FINAL STUDY REPORT

CITY OF SPOKANE VALLEY RIDGEMONT ESTATES

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1 EXECUTIVE SUMMARY

The City of Spokane Valley (City) has contracted Osborn Consulting (Osborn) and subconsultants, GeoEngineers and Simpson Engineers, to conduct a study that evaluates site conditions and develops design alternatives for a proposed Ridgemont Estates Roadway and Stormwater Improvement Project.

The proposed project is in response to failing roadway conditions in the vicinity. It is suspected that the failing roadway conditions are a result of substandard roadway sections, shallow subsurface groundwater conditions, and a nonstandard existing stormwater system.

The project area is in the southeast area of Spokane Valley in the Ridgemont Estates residential development and nearby developments. Through this report, two terms are used to refer to different defined areas, which are defined below and shown in **Figure 1-1**.

- **Project Area:** "Project area" refers to the area where road and stormwater improvements will be completed. The area is identified by the City's Pavement Management Program and road sections with low Pavement Condition Index (PCI) scores indicating poor roadway conditions. The final project area will be determined by the results of this study, available funding, impact, public engagement, and city council approval.
- **Study Area:** A "study area" was identified to evaluate the site conditions contributing to the failing roadways. The study area encompasses roughly 340 acres. The study area was identified based on topography and drainage patterns and includes any areas that collect and convey stormwater runoff through the project area.

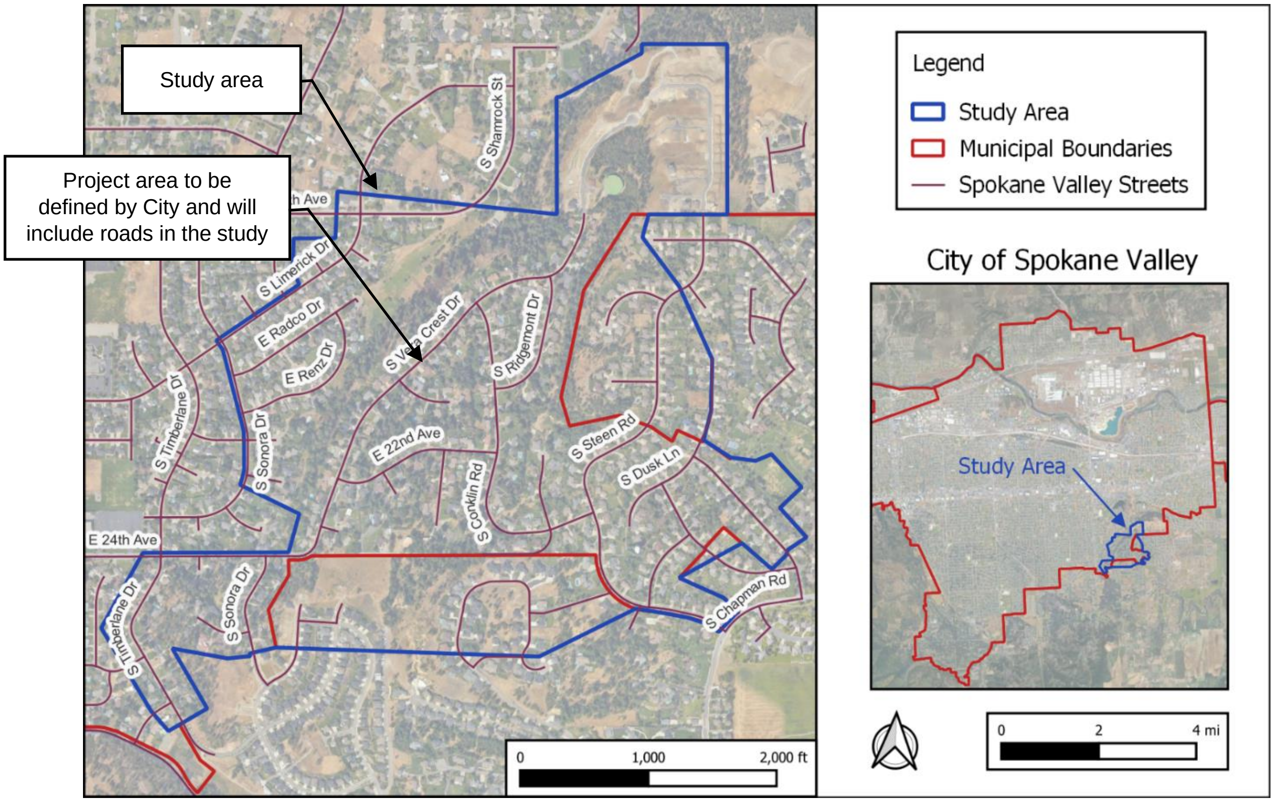


Figure 1-1: Ridgemont study area

The primary goal of this study is to identify improvements to the existing site conditions contributing to the current failing roadway conditions. The primary improvements include a strengthened roadway section, mitigation of groundwater conditions and improvement to the existing stormwater system.

The primary elements of the study included the following:

- **Existing Conditions Summary (Chapter 3):** This included a review of land use and zoning, reviewing the existing drainage areas and drainage system, site visits to observe drainage patterns and problem areas, flow monitoring to collect stormwater system flow rates and volumes, flow monitoring to determine open channel flow rate and volume loss, CCTV inspections to investigate pipe conditions in certain locations, and a topographic survey.
- **Geotechnical and Hydrogeologic Investigation (Section 3.4 and Appendix B):** The geotechnical investigation included a review of previous geotechnical investigations and general conditions in the study area. Field work was completed through borings, test pits, pavement core samples, and groundwater monitoring wells. Recommendations were then provided for roadway design and stormwater management related to subsurface discharge into the soils.
- **Public Outreach (Section 3.9):** This included creating a public outreach plan, preparing and sending mailers to citizens in the study area to inform them about the study, preparing an online presentation with project updates, and collecting feedback from citizens through an online survey.
- **Hydrologic and Hydraulic Modeling (Chapter 4):** A hydrologic and hydraulic model was developed for the existing stormwater drainage system in the study area. The model was used to assess the existing stormwater conveyance system, ponds, and drywells, and to develop proposed improvements for stormwater management.
- **Summary of Drainage Issues (Section 4.9):** Drainage issues were identified using results of the existing conditions review, field investigations, public outreach, and hydrologic and hydraulic modeling.
- **Proposed Improvements (Chapter 5):** Osborn worked with the City to develop design alternatives as proposed improvements and organize them into four levels:
  - Level 0: Roadway Improvements Only
  - Level 1: Level 0 plus Stormwater System Improvements (Retrofits) for Non-Standard Conditions
  - Level 2: Levels 0 and 1 plus Stormwater Improvements for Maintenance Retrofits
  - Level 3: Levels 0, 1, and 2 plus Stormwater Improvements (Retrofits) for Groundwater Improvements

The proposed improvements and their cost estimates are summarized below in **Table 1-1.** Cost estimates are discussed in **Section 5.2**.

Table 1-1: Planning-level cost estimates for proposed improvement options

Level	ID	Improvement Name	Cost	Level Cost
0	N/A	All Road Improvements (See Table 5-1 for cost for each road)	$6,310,000	$6,310,000
1	1A	Upgrade Grate Inlets	$78,000	$738,000
	1B	Non-Flooded Roadway Widths Less Than 12 Feet	$80,000	
	1C	First Inlet Not More Than 500 Feet from Point Where Gutter Flow Begins	$380,000	
	1D	Reduce Bypass Flow to Less than 0.1 cfs at Intersections	$40,000	
	1E	Replace Stormwater Pipe Tee Connections	$50,000	
	1F	Eliminate Non-standard Bubble-Up Condition	$45,000	
	1G	Provide 10-year Storage at Infiltration Facilities	$25,000	
	1H	Provide 100-year storage to mitigate property damage	$40,000	
2	2A	(Option A): Replace Failing Drywells in Suitable Soils	$340,000	$590,000 (with Option 2A) $735,000 (with Option 2B)
	2B	(Option B): Replace Failing Drywells in Unsuitable Soils	$485,000	
	2C	24th Avenue Infiltration Facility	$200,000	
	2D	Replace, Restore, or Abandon Pipes Identified as Damaged	$50,000	
3	3A	Impermeable Liners at Existing Ponds	$70,000	$705,000 (with Option 3D) $505,000 (with Option 3E)
	3B	Eliminate Pond A	$70,000	
	3C	Eliminate Open Channel Between Conklin and Vera Crest	$90,000	
	3D	(Option A) Reroute Radco Drainage System to 24th Avenue	$375,000	
	3E	(Option B) Radco Drainage System Improvements	$175,000	
	3F	Groundwater Collection at Conklin Road and Ridgemont Drive	$100,000	

For road reconstruction (Level 0 improvements), the pavement design can be further refined, which may provide opportunities to reduce overall costs. For example, for this report, conservative assumptions were used that resulted in a thicker recommended pavement section. This pavement section could possibly be reduced in some areas, particularly if traffic counts are collected on different streets in the study area as a basis for completing site-specific pavement thickness design.

The next steps for this project will be for the City to review and determine which combination of recommended improvements should be selected to move forward based on results of this study, available funding, impact, and city council approval.

2 INTRODUCTION

This chapter describes the project background and location, project goals, and regulations and policies guiding the project.

2.1 PROJECT BACKGROUND

The City of Spokane Valley (City) contracted Osborn Consulting (Osborn) and subconsultants GeoEngineers and Simpson Engineers to conduct a study that evaluates site conditions and develops design alternatives for a proposed Ridgemont Estates Roadway and Stormwater Improvement Project.

The proposed project is in response to failing roadway conditions in the vicinity. The conditions include extensive pavement failure in the form of pavement rutting, potholing, and fatigue cracking. It is suspected that the failing roadway conditions are a result of substandard roadway sections, shallow subsurface groundwater conditions, and a nonstandard existing stormwater system.

The study includes hydrologic, hydraulic, and geotechnical analysis thru evaluation of local surface runoff patterns, identification of shallow subsurface flow, the determination of local geology, and the performance and capacity of the existing stormwater conveyance system.

Study results will support the development of design alternative levels of improvement to improve current conditions and accommodate sustainable roadways in the Ridgemont Estates vicinity.

2.2 PROJECT AREA

The anticipated project area is in the southeast area of Spokane Valley. Shown in **Figure 2-1**.

The anticipated project area is identified by the City's Pavement Management Program and the Pavement Condition Index (PCI), which provides measurement to the condition of roadway surfaces. The index is measured on a scale of 0 to 100. Color shading is then associated to provide reference.

The final project area will prioritize those roadways shaded red and indexed as roadways in very poor or serious condition. The primary roadways considered include Vera Crest Drive, Conklin Road, Ridgemont Drive, Timberlane Drive, and Sonora Drive. Secondary roadways in this area will also be considered. Shown in **Figure 2-1**. Roadways not shaded in red may be considered as project area to accommodate levels of improvement to the stormwater system.

The final project area is not yet determined. The final project area will be determined by the results of this study, available funding, impact, public engagement, and city council approval.

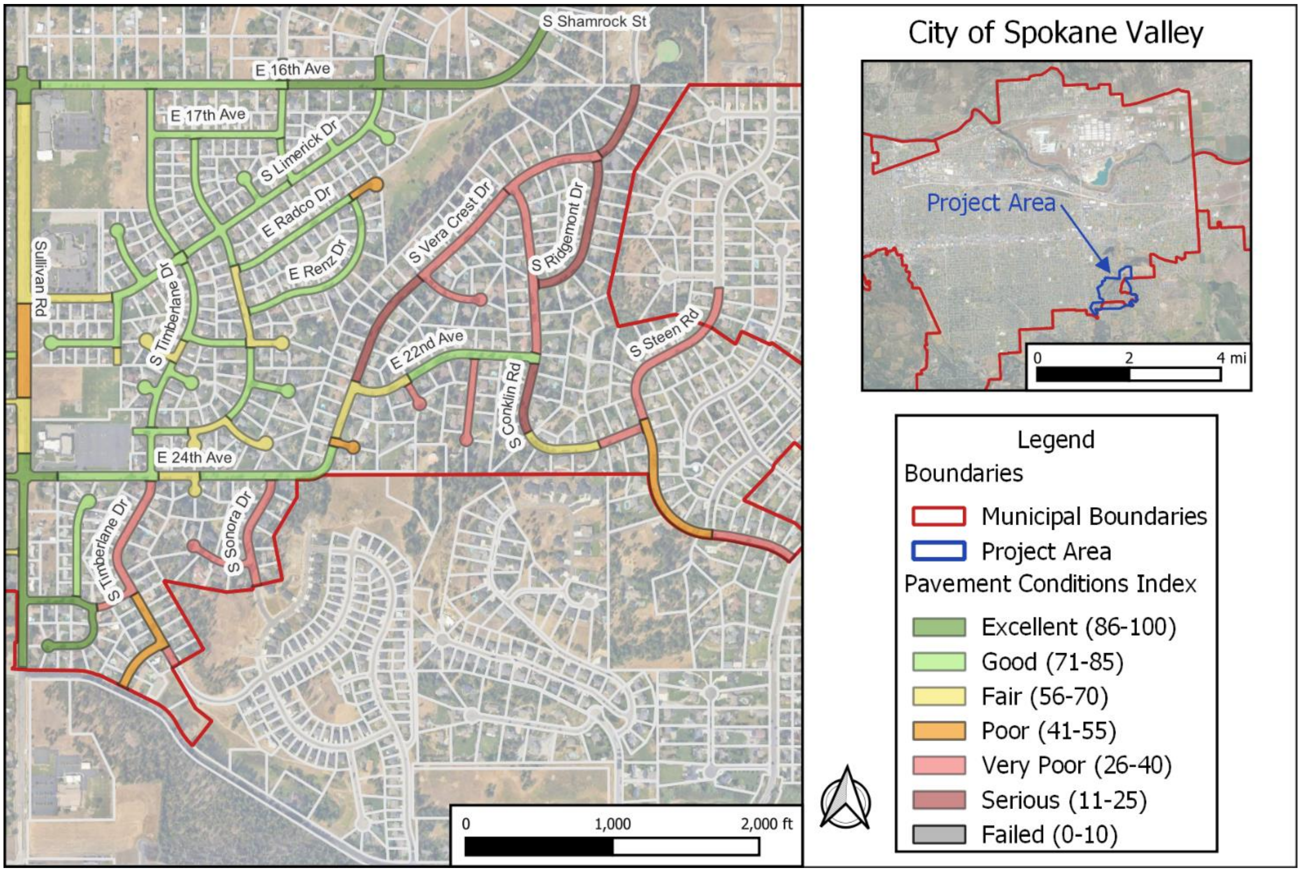


Figure 2-1: The project area and its relative location with Pavement Condition Index

2.3 STUDY AREA

A study area was identified to evaluate the site conditions contributing to the failing roadways in the project area. The study area was determined to be the area necessary to complete the hydrologic, hydraulic and geotechnical analysis.

The study area located in the southeast portion of Spokane Valley encompasses roughly 340 acres of land. Shown in **Figure 2-2**, the study area can be defined as east of South Sonora Street and South Timberlane Drive; west of South Dusk Lane and East Daybreak Lane, south of South Limerick Drive and East 16th Avenue, and north of South Chapman Road and South Steen Road.

The study area is characterized by single-family residential housing developments located at the southeast city limits bordering unincorporated Spokane County. Land and drainage features include steep hillsides, moderate tree coverage, and a stormwater system consisting of pipes, culverts, open channels, and drywells, as well as detention and infiltration ponds.

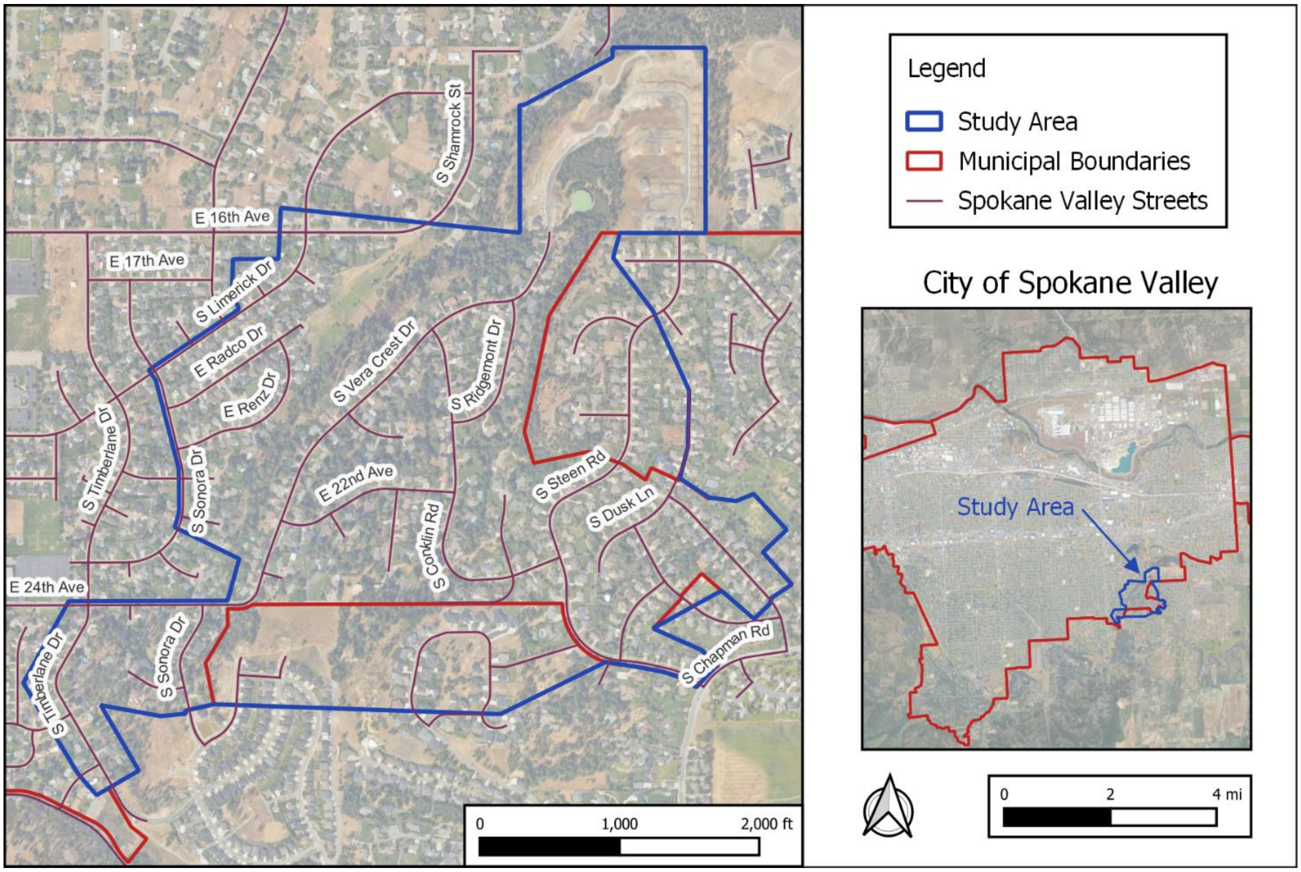


Figure 2-2. The study area and its relative location

2.4 STUDY GOALS

The primary goal is to identify improvements to the existing site conditions contributing to the current failing roadway conditions. The primary improvements include a strengthened roadway section, mitigation of groundwater conditions and improvement to the existing stormwater system.

To meet the aforementioned project goals, the project will involve the following activities:

- Collect and evaluate historical engineering data within the study area.
- Complete field investigations and visual observations to verify field conditions.
- Conduct pavement cores and exploration bores to identify the geology of the study area.
- Perform infiltration testing and UIC testing to evaluate existing capacity.
- Review hydrogeologic data (monitoring wells) to evaluate groundwater conditions.
- Conduct flow monitoring to evaluate open channel losses and hydraulic model calibration.
- Develop a hydrologic and hydraulic model.
- Complete hydraulic model evaluation of the existing stormwater system.
- Develop an alternative analysis level of improvement report identifying project alternative levels of improvement, and summarizing modeling results, and final recommendations.

2.5 RELEVANT REGULATIONS AND POLICIES

The documents that provided planning criteria for the study are listed below. These documents were used to determine design guidelines, develop benchmarks for the study, and develop an understanding of the existing and proposed land use.

- **Spokane Regional Stormwater Manual (SRSM):** The SRSM (Spokane County, 2008) establishes standards for stormwater design and management to protect water quality, prevent adverse impacts from flooding, control stormwater runoff to levels equivalent to those that occurred prior to development, and protect the sole source aquifer. Design guidelines from the SRSM were used for evaluating the existing stormwater facilities, determining hydraulic parameters, and developing concept designs for proposed solutions.

- **Stormwater Management Manual for Eastern Washington (SWMMEW):** The 2019 SWMMEW (Ecology, 2019) was developed by the Washington State Department of Ecology (Ecology) to provide technical guidance on measures to control the quantity and quality of stormwater runoff in Eastern Washington. The SWMMEW was used to reference requirements for underground injection control (UIC) facilities, which include drywells.

3 EXISTING CONDITIONS

This chapter provides an overview of the existing conditions including local land use and the general characteristics and features of the drainage basin. It also provides a geotechnical and hydrologic review and summary of the area based on data collected for the project.

3.1 LAND USE AND ZONING

The study area is located at the southeast City limits bordering unincorporated Spokane County and is predominantly characterized by suburban development. Land use in the drainage basin primarily consists of single-family residential suburban developments. Based on historical property records, development along Vera Crest Drive and the central areas of the study area occurred between 1975 and 1980. Other residential development occurred later. Properties northwest of the 16th Avenue Pond were built in the 1990s, whereas residential development in the eastern part of the study area took place in the mid-2000s. Development in the northernmost section of the study area is ongoing in the present.

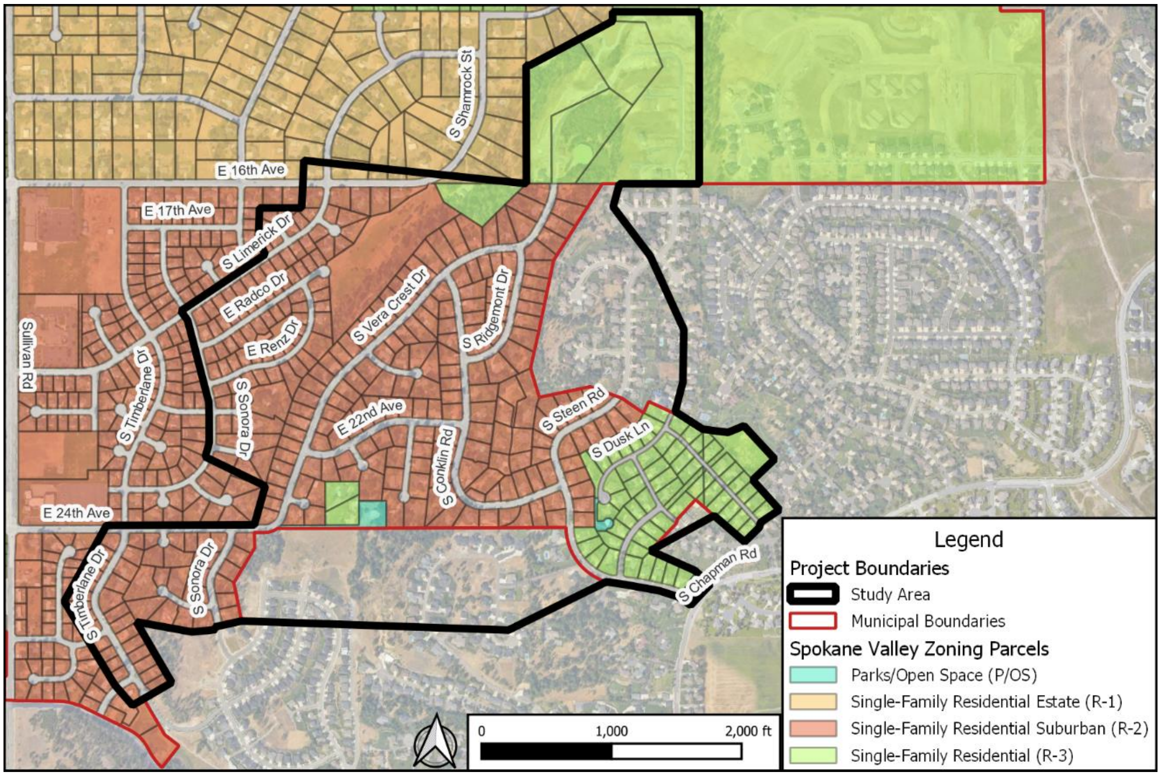


Figure 3-1. Land use and zoning within the study area

3.2 DRAINAGE AREAS

The total study area includes approximately 340 acres. The study focused on three specific drainage areas within the total study area that are approximately 120 acres combined. The areas are characterized by single-family residential land use, moderate tree coverage, and steep hills that are sloped from the southeast section of the study area to the northwest section of the study area. The focus areas were selected based on roadway improvement priority and were delineated by the drainage area discharge points. All discharge points are subsurface discharge, discharged into the ground through infiltration ponds or drywells.

The North Area is 49 acres and includes areas that discharge to the 16th Avenue Pond. The Central Area is 43 acres that discharge to the Radco Pond. The South Area is 28 acres that discharge to drywells in the right-of-way on East 24th Avenue. The drainage areas are shown in **Figure 3-2**. The north and south areas have additional upstream offsite drainage areas that drain into their drainage systems but were not analyzed at the same level of detail because they were not priority areas for roadway improvements. See chapter 4.2 for more detail on Detailed Model Areas and Lumped Model Areas.

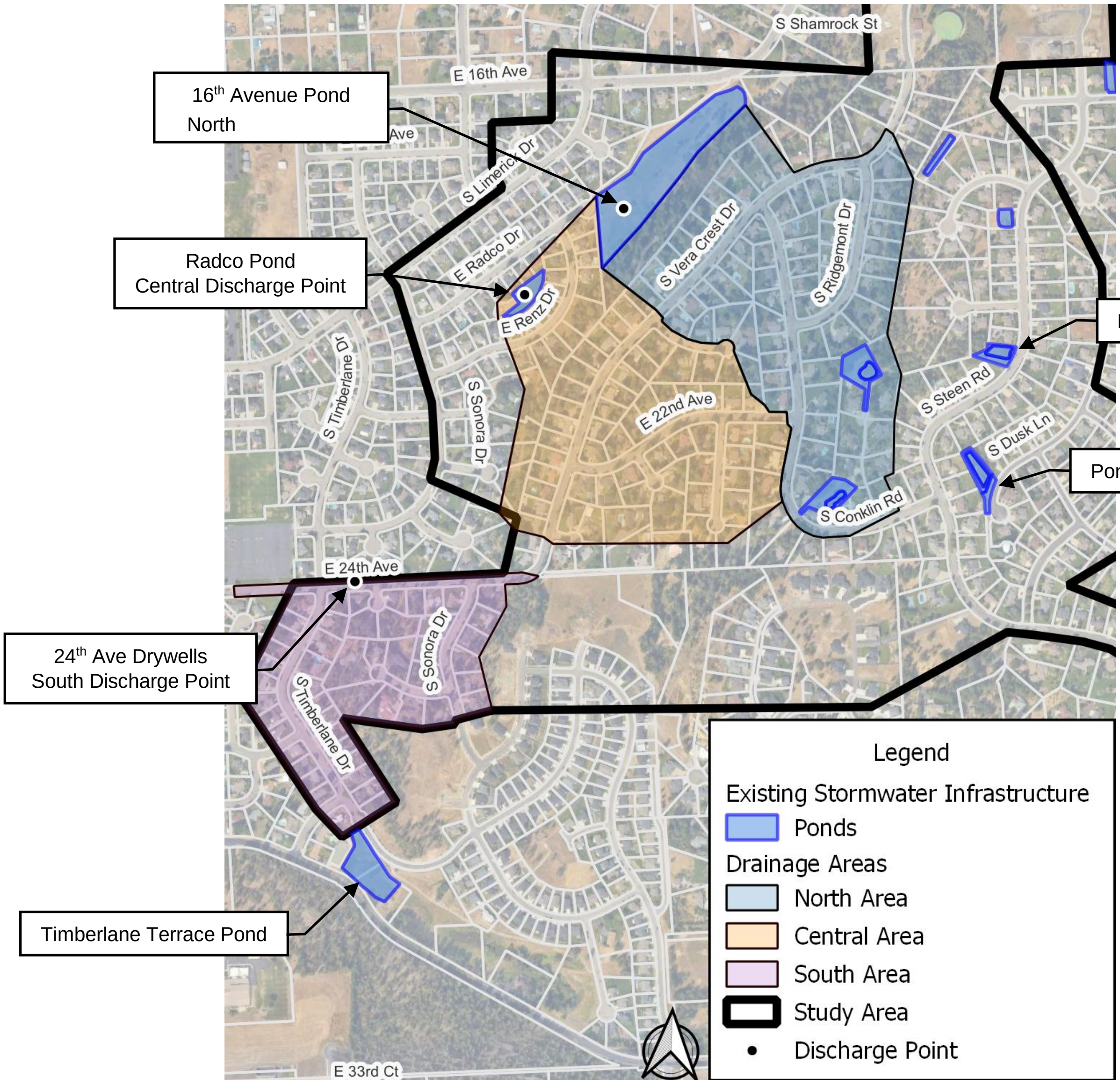


Figure 3-2. Drainage basins and their point of discharge

3.3 DRAINAGE SYSTEM

The existing stormwater drainage system consists of pipes, culverts, open channel ditches, drywells, and detention and infiltration ponds. Osborn identified different components of the drainage system by reviewing the City's existing GIS data for the stormwater system and supplementing the GIS data with topographic survey data, information from record drawings, and field measurements and observations.

The GIS shapefiles provided by the City included point shapefiles that represented stormwater structures such as manholes, catch basins, inlets, and drywells. Information such as elevation and depth data was included for some of the structures. Some missing data was also collected, including line shapefiles representing storm drains, culverts, ditches, and open channels. The data generally included pipe length and diameter, but invert elevations were not provided for most storm drains. Ditches and open channels were shown conceptually in the GIS data but did not have data regarding the shape or conditions of the ditches and channels. This GIS data was supplemented with field data collected during the topographic survey.

The GIS data was used to determine flow patterns for the existing conditions in the study area and as the starting point for hydrologic and hydraulic modeling of conveyance systems. A summary of the existing stormwater conveyance system components in the study area is provided in **Table 3-1** and a map of the existing storm system is included in **Appendix A**.

Table 3-1: Summary of drainage system components

Drainage System Component	Quantity in Study Area
Storm Drains & Culverts	5,690 LF
Open Channel Ditches	3,860 LF
Manholes	14
Catch Basins	93
Drywells	65

There are two main infiltration ponds in the area. The first is the 16th Avenue Pond, located in the northern portion of the study area between East 16th Avenue, South Vera Crest Drive, and South Limerick Drive. The second is the Radco Pond, located in the western portion of the study area between East Radco Drive and East Renz Drive. These two ponds are located in a relatively flat area downslope from the majority of study area located on the steeper hillside. Several smaller detention ponds are located in the hillside area toward the east end of the study area. A summary of the existing ponds in the study area is provided in **Table 3-2** and a map of the existing storm system is included in **Appendix A**.

The existing stormwater drainage system was observed to have points of constant flow. These points of constant flow were observed at various locations. The constant flow source is groundwater collected by PVC or perforated pipes. The collected groundwater is typically discharged to either existing swale/ponds or catch basin type structures. A map of these observed points is included in **Appendix A.**

Table 3-2: Summary of stormwater ponds

Pond	Type	Volume
16th Avenue Pond	Infiltration	6.61 AC-FT
Radco Pond	Infiltration	0.69 AC-FT
Timberlane Terrace Pond	Infiltration	4.67 AC-FT
Pond A	Storage/Infiltrative	1.96 AC-FT
Pond B	Storage/Infiltrative	0.75 AC-FT

In addition to the ponds, drywells are present in the right-of-way at different locations in the study area for discharging runoff. Drywells are generally spaced every few hundred feet along roadways. On East 24th Avenue near South Timberlane Drive, three drywells are located at the downstream end of a storm pipe that handle an increased amount of storm runoff compared to other drywells in the area.

3.4 GEOTECHNICAL AND HYDROGEOLOGIC EVALUATION

GeoEngineers conducted a comprehensive geotechnical and hydrogeologic evaluation of the study area to investigate the subsurface conditions and characterize the local soil strata and permeability. The geotechnical report reviewed the existing data and previous geotechnical reports and included geotechnical borings at selected locations throughout the study area. For the report, GeoEngineers also conducted laboratory testing to analyze soil samples, full-scale infiltration testing at selected drywells, and groundwater modeling for the potential infiltration ponds. The full report is provided in **Appendix B**. The locations investigated are shown in **Figure 3-1**, which was extracted from **Figure 2** in **Appendix B**.

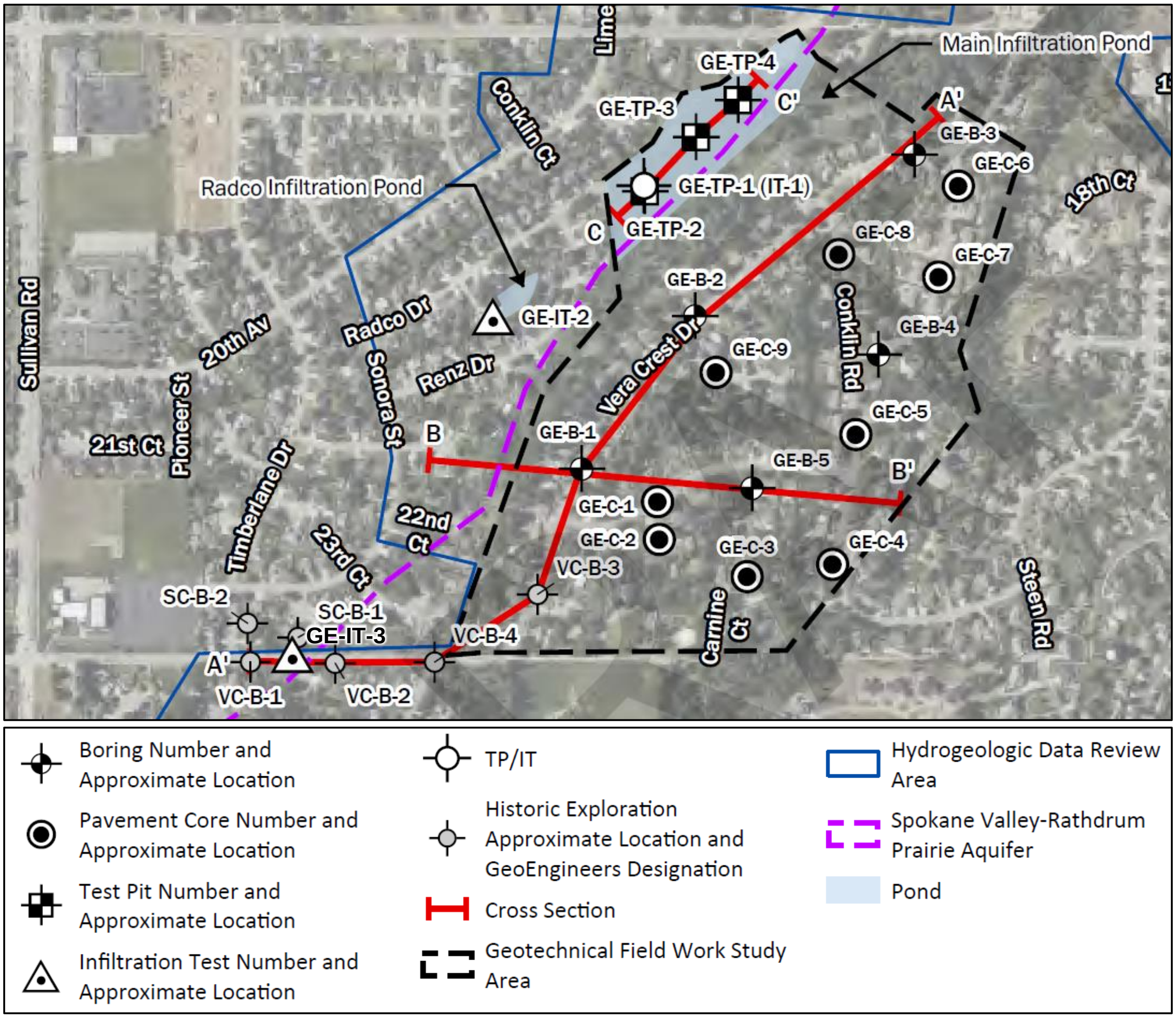


Figure 3-1: Geotechnical exploration map

The key findings of the geotechnical evaluation can be summarized as follows:

- **Subsurface Conditions and Soil Strata:** The geology in the study area is depicted in **Figure 3** in **Appendix B** and generally consists of shallow granitic rock in the upper elevations, followed by soils that are characterized by the relatively impermeable Latah formation in the mid-range elevations around South Vera Crest Drive, Ridgemont Drive, and Conklin Road, with high-permeability glaciofluvial soils in the lower elevations on the valley floor. One pocket of glaciofluvial soils was identified in the Latah formation area in the mid-range elevations and is underlain by other more impermeable soils.

- **Groundwater Conditions:** Groundwater monitoring was performed at four locations (Borings GE-B-2 through GE-B-5 on **Figure 3-1**). Monitoring took place in November 2023 until June 2024. Monitoring covered the time periods when groundwater fluctuations are anticipated most including the wet period during spring snow melt and rain events and the summer irrigation season. Monitoring results are graphed in **Figure 12** in **Appendix B** and show that groundwater steadily built up in the glaciofluvial pocket within the Latah formation (monitoring well GE-B-2, located on South Vera Crest Drive) to a maximum level of roughly five feet below ground surface in March 2024. Other monitoring wells showed that groundwater generally rose and fell in response to rain events and did not significantly build up in elevation over time. GeoEngineers also reviewed groundwater measurements from past geotechnical reports, which are discussed in **Appendix B** (**Section 11.0** and **Figure 11**). GeoEngineers noted there are some areas with shallow impermeable soil layers likely resulting in shallow groundwater and seasonal springs, particularly near the intersection of South Vera Crest Drive and East 24th Avenue and on South Steen Road (**Appendix B Section 11.0**).

- **Infiltration Rates:** Infiltration testing was performed at the surface of East 16th Avenue Pond (GE-TP-1 on **Figure 3-1**), at a drywell in the Radco Pond (GE-IT-2), and at a drywell on East 24th Avenue (GE-IT-3). Results are discussed in detail in **Section 10.0** of **Appendix B** and a brief summary of the results is provided in **Table 3-3**. The infiltration rates for the 16th Ave and Radco Ponds correlated well with the glaciofluvial soils in the area that are known to have high infiltration rates. GeoEngineers concluded the drywell at East 24th Avenue likely has reduced infiltration capacity due to sediment loading over time.

Table 3-3. Infiltration Rates for 16th Avenue Pond, Radco Pond Drywell, and 24th Avenue Drywell

Infiltration Location	Infiltration Rate
16th Avenue Pond	1.03 in/hr
Radco Pond Drywell	2.03 cfs
***24th Avenue Drywell**	0.014 cfs

Notes:

in/h = inches per hour, used for measuring infiltration rate through the ground surface.
cfs = cubic feet per second, used for measuring the outflow rate from a drywell.
* Only 1 of 8 drywells in the vicinity was tested. See GeoEngineer report for details.

- **Paved Surfaces:** Pavement core samples were taken at nine locations in the study area. Pavement cores indicated a wide range of pavement thicknesses with asphalt thickness ranging from 1.5 to 4.75 inches and base course thickness ranging from 1.5 inches to 15 inches. The pavement and base course thicknesses at each core sample location are summarized in Table 1 in **Appendix B** and a discussion of existing pavement conditions and pavement design recommendations from past geotechnical reports is included in 6.3.1 in **Appendix B**.
- **Pavement Recommendations:** The geotechnical report provides recommendations for asphalt and base course thicknesses (**Section 12.2** in **Appendix B**). Depending on the selected equivalent single axle load (ESAL) value, the recommendations range from 3 to 4.5 inches for asphalt and 6 to 9 inches for base course. The report points out that a key decision that will impact cost will be to select an ESAL value to be used for design. Traffic counts could be completed by the City as a way to have a more refined ESAL estimate. **Section 12** in **Appendix B** also provides a comparison between the current pavement recommendations and past pavement design done by Budinger in 2008 for the restoration of 24th Avenue.

3.5 SITE VISITS

Osborn conducted a site visit on November 16, 2023. In addition to Osborn staff, the team also included personnel from the City of Spokane Valley, GeoEngineers and Simpson Engineers. The purpose of this visit was to familiarize all parties with the study area and to observe the existing conditions of the open channel ditches, infiltration ponds, failing roadway conditions, and non-standard stormwater infrastructure in the study area. Pictures taken during this site visit, as well as future additional site visits, are provided in **Appendix C**.

The team observed flows infiltrating in the open channel ditch leading to Radco Pond, preventing the stormwater from reaching this pond. Radco Pond was observed to be in good condition. However, no water appeared to be reaching this location for infiltration. See **Figure 3-3** and **Figure 3-4** below taken during a site visit on January 22, 2024.

Figure 3-3. Flow observed in the upstream end of Rado open channel ditch

Figure 3-4. No flow observed in downstream end of Radco open channel ditch

The team also visited the 16th Avenue Pond and observed water pooling at the northernmost section of the pond. However, the team did not observe evidence of overflow or infiltration failure. **Figure 3-5** below shows ponding observed in the 16th Avenue Infiltration Pond on January 22, 2024.

Figure 3-5. Water observed pooling in 16th Avenue Pond

The team also visited the upstream detention ponds, separately located at the intersections of Conklin Road and Ridgemont Lane and Conklin Road and Ridgemont Drive (Ponds A and B). Standing water was observed in these ponds as the bottom of the ponds are set approximately 1 foot below the invert of the outlet pipes. This has led to growth of cattails in the ponds as shown in **Figure 3-2**.

Figure 3-2: Outlet of Pond A

Throughout the study area, many roadways showed signs pavement degradation including alligator cracking, local pavement failures, longitudinal and transverse cracking, and patching. Regarding roadway drainage conditions, issues were observed including ponding water, drywells full of water, and failing inlet structures. Osborn has observed similar conditions throughout the year during other site visits. **Figure 3-6** below shows failing roadway conditions observed in the study area on May 22, 2023.

Figure 3-6. Roadway failure observed at South Vera Crest Drive and East 20th Court

3.6 FLOW MONITORING

Flow monitoring data was used to evaluate existing drainage patterns and validate the hydrologic and hydraulic model. Flow monitoring began in November 2023 and continued through August 2024. shows the flow monitor locations. Additional maps that identify the location of the equipment, photos of the installed equipment, and a copy of the data collected are provided in **Appendix D**. Flow monitor locations are shown below in **Figure 3-3**.

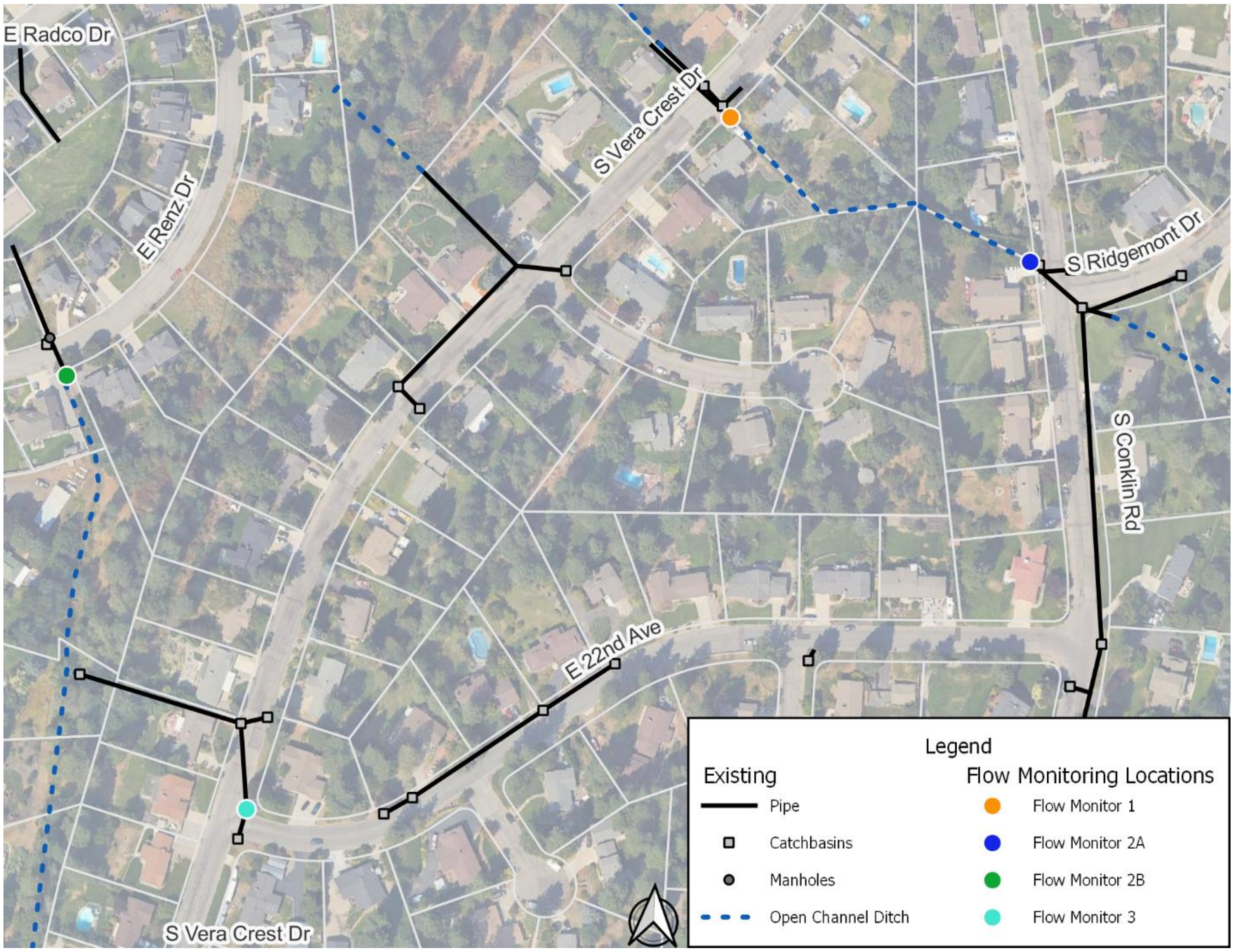


Figure 3-3: Flow monitor locations

The flow monitoring equipment was installed in the four following locations in the study area:

- **Flow Monitor 1 – South Vera Crest Drive:** This flow monitor was installed at the inlet of the left culvert (facing downstream) that crosses South Vera Crest Drive in a southeast-to-northwest direction. This location is at the downstream end of an open channel that captures runoff from residential developments in the areas surrounding South Conklin Road and South Steen Road.
- **Flow Monitor 2 (Location 1) – South Ridgemont Drive and South Conklin Drive:** This flow monitor was installed at the outlet of the culvert crossing South Conklin Road in an east-to-west direction. This location is upstream of Flow Monitor 1 and captures runoff from the same drainage area as Flow Monitor 1, barring the relatively small area that discharges directly to the open channel. These flow monitors were placed nearby each other to determine whether there was a noticeable difference in flow rate at the upstream and downstream ends of the open channel.

- **Flow Monitor 2 (Location 2) – East Renz Drive:** This flow monitor was installed at the inlet of the culvert that crosses East Renz Drive in a south-to-north direction. This location theoretically should receive runoff from the entire drainage basin that contributes to Radco Pond. However, field observations indicated that stormwater runoff may infiltrate prior to reaching this location. The intention of installing the flow monitor at this location was to determine whether any runoff could be observed that would contribute to the Radco Pond.
- **Flow Monitor 3 – South Vera Crest Drive and East 22nd Avenue:** This flow monitor was installed at the north pipe in the catch basin on the northeast side of the intersection. This location receives runoff from East 22nd Avenue and a portion of South Vera Crest Drive. The flow monitor was installed at this location between November 2023 and May 2024, after which it was moved to the location described below. The flow monitor was moved after discussing with the City because the original location was recording minimal amounts of flow and collecting data at a second location was determined to be more valuable for the study.

Flow monitoring data measured a steady baseflow during the spring months that ranged from 0.1 to 0.2 cubic feet per second at the flow monitors near South Conklin Road and South Vera Crest Drive. The baseflow is likely from shallow subsurface flow that infiltrates higher in the drainage basin and then resurfaces into the storm conveyance system lower in the basin. The existing ponds in the upper part of the drainage basin are likely locations where stormwater runoff is infiltrated into the ground to locally recharge groundwater, increasing the volume of shallow subsurface flow.

