from paved areas and snow drifts created by plowing. The amount of this increase will be very small. Water quality impacts on aquifers used for water supply from the changed recharge pattern will be non-detectable mostly because the change in recharge will be very small. Ground-water quality or quantity impacts from highway construction on topographically low ground-water discharge areas will be non-detectable. These portions of the roadway will be constructed on fill or using bridges and, at most, will only result in a small change in location of discharge from local ground-water flow systems. The potential for impacts on domestic wells is extremely small except for those wells which will be destroyed because they are located within the selected road alignment.

REFERENCES CITED

Bush, J.H., J.L. Pierce and G.N. Potter, 2000, Geologic Map of the Moscow East Quadrangle, Latah County, Idaho: Idaho Geological Survey Geologic Map 27.

Bush, J.H., A.P. Provant and S.W. Gill, 1998, Geologic Map of the Moscow West Quadrangle, Latah County, Idaho and Whitman County, Washington, Idaho Geological Survey Geologic Map 23.

Idaho Department of Transportation, 2012, Draft Environmental Impact Statement (DEIS) and Section 4(f) Evaluation US-95 Thorncreek Road to Moscow: Idaho Department of Transportation.

TerraGraphics Environmental Engineering and Ralston Hydrologic Services, 2011, Palouse Ground Water Basin Framework Project Final Report; Prepared for the Palouse Conservation District.

Table 1 Information on Wells from IDWR Website

Owner	Use	TWP	RNG	SEC	Yield (gpm)	Water Level (ft)	Depth (ft)	Well Dia. (in)	Construction Date
DUMROESE	Domestic	38N	05W	5	7	166	300	6	10/16/1991
BIEKER	Domestic	38N	05W	5	4	21	130	8	9/27/1991
CLYDE	Domestic	38N	05W	5	2.6	12	181	6	7/2/1991
CARCICH	Domestic	38N	05W	5	8	144	400	6	6/7/2007
ESPY	Domestic	38N	05W	6	8	164	400	6	3/2/1998
ESPY	Domestic	38N	05W	6	9	34	150	6	1/15/1998
REDINGER	Domestic	38N	05W	7	12	4	88	8	8/9/1998
BLILER	Domestic	38N	05W	8	5	84	261	8	4/5/1998
SMITH	Domestic	38N	05W	8	15	50	254	8	7/2/1996
FUNKE	Domestic	38N	05W	8	18	80	463	8	8/19/1997
FUNKE	Domestic	38N	05W	8	1	80	350	8	6/24/1997
MILLER	Domestic	38N	05W	8	1	7	205	8	8/22/1995
SNOW	Domestic	38N	05W	8	6	10	78	8	9/20/1979
SNOW	Domestic	38N	05W	8	1.25	50	192	8	9/26/1979
BENSON	Domestic	38N	05W	8	5	14	255	8	6/11/1992
BENSON	Domestic	38N	05W	8	5	100	365	8	6/20/1996
BINDL	Domestic	38N	06W	12	12	27	230	8	8/13/1992
GULICK	Domestic	39N	05W	19	6	20	85		9/26/1987
GULICK	Domestic	39N	05W	19	6	20	85	6	9/26/1987
JUDD & BEST	Domestic	39N	05W	19	25	29	72	8	7/22/2002
LOOMIS	Domestic	39N	05W	19	40	10	60	8	10/11/1967
CLYDE	Domestic	39N	05W	19	30	9	80	8	4/4/1997
FLEIGER	Domestic	39N	05W	19	200	29	103	8	5/15/1995
EDDY	Domestic	39N	05W	20	17	17	295	6	5/2/1966
PORT	Domestic	39N	05W	29	12	70	228	8	9/28/1991
ANDERSON	Domestic	39N	05W	29	15	Above	107	6	10/15/1964
SCHOENBERG	Domestic	39N	05W	29	15	56	400	8	5/20/2010
ULLRICH	Domestic	39N	05W	29	2	120	379	8	7/11/1997
DAVIS	Domestic	39N	05W	29	10	80	213	8	11/30/1995
BLUM	Domestic	39N	05W	29	1	65	328	8	9/26/1994
HARRIS	Domestic	39N	05W	29	0.75	68	227	8	10/7/1993
DAVIS	Domestic	39N	05W	29	1.5	30	304	8	5/26/1993
MUNSON	Domestic	39N	05W	29	2	31	450	8	3/15/1996
MUNSON	Domestic	39N	05W	29	15	80	300	6	7/13/2001
ANDY	Domestic	39N	05W	30	12	83	175	6	10/20/2004
GEFFRE	Domestic	39N	05W	30	25	Above	125	6	3/28/1998
FLEIGER	Domestic	39N	05W	30	10	9	155	8	6/28/1971
COSSAIRT	Domestic	39N	05W	30	8	8	64	8	2/7/1973
GERMER	Domestic	39N	05W	30	2	60	350	6	7/7/2007
CLYDE	Domestic	39N	05W	30	14	0	505	8	9/27/2006
SWIFT	Domestic	39N	05W	30	4	105	400	6	7/29/2008
SWIFT	Domestic	39N	05W	30	5	102	300	6	7/24/2008
GERMER	Domestic	39N	05W	30	0	0	0	6	9/4/2007