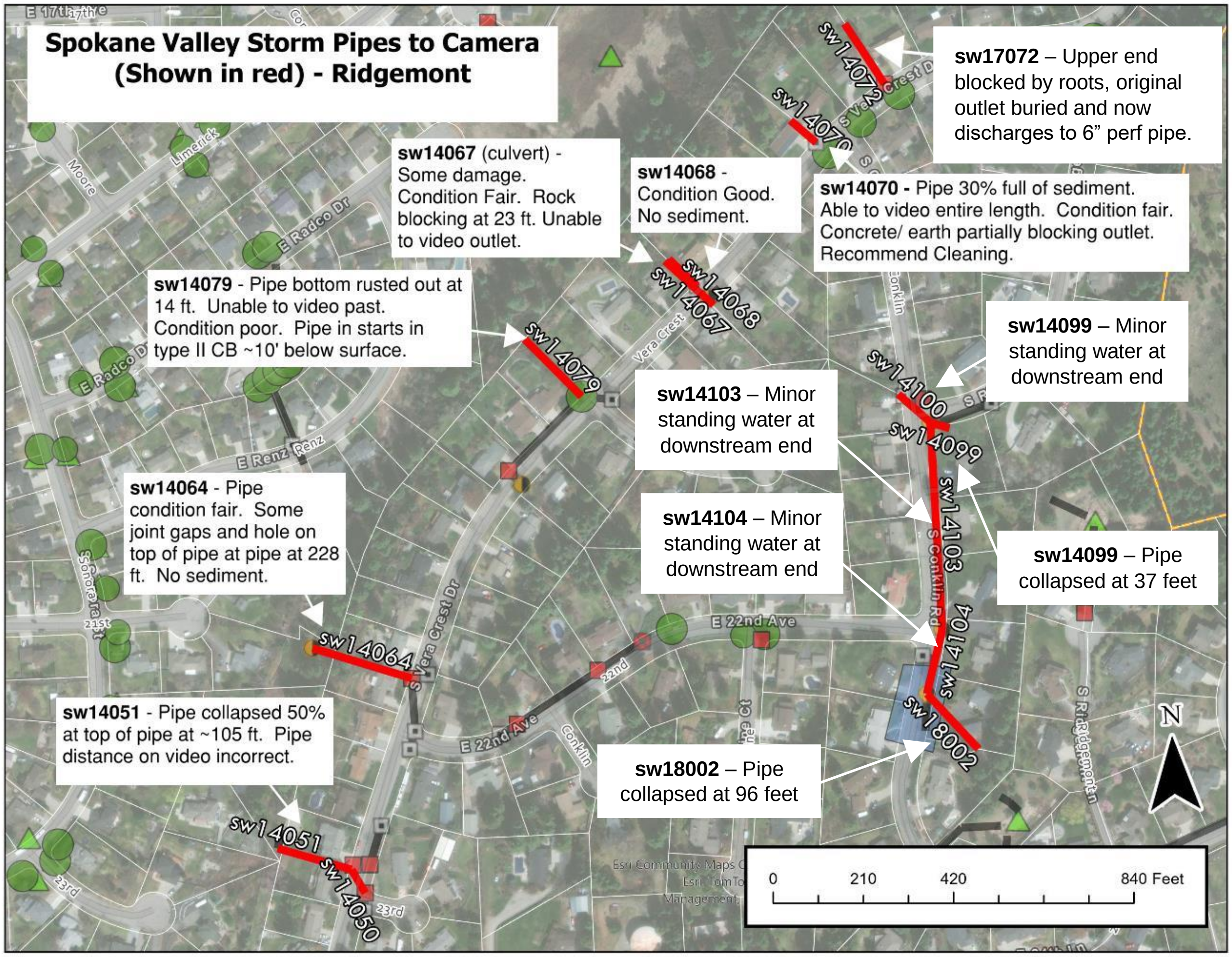
Flow monitoring data shows that there is often a difference in the amount of flow between the upstream and downstream ends of the open channel ditch that conveys flow through private properties located between South Conklin Drive and South Vera Crest Drive. This indicates runoff is likely infiltrating (loss) into the open channel during some parts of the year and shallow subsurface flow is seeping (gain) back into the channel during other parts of the year. During the flow monitoring study period from 10/31/2023 to 4/28/2024 the mean average recorded data indicates an approximate 0.10 cfs gain in flow and a 0.05 cfs loss in flow along this section of open channel. The interpretation of this data is exhibited in **Appendix D.**

Shallow subsurface flow will need to be considered while designing any future stormwater improvements. Flow rates from shallow subsurface flow are not anticipated to be high compared with peak flows from storm events but will likely create conditions with near-constant baseflow seeping into storm drain systems.

3.7 CCTV INSPECTIONS

Closed-circuit television (CCTV) inspection data was provided by the City and included video files and reports documenting observed conditions. The reports took note of observed pipe conditions but did not use any type of formal rating system for assessing pipe conditions (e.g. the commonly used NASSCCO ratings system). A total of 12 pipes and culverts throughout the study area were inspected in February 2024. All pipes inspected in the area were corrugated metal pipes (CMP). The inspections identified several pipes with damage such as collapsed pipes, joint separation, blockages by rocks or other sediment, and rust damage. A screenshot from the inspection noting the condition of some the pipes along South Vera Crest Drive is provided in **Figure 3-4** and more detailed results of the CCTV inspection are provided in **Appendix E**.

Pipes with structural damage such as collapsed pipes or significant loss of pipe wall material due to rust were recommended for abandonment or rehabilitation in the design alternatives provided in Chapter 5. If pipes are abandoned, additional capacity at other locations would likely also be required. These pipes have potential to create further issues such as sinkholes due to piping of earth material through the collapsed or exposed portions of the pipe.



sw17072 – Upper end blocked by roots, original outlet buried and now discharges to 6” perf pipe.

sw14067 (culvert) - Some damage. Condition Fair. Rock blocking at 23 ft. Unable to video outlet.

sw14068 - Condition Good. No sediment.

sw14070 - Pipe 30% full of sediment. Able to video entire length. Condition fair. Concrete/ earth partially blocking outlet. Recommend Cleaning.

sw14079 - Pipe bottom rusted out at 14 ft. Unable to video past. Condition poor. Pipe in starts in type II CB ~10' below surface.

sw14099 – Minor standing water at downstream end

sw14103 – Minor standing water at downstream end

sw14064 - Pipe condition fair. Some joint gaps and hole on top of pipe at pipe at 228 ft. No sediment.

sw14104 – Minor standing water at downstream end

sw14099 – Pipe collapsed at 37 feet

sw14051 - Pipe collapsed 50% at top of pipe at ~105 ft. Pipe distance on video incorrect.

sw18002 – Pipe collapsed at 96 feet

Figure 3-4: CCTV Pipe Inspection Summary

3.8 TOPOGRAPHIC SURVEY

Simpson Engineers conducted a topographic survey of the study area, which is shown in **Figure 3-5**. This survey was created referencing datum NAVD88.

The survey aimed to collect data regarding these structure types found in the study area:

- **Inlets or Catch Basins –** Confirm location, structure, grate type, and grate elevations.
- **Pipes –** Collect invert elevations and document inlet and outlet conditions as well as pipe size and type.
- **Channels –** Collect alignment and cross-section geometrics and grade elevation. Document channel condition, vegetation, and roughness.
- **Ponds –** Survey pond topography, document condition, vegetation, and inlet and outlet structures.
- **Drywells –** Confirm location and document structure depth and condition.
- **Roadways –** Survey curb, flowline, centerline, driveway limits, back of sidewalk, and other street elements within the street section.
- **Other Structures –** Confirm other significant structures such as trees, fences, or retaining walls.

Existing easements were reviewed as part of this study and are summarized in a memo included in **Appendix F**. Some easements provided only general information about stormwater, while others documented specific rights of the City and property owners. Osborn did not identify any language that appears likely to limit any of the proposed solutions presented in this study. However, the City's legal team should review easement language prior to moving forward with any construction within the easements.

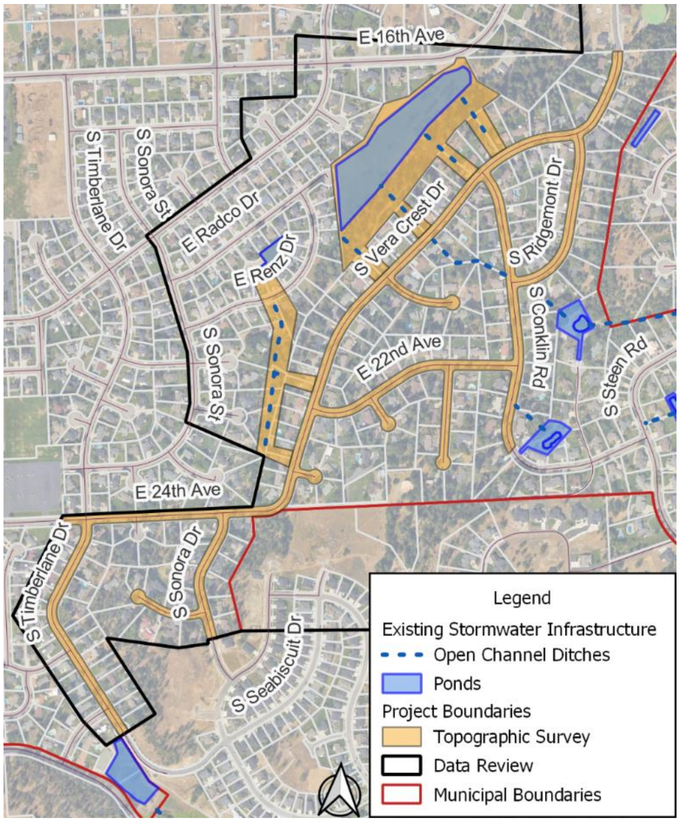
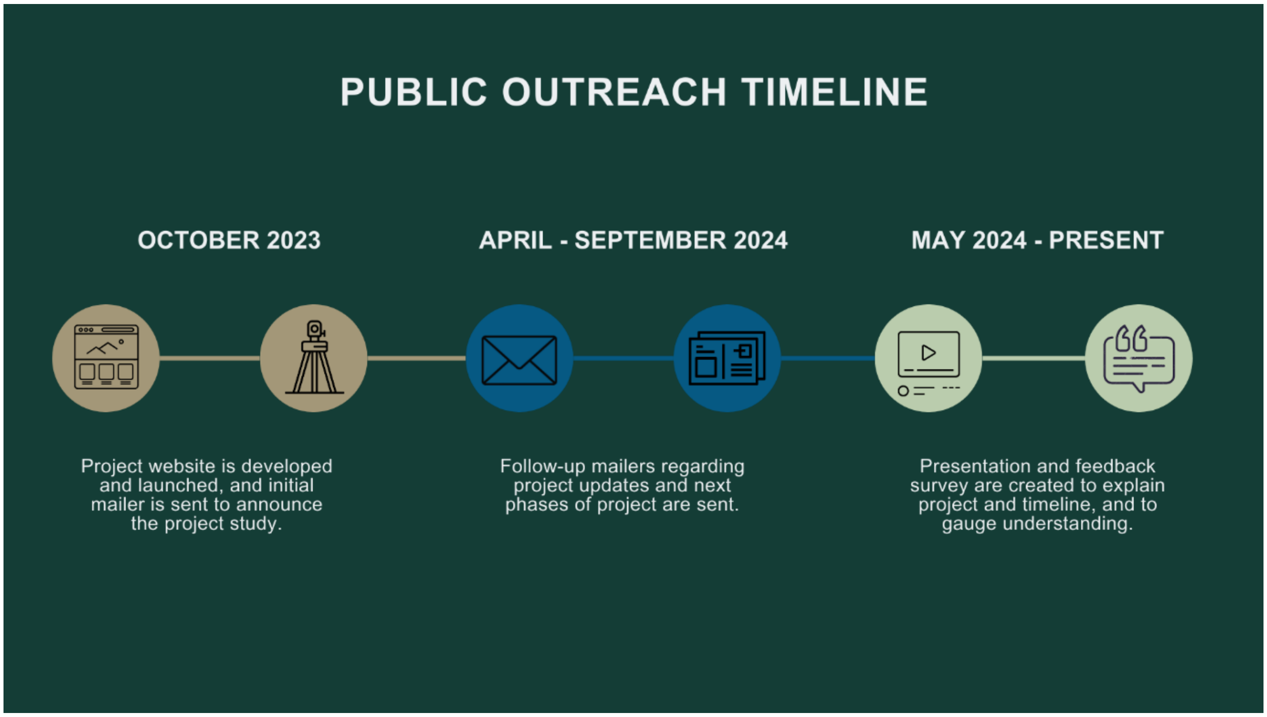


Figure 3-5: Topographic Survey Limits

3.9 PUBLIC OUTREACH

A Community Involvement Plan and schedule were created in collaboration with the City and project subconsultants to identify additional stakeholders, provide key project messaging, create an implementation schedule, and describe the outreach methods. Spokane Valley community members had access to project information and multiple opportunities to provide feedback and contribute to this study.

Engagement was achieved through multiple communication channels including a project webpage, physical mailers, and an online presentation. An initial mailer relaying general project information and project website was sent to residents in October 2023. A follow-up mailer was sent in May 2024 to notify residents of project updates and presentation video. The project mailers can be found in **Appendix G**. The City developed and published a project webpage in October 2023 to provide the community with a timeline, area maps, and City staff contact information. The webpage also provides links to the SRSM and a recorded PowerPoint presentation produced by the project team.



PUBLIC OUTREACH TIMELINE

OCTOBER 2023

Project website is developed and launched, and initial mailer is sent to announce the project study.

APRIL - SEPTEMBER 2024

Follow-up mailers regarding project updates and next phases of project are sent.

MAY 2024 - PRESENT

Presentation and feedback survey are created to explain project and timeline, and to gauge understanding.

Figure 3-6: Public outreach timeline

The presentation was recorded in lieu of an in-person informational event to explain the project and timeline. The presentation video was embedded on the project's webpage and published to their official YouTube channel on May 5, 2024. As of September 25, 2024, the video has amassed 72 views on YouTube.

Feedback was encouraged before and during the development of the level of improvement alternatives. A public outreach survey was published in tandem with the presentation and was also made available on the project webpage. Survey questions collected demographics information as well as the respondents' preferred method of communication for project updates. The questions also gauged their understanding of the project and allowed for comments on drainage problem areas and other issues the City should be aware of.

To date, there have been six survey responses; feedback showed a strong understanding of the project and its goals. Concerns included roadway deterioration and cracking, stormwater runoff, and ice formation contributing to slippery road conditions. A table of survey results can be found in **Appendix G**.

Public feedback was also collected from the City's QAlert records. As a significant source of data for this project, QAlert is a web-based software the City uses to track, manage, and resolve a wide range of citizen service requests. QAlert data includes such details as the submitter's basic information, issue type, and the property or location associated the request. The City provided QAlert data for 31 service requests related to stormwater that were submitted between 2018 to 2024. The QAlert requests that were used to identify stormwater issues for this study are discussed further in **Section 4.9**.

4 HYDROLOGIC MODELING

This chapter provides an overview of the hydrologic and hydraulic modeling performed for this project, providing a description of the modeling platform used, the relevant subcatchment delineation work, model calibration, and the relevant design criteria.

4.1 MODELING PLATFORM

Hydrologic and hydraulic modeling was performed using AutoCAD Storm and Sanitary Analysis (SSA). SSA calculates stormwater runoff from model subcatchments for single storm events or continuous time periods and routes the runoff through a storm drainage network. SSA is typically used for sizing conveyance systems and stormwater management best management practices (BMPs), analyzing problem areas, and planning for changes in land use or hydrology.

4.2 SUBCATCHMENT DELINEATION

The study area includes the north, central, and south drainage areas described in **Section 3.2** along with the upstream offsite drainage areas that contribute flow to the north and south areas. The north detailed area, the Ridgemont No.5 development area, and the north's offsite lumped drainage areas discharge to the 16th Avenue pond. The central area discharges to Radco Pond. The south detailed area and its offsite lumped drainage areas discharge to drywells distributed through the area. Depending on available capacity, overflow from the detailed and lumped south areas can discharge to a set of drywells on East 24th Avenue. The ultimate sag discharge for the south area is located along Sullivan Road approximately 400' north of the East 24th Avenue intersection. For this report, the vicinity of East 24th Avenue and Timberlane Drive is considered the common point of discharge.

To develop the model, the north, central, and south areas were divided into subcatchments, or areas that drain to a common point in the drainage conveyance system. The subcatchments were delineated using topographic survey data, City GIS topography data, aerial images from Google Earth, and field observations. Model subcatchments are shown in **Figure 4-4-1**.

The delineations followed two different methods that were based on areas that were identified through coordination with the City as either being detailed model areas or lumped model areas:

Detailed Model Areas: In detailed model areas, subcatchments were delineated based on the area contributing to each drainage inlet. These areas generally included subcatchments around South Vera Crest Drive, Ridgemont Drive, Conklin Road, 24th Avenue, 22nd Avenue, Timberlane Drive, and Sonora Drive, which were identified by the City as the most likely areas to be prioritized for road and drainage improvements. The detailed delineations allowed for a more refined assessment of the drainage system in these areas. Subcatchments included both the rights-of-way and residential parcels. A total of 65 detailed subcatchments were delineated, ranging in size from approximately 0.1 acres to 18.4 acres.

Lumped Model Areas: Outside of the detailed model areas, a lumped approach was used. Each subcatchment covered a larger area, and parameters were developed to represent average conditions across the subcatchment. In these areas the storm drain inlets, pipes, and stormwater management BMPs were not explicitly modeled but were instead represented through adjusting the overall subcatchment parameters. A total of four lumped subcatchments were delineated, ranging in size from approximately 12.1 acres to 50.2 acres. Lumped subcatchment discharge points and peak flows to each discharge point are summarized in **Table 4-1**.

Table 4-1: Lumped model runoff results

Model Subcatchment	Model Discharge Node	Final Discharge Point	Peak Runoff 10 year 3-hour	Peak Runoff 10 year 24-hour	Peak Runoff 100 year 24-hour
Sub-lump1	16th_Ave_Pond	16th Avenue Pond	3.67 cfs	5.30 cfs	10.97 cfs
Sub-lump2	16th_Ave_Pond	16th Avenue Pond	0.63 cfs	1.08 cfs	2.23 cfs
Sub-lump3	Pond_B	16th Avenue Pond	0.86 cfs	1.45 cfs	3.02 cfs
Sub-lump4	Pond_A	16th Avenue Pond	1.79 cfs	3.37 cfs	6.95 cfs

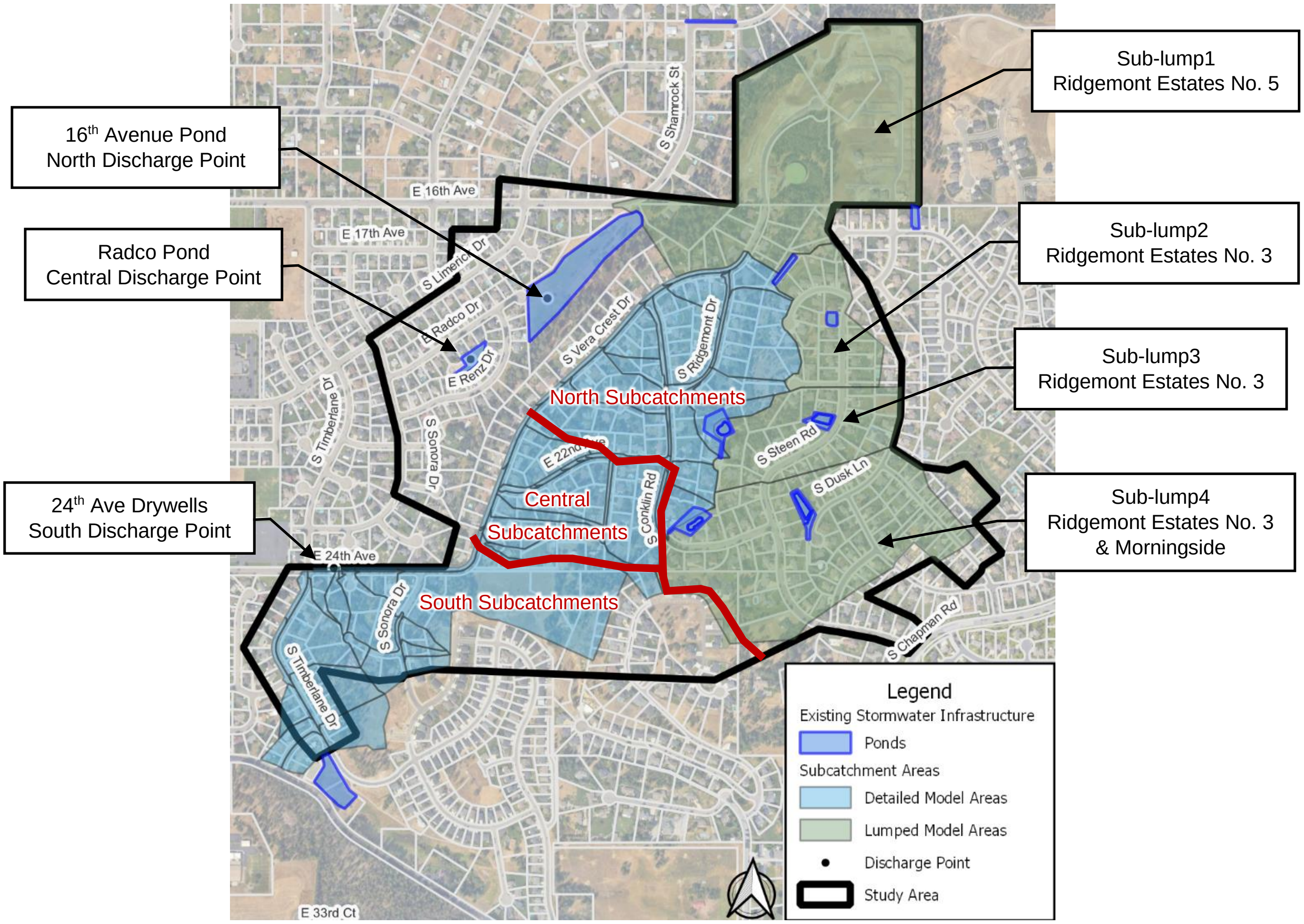


Figure 4-4-1: Subcatchment Delineation Areas

4.3 HYDROLOGY

The Technical Release 55 (TR-55) method was used in SSA to calculate runoff from each model subcatchment based on rainfall data that was input first from historical precipitation data and design storms. Key subcatchment hydrology parameters included the Soil Conservation Service (SCS) curve number and time of concentration. These values were initially selected based on guidance in the Spokane Regional Stormwater Manual (SRSM). The curve numbers were then adjusted during model calibration so the runoff response would more closely match flow monitoring data. The range of values for the parameters are provided in **Table 4-2**, and the methods used to determine the parameters are described in more detail below. Model calibration is discussed in **Section 4.5**.

Table 4-2: Ranges for key subcatchment parameters used in the SSA model

Parameter	Range of Values
Subcatchment area (detailed model area)	0.1 to 18.4 acres
Subcatchment area (lumped model area)	12.1 to 50.2 acres
SCS Curve Number	Initial Value = 80 Calibrated Value = 70
Time of Concentration (detailed model subcatchments)	5 to 59 minutes
Time of concentration (lumped model subcatchments)	37 to 78 minutes

For subcatchment infiltration, the Soil Conservation Service (SCS) curve number method was used to calculate infiltration losses. Curve numbers were initially taken from the SRSM recommended curve numbers for residential developments and impervious areas based on the underlying hydrologic soil group (HSG). HSG data from the NRCS Web Soil Survey was used to assign HSGs and corresponding curve numbers to model subcatchments. After setting the initial curve numbers, their values were adjusted through calibration, as discussed in **Section 4.5**.

The time of concentration (Tc) for each subcatchment was calculated using the TR-55 method in the SSA model. Tc represents the time for runoff to travel from the hydraulically most distant point of the subcatchment to the subcatchment discharge point. Tc was computed by summing the travel times for consecutive components of the drainage conveyance system including sheet flow, shallow concentrated flow, and channel flow. For right-of-way subcatchments, sheet flow was used to represent flow between the road centerline and the gutter, and channel flow was used to represent flow along the gutter to the subcatchment discharge point. For parcel subcatchments, sheet flow was used to represent runoff over the first 300 feet in residential yards and undeveloped areas, then shallow concentrated flow was used to represent any additional length before reaching an inlet or ditch. A minimum Tc of 5 minutes was set in the model which allows the model to use 5 minutes when the calculated Tc was less than 5 minutes.

4.4 HYDRAULICS

Model hydraulics included inlets, catch basins, drywells, pipes, ditches, ponds, and pond outlet structures. Data for the model was taken from the topographic survey and filled in with information from record drawings as needed. Data included invert and rim elevations, pipe size and material, pond footprints and depths, and orifice and weir dimensions for pond outlet structures. Hydraulic elements were imported as model conduits for linear features like pipes and ditches, and as model junctions for point features like catch basins, drywells, and ponds.

Key hydraulic parameters are summarized in **Table 4-3**. Inlet blockages were set based on typical parameters used by the City. Failed drywells were modeled as junctions with overflow gutter connections, so all flow was bypassed. Functioning drywells were modeled as storage nodes, which allows an infiltration rate to be assigned in SSA. Drywells with open grates were initially modeled as inlets connected to storage nodes, but this created instabilities in the model, so the simpler method of using either a junction or storage node was used to allow the model to calculate stable results. Clogged and collapsed pipes were represented by reducing the diameter of the pipes so the pipe diameter in the model was equivalent to the open area reported in the CCTV inspections.

Table 4-3: Key model hydraulic parameters

Parameter	Value
Inlet Width	Varies based on field measurements and standard plans dimensions
Inlet Blockage	Inlets on sag: 50% blockage Inlets on grade: 35% blockage
Failed Drywells	Modeled as junctions with overflow gutter connection
Functioning Drywells	Modeled as storage nodes with infiltration rate assigned
Collapsed/Clogged Pipes	Pipe size reduced until diameter was equivalent to open area based on CCTV inspections

4.5 MODEL CALIBRATION

After assigning initial model parameters, the model was calibrated by comparing model runoff to observed runoff from the flow monitoring data as well as video data provided by the City. Model calibration was considered important for this study for two reasons. First, there are baseflows in the study area from groundwater that seep up into the drainage conveyance system. These baseflows were captured in the flow monitoring data and added into the model. Second, there is a significant range of model parameters that fall within typically accepted values. Calibration allowed adjustment of some of these parameters to prevent the model from over- or underpredicting flow rates while keeping all model parameters within typical values. Calibration focused on adjusting infiltration curve numbers, storage node volumes, and base flows that represented shallow subsurface flow seeping into the drainage system.

Model calibration was first done using flow monitor data, then the model was recalibrated to more closely match video data provided by the City. These two methods are described below:

- **Flow monitor calibration:** Model parameters were adjusted until the modeled and observed flows matched as closely as possible. The model was calibrated for the period of November 2023 through May 2024. The flow monitor model calibration is described in more detail in **Appendix H** including graphs showing a comparison of the calibrated model and the flow monitor data for several storm events.
- **Video data recalibration:** After reviewing model results with the City, the model was recalibrated to more closely match conditions that were visually observed and documented in videos provided by the City from a storm event in early May 2023. Specifically, the model was updated to show a greater amount of gutter flow in locations where video evidence indicated significant gutter flow. Flow volume to the 16th Avenue Pond was also reduced based on City observations from past storm events that indicated the model was likely overpredicting ponding depth. The model also underwent significant hydraulic updates during the recalibration. The model was not recalibrated to flow monitoring data since the goal was to more closely match video and anecdotal evidence provided by the City.

4.6 DESIGN STORMS AND DESIGN CRITERIA

After developing and calibrating the model, design storms were used to assess the capacity of drywells in the existing subcatchments and to develop proposed solutions for drainage issues. Design storms were selected using design criteria in the SRSM and SWMMEW and through conversations with City staff during project scoping.

Conveyance capacity criteria was used to evaluate existing conditions and develop potential conveyance solutions. Infiltration pond capacity criteria , along with drywell testing, was used to evaluate the capacity of existing discharge points and develop alternatives for I new, expanded, or revised stormwater facilities. A summary of the design storms used in this study and design criteria is listed in **Table 4-4**.

Table 4-4: Design storms used in the SSA model

Criteria	Design Storm
Conveyance Capacity	**10 year 3-hour storm** Per the SRSM, storm drains should be designed to convey the 10-year design storm without surcharging.
Infiltration Pond Capacity	**100 year 24-hour Type 1A storm** Per the SRSM, infiltration facilities must have an overflow path with capacity to convey the 100-year storm event such that the overflow route or termination of stormwater does not adversely impact down-gradient properties or structures. Because there is no overflow path in the study area, the 100-year storm was used for evaluating pond sizing.

4.7 EXISTING SYSTEMS EVALUATION

The existing stormwater system was evaluated by reviewing conveyance system capacity, peak flows to the discharge locations (16th Avenue Pond, Radco Pond, and East 24th Avenue drywells), and infiltration capacity at each discharge location.

In general, the model indicated that the existing pipes and open channels in the conveyance system have capacity for carrying runoff. In most locations, pipes and open channel ditches were not shown as surcharging even up to the 100-year event. However, there were multiple locations where inlets were shown not to have adequate capacity for capturing runoff resulting in bypass flows and ponding of water in the roadway. These locations are discussed further in the proposed improvements presented in Chapter 5.

Peak flows to each discharge location are listed in **Table 4-5**.

Table 4-5: Peak flows at points of discharge

Discharge Point	Peak Inflow 10 year 3-hour	Peak Inflow 10 year 24-hour	Peak Inflow 100 year 24-hour
16th Avenue Pond	14.34 cfs	16.60 cfs	23.88 cfs
Radco Pond	2.90 cfs	2.97 cfs	5.55 cfs
24th Avenue Drywells	1.26 cfs	1.98 cfs	5.43 cfs

At the 16th Avenue Pond, the model showed adequate capacity for infiltrating all modeled storm events (10-year 3-hour event, 10-year 24-hour event, and 100-year 24-hour event). The model showed the pond filling to maximum depths of 0.20 feet, 1.83 feet, and 3.89 feet for these respective storm events. At a depth of approximately 5 feet, water will overflow from the pond and into the East Radco Court cul-de-sac. The infiltration and storage capacity at the 16th Avenue Pond is summarized in **Table 4-6**.

Table 4-6: 16th Avenue Pond infiltration and storage capacity

Parameter	Value
Infiltration Rate 55,770 sf (bottom footprint) x 0.94 in/hr (average of constant head and falling head infiltration tests) x 1/3600 (conversion of hours to seconds) + 2 cfs (1 cfs per drywell based on SRSM typical values for double barrel drywells in infiltrative soils)	3.21 cfs
Storage Volume Volume at 3-ft depth (top of pond berm, based on 2024 topographic survey) = 287,887 cf = 6.6 ac-ft Volume at 5-ft depth (overflow elevation, based on record drawings) = 594,470 cf = 13.6 ac-ft Existing conditions design volume with 1-ft freeboard (calculated based on water depth 1 foot below overflow elevation) = 10.1 ac-ft	10.1 ac-ft

The model reported no capacity issues at the Radco Pond with all flows from the upstream drainage basin being routed into the pond. This was consistent with infiltration testing, which measured a high infiltration rate at one of the pond’s drywells. However, based on field observations and flow monitoring data, runoff does not appear to reach the pond and is believed to fully infiltrate into the open channel ditch upstream of the pond. Based on the model results, the pond has capacity to infiltrate the full amount of runoff if it were to be routed into the pond. The infiltration and storage capacity at the Radco Pond is summarized in **Table 4-7**.

Table 4-7: Radco Pond infiltration and storage capacity

Parameter	Value
Infiltration Rate 0.812 cfs (field-tested drywell infiltration rate) x 6 drywells = 4.871 cfs	4.872 cfs
Storage Volume Volume at 2-ft depth (maximum design depth, based on record drawings) = 30,215 cf = 0.7 ac-ft	0.7 ac-ft

At the East 24th Avenue drywells, the model showed inadequate capacity for infiltrating runoff when using the infiltration rate of 0.3 cfs per drywell. It should be noted that this infiltration rate is higher than the 0.014 cfs rate that was measured in the field during the geotechnical investigation. The geotechnical investigation indicated these drywells likely have a reduced capacity due to sediment loading. However, based on conditions observed in the field by both Osborn and the City, minimal ponded water has been observed in this area during storm events. This infiltration rate was increased after discussion with the City in order to recreate conditions observed in the field. Because of the low infiltration rate, the model showed the existing drywells do not have capacity to manage the 10-year event. This study recommends additional drywell testing along 24th Ave. nearer Sullivan Road to determine if higher capacity rates are available. The infiltration capacity at the East 24th Avenue drywells is summarized in **Table 4-8**.

Table 4-8: East 24th Avenue infiltration capacity

Parameter	Value
Infiltration Rate Field-measured drywell exfiltration rate = 0.014 cfs Approximated drywell exfiltration rate based on field observations of minimal ponded water = 0.3 cfs	* 0.3 cfs/drywell

* Approximately 3 drywells in this vicinity are assigned this value.

Based on conversations with the City, there have not been issues with the Timberlane Terrace pond after the improvements that were installed in 2017. Because this pond was outside the detailed model area and this surrounding area is expected to drain into this pond, this was not included in the model. Drywells along Timberlane have been modeled as storage nodes with zero infiltration rate to assume a worst-case scenario where all runoff overflows to East 24th Avenue. This infiltration rate is recommended to be adjusted if more field testing is done in the future.

4.8 PROPOSED IMPROVEMENTS EVALUATION

The proposed improvements were evaluated by creating the proposed pipe network in SSA and running the design storms through this network. The proposed conveyance system was sized using the 10-year 3-hour design storm. Any pipes showing surcharging were upsized. Pipes downstream of surcharging areas were also upsized to prevent any decreases in pipe sizes that could potentially surcharge the conveyance system. Proposed improvements are discussed in detail in **Chapter 5**.

4.9 SUMMARY OF DRAINAGE ISSUES

Drainage issues were identified through interviewing City staff, reviewing the City's QAlert GIS data, observing problem areas in the field, using the results of the public outreach survey, and a hydrologic and hydraulic modeling assessment of the existing drainage system.

The drainage issues were subdivided into three groups representing the north, central, and south portions of the overall study area. These areas are shown in **Figure 4-2**. The drainage issues identified in each area are summarized in the subsections that follow and a map showing the specific locations of drainage issues is included in **Appendix I**.

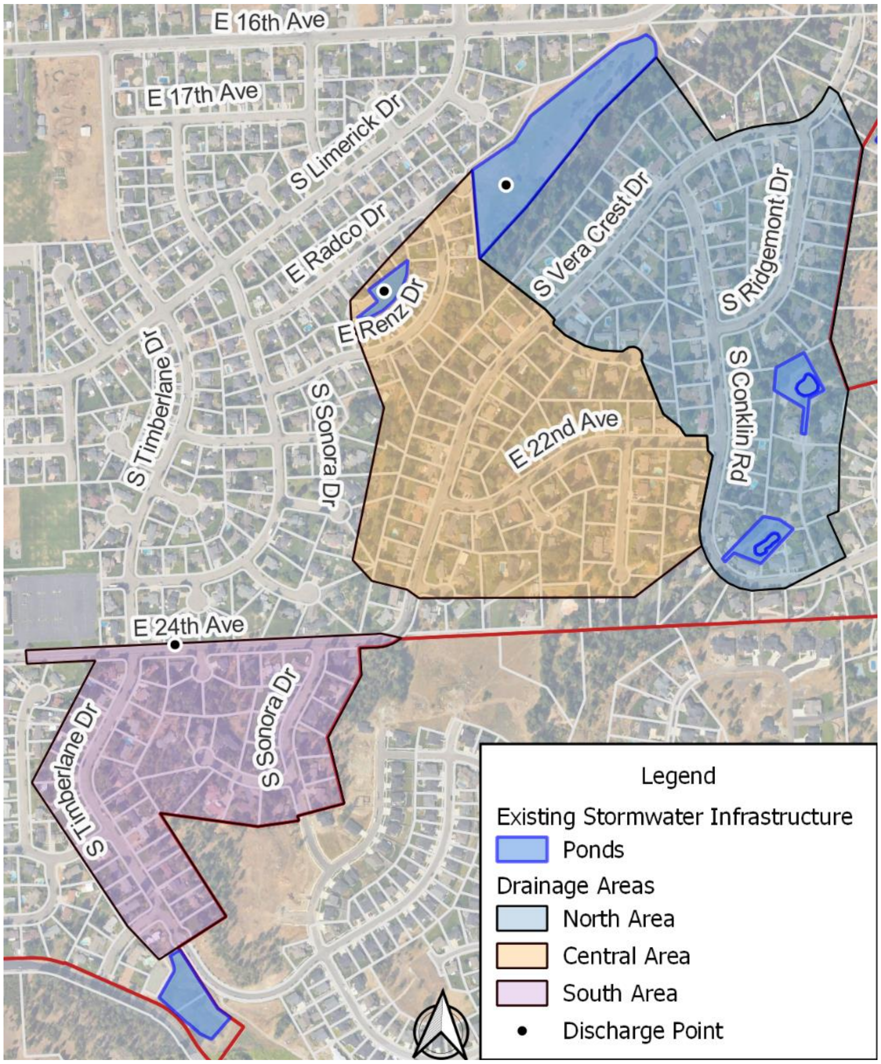


Figure 4-2: North, central, and south areas for grouping drainage issues

4.9.1 North Area

The following drainage issues were identified in the North Area. Issues are arranged by those identified by QAlert reports, by Osborn, or by the City.

- **City QAlerts**
  - QAlert data included multiple reports of ponding water, soil erosion, residential groundwater issues, and damaged roadways, mostly by South Vera Crest Drive and South Ridgemont Drive.
  - A sinkhole was reported at the intersection of Conklin Road and Ridgemont Drive, which the City identified as a partly collapsed and rusted culvert, shown in **Figures 1** and **2** in **Appendix C**. The City has provided a temporary prepare of this pipe..

- **Osborn-Identified Problem Areas**
  - Based on inlet spacing calculations, there are seven locations along South Vera Crest Drive that currently show a higher rate of runoff bypassing the inlet than what is recommended by WSDOT design standards.
- Flow monitoring data measured a steady baseflow during the spring months that ranged from 0.1 to 0.2 cubic feet per second at the flow monitors near South Conklin Road and South Vera Crest Drive. Flow monitoring data at this location is shown in the Flow Monitor 1 and Flow Monitor 2 graphs in **Appendix D**. The baseflow is likely from shallow subsurface flow that infiltrates higher in the drainage basin and then resurfaces into the storm conveyance system lower in the basin. This is consistent with the findings in the geotechnical report noting that regular recharge is expected for groundwater in the sedimentary unit in the project area (**Appendix B Section 5.2.5**). The existing ponds in the upper part of the drainage basin are likely locations where stormwater runoff is infiltrated into the ground to locally recharge groundwater, increasing the volume of shallow subsurface flow.
  - Flow monitoring data (**Appendix D**, figures for Flow Monitor 1 and Flow Monitor 2) shows that there is often a difference in the amount of flow between the upstream and downstream ends of the open channel ditch that conveys flow through private properties located between South Conklin Drive and South Vera Crest Drive. For storm events with flows ranging from roughly 0.5 to 1.5 cfs, the difference between the flow monitors was up to roughly 0.2 cfs with either meter measuring a higher flow depending on the event. This indicates runoff is likely infiltrating into the open channel during some parts of the year and shallow subsurface flow is seeping back into the channel during other parts of the year. The proposed storm drain will minimize this interaction between surface runoff and shallow subsurface flow.
  - The Geotechnical boring near South Conklin Road and South Ridgemont Drive indicated the presence of shallow Latah soils. There is an open channel immediately upstream of this location where runoff likely infiltrates into the ground. Infiltrated runoff likely does not permeate through the Latah soils but is believed to move laterally above them until reaching more gravelly soils that were identified around South Vera Crest Drive. This may create a problem at this specific intersection with shallow groundwater that could be high enough to cause saturation in the road subgrade.
- **City-Identified Problem Areas**
  - Based on conversations with the City, all the drywells along South Vera Crest Drive have experienced failure at some point in the past, contributing to roadway ponding and damage.
  - Some pipe outfalls that discharge runoff from South Vera Crest Drive to the East 16th Avenue Pond are in poor condition. Based on the City’s CCTV inspection completed as part of this study, damage was observed including collapsed pipes, rust damage, holes in the pipes, and joint separation.
  - Based on the City’s pavement inspections, roadways in this area have deteriorated with local Pavement Condition Index scores from 11 to 40, which fall into the “very poor” and “serious” categories for road conditions.

4.9.2 Central Area

The following drainage issues were identified in the Central Area. Issues are arranged by those identified by QAlert reports, by Osborn, or by the City.

- **City QAlerts**
  - QAlert reports for this area are related to easement and maintenance access concerns, most of which have already been addressed. Maintenance concerns pertaining to the catch basin located at the intersection of South Vera Crest Drive and East 22nd Avenue were not addressed.
- **Osborn-Identified Problem Areas**
  - The pipe that discharges at the top of the Radco open channel ditch has collapsed by 50 percent, which has led to observable water seepage on the hillside, shown in **Figure 6** in **Appendix C**.
  - Osborn identified open channel ditches draining towards the Radco Pond as problem areas. Even when flows were observed upstream in this open channel, no water would reach downstream where an inlet pipe connects this channel to the Radco Pond or in Radco Pond, shown in **Figures 7–10 in Appendix C**.
  - Water ponding was also observed at the intersection of South Vera Crest Drive and East 22nd Avenue, shown in **Figure 15** in **Appendix C**. This has included catch basins along East 22nd Avenue that have overflowed into the roadway with ponding observed at a low point between two catch basins.
  - Flow monitoring data showed no flow measured in the culvert upstream of Radco Pond that conveys flow from the main open channel ditch to the pond. This indicated that runoff likely does not reach the pond due to infiltration into the open channel ditch.
  - The existing stormwater system on East 22nd Avenue is disconnected from the downstream storm drains. , there is a significant amount of runoff that flows along the curb until reaching catch basins at the intersection of 22nd Avenue and South Vera Crest Drive.
- **City-Identified Problem Areas**
  - Several issues were noted with the open channel ditch that conveys flow to Radco Pond. The City reported that the hillside above the open channel ditch is saturated by high groundwater. The pipe that discharges at the midpoint of the open channel ditch was reported to be rusted out and leaking. The City noted that an area towards the bottom of the open channel ditch may be where water infiltrates, which has caused stormwater to rarely reach Radco Pond. The City has also received complaints about the open channel ditch not being maintained, with litter accumulating in the channel in the past.
  - The City noted that significant amounts of gutter flow have been observed on East 22nd Avenue and that asphalt is visibly damaged in this area along the road edges where asphalt transitions to concrete gutter. Ponding has been observed at the downstream end of this area at intersection of South Vera Crest Drive and East 22nd Avenue where runoff from several catch basins along East 22nd Avenue overflows into the roadway.
  - The sewer maintenance hole at the intersection on East 23rd Avenue and South Vera Crest Drive has been subject to groundwater intrusion.
  - Drywells at the intersection of East 22nd Avenue and South Conklin Avenue are likely failed with standing water present. Roads in this area are reported to be icy in the wintertime.
  - Based on the City’s pavement inspections, roadways in this area are partially deteriorated with Pavement Condition Index scores in the range of 11 to 55, which fall into the “fair,” “very poor,” and “serious” categories for road conditions. Roughly two-thirds of this portion of South Vera Crest Drive is in the “serious” category.

4.9.3 South Area

The following drainage issues were identified in the South Area. Issues are arranged by those identified by QAlert reports, by Osborn, or by the City.

- **City QAlerts**
  - Several QAlerts report ponding along South Timberlane Drive and adjacent private properties. For example, one QAlert reported significant ponding that resulted in water intrusion into a residential driveway and garage, shown in **Figure 16** in **Appendix C**. This ponding was likely caused by a large storm event potentially combined with clogged storm drains.
  - Several other QAlerts reported groundwater concerns, including one report of groundwater springs in a residential front yard, with flows spreading to East 24th Avenue.
- **Osborn-Identified Problem Areas**
  - Corroborating the details of the QAlert mentioned above, Osborn observed a groundwater spring located in the front yard of 15912 East 24th Avenue, a property located along East 24th Avenue. The groundwater spring occurred in the winter, leading to ice in the street, shown in **Figures 17** and **18** in **Appendix C**.
  - Osborn observed significant ponding of residential driveways at the intersection of Timberlane Drive and 24th Avenue (2023 and 2024 South Timberlane Drive, shown in **Figures 21** and **22** in **Appendix C**.
  - During a storm event, Osborn observed heavy ponding in the cul-de-sac of East Cameron Court. This cul-de-sac has two drywells, which were full of water, causing heavy ponding and snow build up, shown in **Figures 23** and **24** in **Appendix C**. The cul-de-sac is at a low point causing water to drain to this area. This likely has led to icy and hazardous driving conditions in the winter.
  - The three existing drywells on East 24th Avenue do not have adequate capacity for the flows currently routed to them. The hydrologic and hydraulic model indicates that a drywell outflow rate of 16 cfs is needed to manage the runoff currently routed to the drywells. Based on infiltration testing performed during this project, the drywells have an outflow rate of only 0.014 cubic feet per second.
- **City-Identified Problem Areas:**
  - The City has observed that all drywells along South Timberlane Drive, South Sonora Drive, and the drywell located at the intersection of East 24th Avenue and East 24th Court have had ponding. This is likely caused by high groundwater, a shallow, non-infiltrative basalt rock formation, and poor infiltrative soils. These issues likely also cause water on Timberlane Drive and Sonora Drive to overflow into East 24th Avenue.
  - The City noted that the infiltration pond located on the southern end of South Timberlane Drive has overflowed onto the street and caused runoff intrusion onto private properties and driveways. The infiltration pond has been upsized, and the City added extra drywells along Timberlane Drive to deal with future flood events. However, these drywells are reported to still be in failing condition and do not currently function as intended.

5 PROPOSED IMPROVEMENTS

This chapter describes the drainage issues that were identified during the study, the proposed improvements to address the issues identified, and cost estimates for the improvements.

5.1 PROPOSED IMPROVEMENTS

The proposed improvements have been organized as a menu of improvement options divided into four levels. Level 0 represents the minimum improvements that could be completed to improve roadways only. Each subsequent level adds improvements for the stormwater collection system and facilities. This approach captures a range, beginning at a minimum level and progressing to a maximum level of improvements and is intended to allow the City to set the project scope of work by choosing improvements based on the City's priorities, available budget, and considerations of equitable value. The levels of improvement are described below.

- **Level 0: Roadway Improvements Only**
  - For Level 0, all roadways in project area would be rebuilt that are rated in the "very poor" or "serious" categories based on the City's Pavement Condition Index. This includes roughly half the roads in the study area boundary with the main roads needing replacement being in the vicinity of South Vera Crest Drive and South Ridgemont Drive.
  - The existing stormwater system would remain as-is.
- **Level 1: Roadway Improvements**
  + Stormwater System Improvements (Retrofits) for Non-Standard Conditions
  - For Level 1, improvements would be completed for components of the drainage system that do not meet current standards in the SRSM. The standards from Basic Requirement No. 5 – Natural and Constructed Conveyance Systems in the SRSM would be used to identify which components do not meet current standards; including:
    A. Remove and replace non-standard grates with vaned grates
    B. Inlets in locations with non-flooded roadway widths less than 12 feet at the 10-year event
    C. The first inlet shall not be located more than 500 ft. from the point where the gutter flow path originates.
    D. Inlets with bypass flows greater than 0.1 cfs at intersections at the 10-year event
    E. Replace stormwater pipe t-connections with structures.
    F. Bubble-up catch basin conditions.
    G. Provide 10-year storage at infiltration facilities
    H. Provide 100-year storage at infiltration facilities to mitigate property damage.
- **Level 2: Roadway Improvements**
  + Stormwater System Improvements (Retrofits) for Non-Standard Conditions
  + Stormwater Improvements for Maintenance Retrofits
  - For Level 2, improvements would be completed for components of the drainage system in need of maintenance retrofits, which would include:

A. Replace failing drywells (remaining after level 1 improvements) identified as failed and are in suitable soils (failing drain field). Specific drywells will need to be determined with additional geotechnical investigations.

B. New stormwater system to replace failing drywells (remaining after level 1 improvements) identified as failed based on unsuitable soils. Specific drywells will need to be determined with additional geotechnical investigations.

C. 24th Ave. infiltration facility.

D. Replace, restore or abandon pipes identified as damaged or failed based on CCTV inspections or visual observations of damage

- **Level 3 - Roadway Improvements**
  + Stormwater System Improvements (Retrofits) for Non-Standard Conditions
  + Stormwater Improvements for Maintenance Retrofits
  + Stormwater Improvements (Retrofits) for Groundwater Improvements

  – For Level 3, improvements would be completed for components of the drainage system where undesired groundwater is interacting with the drainage system, either through groundwater resurfacing and entering the drainage system or stormwater runoff infiltrating into the ground at undesired locations in the drainage system such as open channel ditches.

    A. Impermeable liners at existing ponds.

    B. Eliminate existing roadway stormwater system discharge to Pond A.

    C. Eliminate existing stormwater system discharge to open channel between Conklin and Vera Crest.

    D. Reroute Radco drainage system to 24th Ave. - Eliminate existing stormwater system discharge to open channel.

    E. Radco drainage system improvements – Replace open channel flow with closed system.

    F. Groundwater collection at Conklin Rd. and Ridgemont Dr. intersection.

The drainage improvements identified in each level are summarized in the subsections below.

5.1.1 Level 0 Improvements

The proposed improvements for Level 0 are depicted in **Figure 5-1**. The roadway will be reconstructed at all locations where roads are rated in the “very poor” or “serious” categories based on the City’s Pavement Condition Index. This will include excavating the existing asphalt, base course, and a portion of the subbase and installing a new, thicker layer of base course and new asphalt. Based on the geotechnical evaluation and the current level of design, 4.5 inches of asphalt over 9 inches of crushed surfacing base course was assumed for all areas identified for roadway replacement. During final design, the pavement and subgrade design can be refined to match the site conditions, with varying depths of pavement and base course.

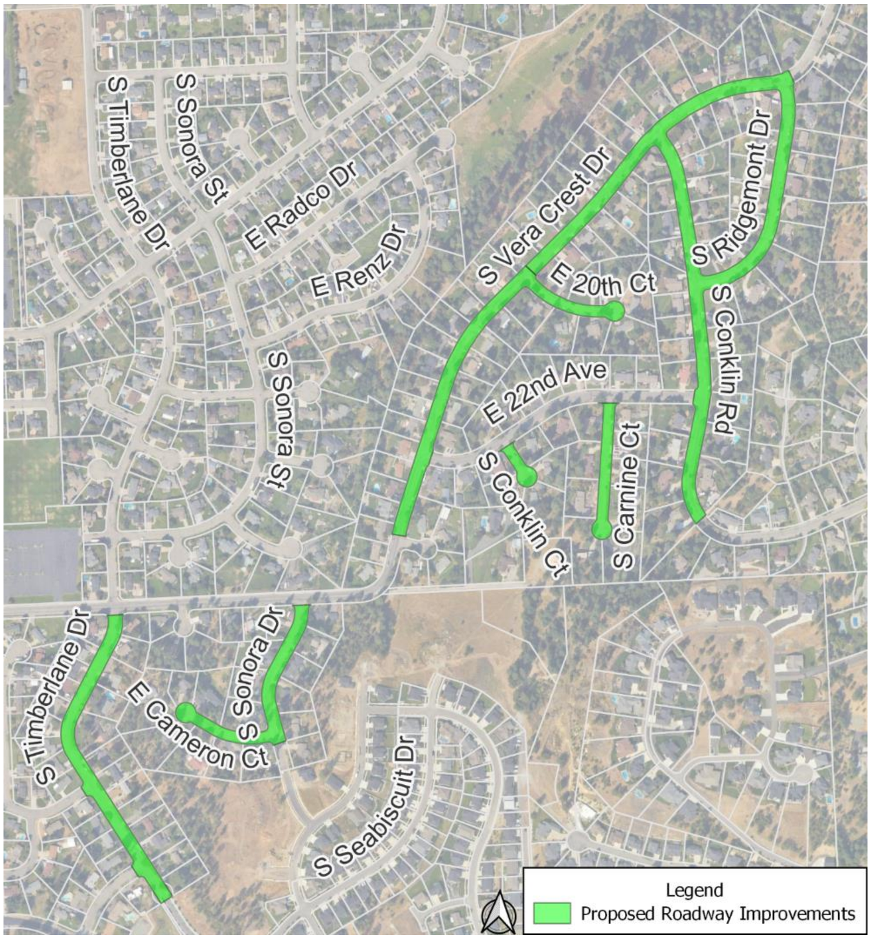


Figure 5-1: Proposed Level 0 Roadway Improvements

Length of road to be rebuilt and costs for the road improvements were calculated per street and are listed in **Table 5-1**.

Table 5-1: Length and Cost for Level 0 Road Improvements

Street	PCI Condition	Catchment Area	Area (sf)	Cost
South Vera Crest Drive	Very poor/serious	North & Central	115,300	1,910,000
South Conklin Road	Very poor/serious	North & Central	72,100	$1,190,000
South Ridgemont Drive	Serious	North	40,500	$670,000
South Sonora Drive	Very poor	South	23,900	$400,000
South Timberlane Drive	Very poor	South	60,000	$1,000,000
South Carnine Court	Very poor	Central	24,100	$400,000
South Cameron Court	Very poor	South	17,000	$280,000
South Conklin Court	Very poor	Central	9,900	$160,000
East 20th Court	Very poor	North	18,100	$300,000
Total Cost (Rounded)				$6,310,000

A unit cost of $16.59 per square foot was calculated for the road improvements. The unit cost was determined based on the total cost of all roadway replacement divided by the total area of roadway to be replaced. The total cost calculated for the entire project area was determined using the cost for mobilization, roadway excavation including haul, crushed surfacing base course, and HMA pavement. This price was adjusted for an estimated inflation (of 9%), contingency (of 30%), and a design fee (of 20%).

5.1.2 Level 1 Improvements

The proposed Level 1 improvements are depicted in **Figure 5-2** and the menu of improvements is described in the following pages.

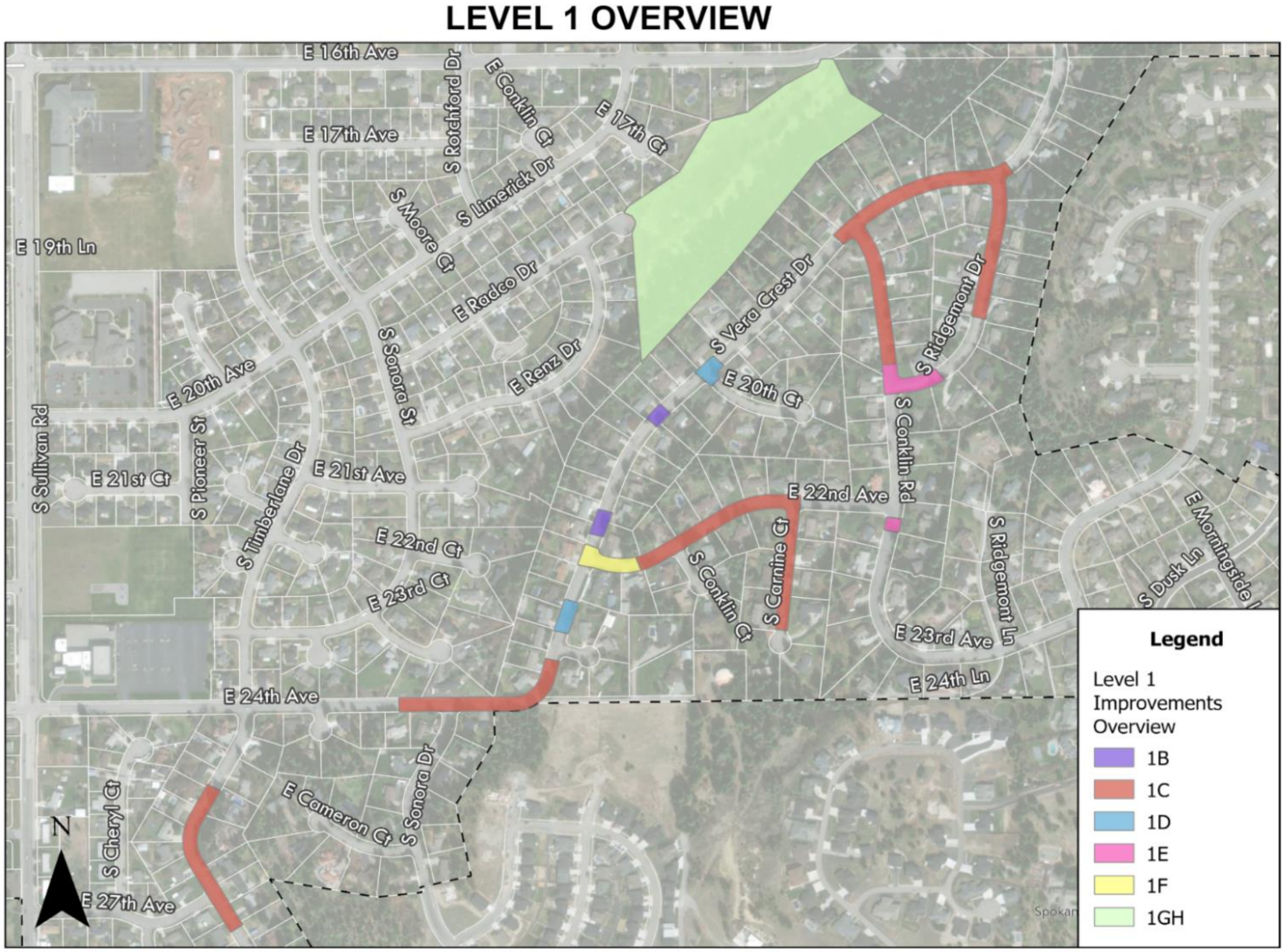


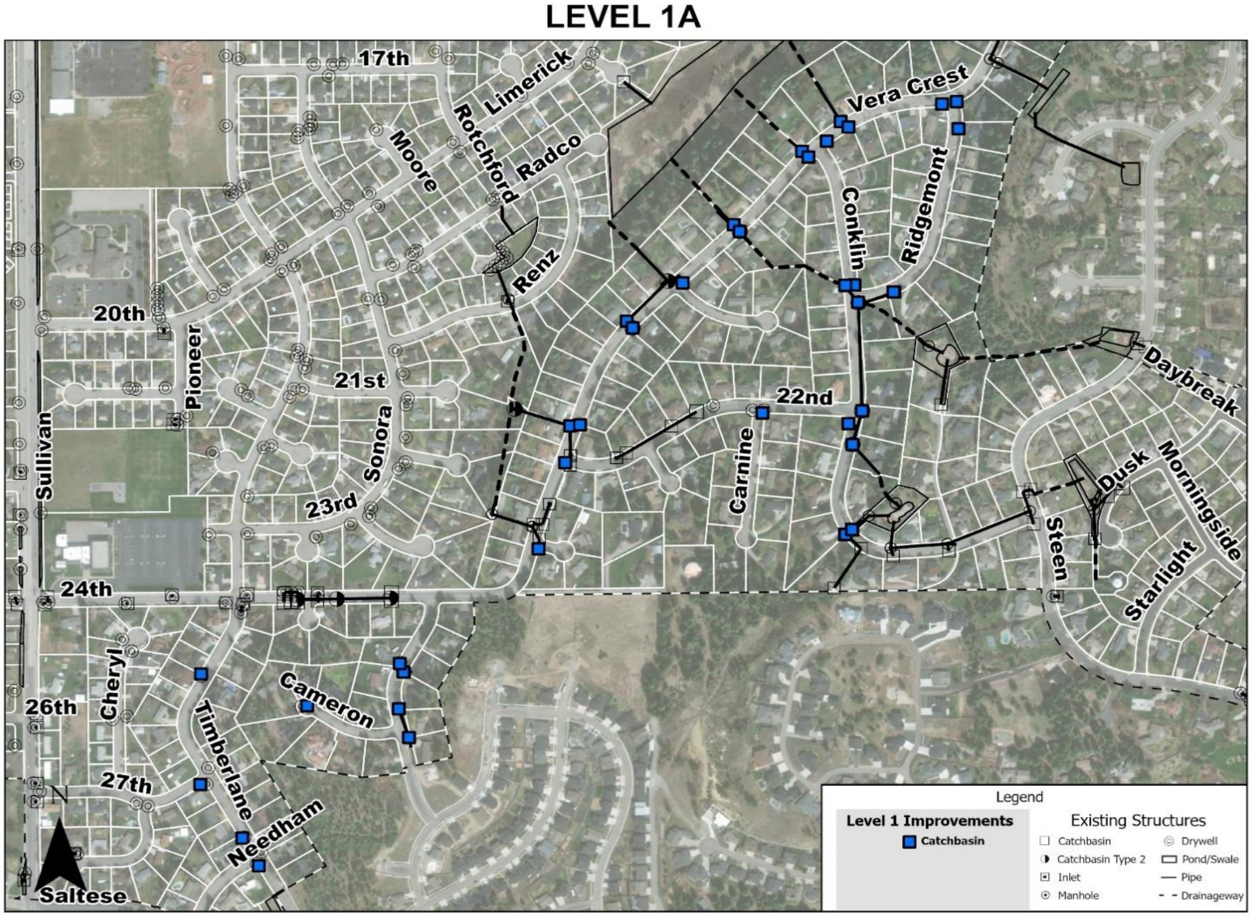
Figure 5-2: Overview of Level 1 improvements

Improvement 1A: Upgrade Grate Inlets

Proposed Improvements: Throughout the project area are round slotted, herringbone, and WSDOT slotted grate types. These non-standard grate types are recommended to be replaced with a standard vaned grate type.

Justification: Standard inlets improve capture resulting in less bypass and curb flow. This will require minimal improvement effort.

Planning Estimated Cost: $78,000



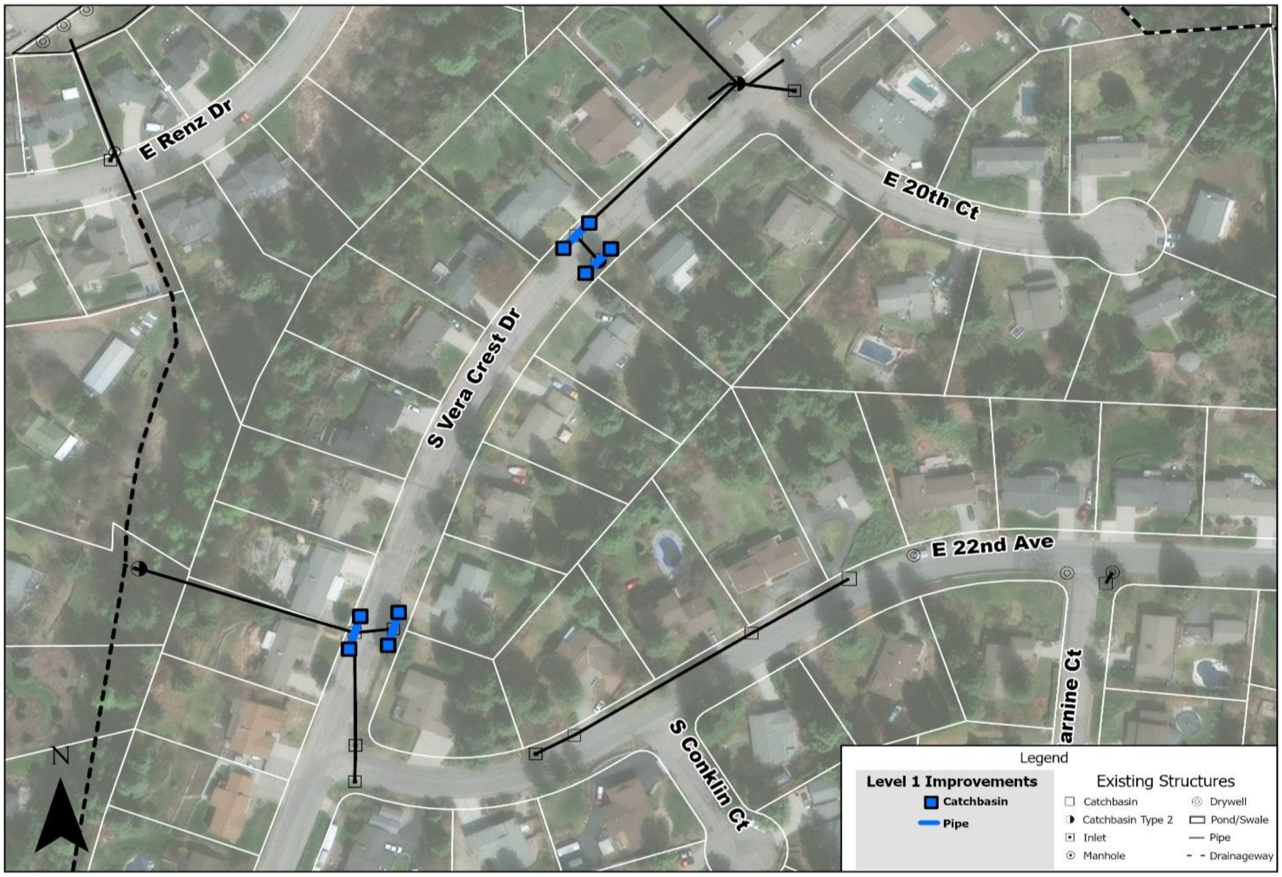
Improvement 1B: Non-Flooded Roadway Widths Less Than 12 Feet

Proposed improvements: Eight new catch basins will be installed at two sag locations in the project area. Four flanking catch basins will be installed at the sag location near South Vera Crest Drive and East 22nd Avenue. Four flanking catch basins will be installed the sag location near South Vera Crest Drive and East 20th Court. Approximately 160 feet of new storm drain pipe will be installed to connect the new catch basins to the existing catch basins.

Justification: This improvement will increase inlet capacity at the sags, reduce ponding water on the roadway, and maintain 12 feet of non-flooded roadway width.

Planning Estimated Cost: $80,000

LEVEL 1B

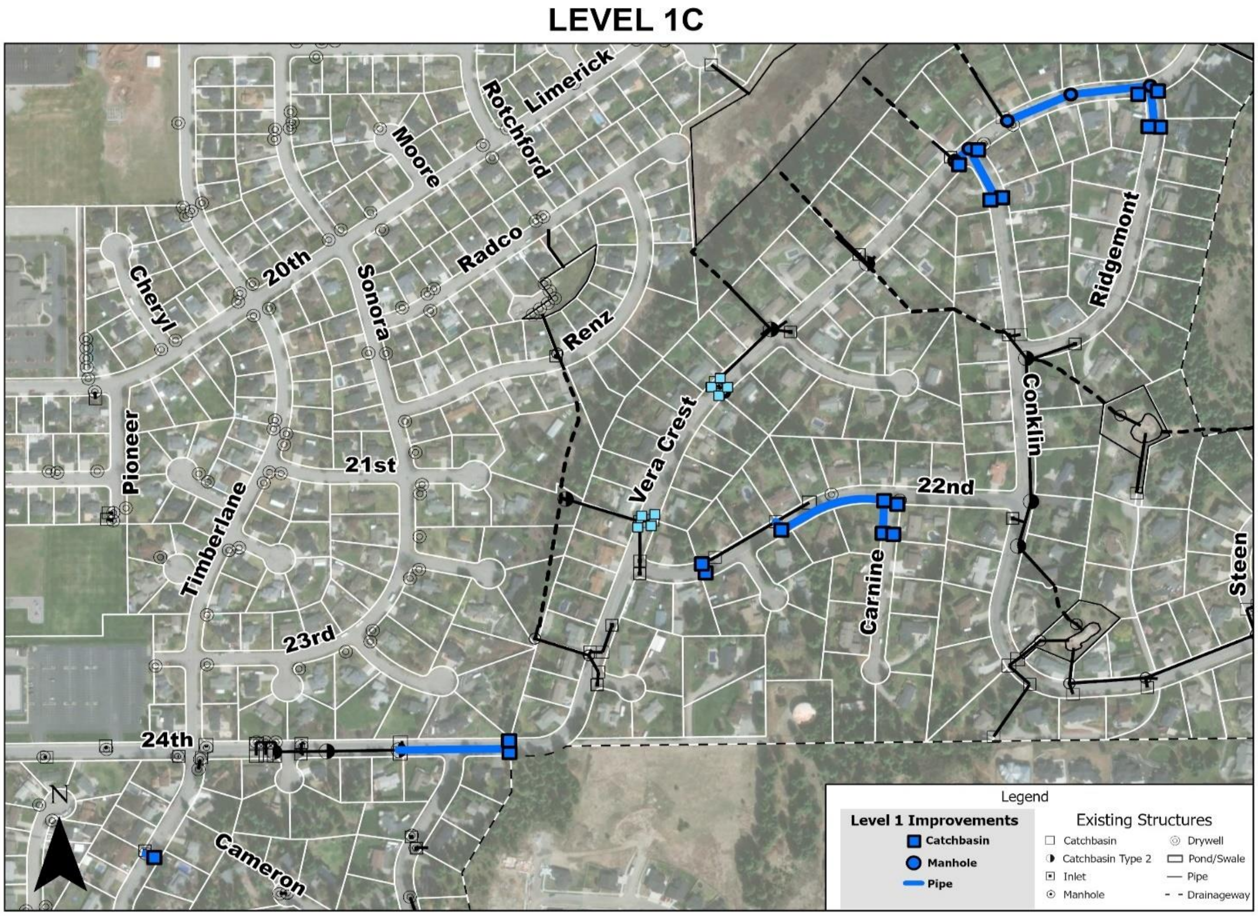


Improvement 1C: First Inlet Not More Than 500 Feet from Point Where Gutter Flow Begins

Proposed Improvement: Six locations within the project area lacked capture over 500 feet from the point where the gutter flow begins. These include locations along Ridgemont Dr., Conklin Rd, S. Carnine Ct. 22nd Ave., 24th, Ave. and Timberlane Dr. New storm drain systems will be installed including catch basin and pipe at these locations. Existing drywells in the North basin are removed/abandoned as part of this improvement.

Justification: This improvement increases capture, reduces curbline flow, spread, and velocity, and reduces flow bypass at intersections.

Planning Estimated Cost: $380,000

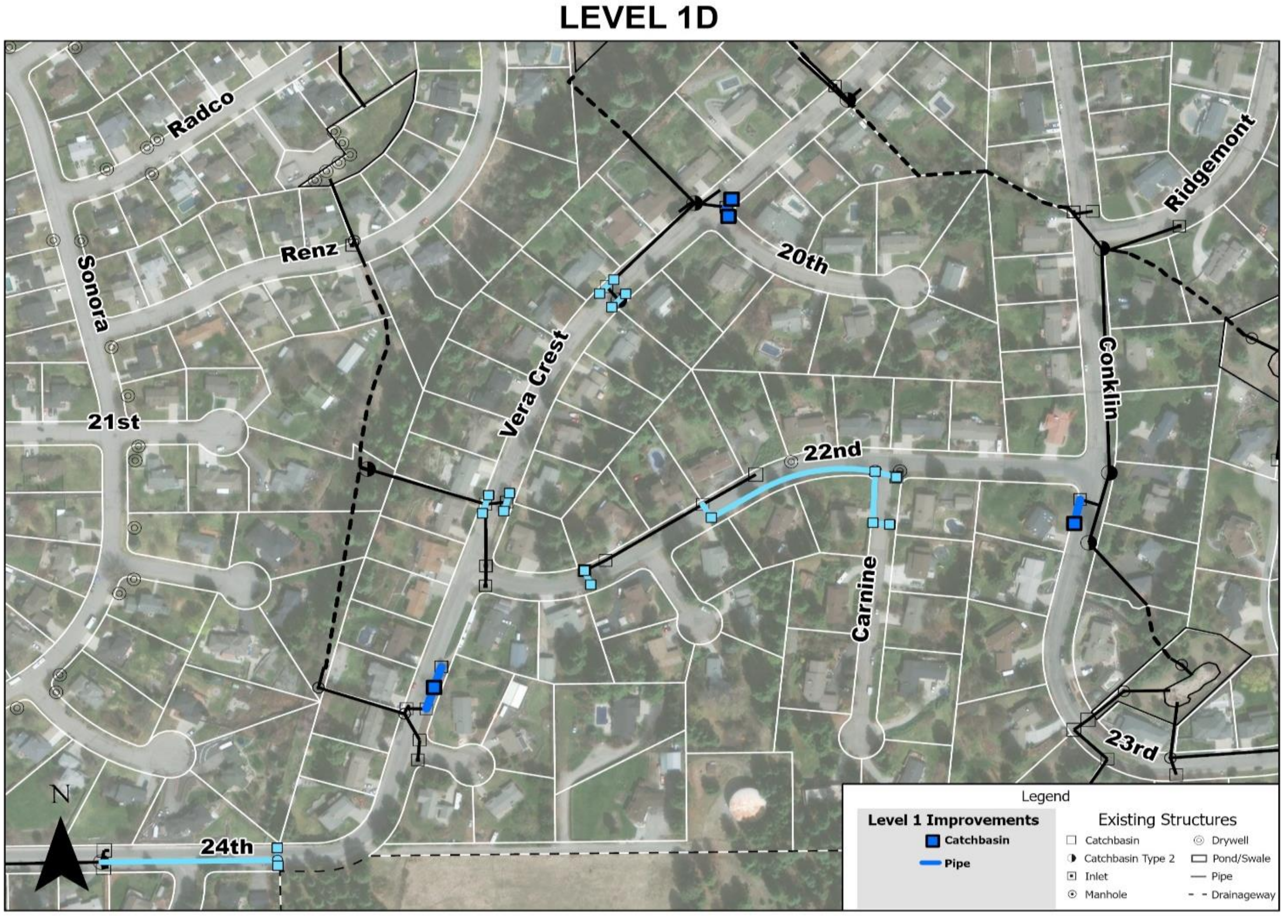


Improvement 1D: Reduce Bypass Flow to Less than 0.1 cfs at Intersections

Proposed Improvement: In coordination with other improvements, two sites remain where bypass flow (Qbp) at intersections is greater than 0.1 cfs. These locations are in the vicinity of the intersections at Vera Crest and E. 20th Ct and Vera Crest and E 23rd Ct. Additional catch basins and pipe will be installed at these locations.

Justification: This improvement will reduce the bypass flow at the intersection of E 20th and E 23rd Ct to less than 0.1 cfs. Reduced bypass reduces curbline flow, spread, and velocity.

Planning Estimated Cost: $40,000



Improvement 1E: Replace Stormwater Pipe Tee Connections

Proposed Improvement: Two locations have non-standard pipe connections. These locations are near the intersections of Conklin Rd and 22nd Ave. and Conklin Rd. and Ridgemont Dr. The tee connections will be replaced with catch basin junctions. Additional storm drain pipe is required at the intersection of Conklin Rd and Ridgemont Dr. to re-convey through the intersection.

Justification: This improvement will increase flow capacity and improve maintenance accessibility.

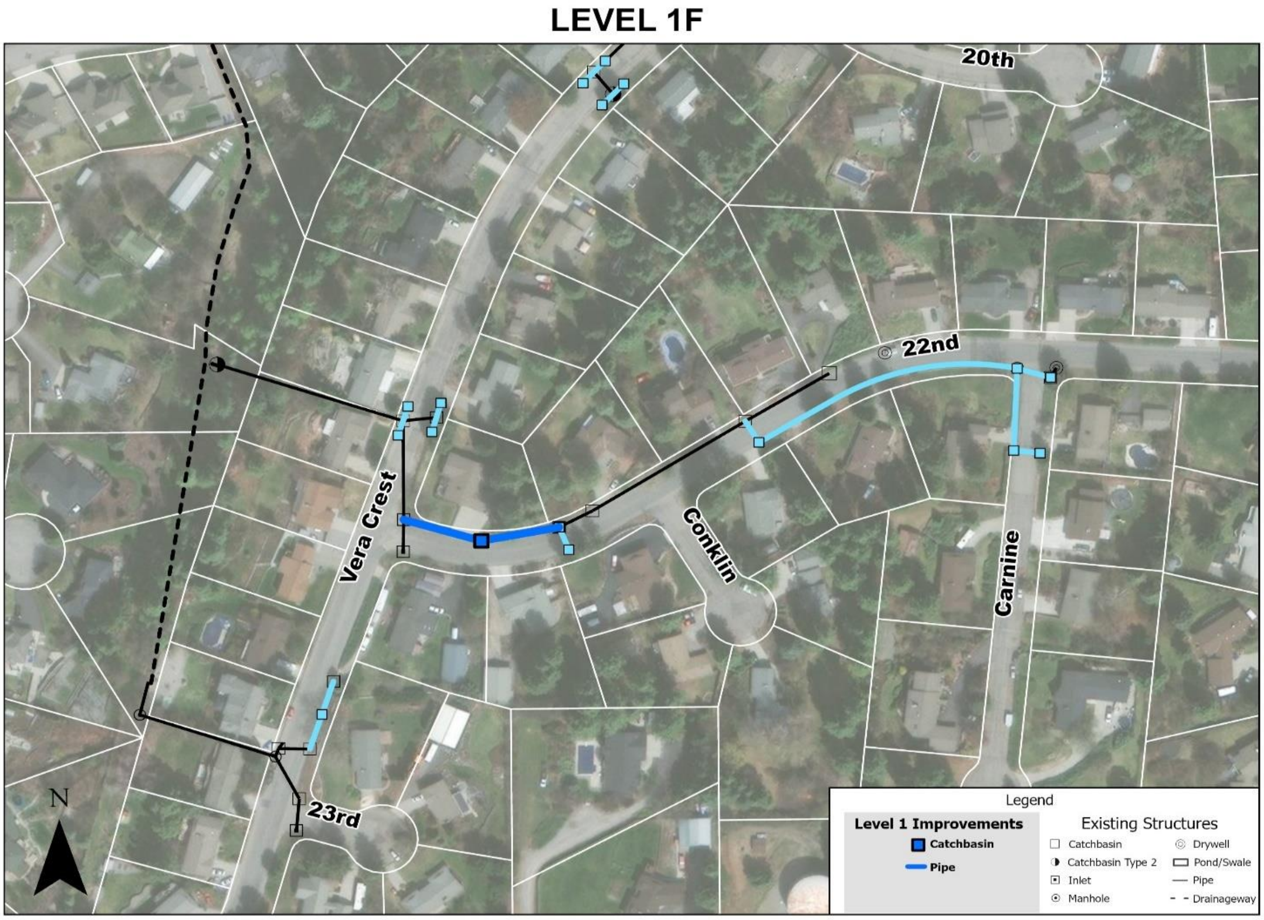
Planning Estimated Cost: $50,000

Improvement 1F: Eliminate Non-standard Bubble-Up Condition

Proposed Improvement: Approximately 240 feet of new storm drain system will be installed on E. 22nd Ave. east of the intersection with S. Vera Crest Dr. The storm drain will connect the downstream end of the existing bubble-up structure with the existing storm drains at the intersection that collects and conveys flow toward Radco Pond.

Justification: This improvement reduces roadway flow and decreases bypass flows at the intersection of Vera Crest and 22nd Ave. This improvement keeps flow in a piped system instead of allowing flow at the bubble-up structure to discharge back to the gutter.

Planning Estimated Cost: $45,000



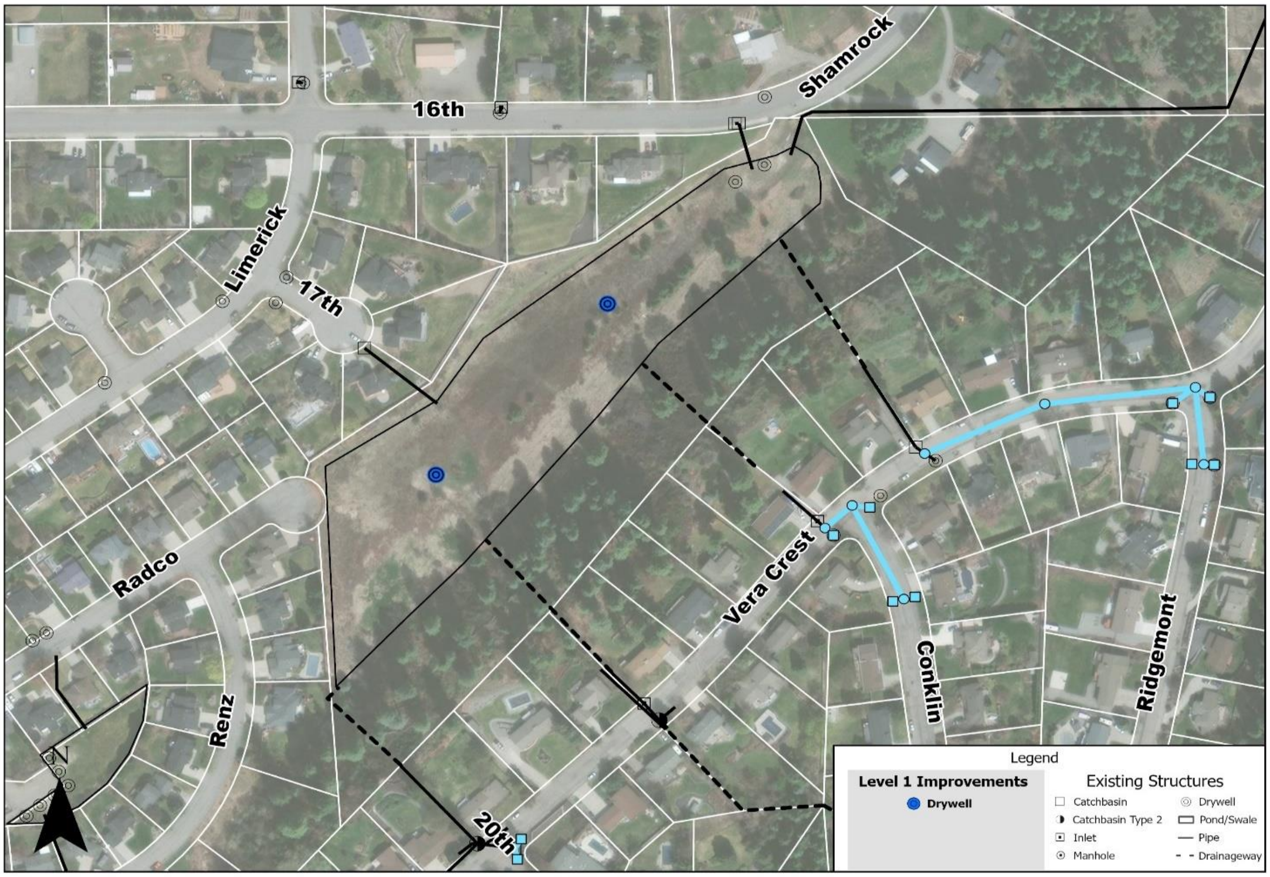
Improvement 1G: Provide 10-year Storage at Infiltration Facilities

Proposed Improvement: The location of this proposed improvement is at the 16th Avenue Pond. Based on results from the hydraulic modeling, this improvement is not needed at this time. However, if future developments or improvements result in an increase in flows, the number of drywells may need to be increased to provide storage of the 10-year design storm event.

Justification: Eliminate potential flooding.

Planning Estimated Cost: $25,000

LEVEL 1G

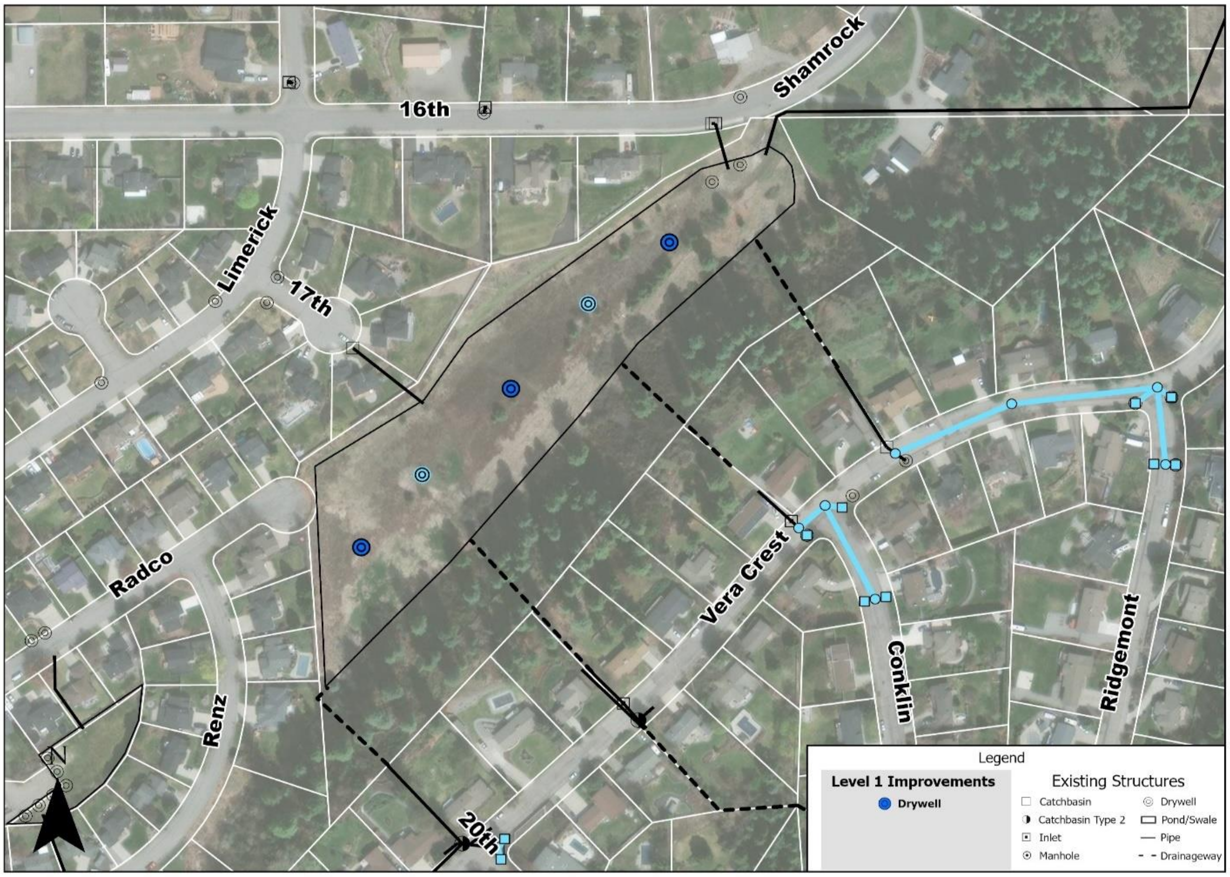


Improvement 1H: Provide 100-year storage to mitigate property damage

Proposed Improvement: The location of this proposed improvement is at the 16th Avenue Pond. Based on results from the hydraulic modeling, this improvement is not needed at this time. However, if future developments or improvements result in an increase in flows, the number of drywells may need to be increased to provide storage of the 100-year design storm event.

Justification: Eliminate potential flooding and property damage.

Planning Estimated Cost: $40,000



LEVEL 1H

5.1.3 Level 2 Improvements

The proposed Level 2 improvements are depicted in **Figure 5-3** and the menu of improvements is described in the following pages.

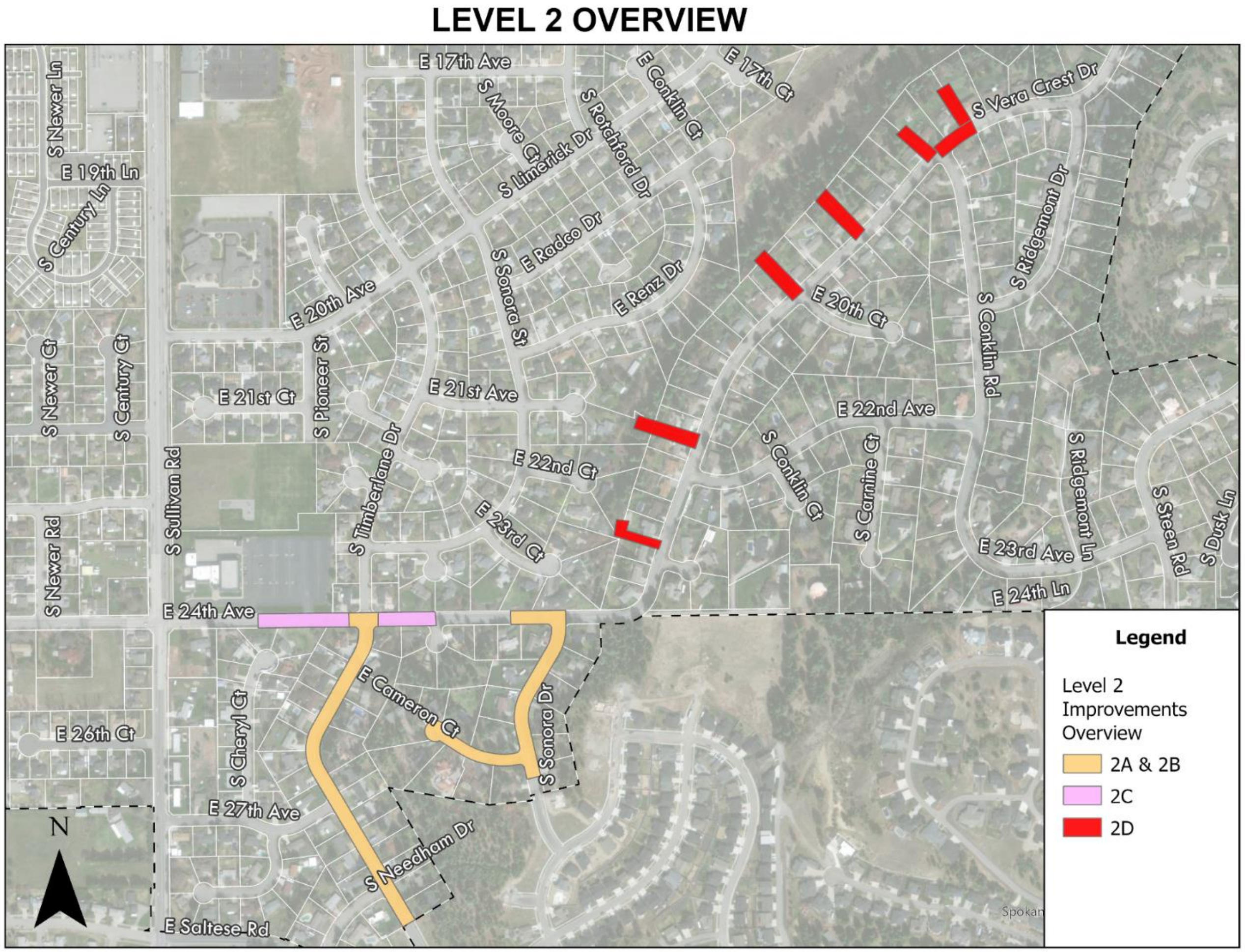


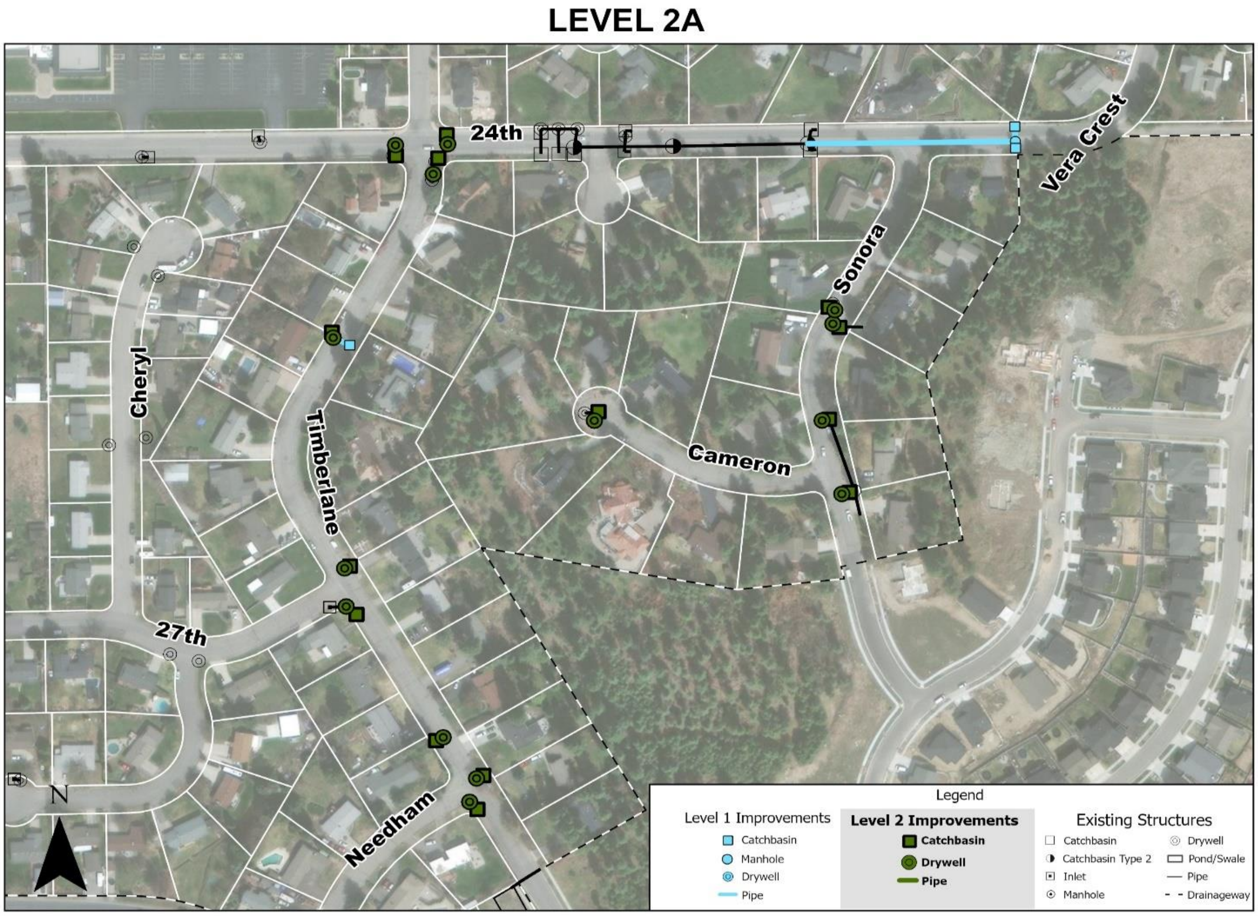
Figure 5-3: Overview of Level 2 improvements

Improvement 2A (Option A): Replace Failing Drywells in Suitable Soils

Proposed Improvement: The remaining failing drywells, not covered by level 1 or 2 improvements, are located along Sonora, Timberlane Dr., and E. Cameron Ct. Improvements include removing and replacing existing drywells. Type 1 catch basins will precede the new drywells. Additional Geotech evaluation and/or drywell testing will be required to determine if soils are suitable for drywells.

Justification: These improvements increase capture and capacity, reduce curbline flow, spread, and bypass.

Planning Estimated Cost: $340,000



Improvement 2B (Option B): Replace Failing Drywells in Unsuitable Soils

Proposed Improvement: Remaining failing drywells, not covered by level 1 or 2 improvements, are located along Sonora, Timberlane Dr. and E. Cameron Ct. Existing failing drywells will be removed and replaced with a stormwater system. The stormwater system will include catch basins and pipe. Stormwater will be collected and conveyed to E. 24th and discharged to a new drywell gallery. Additional Geotech evaluation and/or drywell testing will be required to determine if soils are suitable for drywells.

Justification: These improvements increase capture and capacity, reducing curbline flow, spread, and bypass.

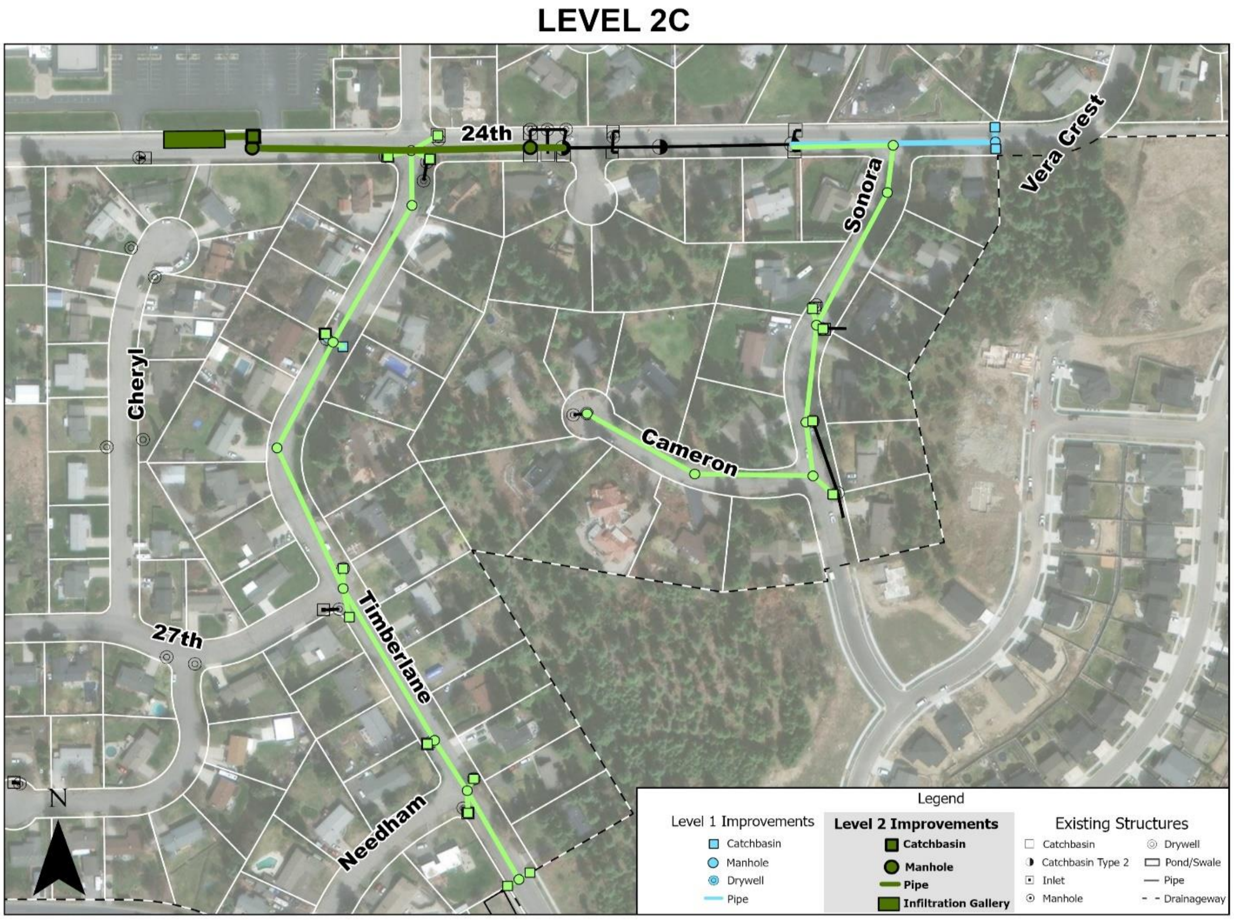
Planning Estimated Cost: $485,000

Improvement 2C: 24th Avenue Infiltration Facility

Proposed Improvement: Additional drywells or other subsurface infiltration facilities will be installed to supplement infiltration capacity at the three existing drywells east of the intersection of E. 24th Ave. and S. Timberlane Dr. The new infiltration facilities would be installed further west in the E. 24th Ave. right-of-way. Soils are anticipated to be more permeable. Additional Geotech evaluation and/or drywell testing will be required to determine if soils are suitable for infiltration.

Justification: This improvement will address inadequate capacity of the existing drywells on 24th Ave.