Table 1 Information on Wells from IDWR Website (continued)

Owner	Use	TWP	RNG	SEC	Yield (gpm)	Water Level (ft)	Depth (ft)	Well Dia. (in)	Construction Date
GERMER	Domestic	39N	05W	30	4	61	400	6	9/3/2007
GERMER	Domestic	39N	05W	30	2	42	575	6	8/30/2007
GERMER	Domestic	39N	05W	30	3	67	200	6	8/27/2007
GERMER	Domestic	39N	05W	30	2	94	275	6	8/23/2007
GERMER	Domestic	39N	05W	30	2.5	80	350	6	8/1/2007
GERMER	Domestic	39N	05W	30	3.5	62	325	6	7/27/2007
GERMER	Domestic	39N	05W	30	0	0	0	6	7/24/2007
GERMER	Domestic	39N	05W	30	3	60	350	6	7/13/2007
GERMER	Domestic	39N	05W	30	2	60	300	6	7/11/2007
GERMER	Domestic	39N	05W	30	15	68	150	6	7/10/2007
GERMER	Domestic	39N	05W	30	3	100	600	6	7/10/2007
GERMER	Domestic	39N	05W	30	3	103	650	6	7/3/2007
GERMER	Domestic	39N	05W	30	4	67	175	6	6/1/2007
GERMER	Domestic	39N	05W	30	10	82	150	6	5/31/2007
GERMER	Domestic	39N	05W	30	4	62	225	6	7/24/2007
GERMER	Domestic	39N	05W	30	5	148	250	6	7/19/2007
GERMER	Domestic	39N	05W	30	10	88	250	6	7/18/2007
GERMER	Domestic	39N	05W	30	12	148	250	6	7/18/2007
CLYDE	Domestic	39N	05W	30	0	0	0		
LUCAS	Domestic	39N	05W	30	25	53	380	8	6/21/1964
MILTENBERG	Domestic	39N	05W	30	4	88	275	6	7/14/2009
LUCAS	Domestic	39N	05W	30	15	20	450	8	5/15/1997
CLYDE	Domestic	39N	05W	30	3	154	430	8	9/17/1996
PUDDESTER	Domestic	39N	05W	30	3	48	133	8	9/11/1994
GERMER	Domestic	39N	05W	30	3	88	275	6	8/27/2007
NIEHENHI	Domestic	39N	05W	30	20	130	345	5	4/20/1972
GERMER	Domestic	39N	05W	30	4	60	350	6	7/16/2007
GERMER	Domestic	39N	05W	30	2	74	350	6	7/13/2007
GERMER	Domestic	39N	05W	30	2	4	375	6	8/22/2007
GERMER	Domestic	39N	05W	30	2	85	375	6	8/21/2007
GERMER	Domestic	39N	05W	30	2	88	275	6	8/18/2007
GERMER	Domestic	39N	05W	30	2	74	325	6	8/14/2007
GERMER	Domestic	39N	05W	30	3.5	61	525	6	8/28/2007
ANDREWS	Domestic	39N	05W	30	3	112	178	8	3/31/1994
BLUM	Domestic	39N	05W	30	4.5	10	250	6	5/30/2007
KRICK	Domestic	39N	05W	31	0	38	130	6	9/10/1996
MILTENBERG	Domestic	39N	05W	31	2	61	400	6	7/15/2009
SNOW	Domestic	39N	05W	31	99999.99	Above	262	6	7/16/1968
SNOW	Domestic	39N	05W	31	5	101	310	8	2/18/1981
BENSON	Domestic	39N	05W	31	50	28	164	8	1/11/1973
WRAY	Domestic	39N	05W	32	30	110	300	8	6/14/2010
OLSON	Domestic	39N	06W	24	50	22	80	8	10/27/2005
OLSON	Domestic	39N	06W	24	2.5	27	130	8	9/16/1994