Planning Estimated Cost: $200,000

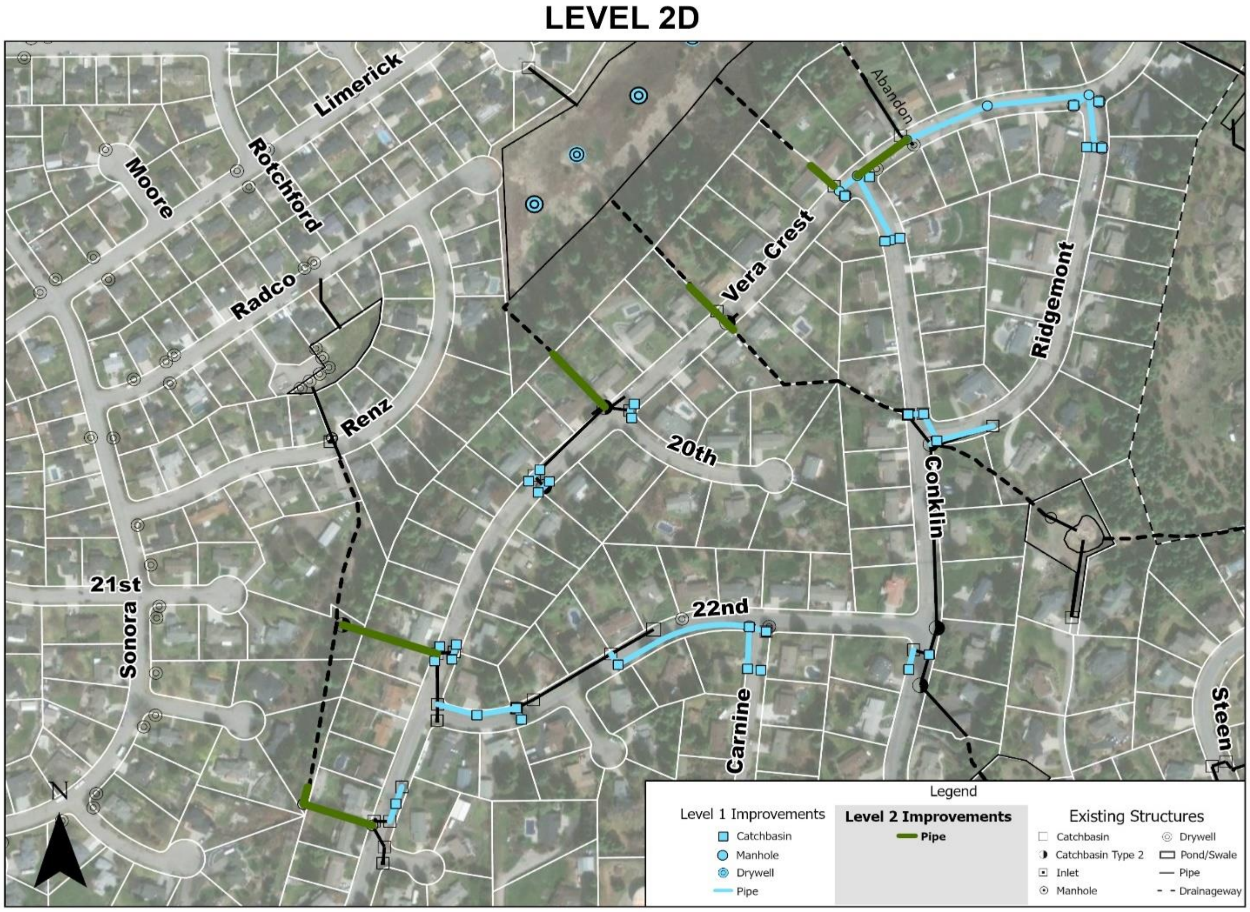


Improvement 2D: Replace, Restore, or Abandon Pipes Identified as Damaged

Proposed Improvement: Pipes identified as damaged or failing are located along Vera Crest and are the discharge points to the 16th Avenue Pond and Radco Pond. Due to constructability constraints replacing these pipes results in high impact and high cost. Improvement of these pipes could include restoration or abandonment. Restoration is expected to be in form of trenchless restoration. Further evaluation is necessary to determine the feasibility of restoration.

Justification: These improvements will increase discharge capacity, reducing curbline flow, spread, and bypass.

Planning Estimated Cost: $50,000



5.1.4 Level 3 Improvements

The proposed Level 3 improvements are depicted in **Figure 5-4** and the menu of improvements is described in the following pages.

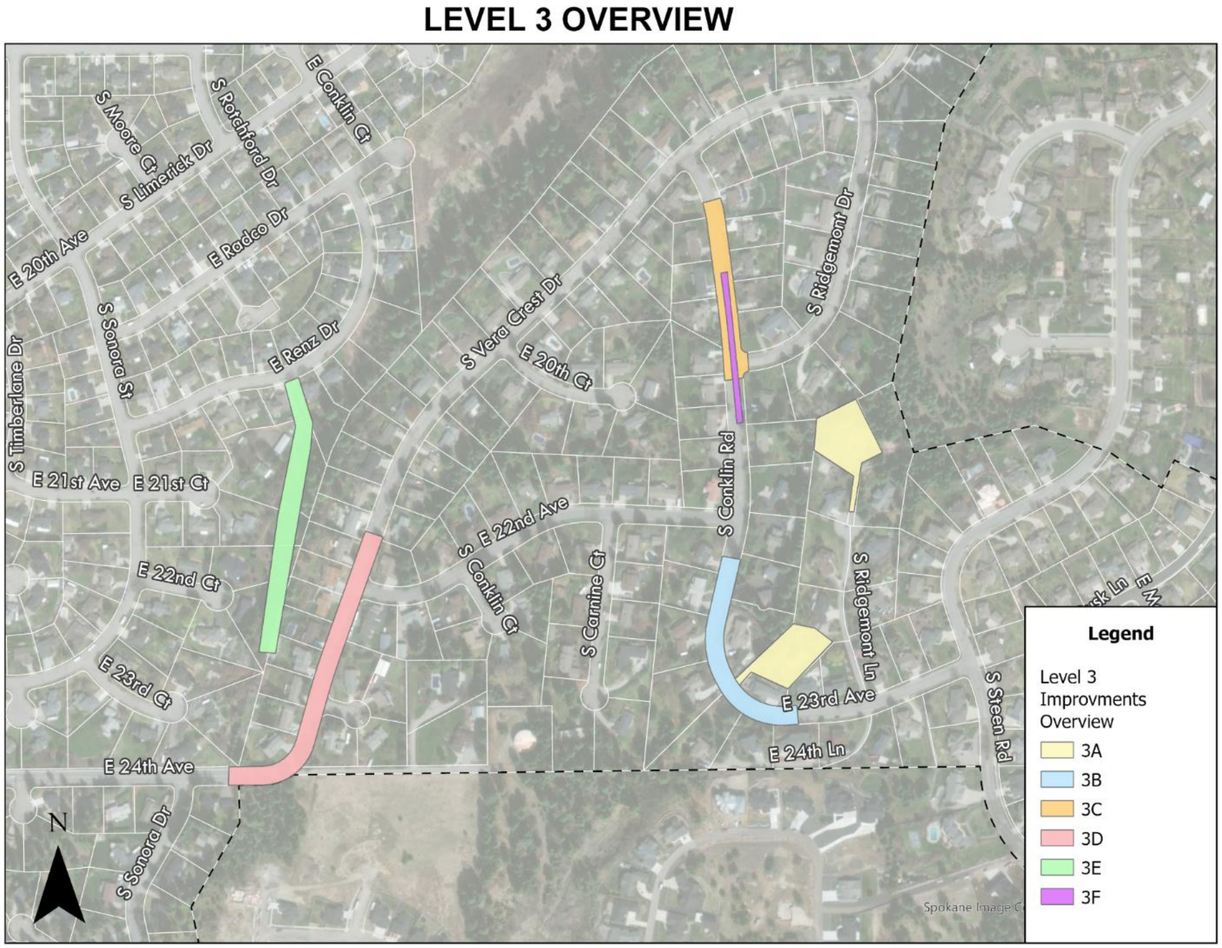


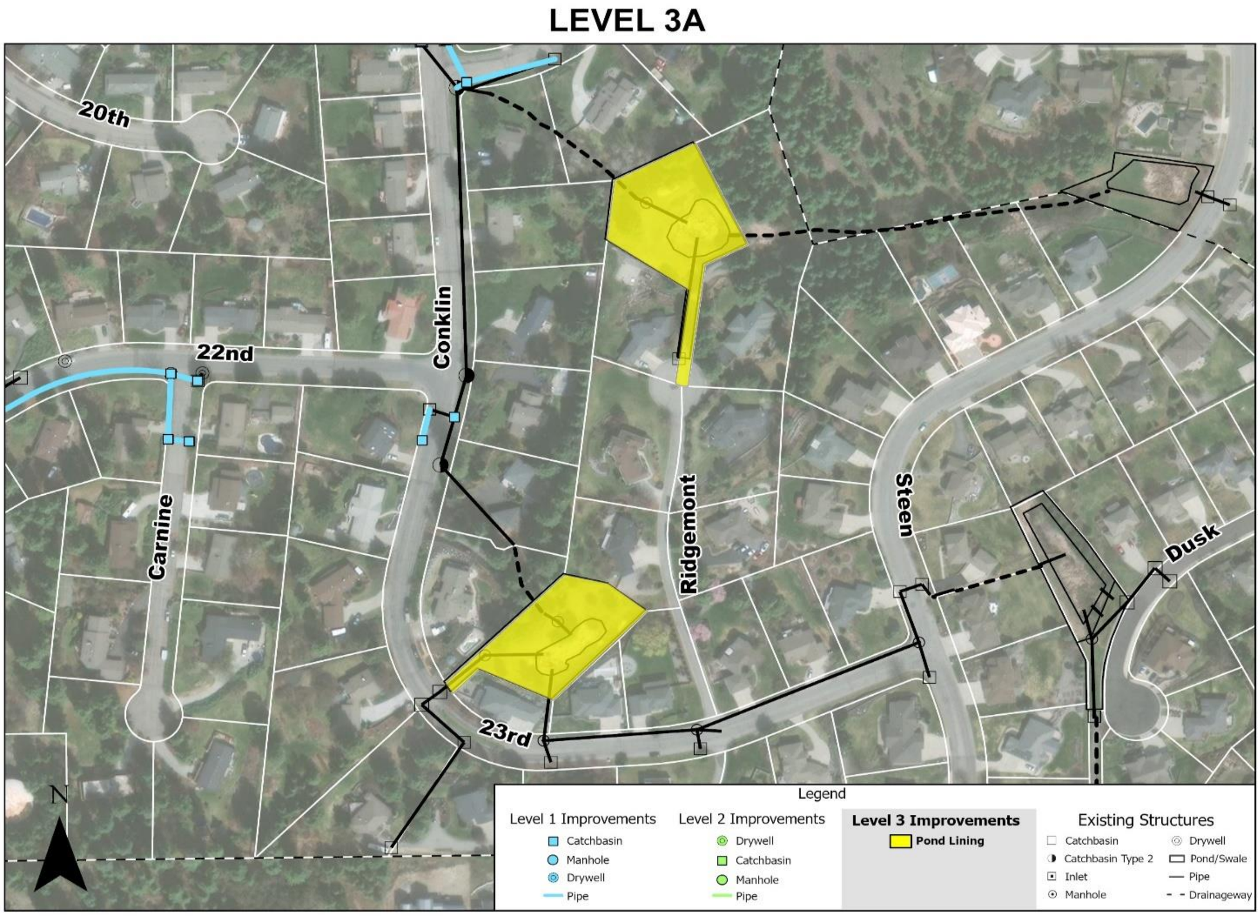
Figure 5-4: Overview of Level 3 improvements

Improvement 3A: Impermeable Liners at Existing Ponds

Proposed Improvement: Liners will be installed at the existing neighborhood ponds that are part of the conveyance system in the North basin area that drains to the 16th Avenue Pond. Liners will consist of a low permeability soil material, such as bentonite. The liners will be placed at the Ridgemont Third Addition ponds, Ponds A and B. These tracts are owned by the City of Spokane Valley.

Justification: This improvement will reduce groundwater recharge and decrease shallow subsurface flow below road surfaces and near private residences.

Planning Estimated Cost: $70,000



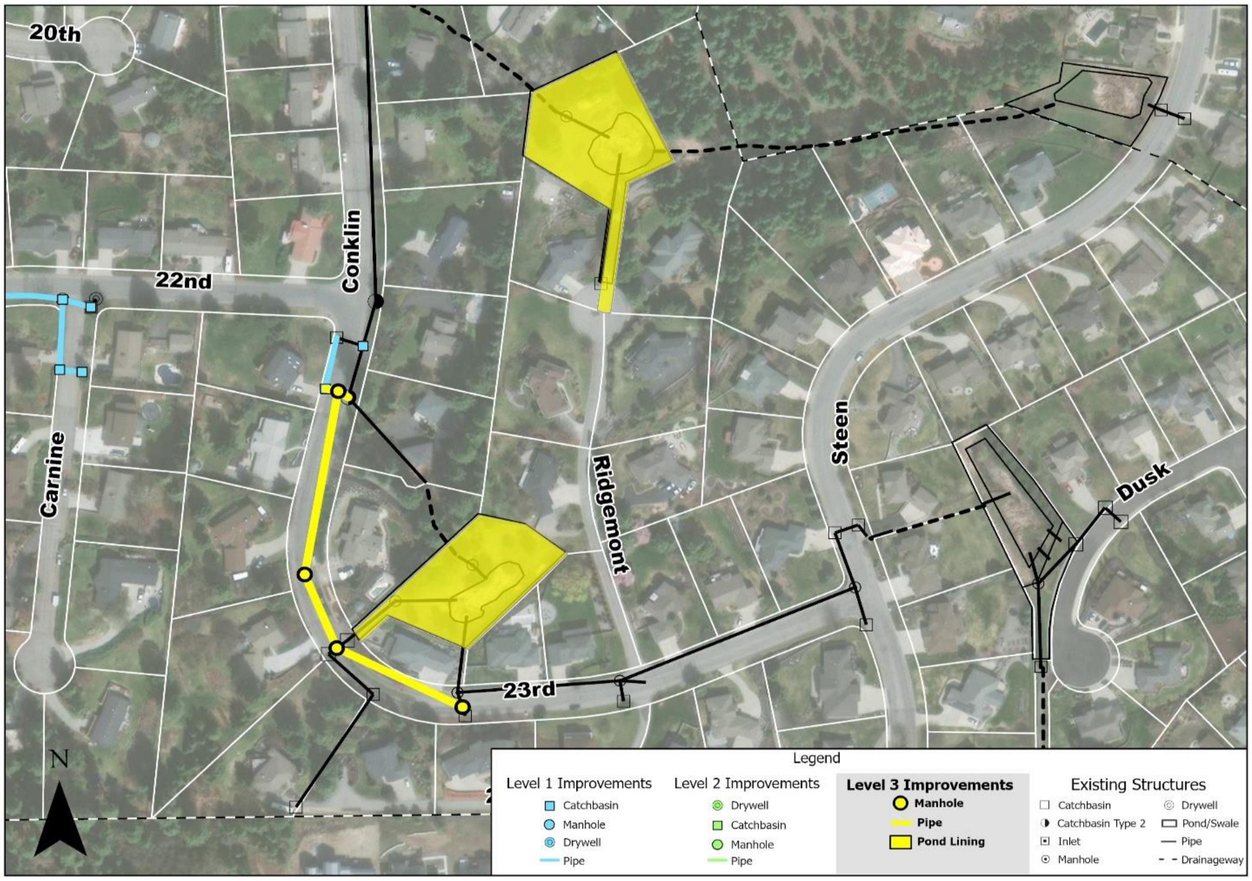
Improvement 3B: Eliminate Pond A

Proposed Improvement: Discharge to pond A from the existing roadway stormwater system will be eliminated. Instead, the existing roadway stormwater system along 23rd Ave will be extended along 23rd Ave. and joined to the existing stormwater system on Conklin Rd in the vicinity of 22nd Ave.

Justification: This improvement eliminates open channel flow from Pond A and the connection to the existing stormwater system on Conklin Rd. near the 22nd Ave. intersection. Eliminating the open channel flow will reduce groundwater recharge and decrease shallow subsurface flow below road surfaces and near private residences.

Planning Estimated Cost: $70,000

LEVEL 3B



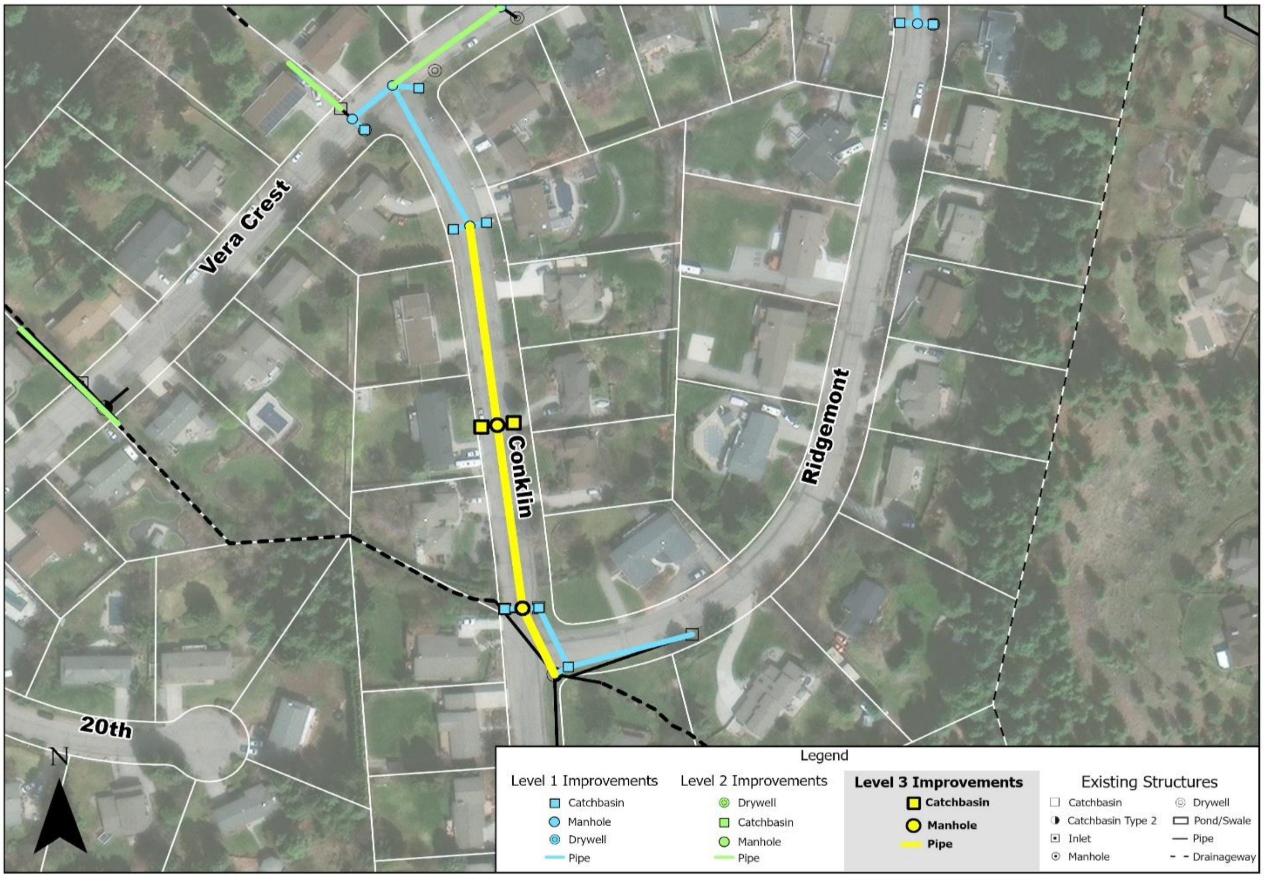
Improvement 3C: Eliminate Open Channel Between Conklin and Vera Crest

Proposed Improvement: Discharge from the existing stormwater system to the open channel between Conklin Rd and Vera Crest Dr. will be eliminated. Stormwater will be collected at the intersection of Conklin Rd. and Ridgemont Dr. The collected stormwater will be conveyed in a proposed stormwater system along Conklin Rd. The proposed stormwater system will join the proposed stormwater system from level 1 and 2 improvements.

Justification: Eliminating this section of open channel flow will reduce groundwater recharge and decrease shallow subsurface flow below road surfaces and near private residences.

Planning Estimated Cost: $90,000

LEVEL 3C

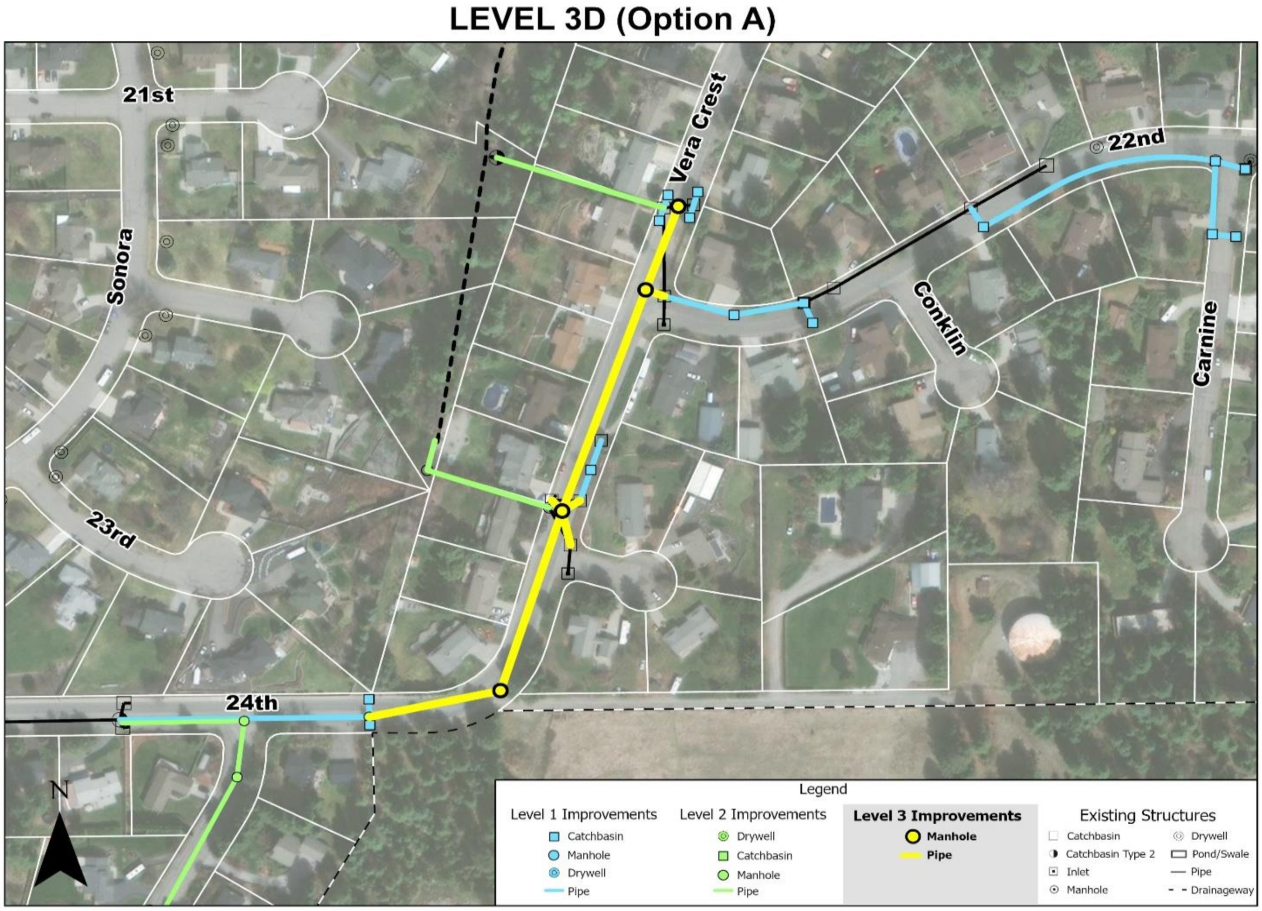


Improvement 3D: (Option A) Reroute Radco Drainage System to 24th Avenue

Proposed Improvements: Discharge from the existing stormwater system to the open channel between Vera Crest Dr. and Renz Rd will be eliminated. This discharge is conveyed to the Radco pond for treatment and subsurface discharge. Discharge is from two discharge points along Vera Crest in the vicinity of 22nd Ave and 23rd Ct. Stormwater will be collected at the sag point near the intersection of Vera Crest Rd. and 22nd Ave and along grade near Vera Crest Dr. and 23rd Ct. The collected stormwater will be conveyed in a proposed stormwater system along Vera Crest Dr. The proposed stormwater system will join a stormwater system on 22nd Ave. and 24th Ave. proposed in level 1 and 2 improvements. The stormwater system will discharge to the infiltration facilities proposed in level 1 and 2 improvements.

Justification: Eliminating this section of open channel flow will reduce groundwater recharge and decrease groundwater impact on private residences. Field observations and flow monitoring data indicate that runoff conveyed by the channel does not reach the Renz Rd. crossing that continues to Radco Pond, but instead infiltrates into the channel.

Estimated Cost: $375,000



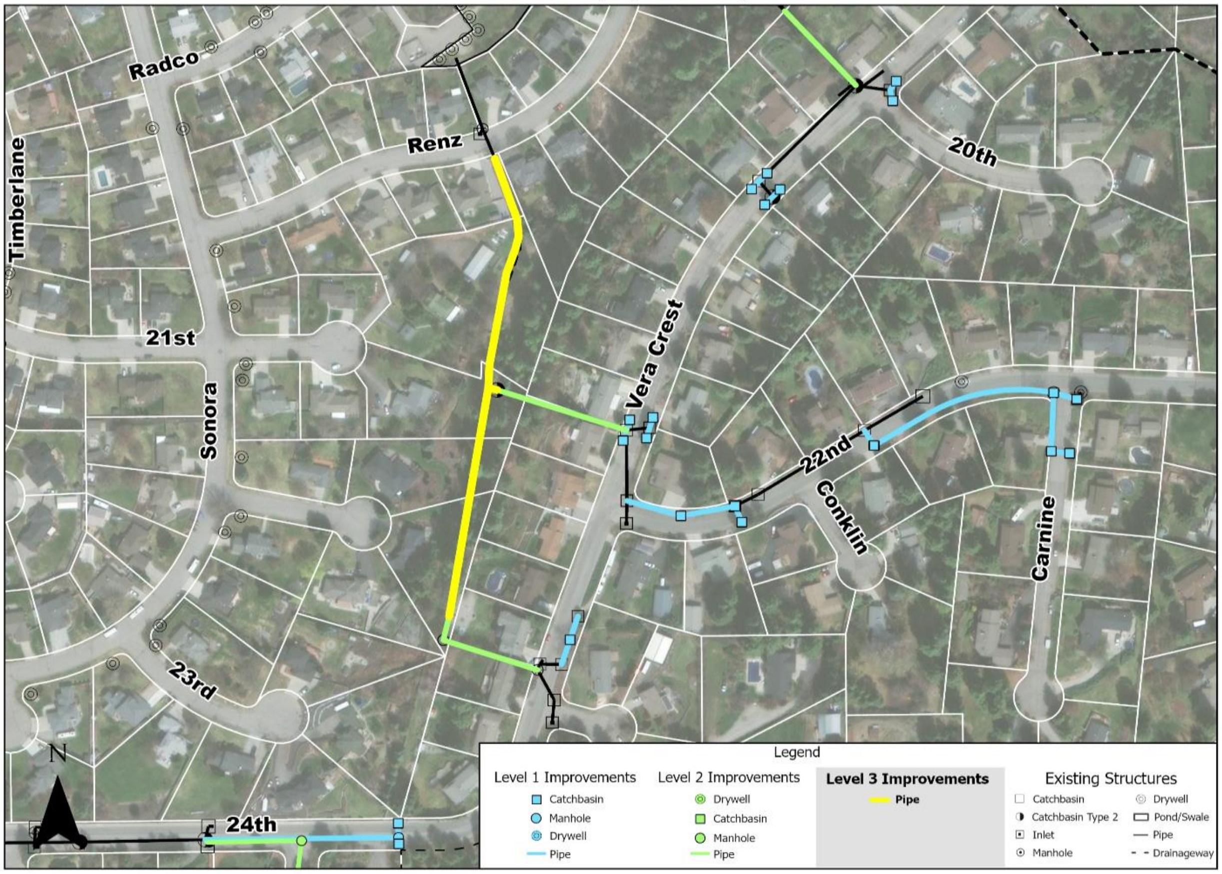
Improvement 3E: (Option B) Radco Drainage System Improvements

Proposed Improvements: A new storm drain (pipe) will be installed along the open channel and easement that conveys discharge from two locations on South Vera Crest Drive. The open channel conveys to Renz Rd. and discharges to Radco Pond. Constructability concerns need to be investigated further to determine the feasibility of this improvement. The feasibility will consider both a buried pipe and a non-buried pipe along the channel surface.

Justification: Eliminating this section of open channel flow will reduce groundwater recharge and decrease groundwater impact on private residences. Field observations and flow monitoring data indicate that runoff conveyed by the channel does not reach the Renz Rd. crossing that continues to Radco Pond, but instead infiltrates into the channel.

Estimated Cost: $175,000

LEVEL 3E (Option B)

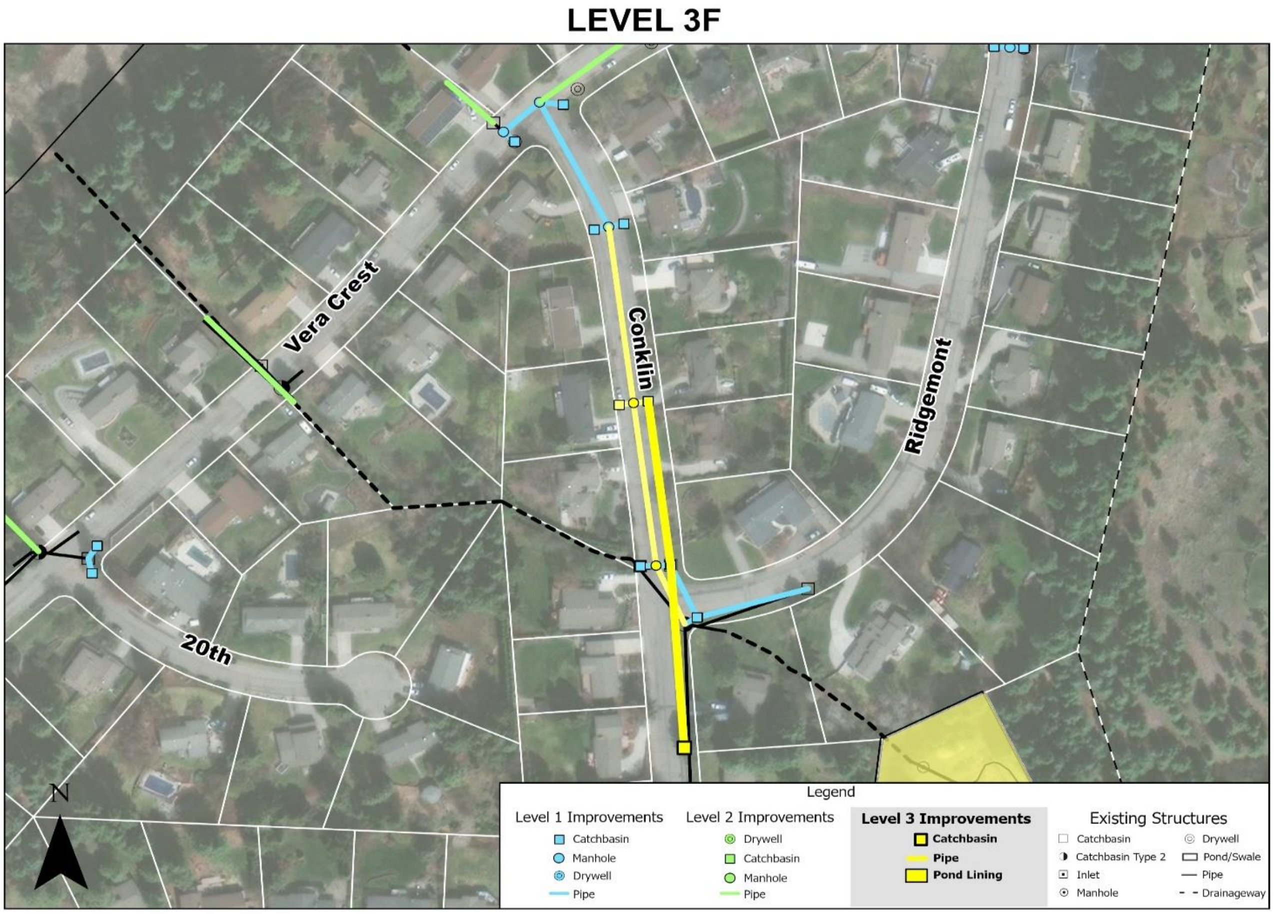


Improvement 3F: Groundwater Collection at Conklin Road and Ridgemont Drive

Proposed Improvements: Underdrains will be installed near the intersection of Conklin Rd. and Ridgemont Dr., in the right-of-way, to intercept groundwater and reroute it into the new storm conveyance system proposed in level 1 and 2 improvements.

Justification: This improvement will address groundwater issues by collecting shallow subsurface flow instead of allowing it to move through the near-surface soils where excess water may impact the roadway pavement and subgrade.

Estimated Cost: $100,000



5.2 PLANNING-LEVEL COST ESTIMATES

Cost estimates were prepared by the City for the different menu items in each of the improvement levels and are summarized in **Table 5-2**. Cost estimates include a contingency of 25 percent. Detailed cost estimates are included in **Appendix K**.

Table 5-2. Planning-level cost estimates for proposed improvement options.

Level	ID	Improvement Name	Cost	Level Cost
0	N/A	All Road Improvements (See Table 5-1 for cost for each road)	$6,310,000	$6,310,000
1	1A	Upgrade Grate Inlets	$78,000	$738,000
	1B	Non-Flooded Roadway Widths Less Than 12 Feet	$80,000	
	1C	First Inlet Not More Than 500 Feet from Point Where Gutter Flow Begins	$380,000	
	1D	Reduce Bypass Flow to Less than 0.1 cfs at Intersections	$40,000	
	1E	Replace Stormwater Pipe Tee Connections	$50,000	
	1F	Eliminate Non-standard Bubble-Up Condition	$45,000	
	1G	Provide 10-year Storage at Infiltration Facilities	$25,000	
	1H	Provide 100-year storage to mitigate property damage	$40,000	
2	2A	(Option A): Replace Failing Drywells in Suitable Soils	$340,000	$590,000 (with Option 2A) $735,000 (with Option 2B)
	2B	(Option B): Replace Failing Drywells in Unsuitable Soils	$485,000	
	2C	24th Avenue Infiltration Facility	$200,000	
	2D	Replace, Restore, or Abandon Pipes Identified as Damaged	$50,000	
3	3A	Impermeable Liners at Existing Ponds	$70,000	$705,000 (with Option 3D) $505,000 (with Option 3E)
	3B	Eliminate Pond A	$70,000	
	3C	Eliminate Open Channel Between Conklin and Vera Crest	$90,000	
	3D	(Option A) Reroute Radco Drainage System to 24th Avenue	$375,000	
	3E	(Option B) Radco Drainage System Improvements	$175,000	
	3F	Groundwater Collection at Conklin Road and Ridgemont Drive	$100,000	

For improvements that include road reconstruction (Level 0 improvements), the pavement design can be further refined, which may provide opportunities to reduce overall costs. For example, for this report, the most conservative equivalent single axle load (ESAL) value of 630,000 was used, which resulted in a pavement section consisting of 4.5 inches of asphalt and nine inches of crushed surfacing base course. This pavement section could possibly be reduced in some areas, particularly if traffic counts are collected on different streets in the study area as a basis for completing site-specific pavement thickness design.

Additionally, the following factors should be considered when planning for the cost of the improvements:

- The cost estimates assume that no additional easements will need to be acquired for construction of the improvements. If this changes in the future, then easement acquisition costs should be added.
- Cost estimates were developed assuming the improvements will be exempt from retail sales tax under WAC Rule 171, which applies to public roadway improvement projects. If utilities such as water or sewer are added to any of the projects then sales tax may be applicable.
- Cost estimates are based solely on the quantities of stormwater improvements such as the number of catch basins or length of pipe for each improvement. These costs do not include other construction items such as surface restoration, utility adjustments, contractor mobilization, or temporary erosion and sediment control.
- Cost estimates do not include design fees, additional geotechnical explorations, or construction management services.
- Costs do not include escalation or inflation factors. Depending on when they are constructed, the actual costs may increase.
- For smaller-cost items from the menu of improvements, it is assumed that these improvements would be incorporated into one of the larger road and storm drain projects as they likely could not be completed under public contracting as stand-alone projects.

5.3 CONSIDERATIONS OF IMPACTS

Some of the proposed improvements would impact the existing drainage system. Key considerations before selecting improvements to move forward are discussed below.

- **Improvements 2B and 2C:** These improvements would route additional flow to a new infiltration facility on East 24th Avenue. This would significantly impact East 24th Avenue by increasing the volume of stormwater runoff routed to that location. As mentioned in these improvement summaries in the sections above, additional geotechnical testing is recommended before advancing these improvements and there may be alternative improvements to add or restore drywell infiltration capacity instead of routing runoff to East 24th Avenue.
- **Level 2 and Level 3 Conveyance Improvements in North Basin:** These improvements would route additional flow to the 16th Avenue pond by conveying runoff away from failed drywells and to the pond. If these improvement moves forward, they should be considered in combination with Improvements 1G and 1H, which would add additional infiltration capacity at the 16th Avenue pond.
- **Improvement 3C:** This improvement would remove flow from the open channel that passes through back yards between Conklin Road and Vera Crest Drive. During this study we have not received any public feedback that this channel is desirable as a landscaping feature, but this should be confirmed with the specific homeowners in this location before moving forward.
- **Improvement 3B:** This improvement would bypass Pond A and cause higher peak flows in the downstream conveyance system. Based on modeling, the downstream conveyance system would be nearly at full capacity after removing this pond so pipes would likely need to be upsized. Additionally, the flows would ultimately discharge to the 16th Avenue pond, so this improvement should be considered in combination with Improvements 1G and 1H, which would add additional infiltration capacity at the 16th Avenue pond.

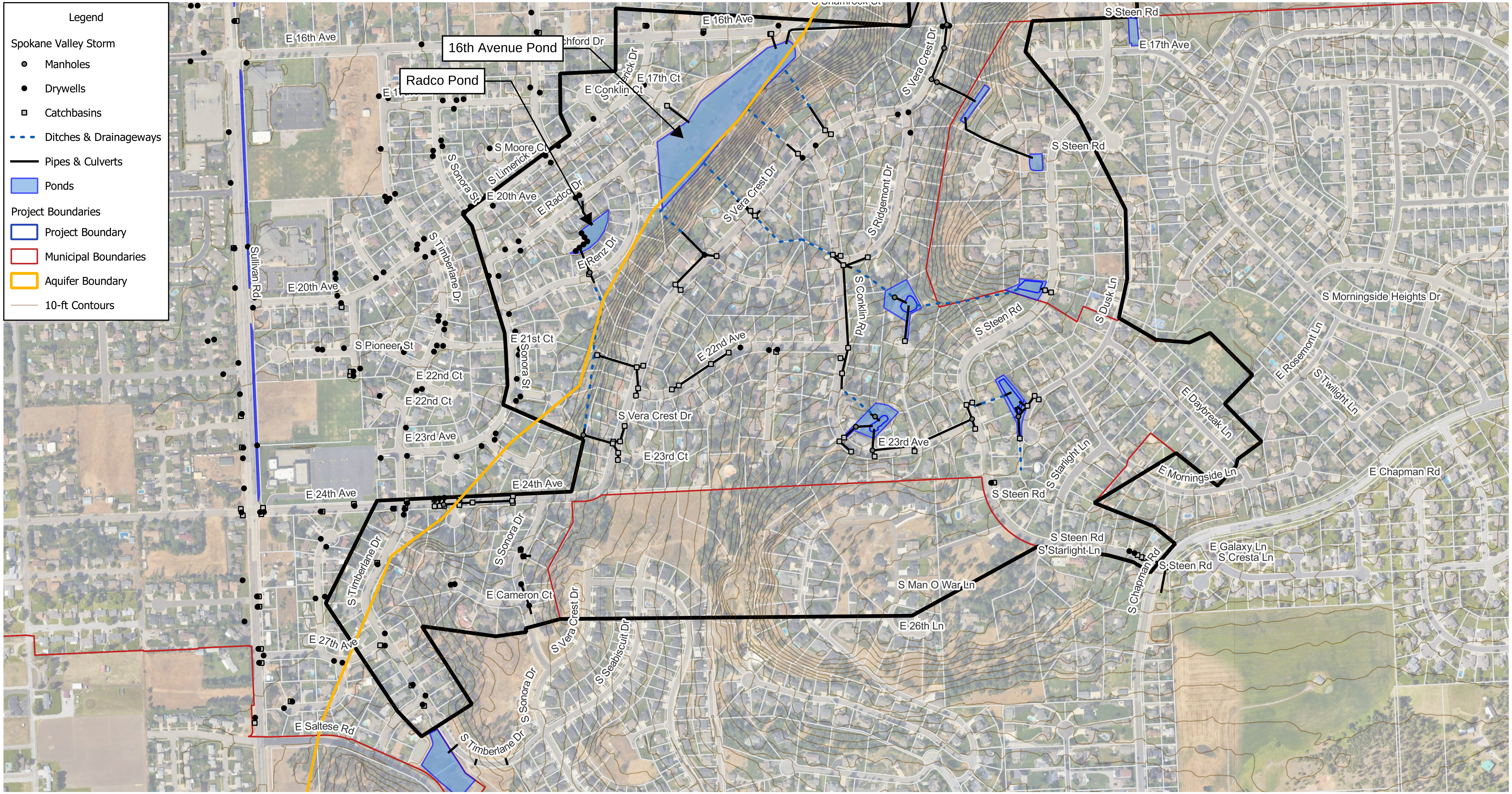
6 REFERENCES

Ecology (Washington State Department of Ecology). 2019. Stormwater Management Manual for Western Washington (SWMMWW). Publication Number 19-10-021. July.

City of Spokane Valley. 2022. Stormwater Utility Program Master Plan. December.

Spokane County. 2008. Spokane Regional Stormwater Manual (SRSM). April.

APPENDIX A
DRAINAGE SYSTEM MAPS



City of Spokane Valley Ridgemont Estates Stormwater

Spokane Valley, WA

APPENDIX B
GEOTECHNICAL REPORT

Technical Memorandum
Geotechnical and Hydrogeologic

Ridgemont Estates Stormwater Improvements
Spokane Valley, Washington

for

Osborn Consulting

January 7, 2025

523 East Second Avenue
Spokane, Washington 99202
509.363.3125

GeoEngineers

Technical Memorandum
Geotechnical and Hydrogeologic Investigation

Ridgemont Estates Stormwater Improvements
Spokane Valley, Washington

File No. 11264-044-00
January 7, 2025

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1.0 Introduction

This report summarizes the results of our geotechnical and hydrogeologic investigation associated with the Ridgemont Estates Stormwater Improvement project area, which is located in the vicinity of the Ridgemont Estates neighborhood in Spokane Valley, Washington, approximately as shown in the Vicinity Map, Figure 1. The project area includes portions of the Ridgemont Estates Plateau (REP) including the Ridgemont Estates neighborhood and adjacent subdivisions, generally bounded by Vera Crest Drive to the west, Steen Road to the north, Incline Drive to the east and Man O' War Lane to the south. Additional areas of study included portions of the surrounding valley lowlands including the Main Infiltration Pond (Main Pond) and the Radco Infiltration Pond (Radco Pond) as shown in the Project Area Site Plan, Figure 2 (all areas are collectively incorporated for the purpose of this project and are herein referred to as the "Project Area"). The initial goal of the project, which is being led by Osborn Consulting (Osborn), is to evaluate surface runoff, shallow subsurface flow and the condition of existing stormwater infrastructure within the Project Area in response to suspected stormwater-related pavement damages, flooding and icy conditions reported within the Project Area. Project results will be used to identify and inform stormwater improvement alternatives for consideration by the City of Spokane Valley (the City).

GeoEngineers, Inc. (GeoEngineers) conducted the geotechnical and hydrogeologic investigation under contract with Osborn Consulting (Osborn). Our services were conducted under the Subconsultant Professional Services Agreement with Osborn dated October 9, 2023 and primary Contract No. 23-158 with the City dated September 20, 2023.

Our geotechnical and hydrogeologic investigation consisted of two components, a hydrogeologic data review and a geotechnical assessment. The hydrogeologic data review primarily served as a desktop study of existing hydrogeologic information throughout the Project Area. The geotechnical assessment included field exploration, monitoring well installation, water level monitoring and infiltration testing in a targeted portion of the Project Area around South Vera Crest Drive and South Conklin Road (Geotechnical Field Work Study Area) with known stormwater impacts. GeoEngineers explorations, hydrogeologic and geotechnical investigation areas and other key site features are presented in Figure 2.

The Ridgemont Estates stormwater system, in its current state, captures and transmits stormwater through a network of catch basins, pipes and ditches on the REP to designed infiltration infrastructure at the base of the REP near the northwest and western edges of the Project Area. Infiltration infrastructure includes the Main and Radco Ponds, and a series of catch basins and drywells.

2.0 Scope of Services

Our services were conducted consistent with Exhibit B of our Professional Services Agreement between GeoEngineers and Osborn dated and signed October 9, 2023. Our specific scope of services consisted of the following:

1. Conducted a hydrogeologic data review of the project area.
    a. Compiled and reviewed existing geotechnical and hydrogeologic information for the project area.
    b. Reviewed drainage complaint information and home-owner improvements provided by the City.
    c. Tabulated existing stormwater infiltration and groundwater data.

   - **d.** Generated maps of the project area summarizing geotechnical and hydrogeologic data.
   - **e.** Generated cross sections showing the anticipated hydrogeologic conditions.
   - **f.** Identified potential stormwater problem areas within the project based on compiled data and conducted field reconnaissance to observe identified problem areas.
2. Assisted with development, subsurface exploration and testing locations for geotechnical assessment.
3. Conducted geotechnical assessment activities at key locations within the project area.
   - **a.** Evaluated pavement and subgrade conditions and hydrogeologic conditions at select locations by conducting subsurface drilling, sampling and laboratory testing operations.
   - **b.** Installed and developed monitoring wells at select locations to evaluate perched groundwater conditions and monitor groundwater response to storms and seasonal fluctuations in precipitation.
      - **i.** Installed pressure transducers within the monitoring wells to monitor groundwater conditions within the project area.
      - **ii.** Downloaded and analyzed groundwater data from the transducers on a periodic interval.
   - **c.** Evaluated subsurface soil conditions at the Main Pond by conducting test pit explorations, soil sampling and laboratory testing.
   - **d.** Performed pilot infiltration testing of existing conditions at the Main Pond in general accordance with the 2019 Stormwater Management Manual for Eastern Washington.
   - **e.** Analyzed infiltration test data for infiltration rate and hydraulic conductivity.
   - **f.** Performed full-scale drywell infiltration testing of two selected drywells in general compliance with the 2019 Stormwater Management Manual for Eastern Washington and the 2008 Spokane Regional Stormwater Manual.
      - **i.** Analyzed infiltration test data for normalized and design outflow rates.
   - **g.** Provide hydrogeologic recommendations on the feasibility of stormwater infiltration at the Main Pond.
   - **h.** Provide pavement recommendations based upon observed soil and pavement conditions, laboratory testing and hydrogeologic conditions.
   - **i.** Provide this technical report summarizing project results and recommendations.

3.0 Site Background

3.1 PHYSIOGRAPHY

Spokane Valley is situated within the northeast portion of the Columbia Plateau physiographic province. The existing topography of the area developed during the Pleistocene Epoch (about 2.6 million years [Ma] to 11,700 years ago) and the Holocene Epoch (about 11,700 years ago to present). In the Pleistocene, a sequence of catastrophic flood events, generated by the failure of ice dams in western Montana and northern Idaho, deposited hundreds of feet of highly permeable sediments within the Spokane River valley.

Along valley flanks, the floods stripped away overlying sediments, leaving erosional features in the underlying basalt surface (Whiteman et al., 1994) and exposing underlying Miocene age (16 to 11.6 Ma) sedimentary rocks such as the Latah Formation and Precambrian age (542 MA and older) basement rock such as the Hauser Lake Gneiss. More recent stream erosion and alluvium deposition has slightly modified this landscape.

The Project Area is located within or at the margin of Spokane Valley between the Saltese Flats and Dishman Hills. The Project Area is primarily located on an elevated plateau that varies from about 2,300 feet to 2,380 feet in elevation. Relatively steep margins descend to approximately 2,140 feet in elevation at the base of the REP (Elevations in this report refer to the North American Vertical Datum of 1988 [NAVD 88], unless otherwise specified). With the exception of ephemeral streams in shallow drainage features, the REP is largely devoid of surface water. Occasional springs and stormwater drainage features are located along the crest and bases of the REP. The REP is bordered by the Spokane River Valley to the north and west and Saltese Flats to the east.

3.2 CLIMATE SUMMARY

The climate of the Spokane Valley area is semi-arid, with warm, dry summers and cool, wet winters. At Spokane Airport Climate Station No. 457938 (situated about 16 miles southwest of the Project Area), annual precipitation is approximately 16 inches. Annual snowfall is approximately 41 inches per year. Much of the precipitation occurs during fall and winter months and runoff/groundwater recharge conditions are high during spring.

3.3 LAND USE

Land use surrounding the Project Area consists primarily of single-family residential properties serviced by municipal water supply and municipal sewer.

4.0 Compilation of Existing Subsurface Information

4.1 DATA SOURCES

GeoEngineers reviewed and compiled subsurface information provided by the City, including:

- Geotechnical reports for previous projects conducted within the vicinity of the Project Area.
- A summary of the complaints received by the City related to high groundwater within the Project Area.
- Specific as-built plans for infiltration structures within the Project Area, such as drywells, catch basins and infiltration trenches.

GeoEngineers reviewed water well reports (well logs) on file with the Washington State Department of Ecology (Ecology) for the following geographic areas:

- Section 30 of Township 25 North, Range 45 East.
- Section 24 of Township 25 North, Range 44 East.
- Section 25 of Township 25 North, Range 44 East.

Exploration logs from previous geotechnical reports are provided in Appendix A. Explorations logs have been assigned a designation based on the project name and exploration number, these designations are provided in the upper right corner of each log.

Compiled well logs are provided in Appendix B. Each well log has been assigned a designation based on its Public Land Survey System (PLSS) location, these designations are provided in the upper right-hand corner of the each well log.

4.2 SUBSURFACE DATABASE

GeoEngineers developed databases of existing subsurface data. Compiled data are summarized in the following tables:

- Compilation of Subsurface Data from Existing Explorations, Table A-1.
- Compilation of Subsurface Data from Water Well Reports, Table B-1.

This data, as well as results of GeoEngineers' Project Area explorations and testing, were used to develop the geologic and hydrogeologic setting information described below.

5.0 Summary of Geologic and Hydrogeologic Setting

5.1 GEOLOGIC SETTING

Surficial geology within and near the Spokane Valley is presented in the Surficial Geologic Map, Figure 3. Basement rocks underlying the Project Area generally consist of metamorphic rocks of Precambrian age (greater than about 541 Ma). Precambrian rocks were intruded by granitic plutonic rocks during the Mesozoic Era (about 252 to 66 Ma) and the Paleogene Period (about 66 to 23 Ma). Basement rocks outcrop along the northwest and southwest margins of the REP and underlie the entire study area at depth.

Basement rocks are stratigraphically overlain by Miocene age basalt flows associated with the Columbia River Basalt Group (CRBG) (Pardee et al., 1926; Whiteman et al., 1994; Kahle et al., 2011; Smith et al., 1989; Leek, 2006, Reidel and Tolan, 2013). The CRBG was deposited during an extended period of Miocene (about 23 to 5.3 MA) volcanism that extruded a series of fluid lava flows. The lava flowed from north-northwest trending fissures as much as 90 miles long, which were located primarily in northeastern Oregon and eastern Washington (Hooper, 1982; Tolan et al., 1989). The resulting basalt deposits are hundreds to thousands of feet thick in some areas of eastern Washington and extend throughout the Columbia Plateau. As the basalt flowed into the area surrounding Spokane (which is situated near the eastern terminus of the CRBG), it filled preexisting depressions, lapping onto elevated areas of older, uplifted metamorphic and igneous rocks.

The CRBG is divided into five formations that include, from oldest to youngest, the Steens Basalt, Imnaha Basalt, Grande Ronde Basalt (including the Picture Gorge Basalt), Wanapum Basalt and Saddle Mountains Basalt (Swanson et al., 1979; Beeson et al., 1985; Reidel and Fecht. 1987; Tolan et al., 1989). The Wanapum Basalts are mapped within the Spokane Valley area and, more specifically, the Project Area.

Interbedded within the CRBG deposits within the Project Area are sedimentary rocks associated with the Latah Formation. The Latah Formation was formed in the middle Miocene (16 to 11.6 Ma) time period where eastern Washington and parts of northwest Idaho were intermittently inundated resulting in the formation of fluvial and lacustrine deposits. The Latah formation consists of variably indurated finely laminated siltstone, claystone and minor sandstone rocks and is commonly found to be interbedded with Miocene age basalt flows associated with the CRBG (Pardee et al., 1926; Whiteman et al., 1994; Kahle et al., 2011; Smith et al., 1989; Leek, 2006; Reidel and Tolan, 2013). The Latah Formation outcrops within slopes at the margin of the REP and is overlain by CRBG within the eastern portions of the Project Area.

Throughout the REP, CRBG and Latah Formation deposits are primarily overlain by Pleistocene glaciofluvial (flood) deposits, which consist of unsorted mixtures of silt, sand, gravel, cobbles and boulders. Sediments across the REP tend to be undulating with variable thickness although glaciofluvial deposits generally are thin to absent within the REP portion of the Project Area. Flood deposits form the Spokane Valley/Rathdrum Prairie (SVRP) Aquifer located north and west adjacent to the base of Project Area and are hundreds of feet thick (Kahle and Bartolino, 2007). Flood deposits frequently are interbedded with glaciolacustrine sediments consisting primarily of clay, silt or silty fine sand. Minor Quaternary (less than about 2.6 MA) mass wasting deposits occur along the flanks of the REP and consist primarily of fine-grained sediments and other debris shed from the REP.

5.2 HYDROGEOLOGIC SETTING

5.2.1 General

Groundwater underlying the Project Area occurs within four primary hydrogeologic units. These units include the: (1) Basement rock unit; (2) CRBG unit; (3) Latah unit and (4) Sedimentary unit (including the SVRP Aquifer).

5.2.2 Basement Rock Unit

Groundwater occurs in basement rock in fractured and/or weathered zones. Porosity, hydraulic conductivity and transmissivity are generally low. Basement rock surrounding and underlying the Project Area include plutonic igneous rock of granitic origin and metamorphic rock that typically exhibit very poor infiltration rates. As such, basement rock are not typically targeted for infiltration.

5.2.3 CRBG Unit

The CRBG consists of a series of individual basalt flows. Groundwater is most readily transmitted through the broken vesicular and scoriaceous interflow zones that characterize the top of each basalt flow. The interflow zones are separated by the less porous and less transmissive entablature and colonnade, which comprise 90 to 95 percent of the total flow volume (Whiteman et al., 1994).

In general, groundwater within the CRBG unit flows from upland areas to surface drainage features such as the Columbia River and its tributaries (Kahle et al. 2011). Groundwater flow is controlled by topography, geologic structures, basement topography, recharge and discharge conditions, unit continuity and permeability variations. Basalt permeability is controlled by primary rock texture and secondary jointing and fracturing. In many locations, the permeability of the CRBG interflow zones has been reduced by secondary mineralization of zeolites and/or clay infilling joints and fractures.

The CRBG is overlain, in places, by Latah Formation deposits. In other locations, the CRBG directly crops out on the surface. Recharge to the CRBG occurs through direct precipitation, vertical infiltration from overlying unconfined aquifers and lateral recharge from upgradient areas to the north and east. Discharge from the CRBG occurs through leakage to adjacent aquifers (such as the SVRP Aquifer), along gaining reaches of streams and to water supply wells.

Recharge to shallow water-bearing zones within the CRBG is generated from precipitation, infiltration of irrigation water and by leakage from overlying aquifers (if any). The semi-arid nature of the Project Area limits the amount of available natural recharge from precipitation. Groundwater discharge from shallow water-bearing zones within the CRBG occurs as springs, base flow to surface water systems, geologically slow leakage to aquifers with lower potentiometric heads and water supply wells.

5.2.4 Latah Unit

The Latah Formation consists of a series of fine-grained lacustrine sedimentary deposits that are commonly found interbedded with CRBG basalt flows. Due to the fine-grained nature, the Latah Formation deposit does not readily transmit groundwater. Porosity, hydraulic conductivity and transmissivity are generally low.

5.2.5 Sedimentary Unit

The sedimentary unit consists of the various sediments that overlay the CRBG, Latah Formation and basement rocks within the Project Area. Sediments primarily include Pleistocene glaciofluvial and glaciolacustrine deposits.

North and west of the REP, approaching the Spokane Valley and Spokane River, glaciofluvial sedimentary deposits consist of thick sequences of sand, gravel, cobbles and boulders to depths of up to 600 feet with interbedded lenses and pockets of fine-grained glaciolacustrine deposits. These sedimentary sequences form the SVRP Aquifer, as shown in Figure 3. The sedimentary deposits that make up the SVRP are highly transmissive and unconfined making it a target location for stormwater infiltration. The SVRP Aquifer is recharged by snowmelt within adjacent and nearby upland areas, direct infiltration of precipitation, outdoor water use, septic discharge and stormwater infiltration. The SVRP Aquifer primarily discharges to the Spokane River, the Little Spokane River, vertically to underlying bedrock aquifers and to water supply wells.

The sedimentary unit within the REP is thin (generally less than 20 feet) relative to the SVRP Aquifer. Sediments on the REP overlay either the CRBG, Latah Formation or basement rock.

Recharge to the sedimentary unit on the REP is primarily from infiltration of precipitation, infiltration of surface water along losing stream reaches, seepage of irrigation water from lawns and septic systems. In urban areas, like Ridgemont Estates, additional recharge results from infiltration of stormwater runoff from impervious surfaces associated with roads, parking lots and buildings. Discharge from the sedimentary unit generally occurs as base flow to surface water such as springs, streams and ponds located in low-lying areas adjacent to the REP. Subsurface discharge to the underlying basalt aquifer system also may occur locally.

Because of the generally poor infiltration characteristics of basalt and the Latah Formation observed on the REP, the sedimentary deposits that make up the SVRP at the base of the REP are of primary significance as a target for stormwater infiltration within the Project Area and surrounding area. Infiltration capacity of the sedimentary unit is controlled by physical heterogeneities associated with the sediment deposits and moisture content. Vadose zone heterogeneities and moisture variations result in complex flow paths that include downward percolation, lateral movement and perched water in the vadose zone. Perched groundwater occurs where discrete areas or lenses of fine-grained materials or bedrock exist and act to inhibit downward percolation. In coarse strata vertical moisture movement in the vadose zone can be measured at several feet per day, depending on moisture content. Vertical movement of moisture through fine vadose zone strata will be several orders of magnitude lower.

6.0 Project Explorations

6.1 GENERAL

Subsurface conditions within the Geotechnical Fieldwork Study Area were explored using drilling, coring and test pit excavation methods. Explorations within the Geotechnical Fieldwork Study Area were advanced within the REP and Main Pond. Five hollow-stem-auger borings with monitoring wells (GE-B-1 through GE-B-5) and nine pavement cores (GE-C-1 through GE-C-9) were completed within the REP. Four test pits (GE-TP-1 through GE-TP-4) were completed within the Main Pond. Approximate exploration locations within the REP are shown in Figure 2. In addition, exploration locations within the Main Pond are shown in detail in the Infiltration Test Site Plan, Figure 4. Descriptions of GeoEngineers' field exploration equipment and procedures, exploration and monitoring well logs and results of laboratory testing are provided in Appendix C.

6.2 BOREHOLES, WELLS, PAVEMENT CORES AND TEST PITS

Subsurface conditions were explored at the REP through the following explorations:

- Hollow-stem-auger boring GE-B-1, drilled to 10 feet bgs on October 17, 2023.
- Hollow-stem-auger borings GE-B-2 through GE-B-5, drilled to 26½ feet bgs between October 17 through 19, 2023.
- Pavement cores GE-C-1 through GE-C-9, advanced to a depth of 1 foot bgs on October 20, 2023.

Borings GE-B-2 through GE-B-5 were completed with 2-inch-diameter polyvinyl chloride (PVC) monitoring wells. Boring GE-B-1 was abandoned after drilling in accordance with Chapter 173-160 of the Washington Administrative Code (WAC).

Subsurface conditions were explored at the Main Pond through the following explorations:

- Test pit GE-TP-1, excavated within the Main Pond to a depth of 2 feet bgs for pilot infiltration testing on March 18, 2024.
- Test pits GE-TP-2 through TP-4, excavated within the Main Pond to depths in the range of 11½ to 12 feet bgs on March 18, 2024.

GeoEngineers analyzed a total of sixteen discrete samples for analysis of grain-size distribution per ASTM Method C 136 and moisture content by ASTM Method D2216. Results of our grain-size distribution analyses are presented in Appendix C, Figures C-11 through C-16.

6.3 SURFACE CONDITIONS

6.3.1 Existing Pavement Condition

The existing pavements within the project area are generally in poor condition and exhibit significant fatigue (alligator) cracking (particularly pavement in older portions of the development that are approaching 50 years old) as well as transverse and longitudinal cracks. In some areas, fatigue cracking has progressed to a point of complete disintegration of the asphalt surfacing. There also is evidence of previous patching, particularly for underground utility work. We did not observe areas indicative of subgrade failures (subgrade failures often consist of fatigue cracking coupled with significant rutting, potholes or other evidence of loss of subgrade support).

The following is a summary of existing pavement information based on review of available plans and previous geotechnical engineering reports provided by the City.

- Budinger Associates (Budinger) submitted a report in 2008 that included recommendations for reconstruction of 24th Avenue east of Sullivan Road, extending along a portion of South Vera Crest Drive. The City also produced plans for the reconstructed pavement. Based on review of Google Earth Imagery, it appears the project was completed sometime between 2008 and 2011. The design pavement sections for Vera Crest consisted of:
    - An approximate 150-foot-long segment starting at the top of the hill near the intersection of South Vera Crest and East 24th Avenue: 5 inches of hot mix asphalt (HMA) surfacing overlying 6 inches cement treated base (constructed using full depth reclamation processes) overlying 10 inches of permeable ballast.
    - An approximate 450-foot-long segment continuing along South Vera Crest Drive to the end of the project at the north side of the intersection of South Vera Crest Drive and East 22nd Avenue: 5 inches of HMA surfacing overlying 6 inches of crushed surfacing, overlying 10 inches of permeable ballast.
    - Separation geotextile was included in the design to be placed on top of prepared subgrade. The project also included recommendations for pavement underdrains to be installed along the edges of the roadway (both sides on tangent sections and just on the low side on superelevated sections).
- 1975 plans for Renz Subdivision No. 1 indicated the design pavement section was 2 inches of asphalt concrete pavement over 4 inches of crushed surfacing. The project included South Vera Crest Drive from the top of the hill to approximately 285 feet north of East 20th Court, all of East 20th Court, East 22nd Avenue between Vera Crest and South Conklin Road, South Carnine Court and South Conklin Court.

6.4 SUBSURFACE SOIL CONDITIONS

6.4.1 Ridgemont Estates Plateau

Subsurface soil conditions within the REP are composed of a complex sequence of glaciofluvial sediments overlying fine-grained sedimentary deposits, generally interpreted at variable depths as the Latah Formation, CRBG and basement rock, as shown in Figure 5, Cross Section A-A' and Figure 6, Cross Section B-B' (cross section transects are shown in Figure 2). Observed subsurface conditions generally consisted of the following:

- Roadways generally were underlain by asphalt pavement surfacing ranging in thickness from 1½ to 5 inches and crushed surfacing base course ranging in thickness from 1½ to 4 inches.
- Where present, glaciofluvial deposits generally consisted of sand and gravel with variable silt content to depths of about 4½ to 15 feet bgs. This unit was not identified in borings B-3 and B-4.
- Silt and clay deposits of variable densities were present to depths of up to about 26½ feet bgs. Deeper stiff to hard silt and clay deposits were interpreted as Latah Formation deposits. The upper contact of this unit was variable and observed at about 15 feet bgs in B-2, at the bottom of base course in B-3 and B-4 and at about 4½ feet bgs in B-5. This unit was not observed in B-1.
- Weathered basalt bedrock, associated with the CRBG, was observed at about 10 feet bgs in exploration B-1.

At the time of drilling, saturated soil conditions were not observed, suggesting depth to the groundwater table exceeded the termination depth of each boring at the time of exploration.

6.4.2 Main Infiltration Pond

Shallow subsurface conditions beneath the Main Pond are composed of a complex sequence of glaciofluvial and glaciolacustrine sediments, as shown in Cross Section C-C', Figure 7 (cross section transects are provided in Figures 2 and 4). Observed subsurface conditions generally consist of the following:

- Surficial silt with organic matter from ground surface to a depth of about 1 foot bgs.
- Interpreted glaciolacustrine deposits consisting of silt with variable sand content from about 1 foot bgs to variable depths up to greater than 12 feet bgs. The lower contact of this unit appears to deepen to the northeast of the Main Pond.
- Interpreted glaciofluvial deposits consisting of sand with gravel and variable silt content from variable depths of 1½ feet bgs to greater than 12 feet bgs. The upper contact of this unit was observed at 1½ feet bgs in TP-1, 3½ feet bgs in TP-2 and 10 feet bgs in TP-3. This unit was not observed in TP-4, though it may be present at depth (Figure 7).

At the time the test pits were completed, saturated soil conditions were not observed, suggesting depth to the groundwater table exceeded 12 feet bgs.

6.4.3 Existing Pavement and Subgrade Soil

The thickness of existing asphalt concrete (AC) surfacing and underlying base course was measured at each of the project boring and core locations. Additionally, dynamic cone penetration (DCP) tests were conducted at each core location (DCP-1 through DCP-9 correspond to core locations GE-C-1 through GE-C-9, respectively). DCP tests consist of advancing a small diameter graduated steel probe into the subgrade soil to a depth of approximately 3 feet using a manually operated slide hammer. The incremental number of blows and depth of probe advancement is recorded, and the results can be used to estimate California Bearing Ratio and/or the resilient modulus of the in-situ subgrade soil. Table 1 presents a summary of the existing pavement thicknesses measured at the core locations and estimated resilient modulus values. Logs of the DCP probes are presented in Appendix D.

TABLE 1. EXISTING PAVEMENT SUMMARY

EXPLORATION	ASSOCIATED DCP TEST	STREET	APPROXIMATE AC SURFACING (IN)	APPROXIMATE BASE COURSE (IN)	SUBGRADE	ESTIMATED SUBGRADE RESILIENT MODULUS (PSI)
GE-C-1	DCP-1	E 22nd Ave	4.75	3	Sand with silt	6,500
GE-C-2	DCP-2	S. Conklin St	2	15	-	7,600
GE-C-3	DCP-3	S. Carnine St	1.25	3	Sand with silt and gravel	7,500
GE-C-4	DCP-4	S. Conklin Rd	1.75	8	Sand with silt	5,600
GE-C-5	DCP-5	S. Conklin Rd.	2.25	6.75	Gravel with sand	6,900
GE-C-6	DCP-6	S. Ridgemont Dr	2.75	5	Gravel with sand	5,000
GE-C-7	DCP-7	S. Ridgemont Dr	2.25	12	-	4,100
GE-C-8	DCP-8	S. Conklin Rd	1.75	4	Gravel with sand	4,200
GE-C-9	DCP-9	E. 20th Ct	2	2	Sand with silt and gravel	9,100
GE-B-1	--	Vera Crest Dr	1.5	1.5	Silt	-
GE-B-2	--	Vera Crest Dr	1.5	2	Sand	-
GE-B-3	--	Vera Crest Dr	5	4	Clay	-
GE-B-4	--	S. Ridgemont	4	4	Clay	-
GE-B-5	--	S. Carnine Ct	3	4	Silty Sand	-

7.0 Grain-Size-Based Hydraulic Conductivity Estimates

A total of nine samples were submitted to GeoEngineers' laboratory for gradation analyses completed in accordance with ASTM Method C 136. GeoEngineers' laboratory test results are presented in Appendix C. The percentages of fines within the samples ranged from 4 percent to 97 percent, as summarized in Table 2.

TABLE 2. FINES PERCENTAGES AND SATURATED HYDRAULIC CONDUCTIVITY

EXPLORATION	APPROXIMATE DEPTH (FEET BGS)	SEDIMENT TYPE	LOCATION	FINES PERCENTAGE [1]	APPROXIMATE SATURATED HYDRAULIC CONDUCTIVITY [2] (INCHES PER HOUR)
GE-B-2	5-6.5	SM	S Vera Crest Dr	18	NA
GE-B-2	10-11.5	SP-SM	S Vera Crest Dr	10	16
GE-B-3	5-6.5	ML	S Vera Crest Dr	67	NA
GE-B-4	5-6.5	ML	S Conklin Rd	61	NA
GE-B-5	2.5-4	SM	E 22nd Ave	21	NA
GE-TP--2	2-3	ML	Main Pond	90	NA
GE-TP-2	7-8	GP	Main Pond	4	1300
GE-TP-3	1.5-2	ML	Main Pond	97	NA
GE-TP-3	10-11	GM	Main Pond	18	NA
GE-TP-4	3.5-4	ML	Main Pond	82	NA

Notes: [1] Fines percentage is the percentage of sample (by weight) that consists of silt- and clay-sized sediment particles passing the U.S. No. 200 sieve.

[2] Saturated hydraulic conductivity was calculated using Equations 6.17 of the Stormwater Management Manual for Eastern Washington (Ecology, 2019).

NA = not applicable.

Grain-size-based hydraulic conductivity analyses generally rely, in part, on the samples d_{10} value (the sieve size that would allow 10 percent of the sample to pass). For samples with d_{10} values that were defined by their respective gradation curve, GeoEngineers estimated saturated hydraulic conductivity based on Equation 6.17 of the *Stormwater Management Manual for Eastern Washington* (Ecology, 2019). Resulting hydraulic conductivity estimates are summarized in Table 1. Estimates range from 16 inches per hour (iph) to 1300 iph.

8.0 Project Area Subsurface Geologic Framework

Based on information compiled from previous reports and collected during this field investigation, we created a series of figures and geologic cross-sections that graphically summarize our interpreted subsurface geologic framework for the Project Area. Aspects of the compiled data within the project subsurface dataset (Appendices A and B) are provided in the following figures:

- Hydrogeologic Cross-Section A-A', Figure 5: This section originates near the southwest corner of the Project Area and trends east and northeast to the northeast corner of the Geotechnical Fieldwork Study Area. Glaciofluvial deposits associated with the SVRP Aquifer occur in the southwest portion of the section and pinch out near VC-B-4. Shallow REP deposits consist of CRBG and interpreted Latah Formation, except near GE-B-2, where an apparent trough of glaciofluvial deposits was observed.

- Hydrogeologic Cross-Section B-B’, Figure 6: This section originates near the western edge of the study area and trends east to the eastern edge of the Geotechnical Fieldwork Study Area. Glaciofluvial deposits associated with the SVRP Aquifer occur within the west portion of the section. Shallow REP deposits underlying this section also primarily consist of CRBG and interpreted Latah Formation, with a thin sequence of glaciofluvial sediments situated near GE-B-5.
- Hydrogeologic Cross-Section C-C’, Figure 7: This section originates near the southwest corner of the Main Pond and trends northeast to the northeast corner of the Main Pond. Subsurface conditions of the Main Pond are of particular interest for potential infiltration of stormwater generated from the REP, specifically from the South Vera Crest Drive and South Conklin Road area. Thick sequences of fine-grained deposits, interpreted as glaciolacustrine deposits, dominate the shallow subsurface of the Main Pond and appear to increase in thickness to the northeast. Glaciofluvial deposits of sand and gravel were encountered at a depth of about 5½ feet bgs at GE-TP-2. Sand and gravel were absent from GE-TP-4, though could occur at depth as shown in Figure 7.
- Thickness of Permeable Sediments, Figure 8: This figure presents approximate thickness of permeable glaciofluvial sediments overlying CRBG, interpreted Latah Formation and/or basement rock. Data used to support this figure primarily was obtained from previous geotechnical explorations (Table A-1) and project explorations (Appendix C). Permeable sediments on the REP are generally thin (less than 20 feet in thickness) and, where present, occur in isolated lenses and pockets, such as the one observed at exploration GE-B-2. Glaciofluvial deposits appear to thicken near the base of the REP, as shown at the southwest corner of the Project Area in borings SC-B-1 and SC-B-2, and north corner of the Project Area in test pits RE-TP-8 through RE-TP-10. This trend appears consistent with typical SVRP deposits found in Spokane Valley.
- Depth to Crystalline Bedrock, Figure 9: This figure presents observed depths to crystalline bedrock (CRBG and/or basement rock) underlying the Project Area. Data used to support this figure is from existing boring and test pit observations (Table A-1) and project explorations (Appendix C). Observed depth to bedrock was variable throughout the Project Area with depths ranging from about 3 feet to greater than 30 feet bgs. Bedrock appeared to become increasingly shallow to the south near the base of the REP, as shown in test pits RH-TP-101 through RH-TP-106.
- Depth to Limiting Stratigraphic Layer, Figure 10: This figure presents our interpretation of depth to the uppermost fine-grained sediments that limit stormwater infiltration. The limiting stratigraphic layer could consist of basalt, basement rock, Latah Formation, weathered/reworked Latah Formation and/or fill material consisting primarily of fine-grained sediment. Data used to support this figure is from existing boring and test pit observations (Table A-1) and project explorations (Appendix C). The limiting stratigraphic layer generally was encountered at shallow depths throughout the Project Area, ranging from approximately 0.3 to 7 feet bgs, with the exception of exploration GE-B-2, where the limiting stratigraphic layer was encountered at approximately 15 feet bgs.

Collectively, this subsurface geologic framework indicates that challenging stormwater infiltration conditions occur throughout the REP. Limiting stratigraphic units occur at relatively shallow depths throughout most of the REP. An isolated zone of surficial glaciofluvial sediments was observed within the approximate center of the Project Area, as shown in Figure 3. However, this glaciofluvial zone appears to be bounded by limiting stratigraphic units in all directions and, therefore, is likely of limited storage and limited functionality in transporting infiltrated stormwater off the REP to downgradient areas.

9.0 Monitoring Instrumentation and Groundwater Elevations

9.1 MONITORING POINT ELEVATION DATA

Monitoring well elevations were provided to GeoEngineers by Osborn and are summarized in Table 3.

TABLE 3. MONITORING POINT ELEVATION DATA

LOCATION	STRUCTURE TYPE	TOC ELEVATION ^{1} (FEET)	GROUND SURFACE ELEVATION ^{1} (FEET)
GE-B-2	Monitoring Well	2,141.43	2,141.68
GE-B-3	Monitoring Well	2,182.41	2,182.71
GE-B-4	Monitoring Well	2,214.76	2,215.06
GE-B-5	Monitoring Well	2,213.68	2,213.93

Notes: [1] Elevations are referenced to the NAVD88 datum.
TOC = top of north rim of PVC well casing

9.2 INSTRUMENTATION

On November 13, 2023, GeoEngineers installed Solinst Model M10 Levelogger 5 pressure transducers/dataloggers in monitoring wells GE-B-2 through GE-B-5. We also installed a Solinst Model Barologger 5 barometer/datalogger within the monument at GE-B-2. The dataloggers were programmed to record water (or air) pressure and temperature on a 2-hour interval for the purpose of characterizing seasonal trends in groundwater elevation and response to precipitation events within shallow groundwater at the monitoring locations.

9.3 GROUNDWATER ELEVATION DATA

9.3.1 Previous Groundwater Measurements

GeoEngineers reviewed 60 exploration logs and 13 water well logs at and adjacent to the Project Area (Tables A-1 and B-1), which were completed during the period from May 1974 through July 2017. Two borings completed in January 2008 (VC-B-3 and VC-B-4) and one test pit completed in April 2017 (RE-TP-5), reported shallow groundwater at depths ranging from 2 to 7 feet (Figure 11). Existing water wells, primarily completed in basalt bedrock, reported depths to groundwater of 50 to 140 feet bgs.

9.3.2 Project Manual Measurements

GeoEngineers collected manual groundwater levels in GE-B-2 through GE-B-5 on November 13, 2023, December 22, 2023, February 28, 2024 and June 14, 2024 (collectively designated the groundwater monitoring events). Results of these groundwater monitoring events are summarized in Table 4. GE-B-5 was dry during the November 2023 event indicating that groundwater elevation at this location was less than 2,204.5 feet (NAVD88).

During the Project Area monitoring events, depth to groundwater was relatively shallow. Depth to groundwater at the four monitoring locations, excluding the dry measurement in GE-B-5 during November 2023, ranged from 3.70 bgs in GE-B-4 to 8.75 feet bgs in GE-B-3. Groundwater elevations ranged from 2,134.63 feet (NAVD88) in GE-B-2 to 2,211.10 feet (NAVD88) in GE-B-4. A summary of groundwater measurements is presented in Table 4.

TABLE 4. MANUAL DEPTH TO GROUNDWATER MEASUREMENTS

MONITORING WELL	DATE	TIME	DEPTH TO GROUNDWATER 1 (FEET BTOC)	GROUNDWATER ELEVATION 1,2 (FEET BGS)	RANGE IN GROUNDWATER ELEVATION (FEET)
GE-B-2	11/13/2023	13:18	7.05	2,134.63	2.35
	12/22/2023	12:41	6.17	2,135.51	
	02/28/2024	11:15	4.70	2,136.98	
	06/14/2024	13:01	6.60	2,135.08	
GE-B-3	11/13/2023	13:46	8.75	2,173.96	2.14
	12/22/2023	12:31	6.61	2,176.10	
	02/28/2024	11:30	7.20	2,175.51	
	06/14/2024	13:21	8.45	2,174.26	
GE-B-4	11/13/2023	14:03	3.96	2,211.10	0.33
	12/22/2023	12:13	3.93	2,211.13	
	02/28/2024	11:45	3.70	2,211.36	
	06/14/2024	13:38	3.63	2,211.43	
GE-B-5	11/13/2023	14:24	Dry	<2,204.48	>2.35
	12/22/2023	12:53	8.45	2,205.48	
	02/28/2024	12:15	7.10	2,206.83	
	06/14/2024	13:52	9.19	2,204.74	

Notes: [1] Elevations are referenced to the NAVD88 datum.

[2] Groundwater elevations were calculated by subtracting the depth to groundwater from the surveyed top of casing elevations.

bTOC = below top of casing; bgs = below ground surface

9.3.3 Electronic Measurements

GeoEngineers downloaded the pressure transducer/dataloggers and barometer deployed in project monitoring wells during each groundwater monitoring event. The project monitoring period, therefore, extends from November 13, 2023 to June 14, 2024.

We corrected the data for barometric pressure fluctuation and reduced the data for depth to groundwater and groundwater elevation. Results are provided and compared to daily precipitation at the Spokane Airport Climate Station (No. 457938) in Depth to Groundwater and Precipitation, Figure 12. Climate station reports are included in Appendix E, Climate Data. Our observations include the following:

- Groundwater monitoring data from monitoring well GE-B-2 generally are indicative of conditions within the limited zone of glaciofluvial sediments outlined in Figure 3. Groundwater monitoring data from monitoring wells GE-B-3 through GE-B-5 generally are indicative of conditions within interpreted Latah Formation sediments.
- Groundwater levels generally rose in project monitoring wells and structures during the winter and spring months from about early December 2023 through early March 2024. The magnitude of the observed increase ranged from approximately 1.5 to 2.75 feet.

- After the early portion of March 2024, groundwater levels generally decreased in the project monitoring wells and structures. The observed magnitude of decrease was on the order of 1.0 to 2.75 feet.
- Groundwater levels within glaciofluvial sediments (monitoring well B-2) tended to increase and decrease gradually over a period of weeks to months. Groundwater levels within interpreted Latah Formation sediments (monitoring wells B-3 through B-5) increased and decreased more rapidly, generally over a period of days.
- Depths to groundwater within monitoring well GE-B-5, generally appeared to follow the seasonal pattern observed in other monitoring wells screened within the interpreted Latah Formation, although the well was intermittently dry. Dry conditions in GE-B-5 were recorded from November to the middle of December 2023, the early portion of January 2024, and early April 2024 through the end of the project monitoring period.
- Project monitoring wells responded variably to major precipitation events.
  - Monitoring locations completed with interpreted Latah Formation sediments (GE-B-3 through GE-B-5) showed a rapid response in groundwater elevation to significant precipitation events.
  - The monitoring location completed within glaciofluvial sediments (GE-B-2) did not respond rapidly to precipitation events. Rather, it appeared to respond gradually to longer-term, seasonal variation in precipitation and associated groundwater recharge.
- A diurnal (daily) fluctuation in groundwater level was observed in most of the monitoring locations. The magnitude of the observed fluctuation was generally less than 0.04 feet. The observed fluctuation also generally decreased with increasing depth to groundwater. This observed diurnal fluctuation could be caused by daily uptake of water by vegetation, daily irrigation practices and/or the transfer of water between the shallow aquifer and capillary fringe related to daily temperature and barometric fluctuation (Turk, 1975).

10.0 Hydraulic Testing

10.1 PILOT INFILTRATION TESTING

10.1.1Test Procedure

The infiltration characteristics of the unsaturated zone at the Main Pond were estimated by completing a large-scale pilot infiltration test (designated IT-1) in test pit TP-1 (Figure 4). The intent of the pilot test was to characterize the capacity of existing shallow soil within the Main Pond to infiltrate stormwater. Therefore, pilot testing was conducted in TP-1 at a depth of 2 feet bgs.

GeoEngineers conducted the pilot infiltration test in general accordance with Appendix 6B of the *Stormwater Management Manual for Eastern Washington* (Ecology, 2019). Pilot infiltration test data are provided and shown in Table F-1 and Figure F-1 of Appendix F.

GeoEngineers used the following testing procedure:

- Excavated a 10.2-foot by 11.0-foot test pit to a depth of 2 feet bgs.
- Installed a temporary 2-inch-diameter PVC piezometer.

- Added clean water to the pit at a rate that maintained a water level between 1 and 2 feet above the bottom of the pit. Water was injected into the pit for an approximate 4-hour soaking period followed by an approximate 1-hour constant head period.
- At regular intervals, the cumulative volume and instantaneous flow rate were measured in gallons per minute (gpm) to maintain the water level at the same point in the piezometer.
- Terminated water discharge and recorded the rate of water level decrease in the test pits for an approximate 2-hour period (falling head test).

10.1.2Test Results

At the Main Pond, water was sourced from an adjacent City fire hydrant. A total of 1,150 gallons was injected during testing. Head within test pit TP-1 was maintained at a height of approximately 1.17 feet above the bottom of the test pit during the constant head period (Figure F-1). To maintain the constant head, an injection rate that ranged from approximately 0.93 gpm to 1.03 gpm was required. Between measurement intervals, this correlates to infiltration rates through the bottom of the test pit that range from 0.80 iph to 0.89 iph. The stabilized infiltration rate for the 1-hour constant rate period was approximately 0.85 iph. The falling head period was recorded for 2 hours, in which the water level in TP-1 dropped 0.18 feet. During the falling-head period, the stabilized infiltration rate was approximately 1.03 iph.

Pilot infiltration testing results are summarized in Table 5.

TABLE 5. PILOT INFILTRATION RESULTS SUMMARY

EXPLORATION	LOCATION	INFILTRATION RATE (IPH)		CORRECTION FACTOR [3]	PRELIMINARY DESIGN INFILTRATION RATE [4] (IPH)
		CONSTANT HEAD PERIOD [1]	FALLING HEAD PERIOD [2]		
TP-1	Main Pond	0.85	1.03	0.34	0.29

Notes: [1] The infiltration rate provided for the constant head period represents a stabilized infiltration rate for final hour of the constant rate period.

[2] The infiltration rate provided for the falling head period represents an average infiltration rate for the falling head period.

[3] The correction factor was adapted from Table 6.4 of the 2019 Stormwater Management Manual for Eastern Washington and assumes the following parameters CFv: 0.50, CFt: 0.75, CFm: 0.9, and CFb: 1.0.

[4] The preliminary design infiltration rate was estimated by applying the correction factor to the stabilized infiltration rate during the constant head period.

iph = inches per hour.

After applying the specified correction factor from the 2019 Stormwater Management Manual for Eastern Washington (Ecology, 2019), preliminary design infiltration rate at the Main Pond was 0.29 iph.

10.2 FULL-SCALE DRYWELL TESTING

10.2.1 Procedure

The performance of existing drywells within the Radco Pond (infiltration test IT-2) and along the north side of East 24th Avenue (infiltration test IT-3) were estimated by completing full-scale drywell infiltration tests in one existing drywell at each location. Approximate test locations are shown in Figure 4. GeoEngineers conducted the full-scale drywell infiltration tests in general accordance with Appendix 6B of the *Stormwater Management Manual for Eastern Washington* (Ecology, 2019) and Appendix 4B of the *Spokane Regional Stormwater Manual* (Spokane County et al., 2008). Full-scale drywell test data for tests IT-2 and IT-3 are provided and shown in Tables F-2 and F-3, and Figures F-2 and F-3 of Appendix F, respectively.

GeoEngineers used the following testing procedure:

- Inspected and measured the dimensions of each drywell selected for drywell testing.
- Installed temporary 2-inch-diameter PVC piezometers within the drywells.
- Added clean water to the drywells at a rate that maintained a water level consistent with the top of the active barrel section or immediately below the lowest lateral connecting pipe, if present. Water was injected into the drywells for a minimum 1-hour constant-head period followed by falling head periods.
- At regular intervals, measured the cumulative volume and instantaneous flow rate in gpm necessary to maintain constant head within the drywells.
- Terminated water discharge and recorded the rate of water level decrease in the drywells for approximately 50 minutes or until the drywells were dry.

10.2.2 Radco Infiltration Pond

At the Radco Pond, the drywell closest to the southwest stormwater inlet was selected for testing. Water for the test was sourced from a City hydrant located on the north side of East Radco Drive adjacent to the Radco Pond access road. A total of 32,134 gallons were injected during testing. Head within the drywell was maintained at a maximum height of 3.44 feet to 3.61 feet during the constant head period (Figure C-2). To maintain the constant head, the hydrant was discharged at maximum capacity. Injection rates ranged from approximately 239 gpm to 294 gpm. The normalized outflow rate for the 1-hour constant rate period was 2.0 cubic feet per second (cfs).

The duration of the falling head period was 6 minutes, which was the time required for the drywell to go dry. The falling-head infiltration rate generally diminished over time as head decreased and, potentially, the wetting front extended to zones of relatively low permeability.

10.2.3 East 24th Avenue

In the sidewalk along the north side of East 24th Avenue, east adjacent to the intersection of East 24th Avenue and South Timberlane Drive, a cluster of three existing drywells is present. The series of three, double-depth concrete drywells, herein designated the west, central and east drywell, are interconnected by approximate 8-inch-diameter lateral piping at a depth of about 5½ feet (drywell rim to bottom of pipe). Initial investigation of the series of drywells indicated moderate to severe siltation in the west and central drywells and minor siltation in the east drywell. As a result, the east drywell was selected for testing, as it appeared to be the least impacted by siltation and debris accumulation.

Water for the test was sourced from a City hydrant located at the northwest corner of the above intersection. A total of 785 gallons were injected during testing. Head within the drywell was maintained at a height of 4.07 feet to 4.09 feet during the constant head period (Figure C-3). Head within the drywell during the constant rate period was limited by the height of lateral connection piping. To maintain the constant head, the hydrant was discharged at injection rates of approximately 78 gpm to 105 gpm. The normalized outflow rate for the 1-hour constant rate period was 0.014 cfs.

The duration of the falling head period was 50 minutes, in which the water level within the drywell decreased by a total of 1.1 feet. The falling-head infiltration rate generally remained constant during the falling head period.

The measured exfiltration rate is generally low for drywells hydraulically connected to glaciofluvial sand and gravel deposits. It is unknown if the low exfiltration rates are a result of lower permeability soil surrounding the drywells, shallow bedrock beneath the drywell base, the condition of the drywells or a combination of the above. Due to the following factors, exfiltration rates generated from the East 24th Avenue full-scale drywell test could be biased low due to the following drywell testing conditions:

- Drywell testing was conducted in a single drywell within the East 24th Avenue drywell cluster

Exfiltration rate was likely limited by siltation and accumulated debris. Minor siltation observed within the east (tested) drywell could have impacted outflow capacity of the drywell. The drywell test was limited to the active barrel section of the east drywell below the lateral interconnecting outlet piping, in accordance with procedures outlined in the Spokane Regional Stormwater Manual. Thus, only a portion of the active barrel section was tested. To provide a representative exfiltration rate of the East 24th Avenue drywell cluster, we recommend conducting a full-scale drywell test on the entire series of drywells including the full active barrel sections of each drywell simultaneously, as practical. Prior to drywell infiltration testing, we recommend all sediment and accumulated debris be removed and drywell slots be thoroughly cleaned to restore exfiltration capacity, to the extent practicable.

10.2.4Summary of Results

Full-scale drywell infiltration testing results are summarized in Table 6.

TABLE 6. FULL-SCALE DRYWELL INFILTRATION RESULTS SUMMARY

TEST NUMBER	LOCATION	NORMALIZED OUTFLOW RATE (CFS) [1]	CORRECTION FACTOR [2]	DESIGN OUTFLOW RATE [3] (CFS)
		CONSTANT HEAD PERIOD		
IT-2	Radco Pond	2.0	2.5	0.81
IT-3	E 24th Ave	0.014	2.5	0.0055

Notes: [1] The normalized outflow rate provided for the constant head period represents the 1-hour constant rate period.

[2] The correction factor was adapted from Table 4B-1 of the 2008 Spokane Regional Stormwater Manual.

[3] The preliminary design outflow rate was estimated by applying the correction factor to the normalized outflow rate during the constant head period.

cfs = cubic feet per second.

After applying the specified correction factor from the 2008 Spokane Regional Stormwater Manual (Spokane County et al., 2008), preliminary design outflow rates range from 0.81 cfs at the Radco Pond and 0.0055 cfs at East 24th Avenue.

11.0 Drainage Complaints

The City provided GeoEngineers with figures describing and showing the approximate locations of: (1) historic citizen complaints received from residents within the Project Area related to shallow groundwater and stormwater runoff; and (2) historic City observations related to seasonal springs, ponded drywells and infiltration pond overflow. The term ponded drywell refers to overflowed drywells with subsequent surface ponding. Associated approximate locations are provided in Historic Drainage Complaints, Figure 13 and are summarized by the following:

- A total of 27 citizen complaints were documented within the Project Area.
- Emergence of flow from seasonal springs generated during discrete large-scale precipitation events or sustained periods of precipitation were reported at seven locations. Five seasonal springs were reported near the southwest corner of the Project Area along South Vera Crest Drive, East 24th Avenue and South Sonora Drive and two seasonal springs were reported near South Steen Road. Based on the observed soil conditions at each spring location, infiltration is likely limited by surface or near-surface fine-grained sediments, which could consist of Latah Formation, weathered/reworked Latah Formation and/or fill material consisting primarily of fine-grained sediment. Depths to fine-grained sediment of about 0.7 to 2.5 feet bgs were observed near the seasonal spring locations (Figure 10). Seasonal springs near South Sonora Drive appear to be impacted by shallow bedrock (Figure 9). Groundwater also was observed at a depth of about 2 feet bgs in a boring drilled by Budinger and Associates in 2008 within South Vera Crest Drive near the intersection with 24th Avenue (Figure 11).
- Ponded drywells observed during large scale rain events or sustained periods of precipitation were reported at fourteen locations. Seven ponded drywells were reported at the northwestern edge of the REP along South Vera Crest and East 22nd Avenue and seven were observed at the southwest corner of the Project Area near South Sonora Drive, South Timberlane Drive and East Cameron Court (Figure 13). Based on subsurface soil conditions in adjacent explorations near the northern seven ponded drywell locations, infiltration appears to be limited by thickness of permeable sediments (Figure 9). Thickness of permeable sediments near the northern ponded drywell locations ranged from 0 to 3.8 feet , except for the ponded drywell documented adjacent to boring GE-B-2 (Figure 8). At boring location GE-B-2, thickness of permeable sediments were about 14.7 feet. We interpret drywell ponding at this location to be associated with stormwater inflow exceeding infiltration capacity of the infiltration structure.
- Stormwater pond overflow was reported at the infiltration pond located at the southwest corner of the Project Area between East Saltese Road and South Timberlane Road. Subsurface exploration data at this location is limited but based upon the geologic subsurface in the immediate vicinity, the pond is likely impacted by shallow bedrock (Figures 3 and 13). Based upon available aerial imagery, wetland vegetation appears to be present throughout the upgradient portion of the valley bottom. Wetland vegetation typically indicates prolonged periods of moist to wet conditions and fine-grained soil deposits. Wetland conditions and fine-grained soil conditions could also impact infiltration capacity.

12.0 Discussion

12.1 PROJECT AREA DRAINAGE CONDITIONS

The Project Area is underlain by a complex stratigraphic sequence of silty surficial deposits, glaciofluvial sediments, glaciolacustrine sediments, fine-grained sedimentary deposits associated with the Latah Formation, basalt flows associated with the CRBG and basement rocks. As cross-sections A-A' through C-C' (Figures 5 through 7) and Figure 8 (Thickness of Permeable Sediments) indicate, permeable sediments generally occur in thin, discontinuous deposits within the Project Area and, therefore, appear to be insufficient to support infiltration of stormwater and residential irrigation water within the Project Area.

Based on project findings, our current conceptual model of the hydrogeologic conditions that have contributed to the drainage issues observed within the Project Area is as follows:

- Stormwater infiltration across the Project Area is limited by shallow glaciofluvial sediment, Latah Formation, CRBG and basement rocks.
- A limited amount of stormwater infiltrates within glaciofluvial sediments which appear to occur within discontinuous depressions, channels and pockets, similar to that observed within project boring GE-B-2. These glaciofluvial deposits, however, generally are bounded by low-permeability sediment and rock and are not effective conduits for transport of infiltrated stormwater off the REP.
- With the advent of residential development, irrigated lawns, impermeable surfaces (paved areas, streets and buildings) and permanent stormwater infrastructure became prevalent within the Project Area. The percentage of water lost to evapotranspiration significantly decreased and stormwater discharge became concentrated at points of discharge (drywells, infiltration trenches and roof downspouts). As a result, more water now infiltrates through existing stormwater infrastructure and the vadose zone within the Project Area relative to pre-development conditions. The mechanisms creating increased infiltration primarily occurs through lawn watering, the removal of evapotranspiration through the loss of native vegetation and construction of impermeable surfaces where stormwater runoff is concentrated at specific infiltration points.
- As the area of development increased, the rate and volume of water entering existing stormwater infrastructure and subsurface soils increased. Eventually, stormwater infiltration seasonally began to exceed the capacity of the sediment strata and stormwater infrastructure resulting in the flooding and drainage issues now occurring in the Project Area.

Ultimately, solution(s) to the drainage problems observed within the Project Area likely will center around routing stormwater off the REP towards down-gradient discharge areas underlain by relatively thick sequences of glaciofluvial sediments overlying the SVRP Aquifer.

12.2 PAVEMENT THICKNESS DESIGN

12.2.1 General

We used procedures outlined in the American Association of State Highway and Transportation Officials (AASHTO) Guide to Design of Pavement Structures (commonly referred to as AASHTO 93) to evaluate potential pavement thicknesses for project streets. AASHTO 93 is an empirical design procedure that requires various input parameters. Site-specific parameters include the subgrade soil resilient modulus and traffic loads. The remaining input parameters are based on the functional classification of the roadway and material properties of the proposed pavement section. We evaluated pavement thicknesses for conventional HMA surfacing supported by crushed surfacing base course.

12.2.2 Subgrade

As indicated previously, a number of pavement cores and borings have been conducted in the Project Area. Results of the borings and pavement cores indicate the existing asphalt concrete surfacing is variable, ranging from about 1 inch to about 5 inches. Base course thickness also is highly variable. The explorations also indicate subgrade soil varies from silt and clay to sand and gravel (likely varying from reworked Latah Formation deposits to imported fill).

Results of our field explorations indicate the resilient modulus of the existing subgrade soil is greater than 3,000 psi, thus per the 2018 City of Spokane Valley Street Standards, standard pavement sections may be used for residential streets, assuming traffic loads result in ESAL values less than about 50,000 for a 20-year design life. Based on our limited time on-site during fieldwork, we observed a considerable volume of traffic along South Vera Crest Drive and East 22nd Avenue. We suggest consideration be given for the City to collect traffic counts as a basis for completing site-specific pavement thickness design for these streets.

12.2.3 Traffic

The traffic parameter used in the AASHTO 93 is based on equivalent single axle loads (ESALs). An ESAL value of 1.0 is equivalent to the load (or damage) a single truck axle loaded to 18,000 pounds will impart to a roadway. ESALs can be estimated by completing traffic counts and estimating the number of different types of trucks that use a particular street or segment of roadway. Load factors (also called truck factors) can then be applied to the different types of trucks within the traffic count. The truck factors provided in the City of Spokane Valley Street Standards are provided in Table 7.

Table 7. Truck Factors from the City of Spokane Valley Street Standards

VEHICLE CLASSIFICATION	TRUCK FACTOR (ESALS PER VEHICLE)
School Bus	2.87
STA Bus	2.57
Refuse Truck	1.03
All other trucks (averaged)	0.42

Other truck factors are also available. For example, the following breakdown of Truck Factors for various vehicle classifications available on the Washington State Department of Transportation (WSDOT) website is presented in Table 8.

Table 8. Example Truck Factors from WSDOT

VEHICLE CLASSIFICATION	TRUCK FACTOR (ESALS PER VEHICLE)
Cars and pickups	0.0007
2-axle, 6-tire single-unit trucks	0.25
3+ axle single-unit trucks	0.58
2 axle truck and semi-trailer double-unit trucks	0.39
4 axle truck and semi-trailer double-unit trucks	0.51
5+ axle truck and semi-trailer double-unit trucks	1.13
Buses	0.57
Twin trailers (multi-unit trucks)	2.4

The City of Spokane Valley Transportation Network on-line map indicates streets within the project limits are not classified as collectors or arterials. Information on site-specific traffic was not available at the time we prepared this report. In the absence of site-specific traffic data, we reviewed the design traffic information that was used for design of the 8 rehabilitation of 24th Avenue and the southern portions of South Vera Crest Drive, completed by Budinger and Associates, Inc. (Budinger) in 2008. The design average daily traffic used by Budinger was 3,000 vehicles per day (vpd) with an assumed 3 percent trucks (200 trucks per day for each 5-day work week). Budinger assumed all of the traffic would be in the design lane and assumed a truck factor of 2.0 ESALs per truck. This resulted in an estimated ESAL value of 1,170,000 ESALs for a 20-year design life for 24th Avenue and Vera Crest Drive.

We conducted a brief parametric study to assess possible alternative ESAL values for project streets. Assuming a growth rate of zero, and assuming 90 percent of the 3 percent total trucks used by Budinger consist of 2-axle, 6-tire single units, 9 percent of the trucks consist of 3 axle single units, and 1 percent of the trucks consist of buses, using the truck factors in Table 8, we estimated a 20-year design life equivalent single axle load (ESAL) value of approximately 225,000. If we assume a 2 percent annual growth rate starting from the 2008 design traffic values, the estimated 20-year design life ESAL value assuming the same contribution of trucks is approximately 350,000. For a 4 percent annual growth rate, the estimated 20-year design life ESAL value is approximately 600,000. If we assume 250 ADT for a residential street, with 3.5 percent trucks (including a mixture of single unit trucks and school buses) we can develop a 20-year ESAL estimate of about 50,000.

Again, we recommend site-specific traffic data be collected in advance of final pavement design to confirm or revise design ESAL values.