Table 1 Information on Wells from IDWR Website (continued)									
Owner	Use	TWP	RNG	SEC	Yield (gpm)	Water Level (ft)	Depth (ft)	Well Dia. (in)	Construction Date
BURSH	Domestic	39N	06W	24	4	15	303	8	12/11/1996
WOOD	Domestic	39N	06W	24	10	80	155	8	11/11/1968
CANODE	Domestic	39N	06W	24	10	9	232	6	12/17/1969
KRAMER	Domestic	39N	06W	25	4	74	280	8	6/18/1996
JENNINGS	Domestic	39N	06W	25	6	40	276	6	12/12/1969
BOWMAN	Domestic	39N	06W	25	25	78	125	6	8/18/2004
CLYDE	Domestic	39N	06W	25	12	45	230	6	10/12/2004
SNOW	Domestic	39N	06W	36	8	30	80	8	7/9/1982

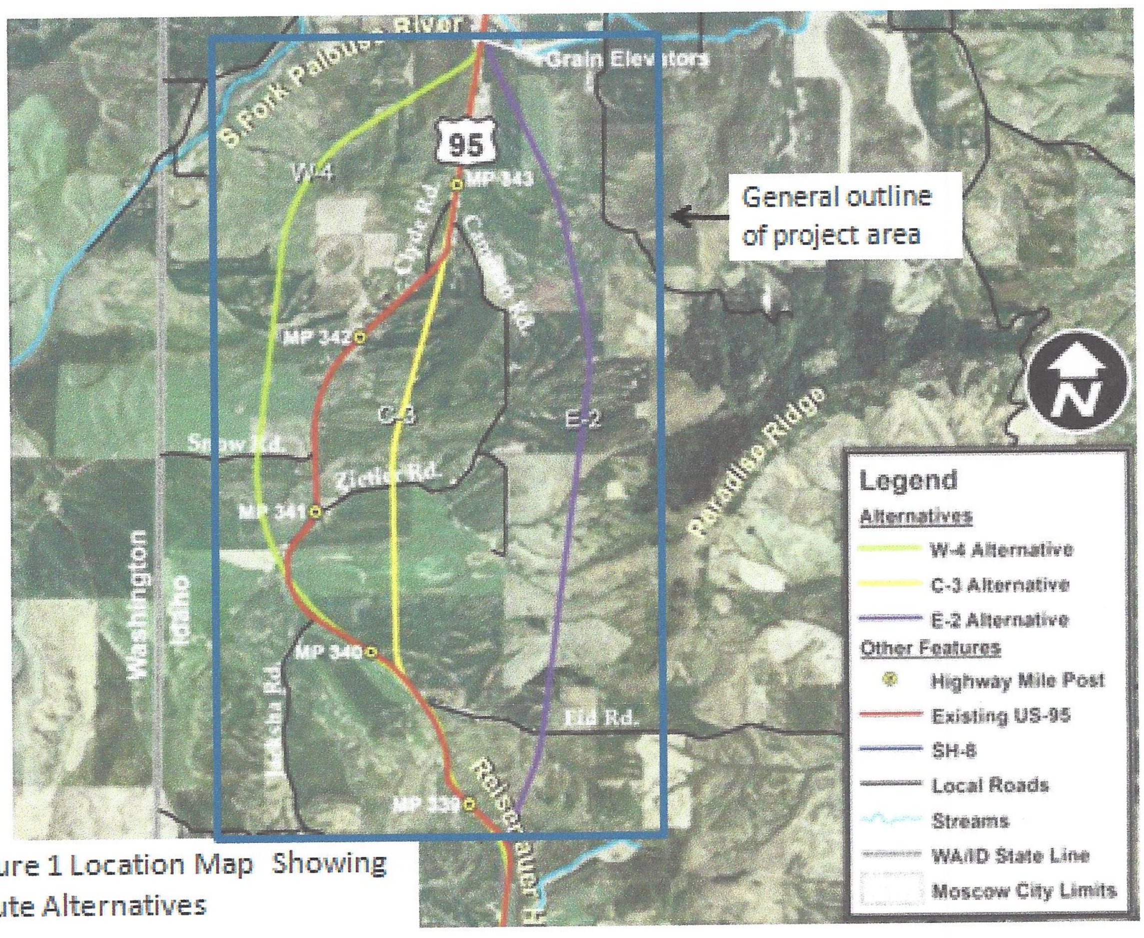

Figure 1 Location Map Showing Route Alternatives

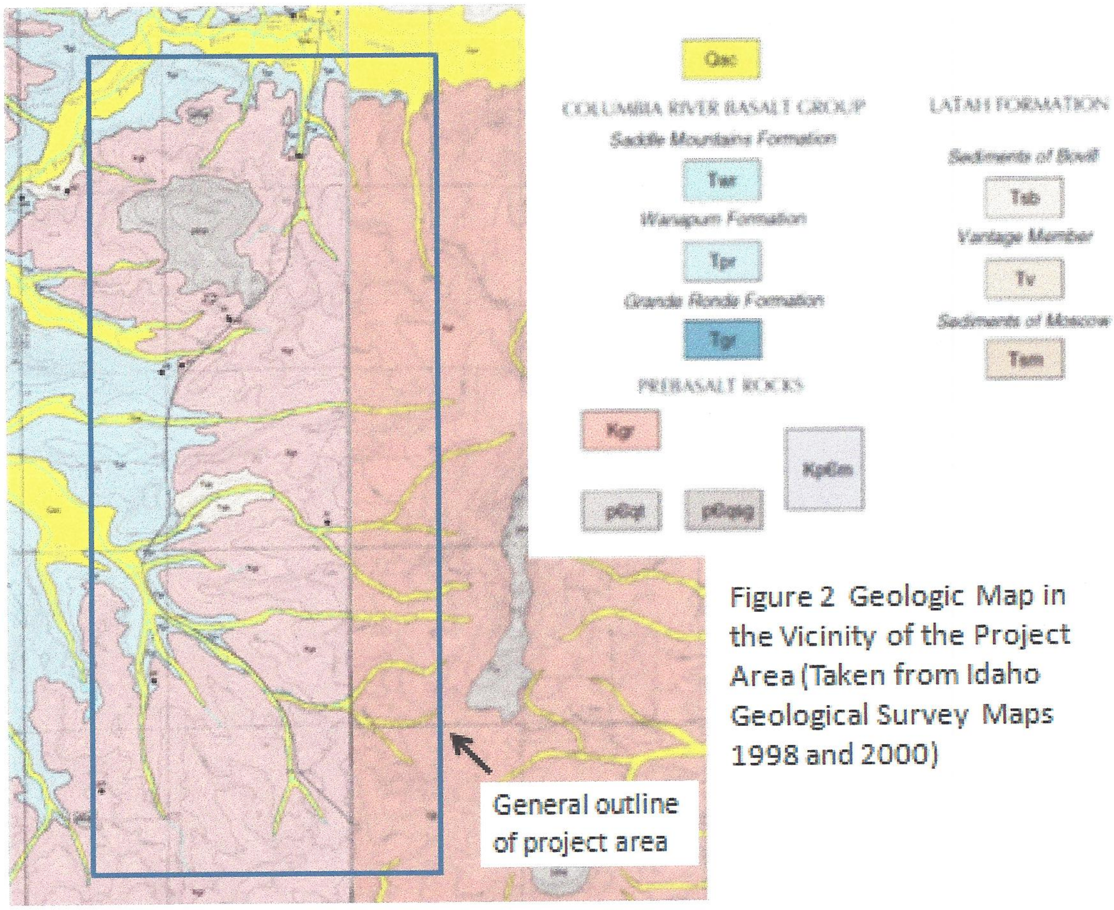

Figure 2 Geologic Map in the Vicinity of the Project Area (Taken from Idaho Geological Survey Maps 1998 and 2000)

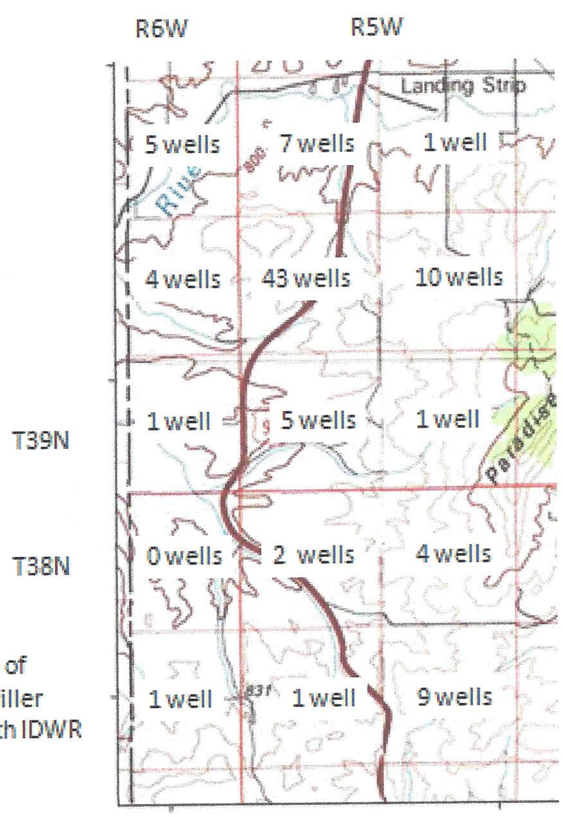

Figure 3 Locations of Wells with Well Driller Reports on File with IDWR