12.3 OTHER INPUT PARAMETERS

We completed preliminary pavement thickness design using procedures outlined in the City of Spokane Valley Street Standards along with the following input parameters:

- ESAL values of 50,000, 225,000; 375,000; 630,000 and 1,170,000 (previous design for 24th Avenue and Vera Crest Drive).
- Based on the results of our explorations, and review of previous efforts by Budinger, the average resilient modulus of subgrade soil within the project area is approximately 6,000 psi.
- Reliability of 75 percent for residential streets and 90 percent for non-residential streets (matching previous pavement design by Budinger). The City of Spokane Valley Street Standards stipulate a reliability level of 75 percent for residential and local non-residential streets, and 90 percent for all other street classifications. Note that reliability is the probability that a pavement section will perform satisfactorily over the traffic and environmental conditions for the design period. Higher reliability levels are typically assigned to more critical roadways within a roadway system. Overall deviation of 0.45 for new or reconstruction in accordance with City of Spokane Valley Street Standards.
- Initial serviceability index of 4.2 in accordance with City of Spokane Valley Street Standards.
- Terminal serviceability index of 2.0 for residential streets and 2.25 for Collectors and Minor Arterials (matching previous pavement design by Budinger). The City of Spokane Valley Street Standards stipulates a terminal serviceability of 2.0 for residential and local non-residential streets, and a terminal serviceability of 2.25 for collectors and minor arterials. The terminal serviceability index is the serviceability level at which a pavement is considered to have exhausted its serviceable life. Higher terminal serviceability levels are typically assigned to collectors and arterials, while lower terminal serviceability indices are typically assigned to residential streets.
- Structural coefficient of 0.42 for HMA and 0.14 for crushed surfacing in accordance with City of Spokane Valley Street Standards.

12.3.1 Results

Tables 9 and 10 present the results of our analyses for Residential and Collector street classifications, respectively. We included pavement thickness results in Table 9 for various ESAL levels greater than 50,000 but did not include pavement thickness for the 1,170,000 ESAL value, as this value is significantly larger than what a typical residential street would be designed for, in our opinion. The 350,000 ESAL value and 630,000 ESAL values also are larger than typical for residential streets. We did not include the 50,000 ESAL value in Table 10, because this is much lower than a typical Collector street classification traffic load.

TABLE 9. PAVEMENT THICKNESS DESIGN SUMMARY BASED ON VARIOUS ESAL VALUES – RESIDENTIAL STREET CLASSIFICATION

ESAL VALUE	HMA THICKNESS (INCHES)	CRUSHED SURFACING BASE COURSE THICKNESS (INCHES)
50,000 (typical residential street ESALs)	3	6
225,000	3.5	8.5
350,000	4	8.5
600,000	4.5	9

TABLE 10. PAVEMENT THICKNESS DESIGN SUMMARY BASED ON VARIOUS ESAL VALUES –COLLECTOR STREET CLASSIFICATION

ESAL VALUE	HMA THICKNESS (INCHES)	CRUSHED SURFACING BASE COURSE THICKNESS (INCHES)
225,000	4	9.5
350,000	4.5	9.5
600,000	5	10
1,170,000 (previous 24th Ave and Vera Crest design value)	5.5	10.5

As shown in Tables 9 and 10, for a given ESAL value, the pavement thickness required for a Collector street is thicker than the pavement thickness for a residential street.

We recommend crushed rock base course meet criteria for “Crushed Surfacing Base Course” (CSBC) per section 9-03.9(3) of the WSDOT Standard Specifications. While historical practice has included use of crushed surfacing top course (CSTC), we recommend consideration be given to using just CSBC, as the larger aggregate size and smaller fines content of CSBC compared to CSTC should provide better long-term support and drainage for HMA pavements in our opinion.

WSDOT has noted that the typical distress experienced by HMA pavements in Washington since adopting Superpave mix design methodologies has been surface cracking, and that rutting generally has been less of an issue. In recent years, WSDOT has begun using more Class ⅜-inch HMA mixes (as opposed to traditional Class ½-inch mixes) as a means of reducing cracking susceptibility of HMA. Class ⅜-inch mixes typically have a higher binder content compared to Class ½-inch mixes and are thus believed to be more flexible and less brittle than Class ½-inch mixes. A review of the on-line WSDOT unit bid analysis web site indicates since 2020 approximately 279,000 tons of Class ⅜-inch HMA have been specified for WSDOT Eastern Region projects vs. approximately 77,000 tons of Class ½-inch HMA. We suggest consideration be given to using a Class ⅜-inch mix.

Subgrade at the locations of most of our explorations consisted of sand and gravel with variable fines content. Thus, at this time we don't anticipate that geotextile separation fabric will be required between subgrade soil and base course. However, it is likely that silt and clay could be encountered at subgrade elevation in some areas. Therefore, contingencies should be included for placement of geotextile fabric in areas where fine-grained (silt and clay) soil is encountered at working subgrade, or where soft spot repair is required.

Subgrade should be prepared in accordance with section 8.3.3 of the City of Spokane Valley Street Standards. If subgrade consists of very stiff to hard silt or clay, alternative measures such as probing or proof-rolling could be considered. The most appropriate means of evaluating subgrade preparation should be determined by the project geotechnical engineer at the time earthwork is performed. If soft spots are encountered, subgrade soil should be excavated to firm bearing or a depth of 2 feet, whichever is greater, and replaced with suitable granular structural fill. Alternatively, the depth of overexcavation could be reduced in conjunction with the use of a high strength geotextile fabric such as Mirafi 380i.

12.4 PAVEMENT UNDERDRAINS

Results of our explorations and groundwater monitoring indicate that depth to groundwater below most of the Project Area is shallow enough to contribute to the observed drainage issues but deep enough to limit the effectiveness of pavement underdrains. The only areas where groundwater has been encountered at depths less than approximately 4 feet bgs is near where 24th Avenue transitions to South Vera Crest Drive. As indicated previously, this section of roadway was reconstructed sometime between 2008 and 2011. Plans indicated pavement underdrains were installed in this area to take advantage of concurrent trenching and installation of a water line, and to address areas of shallow groundwater and surface water seeps along portions of 24th Avenue and the start of Vera Crest Drive. Given the depth to groundwater observed elsewhere, we do not believe that extensive pavement underdrains will provide significant benefit to collect and remove shallow groundwater for most of the site. However, we do recommend consideration be given to installing undrains in the following location(s):

- Along South Conklin Road, where the existing open channel is conveyed into a pipe that crosses below the road. The intent of the proposed underdrain(s) at this location is to collect potential shallow groundwater that could be present near the inlet of the existing open channel.
- Along South Vera Crest Drive where the existing open channel is conveyed into a pipe that crosses below the road. The intent of the proposed underdrain(s) at this location is to collect shallow groundwater that could be present beneath South Vera Crest where the open channel transitions into to lateral piping.

  Subsurface data in the immediate vicinity of this location is limited. Based upon the approximate 15 foot-thick sequence of coarse-grained sediments observed in exploration GEI-B-2, underdrains would not likely show significant benefit, however, this exploration is approximately 250 feet from where the open channel transitions beneath South Vera Crest. For this reason, we recommend conducting a limited subsurface evaluation to determine whether installation of underdrains along South Vera Crest Drive are warranted, particularly near the exiting open channel.

Results of future exploratory work or observation of soft or wet areas during construction could indicate other areas where underdrains are warranted. Pavement underdrains also could be installed to assist in conveying surface water that infiltrates into the roadway base course section to suitable discharge points where fine-grained soil is exposed at working subgrade during construction.

13.0 Limitations

We prepared this report for Osborn Consulting to assist in the characterization of the hydrogeologic and pavement conditions within the Project Area. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the fields of hydrogeology and geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix G, "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

14.0 References

Allwest Testing & Engineering, 2017. Revised Basement Recommendations, Proposed Bellaire Subdivision – Phase 3, Sundance Drive, Spokane County, Washington, Allwest Project No. 217-037G1. Report by Allwest Testing & Engineering of Spokane Valley, Washington for Summit Properties, Spokane Valley, Washington. August 21. 37 p.

Beeson, M.H., Fecht, K.R., Reidel, S.P., and Tolan, T.L., 1985, Correlations within the Frenchman Springs Member of the Columbia River Basalt Group: New insights into the middle Miocene tectonics of northwest Oregon: Oregon Geology, v. 47, p. 87–96.

Budinger & Associates, 2006. Shelley Lake 5th Addition, Spokane, WA, Results of Limited Subsurface Exploration for Evaluation of Storm Water Infiltration. Report by Budinger & Associates of Spokane, Washington for Landmark Builders, Spokane, Washington. July 10. 9 p.

Budinger & Associates, 2008. 24th Avenue & Veracrest Drive, City of Spokane Valley, WA, Results of Geotechnical Exploration and Analysis. Report by Budinger & Associates of Spokane, Washington for the City of Spokane Valley, Washington. February 15. 33 p.

Budinger & Associates, 2019. Geotechnical Engineering Report, Ridgemont Estates #5. Report by Budinger & Associates of Spokane, Washington for George Paras, Spokane, Washington. March 7. 44 p.

City of Spokane Valley, Street Standards. Adopted December 2009, Revised February 2018.

Gifford Consultants, Inc., 1995. Report of Subsurface Exploration and Geotechnical Engineering Studies for the Proposed New Remington Hill Subdivision, Veradale, Washington. Report by Gifford Consultants Inc. of Spokane, Washington for Thomas, Dean, and Hoskins, Inc. of Spokane, Washington. February 24. 22 p.

Gifford Consultants, Inc., 1999. Report of Subsurface Exploration and Geotechnical Engineering Studies for the New Vera Water Tanks, Veradale, Washington. Report by Gifford Consultants Inc. of Spokane, Washington for Womer and Associates, Inc. of Spokane, Washington. March 16. 14 p.

Hooper, P.R., 1982, The Columbia River basalts: Science, v. 215, n. 4539, p. 1463-1468.

Kahle, S.C., and J.R. Bartolino., 2007. Hydrologic framework and ground-water budget of the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington and Bonner and Kootenai Counties, Idaho: U.S. Geological Survey, Scientific Investigations Report 2007–5041; 48 p.

Kahle, S. C., Morgan, D.S., Welch, W.B., Ely, D.M., Hinkle, S.R., Vaccaro, J.J., and Orzol, L.L., 2011. “Hydrogeologic Framework and Hydrologic Budget Components of the Columbia Plateau Regional Aquifer System, Washington, Oregon, and Idaho.” USGS Groundwater Resources Program Scientific Investigations Report 2011-5124.

Leek, F., 2006, Hydrogeological characterization of the Palouse Basin Basalt Aquifer System, Washington and Idaho: Pullman, Wash., Washington State University, Master of Science in Engineering thesis, 38 p.

Pardee, J. T., and Bryan, K., 1926, Geology of the Latah Formation in relation to the lavas of the Columbia Plateau near Spokane, Washington. *In* Shorter contributions to general geology 1925: U.S. Geological Survey Professional Paper 140, p. 1-16.

Reidel, S.P., and Fecht, K.R., 1987, The Huntzinger flow: Evidence of surface mixing of the Columbia River Basalt and its petrogenetic implication: Geological Society of America Bulletin, v. 98, p. 664–677, doi:10.1130/0016-7606(1987)98<664:THFEOS>2.0.CO;2.

Reidel, S. P., and Tolan, T. L., 2013. The Grande Ronde Basalt, Columbia River Basalt Group, in Reidel, S.P., Camp, V.E., Ross, M.E., Wolff, J.A., Martin, B.S., Tolan, T.L., and Wells, R.E., eds., “The Columbia River Flood Basalt Province.” Geological Society of America Special Paper 497, p. 117-153.

Smith, G.A., Bjornstad, B.N., and Fecht, K.R., 1989, Neogene terrestrial sedimentation on and adjacent to the Columbia Plateau: Washington, Oregon and Idaho, in Reidel, S.P., and Hooper, P.R., eds., Volcanism and Tectonism in the Columbia River Flood-Basalt Province: Geological Society of America Special Paper 239, p. 187–198.

Spokane County Engineers, 1990. Subsurface Exploration Logs, 23rd and Timberlane. March 13. 4 p.

Spokane County, City of Spokane, City of Spokane Valley, April 2008. Spokane Regional Stormwater Manual. p. 4-13 to 4-15.

Swanson, D.A., Wright, T.L., Hooper, P.R., and Bentley, R.D., 1979, Revisions in Stratigraphic Nomenclature of the Columbia River Basalt Group: U.S. Geological Survey Bulletin 1457-G, 59 p.

Tolan, T.L., Reidel, S.P., Beeson, M.H., Anderson, J.L., Fecht, K.R., and Swanson, D.A., 1989, Revisions to the estimates of the areal extent and volume of the Columbia River Basalt Group, *in* Reidel, S.P., and Hooper, P.R., eds., Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 1-20.

Turk, L.J. 1975. Diurnal fluctuations of water tables induced by atmospheric pressure changes. Journal of Hydrology, v. 26, p. 1-16.

Washington State Department of Ecology. 2019. Stormwater Management Manual for Eastern Washington. Publication Number 18-10-044. September. 1154 p.

Washington State Department of Transportation. https://wsdot.gov.

Whiteman, K.J., Vaccaro, J.J., Gonthier, J.B., and Bauer, H.H., 1994, The hydrogeologic framework and geochemistry of the Columbia Plateau aquifer system, Washington, Oregon, and Idaho: U.S. Geological Survey Professional Paper 1413-B, 73 p.

Figures

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 11N

Vicinity Map

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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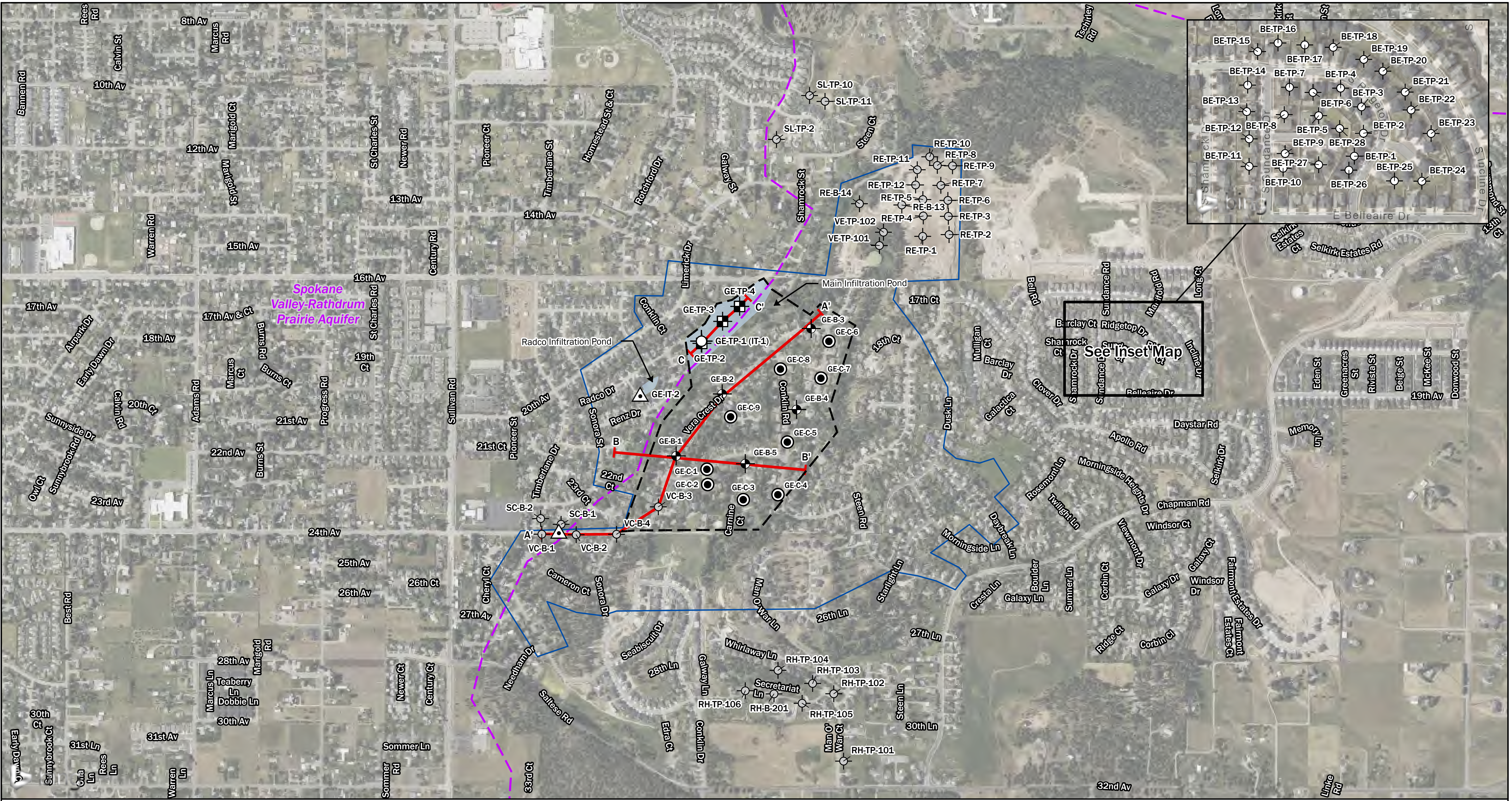
Figure 1

P:\11\11264044\GIS\11264044_Project\11264044_Project.aprx\1126404400_F01_VicinityMapB Date Exported: 06/21/24 by ccabrera



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Legend

Boring Number and Approximate Location

Pavement Core Number and Approximate Location

Test Pit Number and Approximate Location

Infiltration Test Number and Approximate Location

TP/IT

Historic Exploration Approximate Location and GeoEngineers Designation

Cross Section

Geotechnical Field Work Study Area

Hydrogeologic Data Review Area

Spokane Valley-Rathdrum Prairie Aquifer

Pond

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 11N

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N

0 1,000

Feet

Project Area Site Plan

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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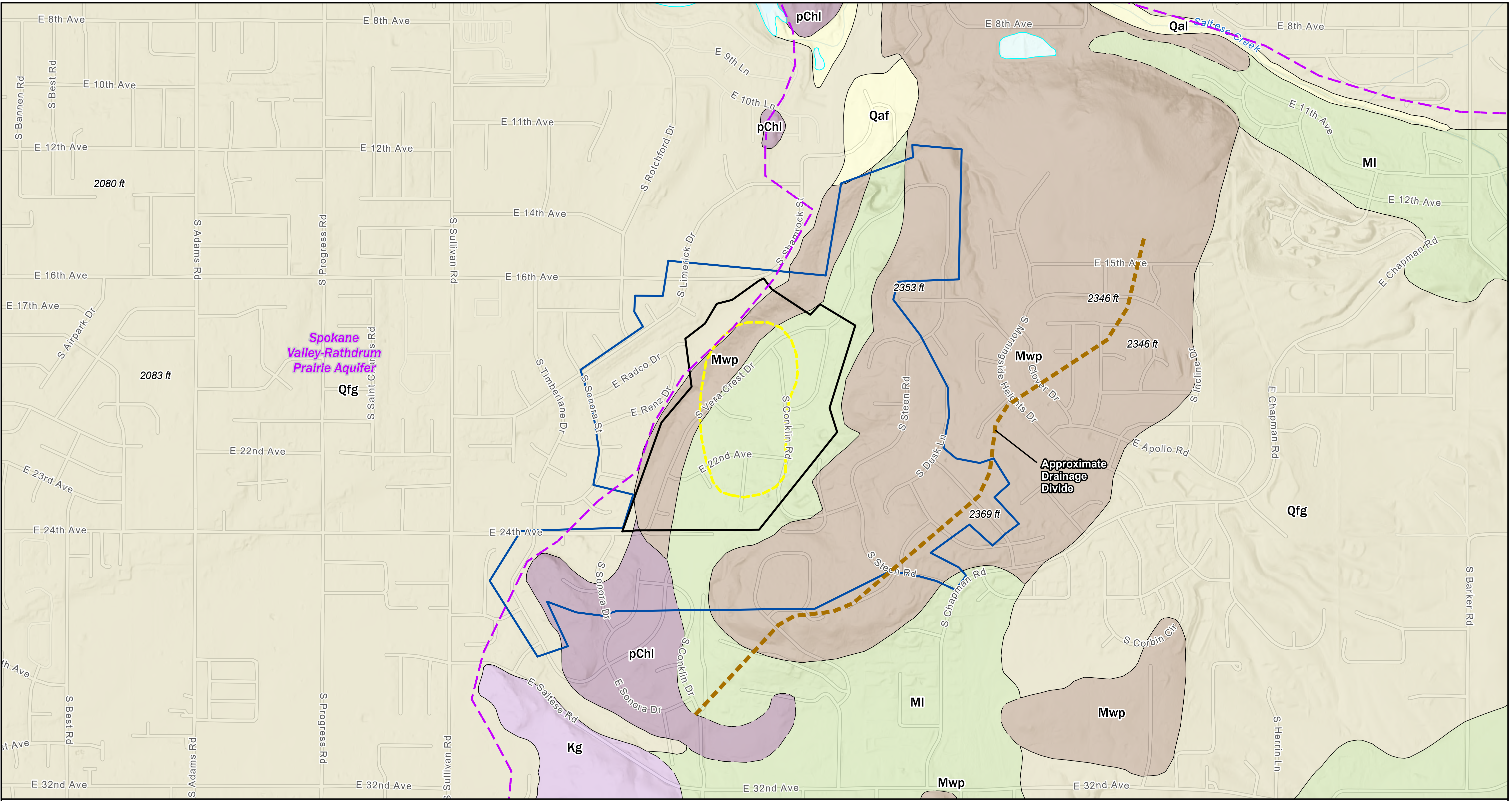
Figure 2



Source(s):
- Washington DNR 1:24K Geology, https://www.dnr.wa.gov/.
- ESRI Terrain Base Map

Coordinate System: NAD 1983 UTM Zone 11N

Legend

Geotechnical Field Work Study Area
Hydrogeologic Data Review Area
Spokane Valley-Rathdrum Prairie Aquifer
Qfg Zone Identified by Project Exploration

Geologic Units 24k

Quaternary Rocks and Deposits
Qaf Quaternary alluvium
Qfg Pleistocene glaciofluvial deposits

Neogene Rocks
MI Miocene Latah Formation
Mwp Miocene Columbia River Basalt Group, undivided

Mesozoic Rocks
Kg Mesozoic intrusive rocks

Precambrian Rocks
pChl Precambrian heterogeneous metamorphic rocks

Water
Water

N

0 1,000
Feet

Surficial Geology Map

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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Figure 3

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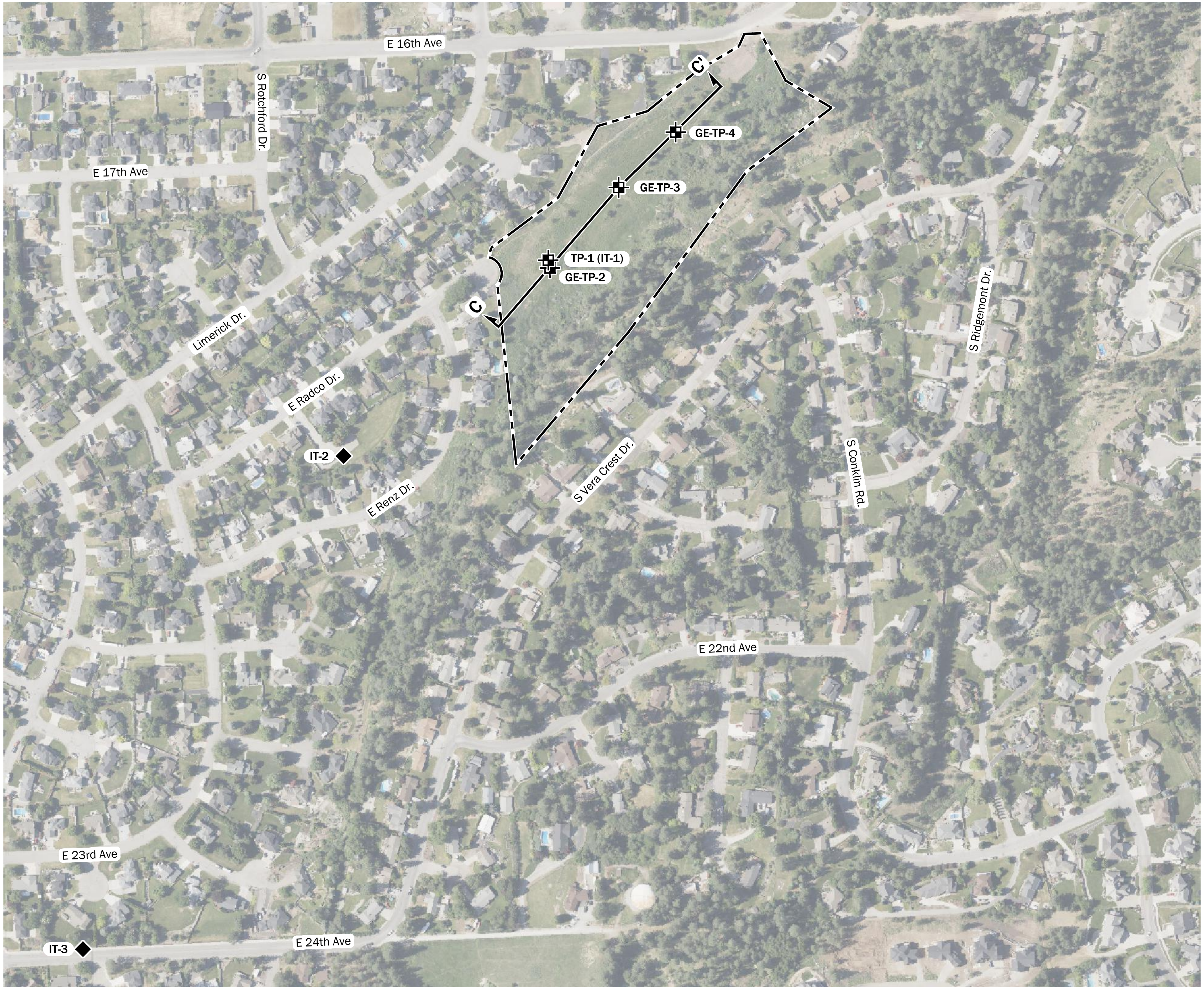

Legend

- - - Main Pond Boundary (Parcel No. 45255.9101)

GE-TP-2 ⊞ Test Pit by GeoEngineers, 2024

IT-2 ◆ Drywell Infiltration Test by GeoEngineers, 2024

A A' Cross Section Location

Source(s):

- Aerial from Microsoft Bing

Coordinate System: WA State Plane, North Zone Zone, NAD83, US Foot

N

0 300
Feet

Infiltration Test Site Plan

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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Figure 4

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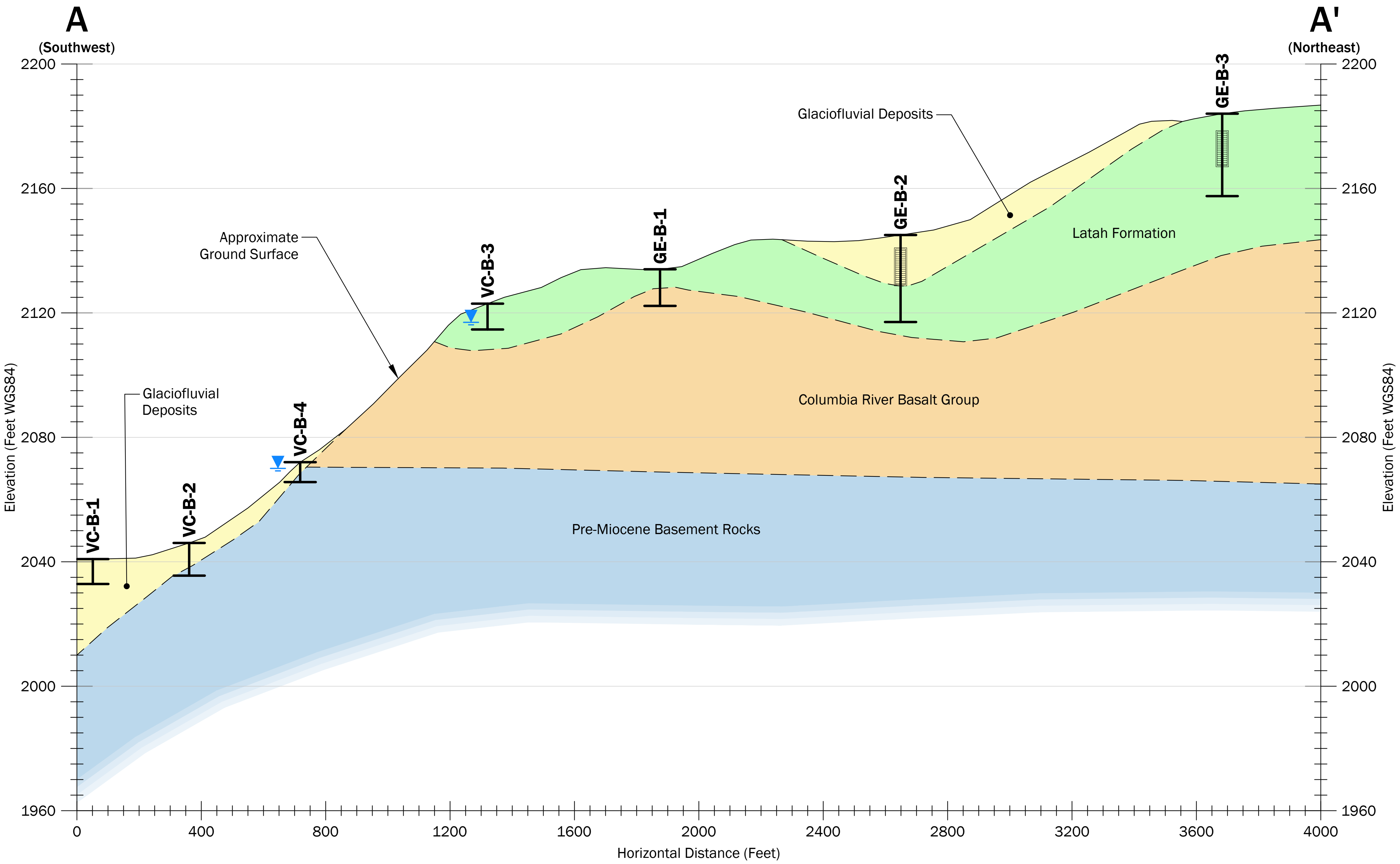

Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.
3. Lithologic contacts were interpreted using boring logs and surficial geologic mapping

Datum: WGS84 = World Geodetic System 1984.

Legend

VC-B-1

Exploration	🟨 Glaciofluvial Deposits
Inferred Lithologic Contact	🟩 Latah Formation
SM Soil Classification	🟧 Columbia River Basalt Group
▨ Screen Section (If Applicable)	🟦 Pre-Miocene Basement Rocks

400 0 400
Horizontal Scale in Feet
40 0 40
Vertical Scale in Feet
Vertical Exaggeration: 10X

Hydrogeologic Cross Section A-A'

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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Figure 5

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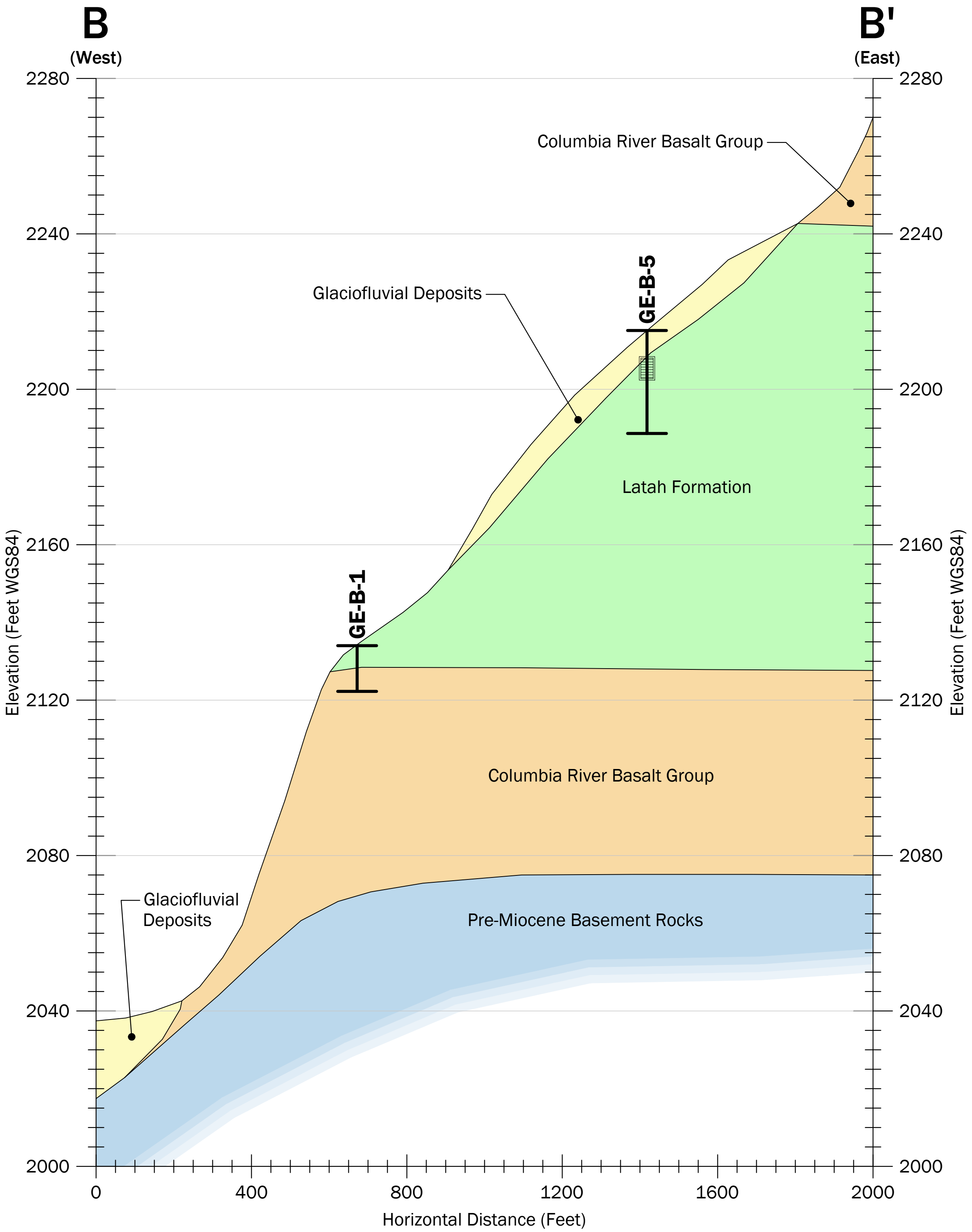

Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.
3. Lithologic contacts were interpreted using boring logs and surficial geologic mapping

Datum: WGS84 = World Geodetic System 1984.

Legend

GE-B-1 Exploration

Inferred Lithologic Contact

SM Soil Classification

Screen Section (If Applicable)

🟨 Glaciofluvial Deposits

🟩 Latah Formation

🟧 Columbia River Basalt Group

🟦 Pre-Miocene Basement Rocks

400 0 400
Horizontal Scale in Feet

40 0 40
Vertical Scale in Feet
Vertical Exaggeration: 10X

Hydrogeologic Cross Section B-B'

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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Figure 6

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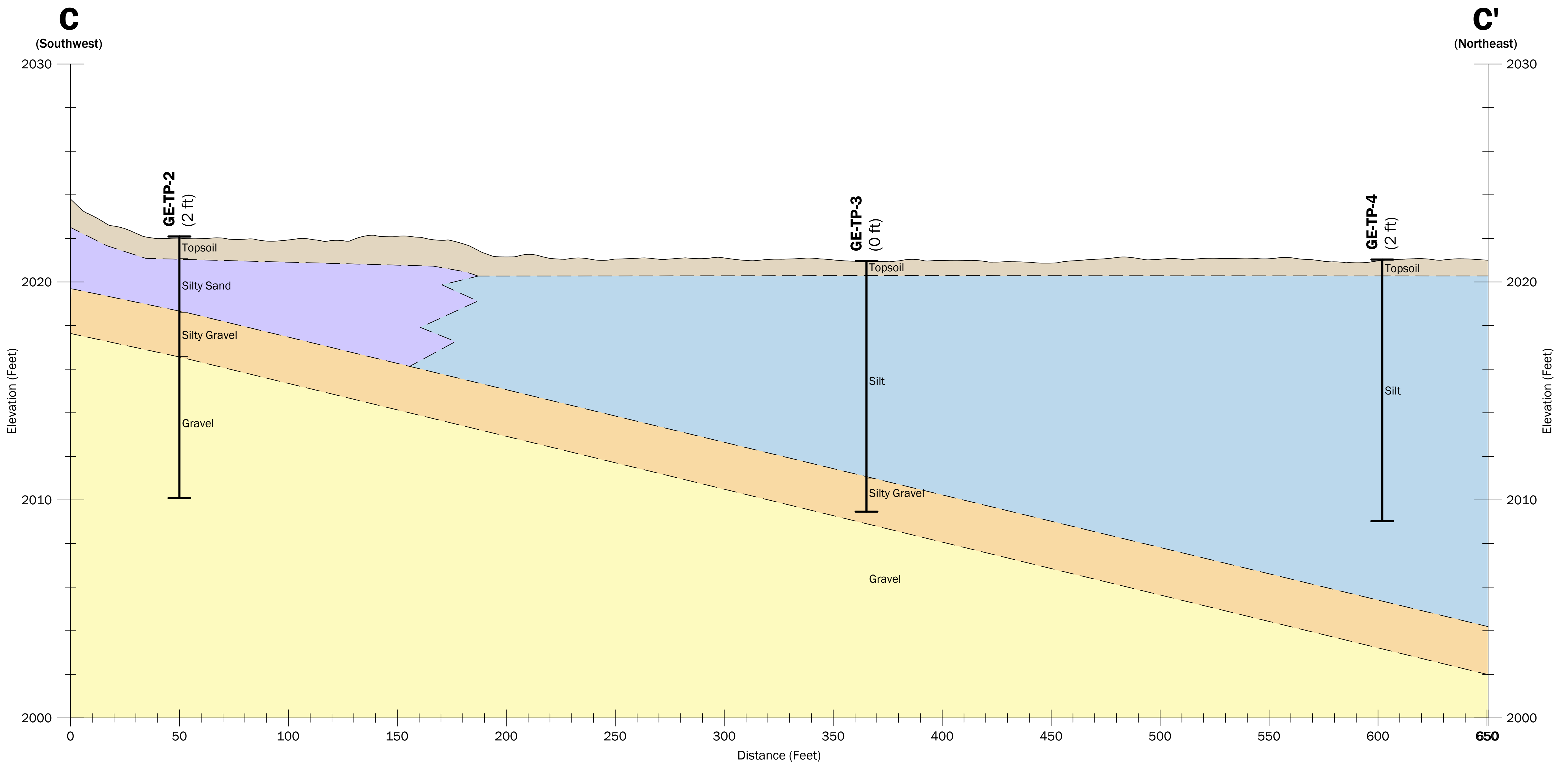

Notes:
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.
3. Lithologic contacts were interpreted using boring logs and surficial geologic mapping

Datum: WGS84 = World Geodetic System 1984.

Legend

Test Pit ID (Offset)

Test Pit

Inferred Soil Contact

▨	Topsoil
▨	Silt (Glaciolacustrine)
▨	Silty Sand (Glaciofluvial)
▨	Silty Gravel (Glaciofluvial)
▨	Gravel (Glaciofluvial)

50 0 50
Horizontal Scale in Feet
5 0 5
Vertical Scale in Feet
Vertical Exaggeration: 10X

Hydrogeologic Cross Section C-C'

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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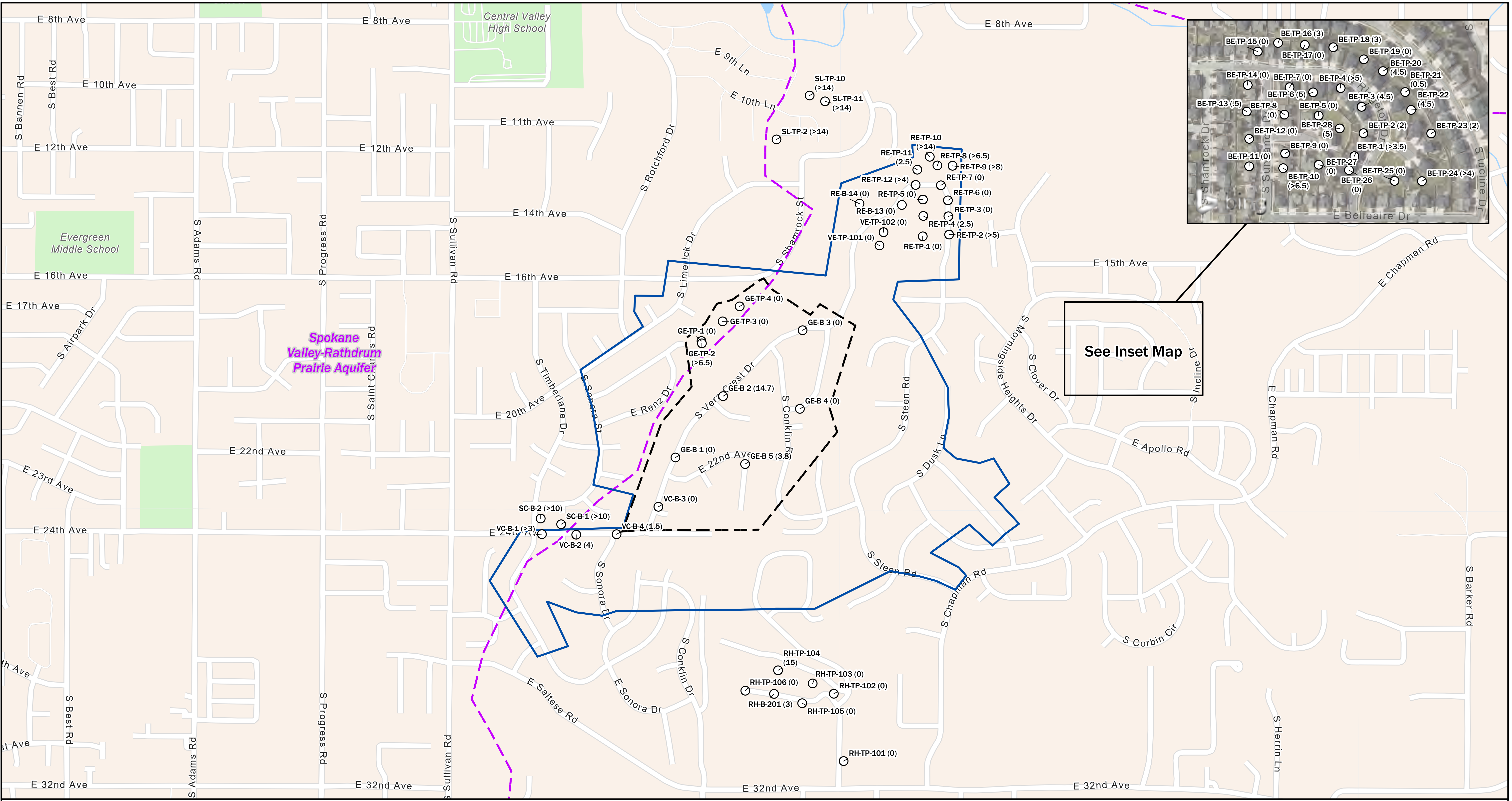
Figure 7



Notes:

1. Permeable sediments are defined as either: (1) sand and/or gravel with less than 12 perfect fines (silt- and clay-sized particles passing the U.S. No 200 sieve); or (2) sediment described as silty but associated with infiltration testing in excess of 72 inches per hour

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 11N

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Legend

BE-TP-1 (>6.5) ○	Exploration Designation and Reported Thickness of Permeable Sediments (feet)
╌	Spokane Valley-Rathdrum Prairie Aquifer
▭	Geotechnical Field Work Study Area
▭	Hydrogeologic Data Review Area

N

0 1,000
Feet

Thickness of Permeable Sediments

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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Figure 8

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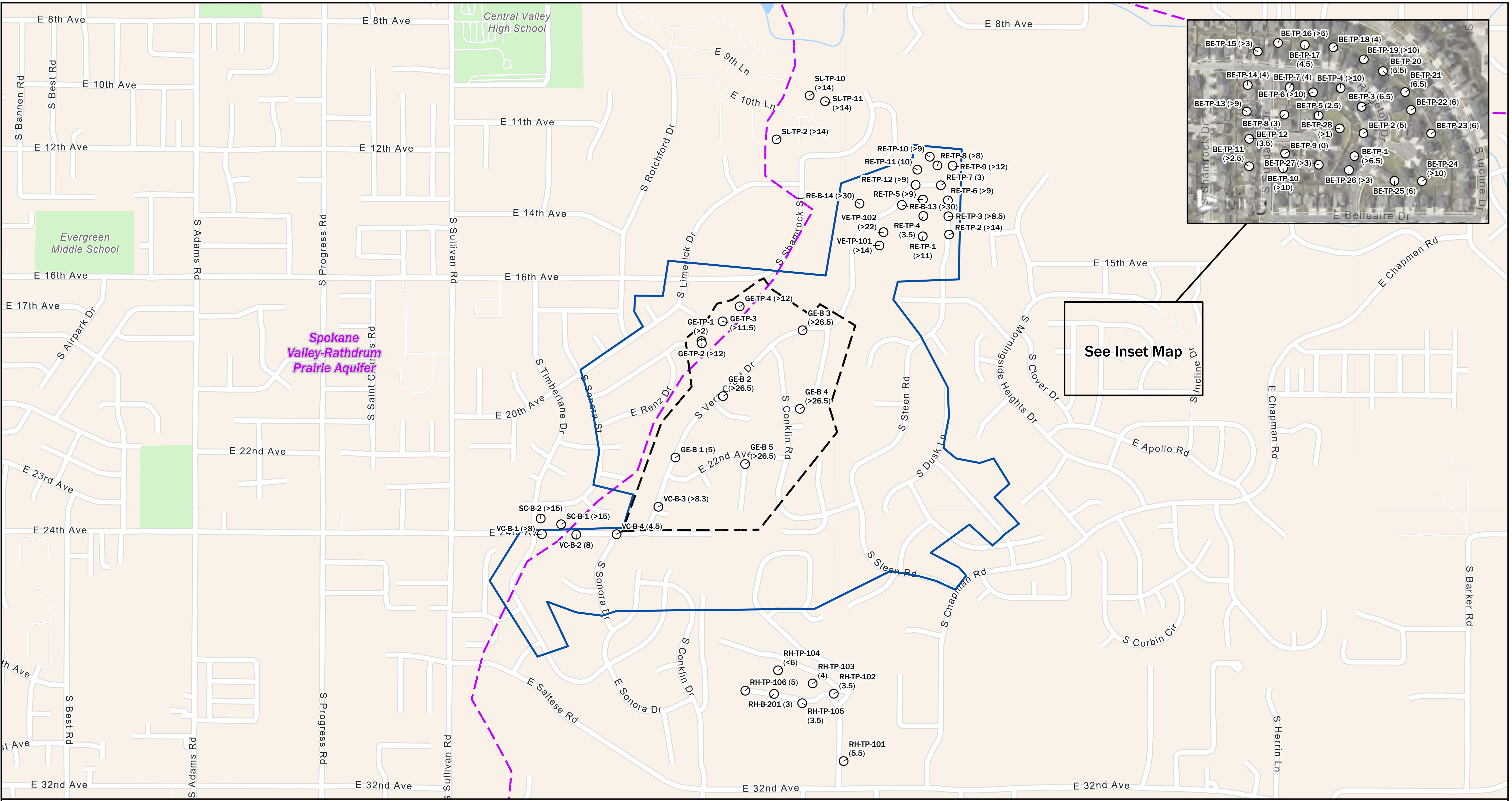

Notes:
1. Crystalline bedrock refers to Miocene age Columbia River Basalt Flows or Pre-Miocene Basement Rock

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 11N

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Legend

BE-TP-1 (>6.5) ○ Exploration Designation and Reported Depth to Crystalline Bedrock (feet)

⬚ Spokane Valley-Rathdrum Prairie Aquifer

⬚ Geotechnical Field Work Study Area

▭ Hydrogeologic Data Review Area

N

0 1,000

Feet

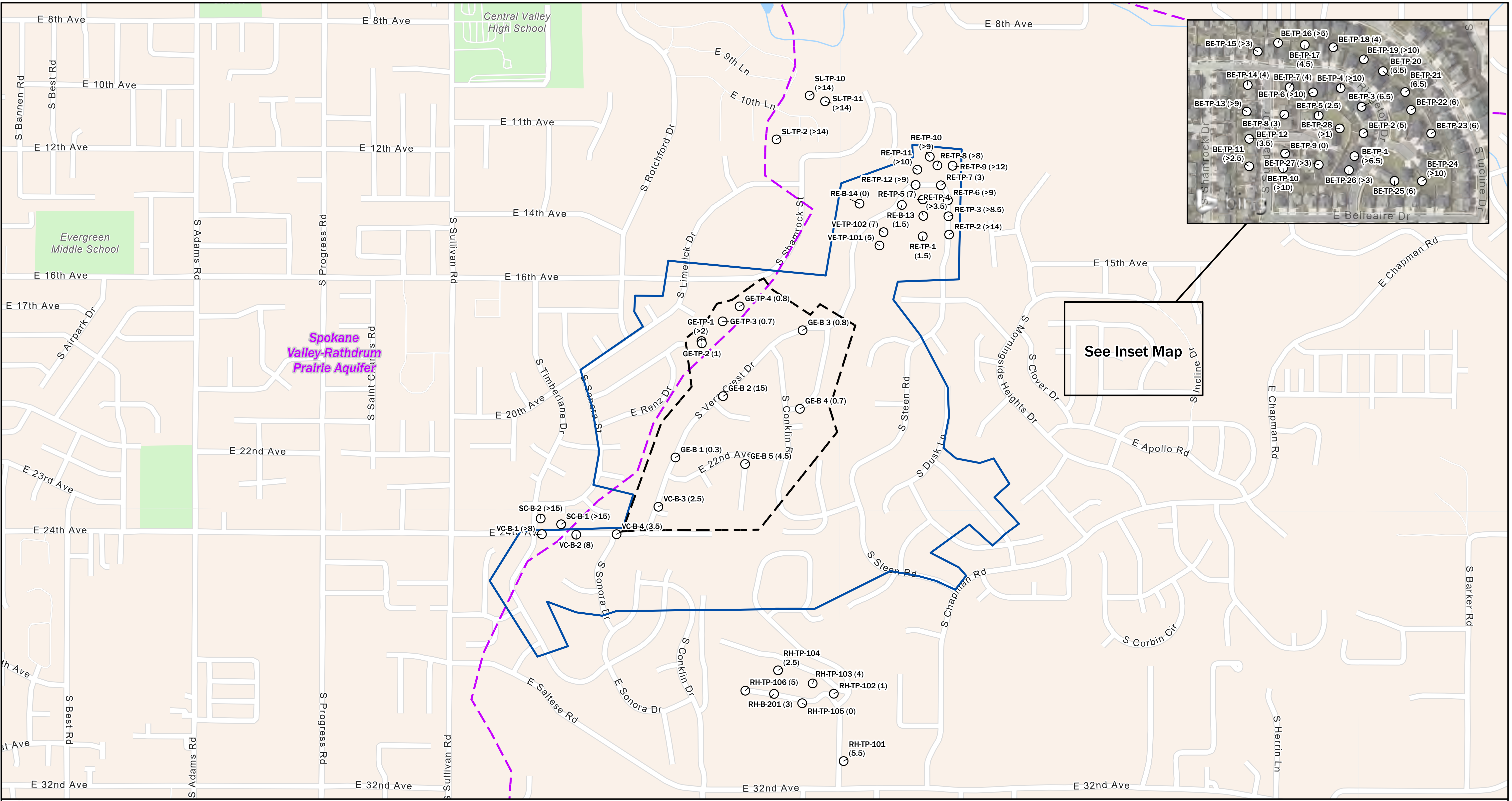
Depth to Crystalline Bedrock

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

GeoEngineers

Figure 9

P:\11\11264044\GIS\11264044_Project\11264044_Project.aprx\11264400_F09_DepthtoCrystallineBedrock Date Exported: 06/21/24 by ccabrera



Notes:
1. Explorations with no reported depth to limiting stratigraphic layer did not have a reported groundwater depth.
2. Limiting stratigraphic layer refers to uppermost lithologic layer composed of interpreted low permeability material that will limit the rate of stormwater infiltration. The limiting stratigraphic layer could be composed of basalt, basement rock, Latah Formation, reworked Latah Formation, and/or fill material composed primarily of fine-grained sediment.

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 11N

Legend

VE-TP-101 (5) ○	Exploration Designation and Reported Depth to Limiting Stratigraphic Layer (feet)
▭	Spokane Valley-Rathdrum Prairie Aquifer
▭	Geotechnical Field Work Study Area
▭	Hydrogeologic Data Review Area

N

0 1,000
Feet

Depth to Limiting Stratigraphic Layer

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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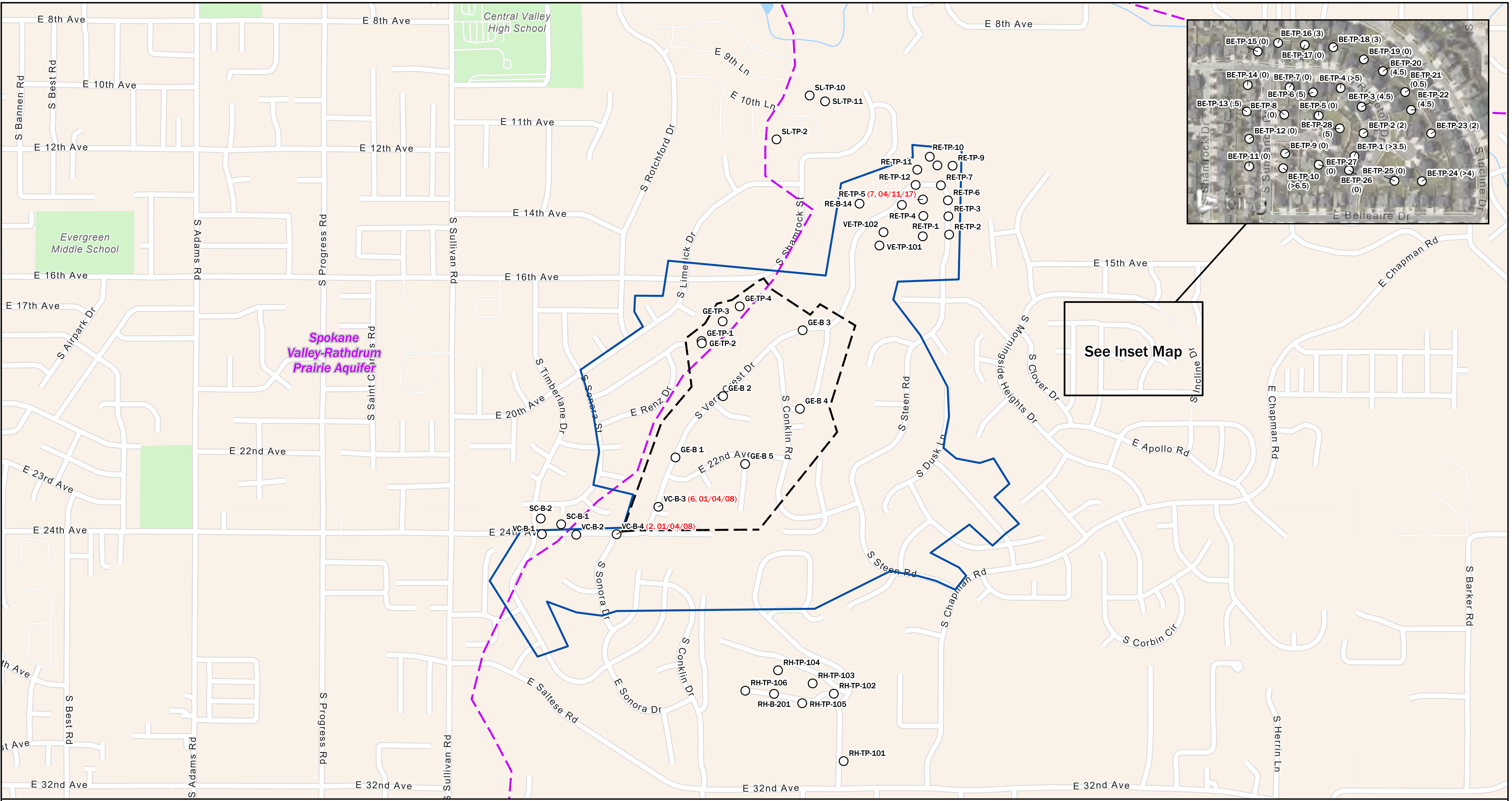
Figure 10

P:\11\11264044\GIS\11264044_Project\11264044_Project.aprx\11264404400_F10_LimitingStratigraphicLayer Date Exported: 06/21/24 by ccabrera



Notes:
1. Explorations with no reported depth to groundwater did not have a reported groundwater depth.

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 11N

Legend

VE-B-3 (6, 01/04/08) ○	Exploration Designation and Reported Depth to Groundwater and Date of Measurement
▭	Spokane Valley-Rathdrum Prairie Aquifer
▭	Geotechnical Field Work Study Area
▭	Hydrogeologic Data Review Area
▭	Spokane Valley-Rathdrum Prairie Aquifer

N

0 1,000
Feet

Depth to Groundwater

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

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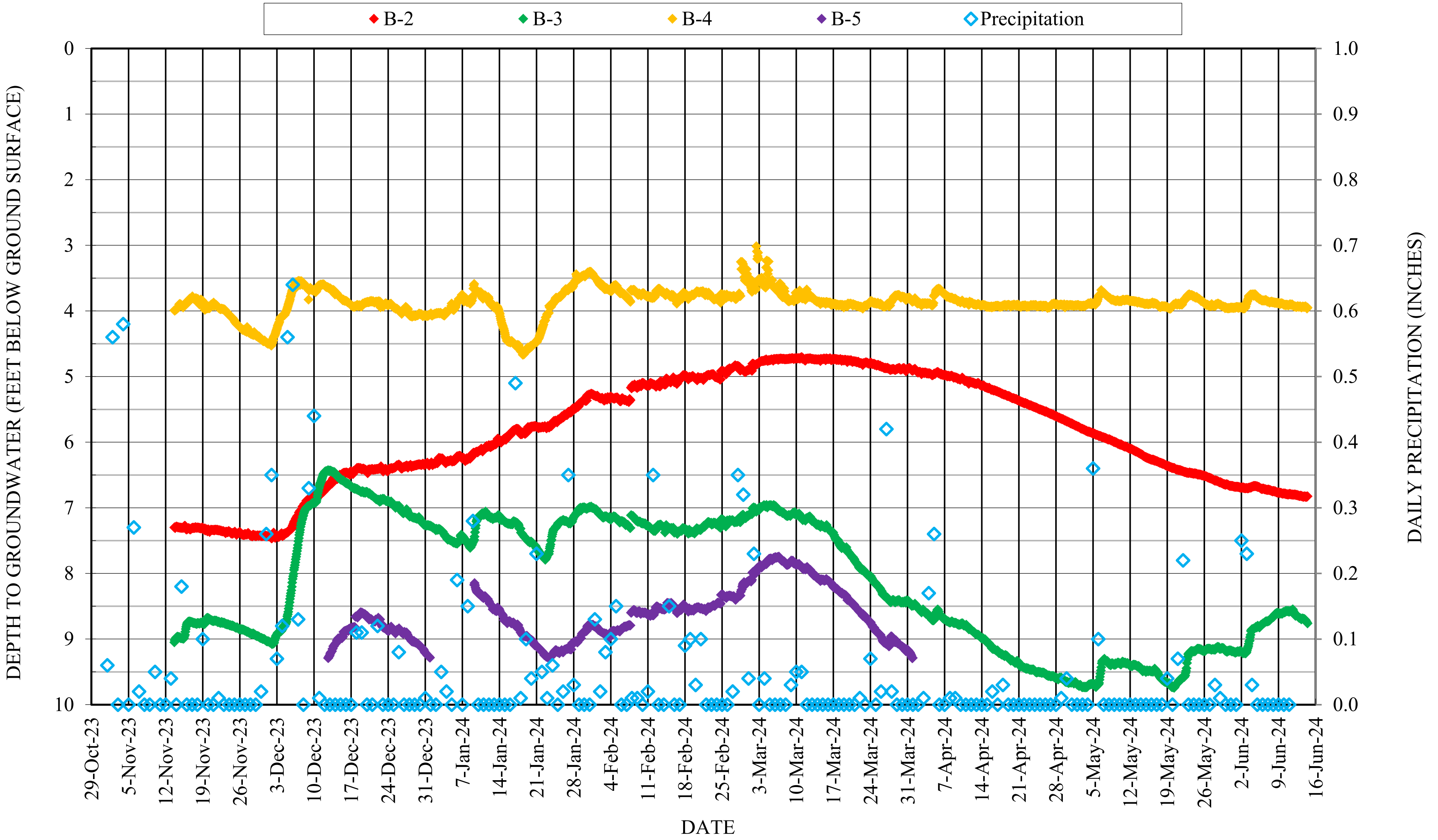
Figure 11

P:\11\11264044\GIS\11264044_Project\11264044_Project.aprx\1126404400_F11_DepthtoGroundwater Date Exported: 06/21/24 by ccabrera



Note:

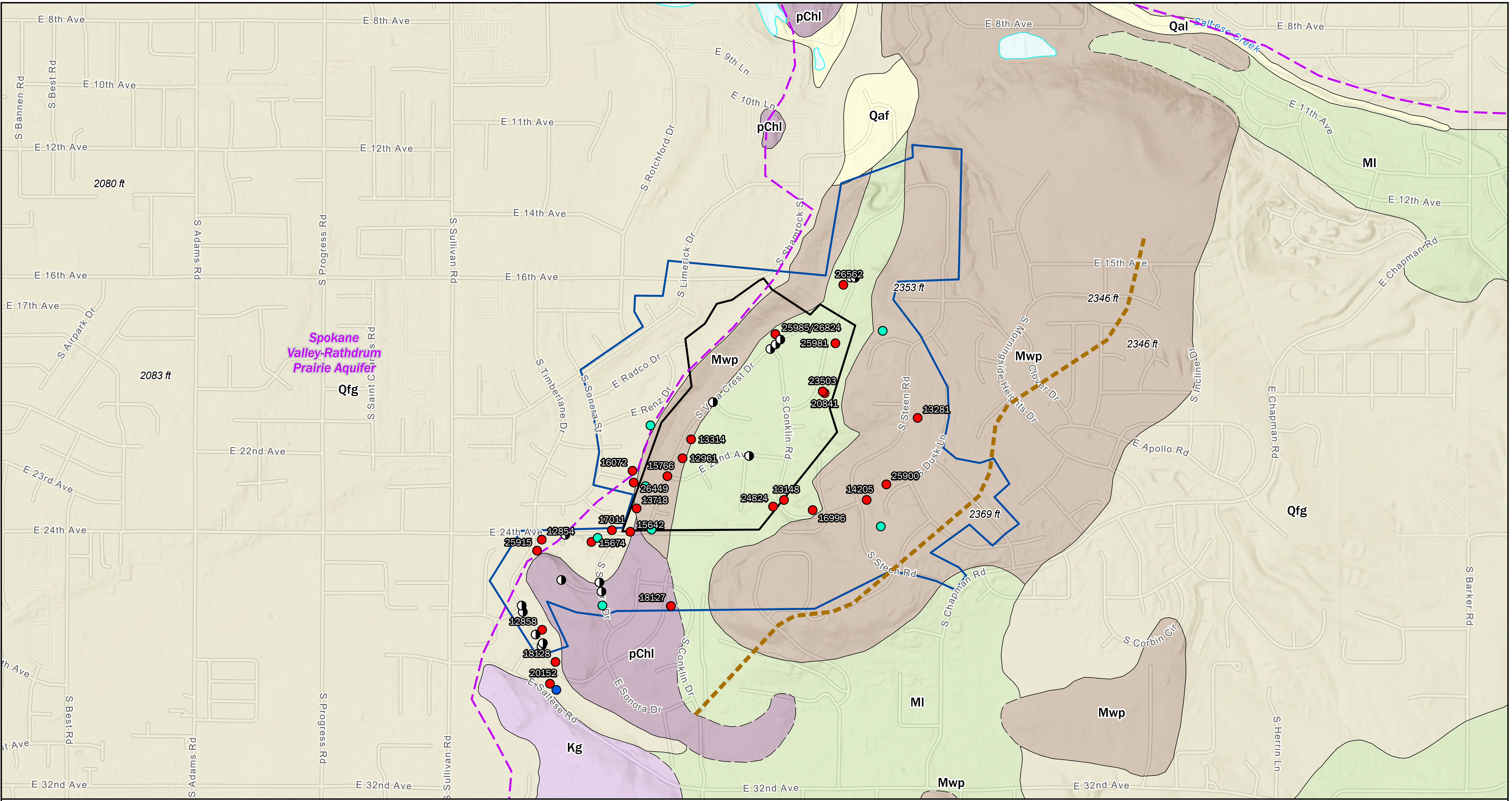
1. Precipitation totals for the Spokane Felts Field, WA US Climate Station (Station No. USW00094176) were obtained from the National Oceanic and Atmospheric Administration on June 17, 2024. Trace amounts are shown as zero.

Depth to Groundwater and Precipitation

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

GEOENGINEERS

Figure 12



P:\11\11264044\GIS\11264044_Project\11264044_Project.aprx\11264044400_F13_HistoricDrainageImpacts Date Exported: 06/21/24 by ccabrera

Source(s):
- Washington DNR 1:24K Geology, https://www.dnr.wa.gov/.
- ESRI Terrain Base Map

Coordinate System: NAD 1983 UTM Zone 11N

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

Legend

- ● Citizen Complaint
- ● Infiltration Pond Overflow
- ◐ Ponded Drywell
- ● Seasonal Spring
- ▬ ▬ Approximate Drainage Divide
- ▭ Spokane Valley-Rathdrum Prairie Aquifer
- ▭ Geotechnical Field Work Study Area
- ▭ Hydrogeologic Data Review Area

Geologic Units 24k

Quaternary Rocks and Deposits

Qaf	Quaternary alluvium
Qfg	Pleistocene glaciofluvial deposits

Neogene Rocks

Ml	Miocene Latah Formation
Mwp	Miocene Columbia River Basalt Group, undivided

Mesozoic Rocks

Kg	Mesozoic intrusive rocks

Paleozoic Rocks

pChl	Paleozoic heterogeneous metamorphic rocks

Water

- ▭ Water

N

0 1,000

Feet

Historic Drainage Impacts

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

GEOENGINEERS

Figure 13

Appendices

Appendix A

Previous Geotechnical Explorations

BE-TP-1

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington

Project No. 217-037G

TEST PIT: **TP-1**

LOCATION:
Lots 2 and 3 Block 2

DATE: **7/6/2017**

SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol		Description of Materials	WL	Tests or Notes
1.0	FILL	▩	STRUCTURAL FILL: Silty Sand with Gravel, medium grained, brown.		
3.0	SM	▦	SILTY SAND WITH GRAVEL, fine grained, dark brown, organic odor. (Topsoil)		
6.5	SP-SM	░	POORLY GRADED SAND WITH SILT AND GRAVEL, coarse grained, grayish brown, with cobbles, moist. (Alluvium)		
			End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-2

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT: **TP-2** LOCATION: **Lots 4 and 5 Block 2**	DATE: **7/6/2017** SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
	FILL	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown, with cobbles, moist.		
3.0	GP-GM	POORLY GRADED GRAVEL WITH SILT, coarse grained, gray, with cobbles and boulders, dry. (Alluvium)		
5.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
7.0		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-3

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington
Project No. 217-037G

TEST PIT: **TP-3**

LOCATION: **Lot 7 and 8 Block 2**

DATE: **7/6/2017**

SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
2.0	FILL	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown.		
6.5	GP-GM	POORLY GRADED GRAVEL WITH SILT, coarse grained, grayish brown, with cobbles and boulders to 4 feet in diameter, moist. (Alluvium)		
7.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-4

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT:	TP-4
		LOCATION:	**Lots 8 and 9 Block 2**
		DATE: 7/6/2017	SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
1.0				
	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
5.0				
	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL, coarse grained, grayish brown, with cobbles, moist. (Alluvium)		
8.0				
	GP	POORLY GRADED GRAVEL WITH SAND, gray, with cobbles and boulders, dry. (Alluvium)		
10.0				
		End of test pit. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-5

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington
Project No. 217-037G

TEST PIT: **TP-5**

LOCATION: **Lots 16 and 17 Block 2**

DATE: **7/6/2017**

SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
2.0	FILL	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown.		
2.5	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
3.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-6

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**
TEST PIT:	**TP-6**
LOCATION:	**Lots 10 and 11 Block 2**
DATE:	**7/6/2017**
SCALE:	**1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
1.5	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
5.0	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
10.0	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL, coarse grained, grayish brown, with cobbles and occasional boulders to 1 foot in diameter, moist. (Alluvium)		
		End of test pit. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-7

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**
TEST PIT:	**TP-7**
LOCATION:	**Lots 12 and 13 Block 2**
DATE:	**7/6/2017**
SCALE:	**1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
1.0	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
4.0	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
5.0	GP	POORLY GRADED GRAVEL WITH SAND, reddish brown to gray, dry. (Fractured Basalt)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-8

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**
TEST PIT:	**TP-8**
LOCATION:	**Lots 14 and 15 Block 2**
DATE:	**7/6/2017**
SCALE:	**1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol		Description of Materials	WL	Tests or Notes
1.5	FILL	▩	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown, organics odor.		
3.0	SM	▒	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
4.0	GP	⁘	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
			End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-9

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT:	**TP-9**
		LOCATION:	**Lots 22 and 23 Block 2**
		DATE: 7/6/2017	SCALE: **1" = 1.5'**

(new title) Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
0.0		Fractured Basalt, coarse, black, moist.		
0.5		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-10

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT: **TP-10** LOCATION: **Lot 21 Block 2** DATE: 7/6/2017 SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
2.0	SM	SILTY SAND WITH GRAVEL, fine grained, dark brown, organic odor. (Topsoil)		
3.5	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
8.5	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL, coarse grained, grayish brown, with cobbles, moist. (Alluvium)		
10.0	GP	POORLY GRADED GRAVEL, coarse grained, gray, with cobbles and boulders, dry. (Alluvium)		
		End of test pit. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-11

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**
TEST PIT:	**TP-11**
LOCATION:	**Lots 1 and 2 Block 3**
DATE:	7/6/2017
SCALE:	**1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
1.0	SM ▨	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
2.5	SM ▨	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-12

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**
TEST PIT:	**TP-12**
LOCATION:	**Lots 3 and 4 Block 3**
DATE:	7/6/2017
SCALE:	1" = 1.5'

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
1.5	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
3.5	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
4.0		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT: **TP-13** LOCATION: **Lots 5 and 6 Block 3** DATE: **7/6/2017** SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
1.0	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
4.0	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
9.0	GP	POORLY GRADED GRAVEL, coarse grained, gray, with cobbles and boulders, dry. (Alluvium)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-14

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington

Project No. 217-037G

TEST PIT: **TP-14**

LOCATION:
Lots 7 and 8 Block 3

DATE: **7/6/2017**

SCALE: **1" = 1.5'**

(new title) Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
0.0	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
2.0	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
4.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
6.0		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-15

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT: **TP-15** LOCATION: **Lots 18 and 19 Block 1** DATE: **7/6/2017** SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol		Description of Materials	WL	Tests or Notes
1.0	FILL	▩	STRUCTURAL FILL: Silty Sand with Gravel, fine to coarse, brown, moist.		
2.0	SM	▦	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
3.0	SM	▦	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
			End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-16

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington**	TEST PIT:	**TP-16**
		LOCATION:	**Lots 17 and 18 Block 1**
	Project No. 217-037G	DATE: 7/6/2017	SCALE: 1" = 1.5'

(new title) 0.0 Depth	ASTM D2487 Symbol		Description of Materials	WL	Tests or Notes
1.0	FILL	▩	STRUCTURAL FILL: Silty Sand with Gravel, fine to coarse, brown, moist.		
2.0	SM	▤	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
5.0	GP-GM	▦	POORLY GRADED GRAVEL WITH SILT, coarse grained, gray, with cobbles and boulders, dry. (Alluvium)		
			End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-17

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT:	**TP-17**
		LOCATION:	**Lots 15 and 16 Block 1**
		DATE: **7/6/2017**	SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol		Description of Materials	WL	Tests or Notes
0.0 – 1.0	SM	▨	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
1.0 – 4.5	SM	▨	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
4.5 – 5.0	GP	⁘	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
			End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-18

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT:	**TP-18**
		LOCATION:	**Lots 13 and 14 Block 1**
		DATE: **7/6/2017**	SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
1.0	GP-GM	POORLY GRADED GRAVEL WITH SILT, coarse grained, gray, with cobbled and boulders, dry. (Alluvium)		
4.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
4.5		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-19

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT:	**TP-19**
		LOCATION:	**Lots 11 and 12 Block 1**
		DATE: 7/6/2017	SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
2.0	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
10.0	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
		End of test pit. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT:	**TP-20**
		LOCATION:	**Lots 9 and 10 Block 1**
		DATE: 7/6/2017	SCALE: 1" = 1.5'

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
1.0	SM	SILTY SAND WITH GRAVEL, fine grained, dark brown, organic odor. (Topsoil)		
5.5	GP-GM	POORLY GRADED GRAVEL WITH SILT, coarse grained, gray, with cobbles and boulders, dry. (Alluvium)		
6.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-21

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington
Project No. 217-037G

TEST PIT: **TP-21**

LOCATION: **Lots 7 and 8 Block 1**

DATE: 7/6/2017

SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
2.0	FILL	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown, with organics odor. (Topsoil)		
6.0	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
6.5	GP	POORLY GRADED GRAVEL, coarse grained, gray, with cobbles and boulders, dry. (Alluvium)		
7.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		

End of test pit due to refusal.

Groundwater not encountered at time of excavation.

Test pit immediately backfilled.

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-22

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**	TEST PIT: **TP-22** LOCATION: **Lots 5 and 6 Block 1** DATE: **7/6/2017** SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
1.5	SM	SILTY SAND, fine grained, dark brown, with organics, moist. (Topsoil)		
6.0	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL, coarse grained, grayish brown, with cobbles, moist. (Alluvium)		
7.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-23

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations Belleaire Phase III Ridgetop Drive and Sundance Drive Spokane County, Washington** **Project No. 217-037G**	TEST PIT: **TP-23** LOCATION: **Lots 3 and 4 Block 1** DATE: **7/6/2017** SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
2.0	FILL	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown, organic odor.		
4.0	SM	SILTY SAND, medium grained, reddish brown, moist.		
6.0	GP	POORLY GRADED GRAVEL, coarse grained, gray, with cobbles and boulders, dry. (Alluvium)		
8.0	GP	POORLY GRADED GRAVEL WITH SAND, coarse grained, reddish brown to gray, dry. (Fractured Basalt)		
		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-24

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations Belleaire Phase III Ridgetop Drive and Sundance Drive Spokane County, Washington Project No. 217-037G**
TEST PIT:	**TP-24**
LOCATION:	**Lots 2 and 3 Block 1**
DATE:	**7/6/2017**
SCALE:	**1" = 1.5'**

(new title) Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
0.0	FILL	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown, organic odor.		
4.0	SM	SILTY SAND WITH GARVEL, medium grained, reddish brown, moist. (Alluvium)		
6.0	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL, coarse grained, grayish brown, with cobbles, moist. (Alluvium)		
10.0		End of test pit. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-25

LOG OF TEST PIT

PROJECT:	**Revised Basement Recommendations** **Belleaire Phase III** **Ridgetop Drive and Sundance Drive** **Spokane County, Washington** **Project No. 217-037G**
TEST PIT:	**TP-25**
LOCATION:	**Lots 1 and 2 Block 1**
DATE:	7/6/2017
SCALE:	**1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
2.0	SM	SILTY SAND WITH GRAVEL, fine grained, dark brown, organic odor. (Topsoil)		
6.0	SM	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
10.0	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL, reddish brown to gray, dry. (Fractured Basalt)		
		End of test pit. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-26

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington
Project No. 217-037G

TEST PIT: **TP-26**

LOCATION: **Lots 1 and 2 Block 2**

DATE: **7/6/2017**

SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol		Description of Materials	WL	Tests or Notes
1.5	FILL	▩	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown, organic odor.		
3.0	SM	▒	SILTY SAND WITH GRAVEL, medium grained, reddish brown, moist. (Alluvium)		
			End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-27

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington

Project No. 217-037G

TEST PIT: **TP-27**

LOCATION:
Lots 19 and 20 Block 2

DATE: **7/6/2017**

SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol	Description of Materials	WL	Tests or Notes
	FILL ▨	STRUCTURAL FILL: Silty Sand with Gravel, fine grained, dark brown, organics odor.		
3.0		End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

BE-TP-28

LOG OF TEST PIT

PROJECT: **Revised Basement Recommendations**
Belleaire Phase III
Ridgetop Drive and Sundance Drive
Spokane County, Washington
Project No. 217-037G

TEST PIT: **TP-28**

LOCATION: **Lots 17 and 18 Block 2**

DATE: 7/6/2017

SCALE: **1" = 1.5'**

(new title) 0.0 Depth	ASTM D2487 Symbol		Description of Materials	WL	Tests or Notes
1.0	FILL	▩	STRUCTURAL FILL: Shot Rock		
			End of test pit due to refusal. Groundwater not encountered at time of excavation. Test pit immediately backfilled.		

(See Report and Standard Plates for elevation and descriptive terminology.)

SL-TP-2

TEST PIT 2

Date: 5-19-06
Excavator: C&B Excavating
Equipment: Hitachi 210 trackhoe
Location: south end of pond adjacent to Lane C
Surface: cleared and grubbed

Elevation: 2030 ft
Logged by: T. Black

DEPTH		MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	
0		moist, brown, medium dense	GRAVEL, some Sand, small amount Silt and Clay, occasional organics (roots)		
5 10	▨	moist to very moist, gray, medium dense	GRAVEL, some coarse Sand, occasional Cobbles and Boulders, rounded, calcerous deposits (layer caves slightly and becomes cleaner with depth)		
15 20		no free groundwater observed	End of Excavation @ 14 ft		

TPW P06169 SHELLEY LAKE.GPJ BUDINGER.GDT 7/10/06

Budinger
& Associates
3820 E. Broadway Ave.
Spokane, WA 99202

TEST PIT LOGS FIGURE 3-2

Project: Shelley Lake 5th Addition
Location: City of the Spokane Valley
Number: P06169

SL-TP-10

TEST PIT 10

Date: 6-27-06
Excavator: C&B Excavating
Equipment: Fermec 760B backhoe
Location: west area of pond in tract B
Surface: grass and weeds

Elevation: 2022 ft
Logged by: T. Black

DEPTH		MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	
0		slightly moist to moist, brown, medium dense	GRAVEL, small amount Sand and Silt, occasional Cobble, coarse		
5		slightly moist, brown to gray, medium dense to dense	GRAVEL, small amount Cobbles, occasional Sand and Boulders, coarse, calcerous deposits on underside of gravels		
10	▨		(layer becomes more coarse with depth)		
15		no free groundwater observed	End of Excavation @ 14 ft		
20					

TEST PIT LOGS **FIGURE 3-10**

Project: Shelley Lake 5th Addition

Location: City of the Spokane Valley

Number: P06169

Budinger
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3820 E. Broadway Ave.
Spokane, WA 99202

TEST PIT 11

Date: 6-27-06
Excavator: C&B Excavating
Equipment: Fermec 760B backhoe
Location: east area of pond in tract B
Surface: grass and weeds

Elevation: 2028 ft
Logged by: T. Black

DEPTH		MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		slightly moist to moist, brown, medium dense	GRAVEL, small amount Sand and Silt, occasional Cobble, coarse	
		slightly moist, brown to gray, medium dense to dense	GRAVEL, small amount Sand, occasional Cobbles, coarse, calcerous deposits on underside of gravels	
5	▨			
10	▨		(layer becomes more coarse with depth)	
		no free groundwater observed	End of Excavation @ 14 ft	
15				
20				

Budinger
& Associates
3820 E. Broadway Ave.
Spokane, WA 99202

TEST PIT LOGS FIGURE 3-11

Project: Shelley Lake 5th Addition
Location: City of the Spokane Valley
Number: P06169

TABLE 1
TEST PIT LOGS

TP-101	GSE JANUARY 27, 1995
0.0 - 1.5 FT.	Loose, dark brown, sandy SILT; moist. Moisture Content = 19.2%
1.5 - 3.0 FT.	Medium dense, brown, silty SAND; moist. Moisture Content = 13.7%
3.0 - 5.5 FT.	Medium dense, light brown, gravelly, silty SAND; moist, cobbly. Moisture Content = 10.6%
5.5 - 6.0 FT.	Dense, dark gray, highly fractured, Basalt BEDROCK.

Note: No ground water encountered.

TP-102	GSE JANUARY 27, 1995
0 - 1.0 FT.	Loose, dark brown, sandy SILT; wet. Moisture Content = 24.4%
1.0 - 3.5 FT.	Loose, brown, sandy SILT; wet. Moisture Content = 17.4%
3.5 - 6.0 FT.	Medium dense, light orange-brown, decomposed GRANITE; wet. Moisture Content = 18.2%

Note: No ground water encountered.

TP-103	GSE JANUARY 27, 1995
0.0 - 1.5 FT.	Loose, dark brown, sandy SILT; wet. Moisture Content = 21.2%
1.5 - 3.0 FT.	Loose, brown, silty SAND; wet, becomes gravelly at 2.0 FT. Moisture Content = 14.7%
3.0 - 4.0 FT.	Medium dense, tan and brown, clayey GRAVEL; wet. Moisture Content = 22.2%
4.0 - 5.5 FT.	Medium dense, gray and brown, decomposed GRANITE; wet. Moisture Content = 16.1%
5.5 - 6.0 FT.	Dense, gray and brown, Granite BEDROCK.

Note: No ground water encountered.

TP-104	GSE JANUARY 27, 1995
0.0 - 1.0 FT.	Loose, brown, silty SAND; wet.
1.0 - 2.5 FT.	Medium dense, brown, silty, sandy GRAVEL; wet, with basalt cobbles. Moisture Content = 13.0%

2.5 - 5.0 FT.	Medium stiff to stiff, light orange-brown, CLAY; wet. Moisture Content = 29.8%	
5.0 - 6.0 FT.	Hard, tan, CLAY; dry Moisture Content = 21.9%	

Note: No ground water encountered

TP-105	GSE	JANUARY 27, 1995
0.0 - 3.5 FT.	Loose, brown, sandy SILT; wet. Moisture Content = 23.5%	
3.5 - 4.0 FT.	Hard, gray, Granite BEDROCK	

Note: No ground water encountered

TP-106	GSE	JANUARY 27, 1995
0.0 - 2.5 FT.	Loose, brown, sandy SILT; wet. Moisture Content = 19.0%	
2.5 - 3.5 FT.	Medium dense, orange-brown, silty SAND; wet. Moisture Content = 11.6%	
3.5 - 5.0 FT.	Medium dense, light orange-brown, clayey GRAVEL; wet, with basalt cobbles. Moisture Content = 23.5%	
5.0 - 5.5 FT.	Medium dense, light gray-brown, decomposed GRANITE; wet. Moisture Content = 19.9%	

Note: No ground water encountered.

RH-B-201

Drilling Method: Hollow-stem auger

Driller: F. Payton **Logged By:** B. Binsfield

Date: 2/7/95

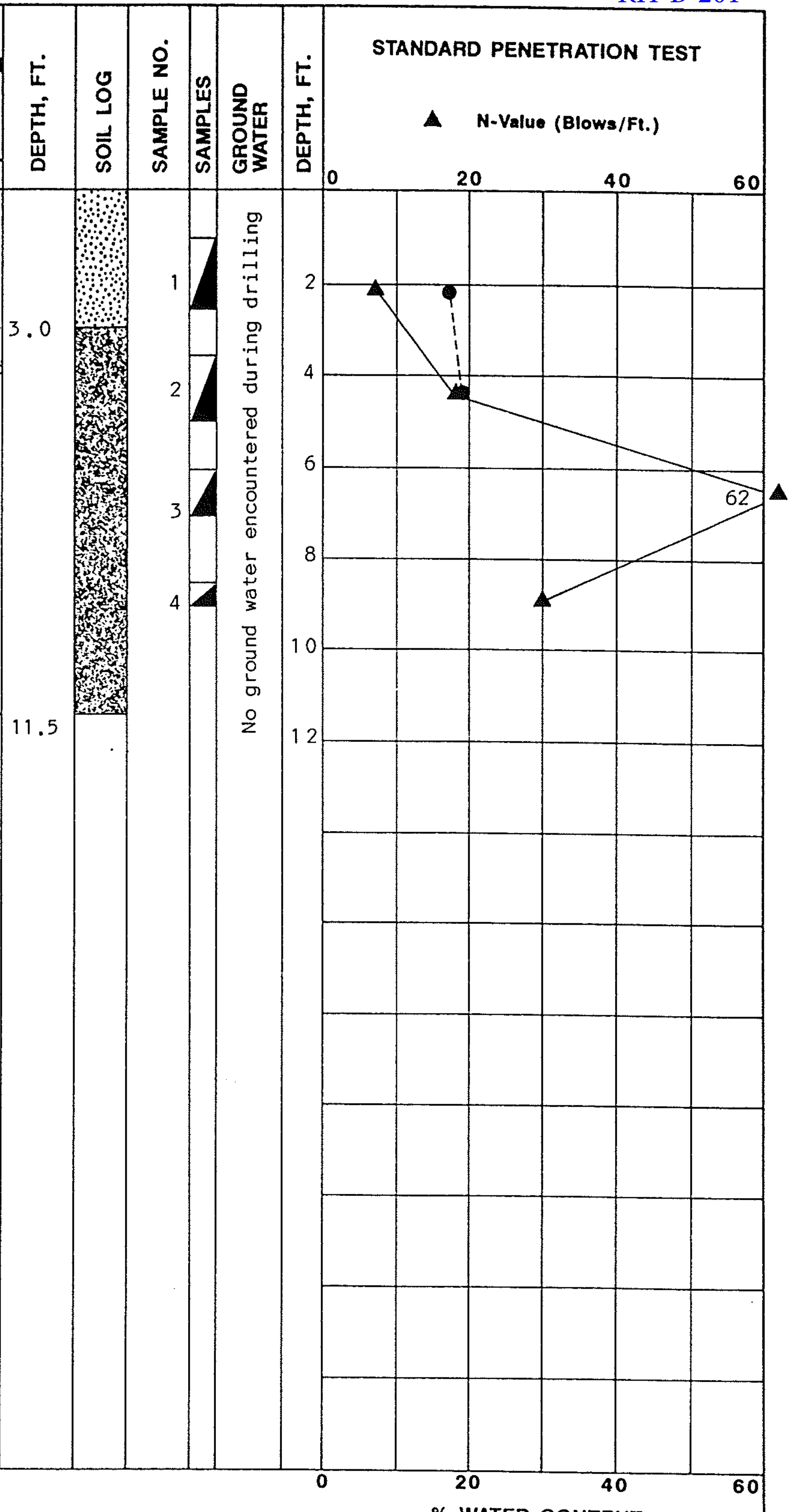
Surface Elevation: ________ **Datum:** ________

DESCRIPTION

Loose, gray-brown, silty SAND; wet.

Very dense, tan and gray, decomposed GRANITE; moist.

Bottom of boring. Auger refusal on hard Granite BEDROCK.
Completed 2/9/95



Plastic Limit ├──●──┤ **Liquid Limit**
Natural Water Content

LEGEND

- ◢ 2" O.D. Split Spoon Sample
- ☐ 3" O.D. Shelby Tube Sample
- * Sample Not Recovered
- ▐ NX Core Run
- ▽ Ground Water Level

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. Refer to KEY for explanation of Soil Log symbols and definitions.
5. This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Drawing Date 2-15-95 Drawn By TDB Checked By ________ Field Rep. ________

Remington Hill Subdivision
Veradale, Washington

LOG OF BORING B-201

February 1995 E-1562-01

GCI GIFFORD CONSULTANTS, INC.
GEOTECHNICAL ENGINEERS
2020 E. Springfield Ave., Spokane, WA 99202

FIG. 3

TABLE 1
TEST PIT LOGS

TP101 GSE 2212 February 24, 1999

0-2.0'	Loose - medium dense, gray-brown, clayey, sandy SILT; wet, roots.
2.0-5.0'	Loose-medium dense, brown, silty SAND; moist.
5.0-11.0'	Stiff, light brown, sandy SILT; dry, locally oxidized orange, paleosol (?).
11.0-14.0'	Very stiff, light brown, silty CLAY; dry.

TP102 GSE 2212 February 24, 1999

0-2.5'	Loose, gray-brown, clayey, sandy SILT; moist to wet, roots.
2.5-3.5'	Medium dense, light brown, clayey, silty GRAVEL; moist.
3.5-5.0'	Medium dense, brown, silty SAND; dry.
5.0-7.0'	Loose, orange-brown, silty, gravelly SAND; dry.
7.0-13.0'	Stiff-very stiff, light brown, silty CLAY; dry.
13-22.0'	Very stiff, dark gray, silty CLAY; dry.

T25 R44 S25 SC-B-1

90
DJ
04

Spokane County Engineers

SUBSURFACE EXPLORATION LOG

BORING NO. 1
SHEET 1 OF 2

JOB NO. ______ JOB TITLE 23^Rd + Timberlane (80' N of 24^th)
LOCATION ______ FEATURE ______ COORDINATES ______ DATE 3-13-90
DRILL ______ ANGLE ______ BEARING ______ REF. EL. ______ DATUM ______
DRILLING CONTRACTOR ______ DRILLER McCollam INSPECTOR ______
SAMPLE HAMMER: WT. ______ DROP ______ TYPE ______

DEPTH FEET	PERC-RATE	SAMPLE C-CORE B-BAG CK-CHUNK R-RING	TUBE SAMPLE NO.	PENETRATION RESISTANCE	(N)VALUE BLOW/FT.	MOISTURE CONTENT, %	Color	MATERIAL DESCRIPTION	GROUNDWATER
	Greater than 72"/hr	"R" Value sample #1				moist	Brown	silty loam w/clay, gravel and cobble	
5						moist	Brown	silty gravel w/decomposed granite + cobble	
15								End of Boring - No Refusal	

s

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

T25 R44 S25 SC-B-2 90 DJ 04

Spokane County Engineers

SUBSURFACE EXPLORATION LOG

BORING NO. 2
SHEET 2 OF 2

JOB NO. ______ JOB TITLE 23rd & Timberlane (125' N of 24th)
LOCATION ______ FEATURE ______ COORDINATES ______ DATE 3-13-90
DRILL 752 ANGLE ______ BEARING ______ REF. EL. ______ DATUM ______
DRILLING CONTRACTOR ______ DRILLER Mc Collam INSPECTOR ______
SAMPLE HAMMER: WT. ______ DROP ______ TYPE ______

DEPTH FEET	PERC-RATE	SAMPLE C-CORE B-BAG CK-CHUNK R-RING	TUBE	SAMPLE NO.	PENETRATION RESISTANCE	(N)VALUE BLOW/FT.	MOISTURE CONTENT, %	Color	MATERIAL DESCRIPTION	GROUNDWATER
	Greater than 72"/hr						moist	Brown	silty loam w/clay, gravel and cobble (same as "R" sample #1)	
							moist	Brown	silty gravel w/decomposed granite + cobble	
									End of Boring- No Refusal	
8										

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

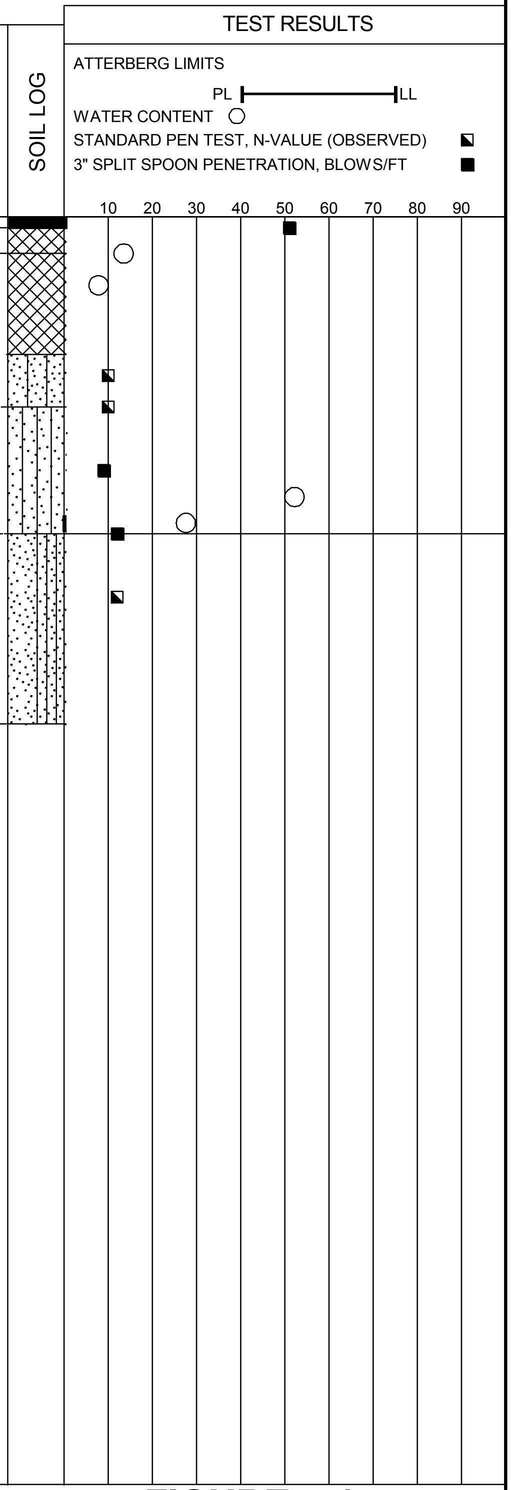
TEST BORING 1

VC-B-1

Date of Boring: 1-4-08
Driller: Budinger & Assoc., Inc.
Type of Drill: Mobile B-57 with automatic SPT hammer
Location: On 24th, east of the intersection at 24th & S. Timberlane Dr.
Surface: asphalt concrete pavement

Elevation: 2040 ft
Logged by: T. Black
Size of hole: 6.5" O.D. (3-1/4" I.D.) hollow stem auger

DEPTH	RQD, BLOW COUNTS N (% RECOVERY)	MOISTURE, COLOR, CONDITION	DESCRIPTION
0	51 (88%)	black	ASPHALT CONCRETE PAVEMENT, logitudinal, horizontal and fatigue cracking
		moist, dark brown, very dense	FILL: Gravel, some Sand, occasional Silt, subangular
		moist, brown, moderately dense	FILL: Sand, small amount Silt, occasional Gravel, slightly micaceous, subangular to subrounded
	10 (100%)	moist, dark brown, loose	
	10 (100%)	moist, brown, loose	SAND, some Silt, slightly cemented
			SILT, some Sand, medium to fine
	9 (88%)		
5	12 (88%)	moist, dark brown, loose	SAND, small amount Silt and Gravel, subrounded, medium
	12 (42%)		
		(SPT sample 6 to 7½ feet - gravel in shoe)	
		no free groundwater observed	(CPT-1 indicated a dense layer beginning at approximately 7½ feet - Gravel layer?)
			End of Boring @ 8 ft
10			
15			
20			



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BORING LOGS

FIGURE 5-1

Project: 24th and Veracrest Drive

Location: City of Spokane Valley

Number: P07370

LWWWT P07370 BORING LOGS.GPJ BUDINGER.GDT 2/7/08

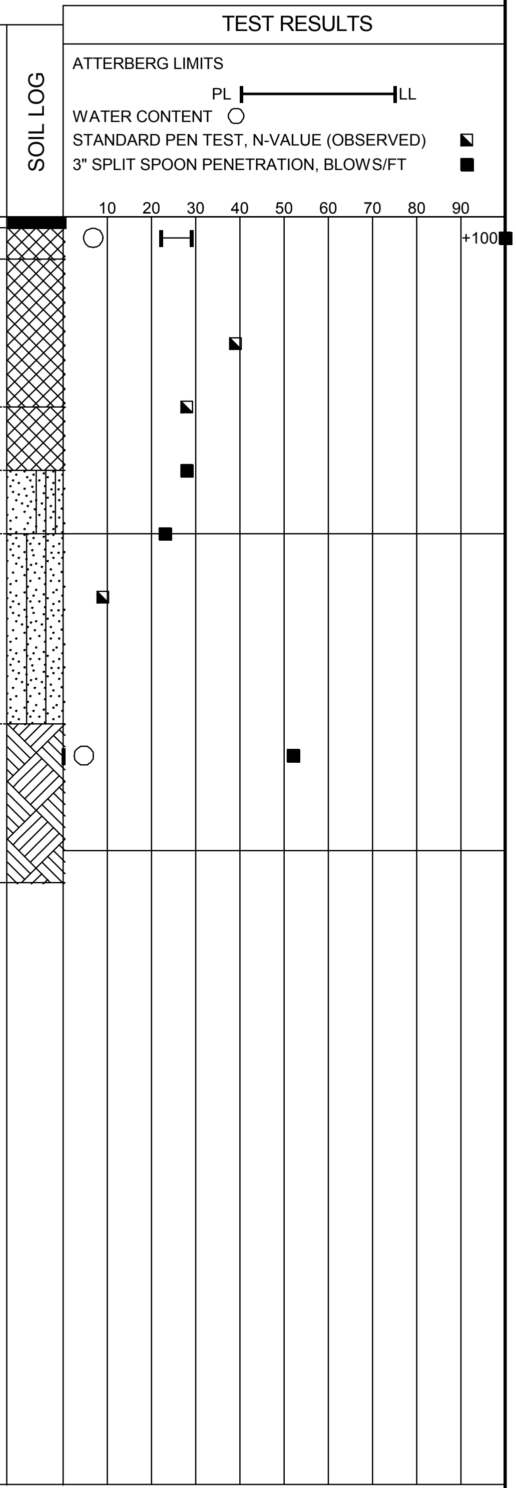
VC-B-2

TEST BORING 2

Date of Boring: 1-4-08
Driller: Budinger & Assoc., Inc.
Type of Drill: Mobile B-57 with automatic SPT hammer
Location: On 24th, east of the intersection at 24th & S. 24th Ct.
Surface: asphalt concrete pavement

Elevation: 2045 ft
Logged by: K. Rudie
Size of hole: 6.5" O.D. (3-1/4" I.D.) hollow stem auger

DEPTH	RQD, BLOW COUNTS N (% RECOVERY)	MOISTURE, COLOR, CONDITION	DESCRIPTION
0	R (100%)	black	ASPHALT CONCRETE PAVEMENT, logitudinal, horizontal and fatigue cracking
		moist, dark brown, very dense	FILL: Gravel, some Sand, small amount Silt, subangular
	39 (88%)	slightly moist, light brown to brown, very dense	FILL: Sand, some Gravel, small amount Silt, fine to medium, angular to subrounded, slightly cemented
	28 (88%)	slightly moist, brown, medium dense	FILL: Sand, occasional Silt, slightly micaceous
	28 (75%)	slightly moist, brown to gray, medium dense	SAND, small amount Gravel, occasional Silt, slightly cemented
5	23 (75%) 9 (100%)	slightly moist, light brown, loose to medium dense	SAND, some Silt, occasional Gravel and organics (roots), fine
10	52 (83%)	slightly moist, brown with gray and reddish orange mottling, soft (rock)	Decomposed Granite/Quartzite? SAND, small amount Silt and Gravel, cemented, weathered, slightly micaceous
		no free groundwater observed	End of Boring @ 10.5 ft
15			
20			



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BORING LOGS **FIGURE 5-2**

Project: 24th and Veracrest Drive

Location: City of Spokane Valley

Number: P07370

TEST BORING 3

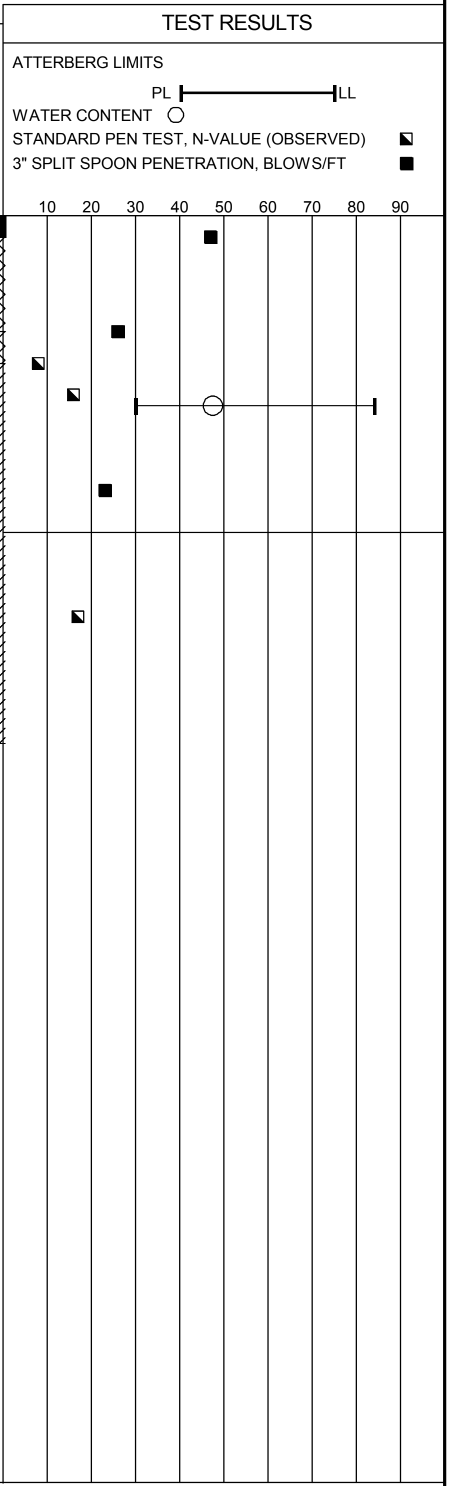
VC-B-3

Date of Boring: 1-4-08
Driller: Budinger & Assoc., Inc.
Type of Drill: Mobile B-57 with automatic SPT hammer
Location: On Veracrest, northeast of the intersection at Veracrest & E. 23rd Ct.
Surface: asphalt concrete pavement

Elevation: 2125 ft
Logged by: K. Rudie
Size of hole: 6.5" O.D. (3-1/4" I.D.) hollow stem auger

DEPTH	SAMPLES RQD, BLOW COUNTS N (% RECOVERY)	MOISTURE, COLOR, CONDITION	DESCRIPTION
0		black	ASPHALT CONCRETE PAVEMENT
	47 (100%)	moist, brown to gray, dense	FILL: Sand, small amount Gravel, Cobbles, and Silt, occasional wood chips, cemented, angular to subangular
	26 (100%)	moist, brown, moderately dense	FILL: Sand, trace Silt, medium to coarse
	8 (100%) 16 (100%) 23 (100%) 17 (100%)	moist, brown with red and gray mottling, stiff	CLAY, small amount Silt, occasional lenses of Sand with Gravel, blocky structure, possible Latah Formation
5			
10			End of Boring @ 8.33 ft
15			
20			

SOIL LOG



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BORING LOGS

FIGURE 5-3

Project: 24th and Veracrest Drive
Location: City of Spokane Valley
Number: P07370

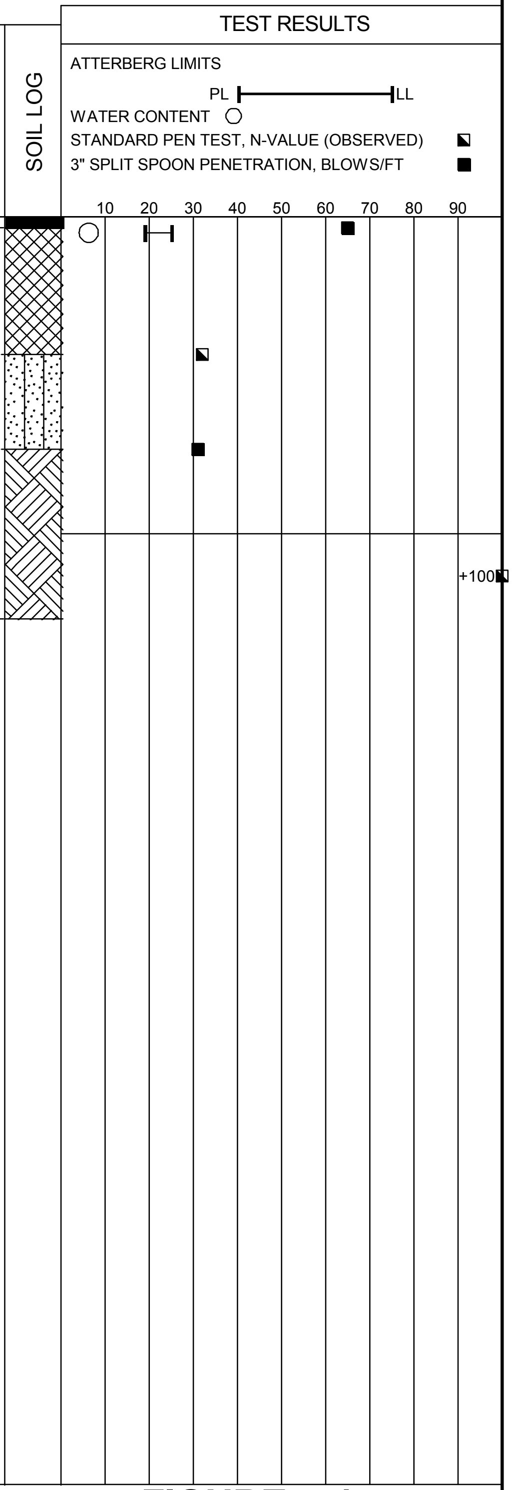
TEST BORING 4

VC-B-4

Date of Boring: 1-4-08
Driller: Budinger & Assoc., Inc.
Type of Drill: Mobile B-57 with automatic SPT hammer
Location: On 24th, east of the intersection at 24th & S. Sonora Dr.
Surface: asphalt concrete pavement

Elevation: 2075 ft
Logged by: K. Rudie
Size of hole: 6.5" O.D. (3-1/4" I.D.) hollow stem auger

DEPTH	SAMPLES	RQD, BLOW COUNTS N (% RECOVERY)	MOISTURE, COLOR, CONDITION	DESCRIPTION
0	■	65 (83%)	black	ASPHALT CONCRETE PAVEMENT
			very moist, brown, dense	FILL (Gravel, some Sand, small amount Silt, occasional Cobble, subangular, medium to coarse
	◣	32 (100%)	very moist, light brown to gray, moderately dense to dense	SAND, some Silt, fine, slightly micaceous
5	■	31 (100%)	slightly moist, reddish brown with orange mottling, soft to moderately hard	Decomposed GNEISS/SCHIST (Clay, occasional Silt and Sand, slightly micaceous) (groundwater flowing through FILL layer on top of Decomposed GNEISS/SCHIST layer?)
	◣	R (100%)		(sample @ 5½ feet refused in rock (gneiss/schist)
				End of Boring @ 6.34 ft
10				
15				
20				



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BORING LOGS

FIGURE 5-4

Project: 24th and Veracrest Drive
Location: City of Spokane Valley
Number: P07370

TEST PIT 1

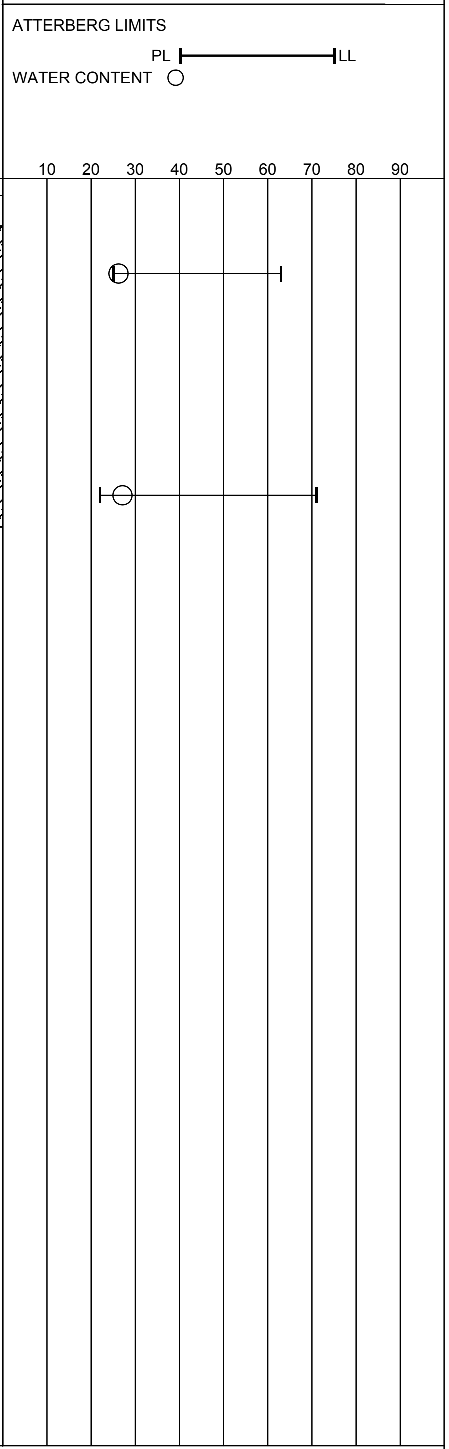
RE-TP-1

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: West end of proposed Lane C
Surface: duff and topsoil

Elevation: 2280 ft
Logged by: J. Pritzl
Size of hole: 12 X 16 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)	
		moist, orange-gray, very stiff	CLAYEY SAND	
5				
10		dry, light gray, hard		
		no free groundwater observed	End of Boring @ 11 ft	
15				
20				
25				
30				
35				
40				

TEST RESULTS



TEST PIT LOGS

FIGURE 4-1

Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

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TEST PIT 2

RE-TP-2

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: Center of intersection of proposed Lane C & Steen
Surface: duff and topsoil

Elevation: 2290 ft
Logged by: J. Pritzl
Size of hole: 10 X 20 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS ATTERBERG LIMITS PL ├──┤ LL WATER CONTENT ○ 10 20 30 40 50 60 70 80 90
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)		
	◩	moist, brown, medium dense	SILTY SAND, medium to fine, moderate roots		
5	◩	moist, brown, dense	SILTY GRAVEL with Sand and Cobbles, angular to subangular		
10	◩	moist, brown, medium dense	SAND with Silt, medium to fine, subangular		
	◩	moist, grayish brown, dense	SAND with Gravel and Cobbles, angular to subangular, micaceous		
15		no free groundwater observed	End of Boring @ 14 ft		
20					
25					
30					
35					
40					

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Spokane Valley, WA 99212

TEST PIT LOGS

FIGURE 4-2

Project: Ridgemont 5

Location: Spokane Valley, WA

Number: S17073

TEST PIT 3

RE-TP-3

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: Center of intersection of proposed Lane D & Steen
Surface: duff and topsoil

Elevation: 2266 ft
Logged by: J. Pritzl
Size of hole: 6 X 15 feet

TEST RESULTS

ATTERBERG LIMITS PL ├──┤ LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)	
		moist, orange-brown, dense	SILTY GRAVEL with Sand and Cobbles, angular to subangular	
5				
10		no free groundwater observed	End of Boring @ 8.5 ft	
15				
20				
25				
30				
35				
40				

TEST PIT LOGS

FIGURE 4-3

Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

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TEST PIT 4

RE-TP-4

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: West end of proposed Lane D
Surface: duff and topsoil

Elevation: 2254 ft
Logged by: J. Pritzl
Size of hole: 8 X 8 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS ATTERBERG LIMITS PL ├──┤ LL WATER CONTENT ○ 10 20 30 40 50 60 70 80 90
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)		
		moist, brown, dense	GRAVEL with Sand and Cobbles, angular to subangular (excavator refused on strong basalt rock at 3.5 feet)	●	
		no free groundwater observed	End of Boring @ 3.5 ft		
5					
10					
15					
20					
25					
30					
35					
40					

TEST PIT LOGS

FIGURE 4-4

Project: Ridgemont 5

Location: Spokane Valley, WA

Number: S17073

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Spokane Valley, WA 99212

TEST PIT 5

RE-TP-5

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: North side of proposed Lot 3 to north of Lane D
Surface: duff and topsoil

Elevation: 2232 ft
Logged by: J. Pritzl
Size of hole: 6 X 11 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS ATTERBERG LIMITS PL ├──┤ LL WATER CONTENT ○ 10 20 30 40 50 60 70 80 90
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)		
5		moist, brown, dense	SILTY GRAVEL with Sand and Cobbles, angular to subangular Perched water flowing across top of clay horizon at 7 feet		
		dry, orange-gray, stiff	CLAYEY SAND		
10			End of Boring @ 9 ft		
15					
20					
25					
30					
35					
40					

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TEST PIT LOGS

FIGURE 4-5

Project: Ridgemont 5

Location: Spokane Valley, WA

Number: S17073

TEST PIT 6

RE-TP-6

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: Northeast corner of proposed Lot 1 to north of Lane D
Surface: duff and topsoil

Elevation: 2247 ft
Logged by: J. Pritzl
Size of hole: 7 X 12 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS ATTERBERG LIMITS PL ├──┤ LL WATER CONTENT ○ 10 20 30 40 50 60 70 80 90
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)		
5		moist, brown, dense	SILTY GRAVEL with Sand and Cobbles, angular to subangular, occasional Boulders CLAYEY SAND lens at 8 feet		
10		no free groundwater observed	End of Boring @ 9 ft		
15					
20					
25					
30					
35					
40					

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TEST PIT LOGS **FIGURE 4-6**

Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

TEST PIT 7

RE-TP-7

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: Center of intersection between proposed Lane E & Lane F
Surface: duff and topsoil

Elevation: 2224 ft
Logged by: J. Pritzl
Size of hole: 6 X 10 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
					ATTERBERG LIMITS PL ├────┤ LL WATER CONTENT ○ 10 20 30 40 50 60 70 80 90
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)		
		moist, brown, dense	SILTY GRAVEL with Sand and Cobbles, angular to subangular (excavator refused on strong basalt rock at 3 feet)		
		no free groundwater observed	End of Boring @ 3 ft		
5					
10					
15					
20					
25					
30					
35					
40					

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TEST PIT LOGS

FIGURE 4-7

Project: Ridgemont 5

Location: Spokane Valley, WA

Number: S17073

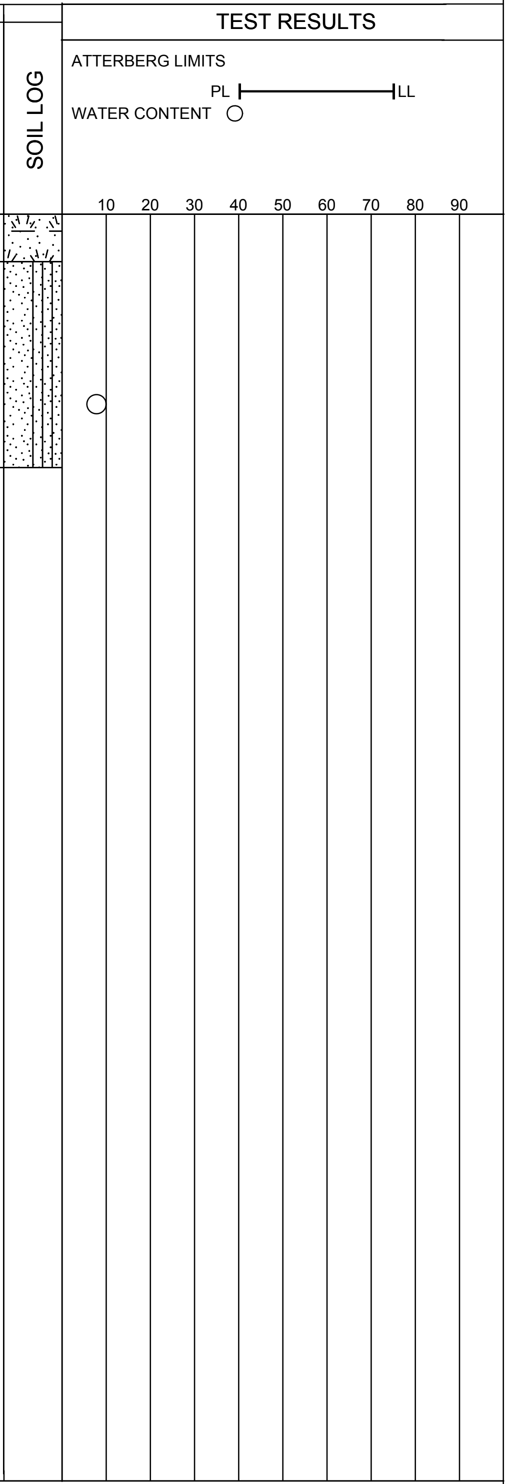
TEST PIT 8

RE-TP-8

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: North of intersection of proposed Lane E & Lane F
Surface: duff and topsoil

Elevation: 2206 ft
Logged by: J. Pritzl
Size of hole: 5 X 9 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)
		moist, brown, medium dense	SAND with Silt, coarse to medium, subangular, micaceous
5			
	▨		
		no free groundwater observed	End of Boring @ 8 ft
10			
15			
20			
25			
30			
35			
40			



TEST PIT LOGS **FIGURE 4-8**

Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

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TEST PIT 9

RE-TP-9

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: Northeast of intersection of proposed Lane E & Lane F
Surface: duff and topsoil

Elevation: 2202 ft
Logged by: J. Pritzl
Size of hole: 6 X 12 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)	
		moist, brown, dense	SILTY GRAVEL with Sand and Cobbles, angular to subangular	
5		moist, brownish gray, medium dense	SAND with Silt, coarse to medium, subangular, micaceous	
10			Coarse sand interbeds confined by 1 to 2 centimeter thick silty clay laminates beginning at 9 feet and extending to 12 feet	
		no free groundwater observed	End of Boring @ 12 ft	
15				
20				
25				
30				
35				
40				

TEST RESULTS

ATTERBERG LIMITS
PL ├──────┤ LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

TEST PIT LOGS

FIGURE 4-9

Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

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TEST PIT 10

RE-TP-10

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: Northwest of intersection of proposed Lane E & Lane F
Surface: duff and topsoil

Elevation: 2193 ft
Logged by: J. Pritzl
Size of hole: 5 X 13 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)	
		moist, brown, medium dense	SILTY SAND with Gravel, occasional Cobbles and Boulders, subangular to subrounded, micaceous	
5		dry, brownish gray, medium dense	SAND with Silt, coarse to medium, angular to subangular, micaceous	
10		no free groundwater observed	End of Boring @ 9 ft	
15				
20				
25				
30				
35				
40				

TEST RESULTS

ATTERBERG LIMITS
PL ├──┤ LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS

FIGURE 4-10

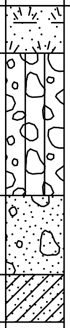
Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

TEST PIT 11

RE-TP-11

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: Northwest of intersection of proposed Lane E & Lane F
Surface: duff and topsoil

Elevation: 2188 ft
Logged by: J. Pritzl
Size of hole: 6 X 8 feet



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)		
		moist, brown, dense	SILTY GRAVEL with Sand and Cobbles, angular to subangular		
5					
		moist, brownish gray, medium dense	SAND with Gravel, coarse, subangular to subrounded		
		moist, light brown, medium dense	SILTY, CLAYEY, fine SAND, micaceous		
10		no free groundwater observed	End of Boring @ 10 ft		
15					
20					
25					
30					
35					
40					

TEST RESULTS

ATTERBERG LIMITS PL ⊢——⊣ LL

WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-11**

Project: Ridgemont 5

Location: Spokane Valley, WA

Number: S17073

TEST PIT 12

RE-TP-12

Date: 4-11-17
Excavator: Murphy Brothers
Equipment: CAT 336D
Location: West of intersection of proposed Lane E & Lane F
Surface: duff and topsoil

Elevation: 2212 ft
Logged by: J. Pritzl
Size of hole: 6 X 12 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0		moist, dark brown, loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)		
		moist, brown, dense	SILTY GRAVEL with Sand, Cobbles and Boulders, angular to subangular		
5		moist, brownish gray, medium dense	SAND, medium, angular to subangular, micaceous, occasional clay rip-up clasts		
10		no free groundwater observed	End of Boring @ 9 ft		
15					
20					
25					
30					
35					
40					

TEST RESULTS

ATTERBERG LIMITS PL ├──┤ LL

WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS

FIGURE 4-12

Project: Ridgemont 5

Location: Spokane Valley, WA

Number: S17073

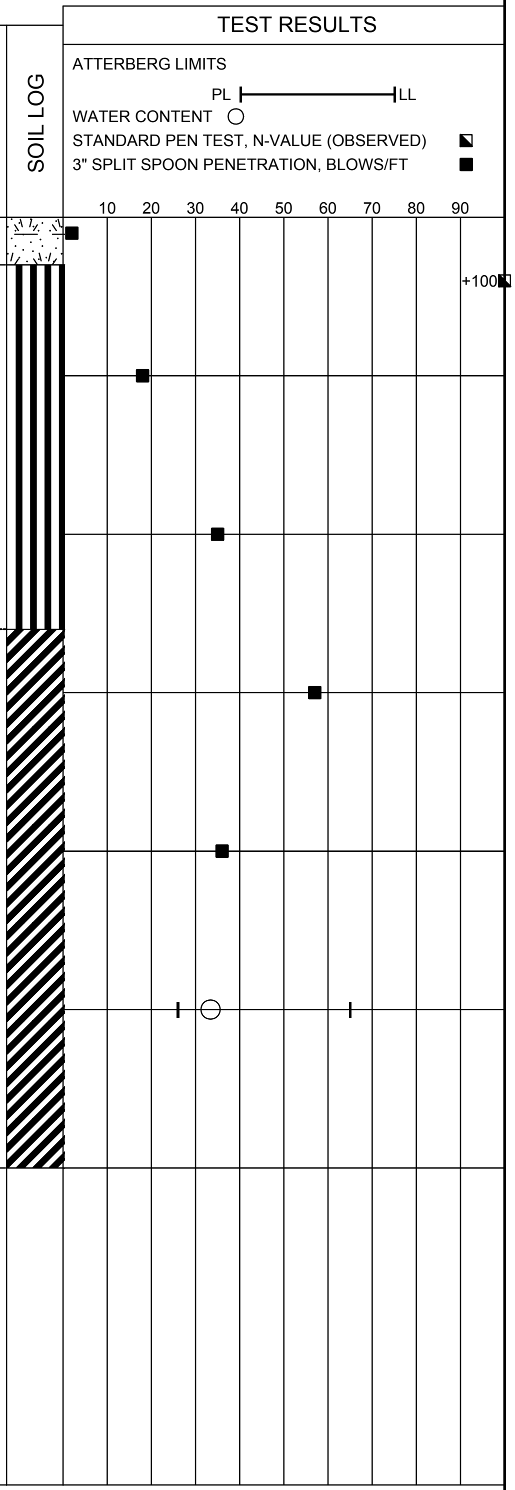
RE-B-13

TEST BORING 13

Date of Boring: 4-13-17
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: Northwest of west end of proposed Lane D
Surface: duff and topsoil

Elevation: 2218 ft
Logged by: J. Pritzl
Size of hole: 6.5" O.D. (3-1/4" I.D.) hollow stem auger

DEPTH	SAMPLES RQD, SPT BLOW COUNTS (% RECOVERY)	MOISTURE, COLOR, CONDITION	DESCRIPTION
0	2 (85%)	moist, dark brown, very loose	SILTY SAND with Gravel, occasional Cobbles, moderate roots (TOPSOIL)
	R (85%)	moist, medium brown, stiff	SILT with Sand, micaceous, moderate plasticity, stratified
			Basalt boulder at 4 feet, fresh, strong, (colluvium)
5	18 (60%)		
		moist, grayish white, very stiff	Iron staining
		orange-yellow	
		grayish white	
10	35 (100%)	dry, light brownish white, hard	Iron staining
		pinkish gray	
		pinkish purple	CLAY, high plasticity, stratified
		grayish purple	
15	57 (100%)		
		dry, hard	Micaceous
			(decreased advancement rate)
20	36 (100%)	dry, hard	
			Less micaceous
25	35 (100%)	dry, hard	
30		no free groundwater observed	End of Boring @ 30 ft
35			
40			



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BORING LOGS

FIGURE 4-13

Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

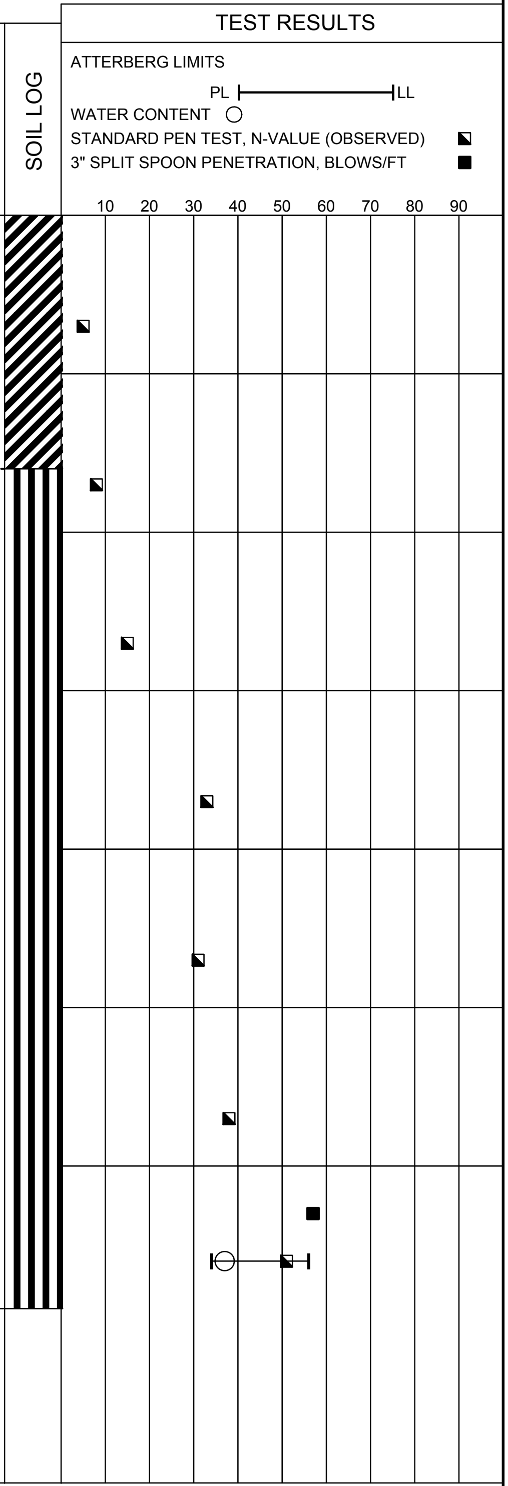
TEST BORING 14

RE-B-14

Date of Boring: 4-14-17
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: North end of proposed Vera Crest
Surface: pine needles and grass

Elevation: 2180 ft
Logged by: J. Pritzl
Size of hole: 6.5" O.D. (3-1/4" I.D.) hollow stem auger

DEPTH	SAMPLES	RQD, BLOW COUNTS N (% RECOVERY)	MOISTURE, COLOR, CONDITION	DESCRIPTION
0			wet, brownish gray, soft	CLAY, high plasticity; slightly micaceous; some iron staining
5	◪	5 (100%)	wet, grayish brown, firm	
			moist, light brown, firm	
10	◪	8 (100%)	moist, pinkish gray, stiff	SILT with Sand, elastic, micaceous, heavy iron staining, stratified
15	◪	15 (100%)	dry, purple-brown, stiff	Very micaceous, some iron staining
20	◪	33 (100%)	dry, purple-gray, hard	(attempted shelby tube sampler but could not advance) (decreasing advancement rate)
25	◪	31 (100%)	dry, hard	
30	◪	38 (100%)	dry, grayish purple, hard	Slightly micaceous
	■	57 (100%)		
35	◪	51 (100%)	hard	
				End of Boring @ 34.5 ft
40				



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BORING LOGS **FIGURE 4-14**

Project: Ridgemont 5
Location: Spokane Valley, WA
Number: S17073

Table A-1

Compilation of Subsurface Data from Existing Explorations

Ridgemont Estates Stormwater Improvements Project
City of Spokane Valley
Spokane Valley, Washington

							Location [4,5]					Groundwater				Crystalline Bedrock [3]		Limiting Stratigraphic Layer[4]		Permeable Sediments [5]			
GeoEngineers' Designation	Investigator	Report	Project Site	Exploration Designation	Exploration Type	Date Completed	Location Identified in Google Earth? [1]	Latitude [1] (degrees)	Longitude [1] (degrees)	Approximate Exploration Elevation [2] (feet)	Total Depth (feet bgs)	Depth to Groundwater (feet bgs)	Groundwater Elevation (feet)	Date of Groundwater Measurement	Aquifer System Well is Open To	Depth to Crystalline Bedrock (feet bgs)	Top of Crystalline Bedrock (feet)	Depth to Limiting Stratigraphic Layer (feet bgs)	Top of Limiting Stratigraphic Elevation [6] (feet)	Depth to Top of Permeable Sediments (feet bgs)	Depth to Bottom of Permeable Sediments (feet bgs)	Permeable Sediment Thickness (feet)	Notes
BE-TP-1	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-1	Test Pit	07/06/17	Yes	47.639971	-117.16744	2335	6.5	Not Encountered	NA	07/06/17	NA	>6.5	<2328.5	>6.5	NA	3	>6.5	>3.5	Refusal at 6.5 feet - no cause noted.
BE-TP-2	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-2	Test Pit	07/06/17	Yes	47.640272	-117.167265	2340	7	Not Encountered	NA	07/06/17	NA	5	2335	5	NA	3	5	2	Refusal at 7.0 feet - no cause noted.
BE-TP-3	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-3	Test Pit	07/06/17	Yes	47.640618	-117.167302	2339	7	Not Encountered	NA	07/06/17	NA	6.5	2333	6.5	NA	2	6.5	4.5	Refusal at 7.0 feet on basalt.
BE-TP-4	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-4	Test Pit	07/06/17	Yes	47.640862	-117.167709	2336	10	Not Encountered	NA	07/06/17	NA	>10	<2326	>10	NA	5	>10	>5	
BE-TP-5	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-5	Test Pit	07/06/17	Yes	47.640501	-117.168134	2345	3	Not Encountered	NA	07/06/17	NA	2.5	2343	2.5	NA	NA	NA	0	Refusal at 3.0 feet on basalt.
BE-TP-6	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-6	Test Pit	07/06/17	Yes	47.640805	-117.168243	2338	10	Not Encountered	NA	07/06/17	NA	>10	<2328	>10	NA	5	10	5	
BE-TP-7	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-7	Test Pit	07/06/17	Yes	47.640872	-117.168699	2338	5	Not Encountered	NA	07/06/17	NA	4	2334	4	NA	NA	NA	0	Refusal at 5.0 feet on basalt.
BE-TP-8	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-8	Test Pit	07/06/17	Yes	47.640514	-117.1688	2341	4	Not Encountered	NA	07/06/17	NA	3	2338	3	NA	NA	NA	0	Refusal at 4.0 feet on basalt.
BE-TP-9	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-9	Test Pit	07/06/17	Yes	47.640004	-117.168782	2343	0.5	Not Encountered	NA	07/06/17	NA	0	2343	0	NA	NA	NA	0	Refusal at 0.5 feet on basalt.
BE-TP-10	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-10	Test Pit	07/06/17	Yes	47.639812	117.168819	2339	10	Not Encountered	NA	07/06/17	NA	>10	<2329	>10	NA	3.5	>10	>6.5	
BE-TP-11	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-11	Test Pit	07/06/17	Yes	47.639835	-117.169479	2340	2.5	Not Encountered	NA	07/06/17	NA	>2.5	<2337.5	>2.5	NA	NA	NA	0	Refusal at 2.5 feet - no cause noted.
BE-TP-12	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-12	Test Pit	07/06/17	Yes	47.640195	-117.169479	2341	4	Not Encountered	NA	07/06/17	NA	3.5	2338	3.5	NA	NA	NA	0	Refusal at 4.0 feet on basalt.
BE-TP-13	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-13	Test Pit	07/06/17	Yes	47.640552	-117.169528	2339	9	Not Encountered	NA	07/06/17	NA	>9	<2338	>9	NA	4	9	5	Refusal at 9.0 feet - no cause noted.
BE-TP-14	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-14	Test Pit	07/06/17	Yes	47.640899	-117.16951	2339	6	Not Encountered	NA	07/06/17	NA	4	2335	4	NA	NA	NA	0	Refusal at 6.0 feet on basalt.
BE-TP-15	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-15	Test Pit	07/06/17	Yes	47.641339	-117.169318	2339	3	Not Encountered	NA	07/06/17	NA	>3	<2336	>3	NA	NA	NA	0	Refusal at 3.0 feet - no cause noted.
BE-TP-16	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-16	Test Pit	07/06/17	Yes	47.641452	-117.168924	2339	5	Not Encountered	NA	07/06/17	NA	>5	<2334	>5	NA	2	5	3	Refusal at 5.0 feet - no cause noted.
BE-TP-17	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-17	Test Pit	07/06/17	Yes	47.641428	-117.168405	2337	5	Not Encountered	NA	07/06/17	NA	4.5	2333	4.5	NA	NA	NA	0	Refusal at 5.0 feet - on basalt.
BE-TP-18	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-18	Test Pit	07/06/17	Yes	47.641397	-117.167854	2334	4.5	Not Encountered	NA	07/06/17	NA	4	2330	4	NA	1	4	3	Refusal at 4.5 feet - on basalt.
BE-TP-19	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-19	Test Pit	07/06/17	Yes	47.64124	-117.167261	2333	10	Not Encountered	NA	07/06/17	NA	>10	<2323	>10	NA	NA	NA	0	
BE-TP-20	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-20	Test Pit	07/06/17	Yes	47.641086	-117.16689	2330	6	Not Encountered	NA	07/06/17	NA	5.5	2325	5.5	NA	1	5.5	4.5	Refusal at 6.0 feet - on basalt.
BE-TP-21	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-21	Test Pit	07/06/17	Yes	47.640813	-117.166458	2331	7	Not Encountered	NA	07/06/17	NA	6.5	2325	6.5	NA	6	6.5	0.5	Refusal at 7.0 feet - on basalt.
BE-TP-22	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-22	Test Pit	07/06/17	Yes	47.640579	-117.166342	2332	7	Not Encountered	NA	07/06/17	NA	6	2326	6	NA	1.5	6	4.5	Refusal at 7.0 feet - on basalt.
BE-TP-23	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-23	Test Pit	07/06/17	Yes	47.640271	-117.165953	2335	8	Not Encountered	NA	07/06/17	NA	6	2329	6	NA	4	6	2	Refusal at 8.0 feet - on basalt.
BE-TP-24	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-24	Test Pit	07/06/17	Yes	47.639646	-117.16613	2334	10	Not Encountered	NA	07/06/17	NA	>10	<2324	>10	NA	6	>10	>4	
BE-TP-25	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-25	Test Pit	07/06/17	Yes	47.639649	-117.166661	2336	10	Not Encountered	NA	07/06/17	NA	6	2330	6	NA	NA	NA	0	
BE-TP-26	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-26	Test Pit	07/06/17	Yes	47.639788	-117.167545	2338	3	Not Encountered	NA	07/06/17	NA	>3	<2335	>3	NA	NA	NA	0	Refusal at 3.0 feet - no cause noted.
BE-TP-27	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-27	Test Pit	07/06/17	Yes	47.639858	-117.168131	2340	3	Not Encountered	NA	07/06/17	NA	>3	<2337	>3	NA	NA	NA	0	Refusal at 3.0 feet - no cause noted.
BE-TP-28	Allwest Testing & Engineering	Allwest (2017)	Bellaire Subdivision Phase 3	TP-28	Test Pit	07/06/17	Yes	47.640334	-117.167725	2344	1	Not Encountered	NA	07/06/17	NA	>1	<2343	>1	NA	NA	NA	0	Refusal at 1.0 feet - no cause noted.
SL-TP-2	Budinger & Associates	Budinger (2006)	Shelly Lake 5th Addition	TP-2	Test Pit	05/19/06	Yes	47.64638	-117.182878	2050	14	Not Encountered	NA	05/19/06	NA	>14	<2036	>14	NA	0	>14	>14	
SL-TP-10	Budinger & Associates	Budinger (2006)	Shelly Lake 5th Addition	TP-10	Test Pit	06/27/06	Yes	47.647637	-117.181481	2027	14	Not Encountered	NA	06/27/06	NA	>14	<2013	>14	NA	0	>14	>14	
SL-TP-11	Budinger & Associates	Budinger (2006)	Shelly Lake 5th Addition	TP-11	Test Pit	06/27/06	Yes	47.647471	-117.180828	2025	14	Not Encountered	NA	06/27/06	NA	>14	<2011	>14	NA	0	>14	>14	
RH-TP-101	Gifford Consultants, Inc.	Gifford (1995)	Remington Hill Subdivision	TP-101	Test Pit	01/27/95	Yes	47.628613	-117.179979	2218	6	Not Encountered	NA	01/27/95	NA	5.5	2213	5.5	NA	NA	NA	0	Basalt encountered at 5.5 feet.
RH-TP-102	Gifford Consultants, Inc.	Gifford (1995)	Remington Hill Subdivision	TP-102	Test Pit	01/27/95	Yes	47.630538	-117.1804	2233	6	Not Encountered	NA	01/27/95	NA	3.5	2230	1	NA	NA	NA	0	Granitic basement encountered at 3.5 feet.
RH-TP-103	Gifford Consultants, Inc.	Gifford (1995)	Remington Hill Subdivision	TP-103	Test Pit	01/27/95	Yes	47.630831	-117.181295	2233	6	Not Encountered	NA	01/27/95	NA	4	2229	4	NA	NA	NA	0	Granitic basement encountered at 4.0 feet.
RH-TP-104	Gifford Consultants, Inc.	Gifford (1995)	Remington Hill Subdivision	TP-104	Test Pit	01/27/95	Yes	47.631098	-117.182726	2275	6	Not Encountered	NA	01/27/95	NA	>6	<2269	2.5	NA	1	2.5	1.5	
RH-TP-105	Gifford Consultants, Inc.	Gifford (1995)	Remington Hill Subdivision	TP-105	Test Pit	01/27/95	Yes	47.630264	-117.181736	2223	4	Not Encountered	NA	01/27/95	NA	3.5	2220	0	NA	NA	NA	0	Granitic basement encountered at 3.5 feet.
RH-TP-106	Gifford Consultants, Inc.	Gifford (1995)	Remington Hill Subdivision	TP-106	Test Pit	01/27/95	Yes	47.630618	-117.184142	2209	5.5	Not Encountered	NA	01/27/95	NA	5	2204	5	NA	NA	NA	0	Granitic basement encountered at 5.0 feet.
RH-B-201	Gifford Consultants, Inc.	Gifford (1995)	Remington Hill Subdivision	B-201	Boring	02/07/95	Yes	47.630618	-117.184142	2221	11.5	Not Encountered	NA	02/07/95	NA	3	2218	3	NA	0	3	3	Refusal at 11.5 feet - on crystalline bedrock.
VE-TP-101	Gifford Consultants, Inc.	Gifford (1999)	Vera Water Tanks	TP-101	Test Pit	02/24/95	Yes	47.643353	-117.178515	2209	14	Not Encountered	NA	02/24/95	NA	>14	<2195	5	2204	NA	NA	0	
VE-TP-102	Gifford Consultants, Inc.	Gifford (1999)	Vera Water Tanks	TP-102	Test Pit	02/24/95	Yes	47.643735	-117.178344	2217	22	Not Encountered	NA	02/24/95	NA	>22	<2195	7	2210	NA	NA	0	
SC-B-1	Spokane County Engineers	Spokane County Engineers (1990)	23rd and Timberlane	B-1	Boring	03/13/90	Yes	47.635363	-117.191945	2029	15	Not Encountered	NA	03/13/90	NA	>15	<2014	>15	NA	5	>15	>10	
SC-B-2	Spokane County Engineers	Spokane County Engineers (1990)	23rd and Timberlane	B-2	Boring	03/13/90	Yes	47.635526	-117.19281	2027	15	Not Encountered	NA	03/13/90	NA	>15	<2012	>15	NA	5	>15	>10	
VC-B-1	Budinger & Associates	Budinger (2008)	24th Avenue and Veracrest Dr.	B-1	Boring	01/04/08	Yes	47.635079	-117.192758	2041	8	Not Encountered	NA	01/04/08	NA	>8	<2033	>8	NA	5	>8	>3	
VC-B-2	Budinger & Associates	Budinger (2008)	24th Avenue and Veracrest Dr.	B-2	Boring	01/04/08	Yes	47.635066	-117.191306	2046	10.5	Not Encountered	NA	01/04/08	NA	8	2038	8	NA	4	8	4	
VC-B-3	Budinger & Associates	Budinger (2008)	24th Avenue and Veracrest Dr.	B-3	Boring	01/04/08	Yes	47.63587	-117.187836	2123	8.3	6	2117	01/04/08	Latah Formation	>8.3	<2037.7	2.5	2121	NA	NA	0	
VC-B-4	Budinger & Associates	Budinger (2008)	24th Avenue and Veracrest Dr.	B-4	Boring	01/04/08	Yes	47.635082	-117.1896	2072	6.3	2	2070	01/04/08	Glaciofluvial	5.5	2067	3.5	NA	2	3.5	1.5	
RE-TP-1	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-1	Test Pit	04/11/17	Yes	47.643619	-117.176684	2283	11	Not Encountered	NA	04/11/17	NA	>11	<2272	1.5	2282	NA	NA	0	
RE-TP-2	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-2	Test Pit	04/11/17	Yes	47.643671	-117.17557	2289	14	Not Encountered	NA	04/11/17	NA	>14	<2275	>14	NA	9	>14	>5	
RE-TP-3	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-3	Test Pit	04/11/17	Yes	47.644194	-117.175603	2268	8.5	Not Encountered	NA	04/11/17	NA	>8.5	<2259.5	>8.5	NA	NA	NA	0	
RE-TP-4	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-4	Test Pit	04/11/17	Yes	47.644202	-117.176662	2257	3.5	Not Encountered	NA	04/11/17	NA	3.5	2253.5	>3.5	NA	1	3.5	2.5	Refusal at 3.5 feet - on basalt.
RE-TP-5	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-5	Test Pit	04/11/17	Yes	47.644671	-117.176681	2232	9	7	2225	04/11/17	Glaciofluvial	>9	<2223	7	2225	NA	NA	0	
RE-TP-6	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-6	Test Pit	04/11/17	Yes	47.644649	-117.175624	2251	9	Not Encountered	NA	04/11/17	NA	>9	<2242	>9	NA	NA	NA	0	
RE-TP-7	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-7	Test Pit	04/11/17	Yes	47.645079	-117.175922	2227	3	Not Encountered	NA	04/11/17	NA	3	2253.5	3	NA	NA	NA	0	Refusal at 3.0 feet - on basalt.
RE-TP-8	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-8	Test Pit	04/11/17	Yes	47.645647	-117.176073	2201	8	Not Encountered	NA	04/11/17	NA	>8	<2193	>8	NA	1.5	>8	>6.5	
RE-TP-9	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-9	Test Pit	04/11/17	Yes	47.645638	-117.17543	2210	12	Not Encountered	NA	04/11/17	NA	>12	<2198	>12	NA	4	>12	>8	
RE-TP-10	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-10	Test Pit	04/11/17	Yes	47.645894	-117.176395	2187	9	Not Encountered	NA	04/11/17	NA	>9	<2178	>9	NA	5	>9	>4	
RE-TP-11	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-11	Test Pit	04/11/17	Yes	47.645523	-117.176921	2190	9	Not Encountered	NA	04/11/17	NA	10	<2180	>10	NA	6	8.5	2.5	
RE-TP-12	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	TP-12	Test Pit	04/11/17	Yes	47.645088	-117.17699	2210	9	Not Encountered	NA	04/11/17	NA	>9	<2201	>9	NA	5	>9	>4	
RE-B-13	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	B-13	Boring	04/11/17	Yes	47.644515	-117.177571	2213	30	Not Encountered	NA	04/11/17	NA	>30	<2183	1.5	2212	NA	NA	0	
RE-B-14	Budinger & Associates	Budinger (2019)	Ridgemont Estates No. 5	B-14	Boring	04/11/17	Yes	47.644548	-117.179362	2158	34.5	Not Encountered	NA	04/11/17	NA	>30	<2128	0	2158	NA	NA	0	
GE-B-1	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-B-1	Boring	10/17/23	Yes	47.63728	-117.18712	2131	10.1	Not Encountered	NA	10/17/23	NA	5	2253.5	0.3	2131	NA	NA	0	
GE-B-2	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-B-2	Boring	10/17/23	Yes	47.63904	-117.18511	2142	26.5	Not Encountered	NA	10/17/23	NA	>26.5	<2118.5	15	2127	0.3	15	14.7	
GE-B-3	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-B-3	Boring	10/18/23	Yes	47.64093	-117.18176	2183	26.5	Not Encountered	NA	10/18/23	NA	>26.5	<2159.5	0.8	2182	NA	NA	0	
GE-B-4	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-B-4	Boring	10/18/23	Yes	47.63868	-117.18186	2215	26.5	Not Encountered	NA	10/18/23	NA	>26.5	<2190.5	0.7	2214	NA	NA	0	
GE-B-5	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-B-5	Boring	10/19/23	Yes	47.6371	-117.18417	2214	26.5	Not Encountered	NA	10/19/23	NA	>26.5	<2191.5	4.5	2209	0.7	4.5	3.8	
GE-TP-1	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-TP-1	Test Pit	03/18/24	Yes	47.64061	-117.18603	2018	2	Not Encountered	NA	03/18/24	NA	>2	<2016	>2	<2016	NA	NA	0	
GE-TP-2	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-TP-2	Test Pit	03/18/24	Yes	47.64055	-117.18601	2019	12	Not Encountered	NA	03/18/24	NA	>12	<2007	1	2018	5.5	>12	>6.5	
GE-TP-3	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-TP-3	Test Pit	03/18/24	Yes	47.64118	-117.18514	2018	11.5	Not Encountered	NA	03/18/24	NA	>11.5	<2006.5	0.7	2017	NA	NA	0	
GE-TP-4	GeoEngineers	GeoEngineers (current study)	Ridgemont Estates Stormwater	GE-TP-4	Test Pit	03/18/24	Yes	47.64160	-117.18442	2018	12	Not Encountered	NA	03/18/24	NA	>12	<2006	0.8	2017	NA	NA	0	

Notes:

[1] Exploration sites were geolocated in Google Earth by GeoEngineers using site plans provided in the respective reports. Locations and associated coordinates should be considered approximate.

[2] Elevations were estimated using Google Earth.

[3] Crystalline bedrock refers to Miocene-age Columbia River Basalt Group basalt flows or pre-Miocene basement rock.

[4] Sequences of stiff to hard silt and/or clay were interpreted to represent Miocene-age Latah Formation sediments.

[5] Permeable sediments are defined as either: (1) sand and/or gravel with less than 12 percent fines (silt- and clay-sized particles passing the U.S. No. 200 sieve); or (2) sediment described as silty but associated with infiltration testing in excess of 72 inches per hour.

bgs = below ground surface; -- = not provided; NA = not applicable

Appendix B

Water Well Reports

Please print, sign and return by mail to Department of Ecology

24M1

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. SE60662

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)*
☑ Construction
☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* ____

Type of Well *(select one)*
☑ Resource Protection
☐ Geotech Soil Boring

Consulting Firm Budinger and Associates, Inc.
Unique Ecology Well ID
Tag No. ____

Property Owner Vera Water and Power
Site Address ____
City Spokane Valley County Spokane
Location SW 1/4-1/4 SW 1/4 Sec 24 Twn 25N R 44 Select One ☒ EWM ☐ WWM

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 above are true to my best knowledge and belief.

☑ Driller ☐ Engineer ☐ Trainee Name (Print) Ethan Hageman
Driller/Engineer /Trainee Signature
Driller or Trainee License No. 2968

If trainee, licensed driller's Signature and License No. 2968

Lat/Long (s, t, r still REQUIRED) Lat Deg ____ Lat Min/Sec ____
Long Deg ____ Long Min/Sec ____
Tax Parcel No. ____
Cased or Uncased Diameter 4.5 O.D Static Level N/A
Work/Decommission Start Date 12/21/2016
Work/Decommission Completed Date 12/21/2016

Construction/Design	Well Data	Formation Description
		GRAVEL
		SILT
		SILTY GRAVEL
		5 Feet
		CLAYEY SILTY
	RECEIVED APR 14 2017 Department of Ecology Eastern Regional Office	
		End boring at 15 feet BAI S16690 TB1

SCALE: 1"= ____ PAGE 1 OF 1

ECY 050-12 (Rev. 2/03)

Ecology is an Equal Opportunity Employer.

25H1

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

505421

☒ Construction
☐ Decommission *ORIGINAL INSTALLATION*
Notice of Intent Number ________

CURRENT

Notice of Intent No. GE00473
Unique Ecology Well ID Tag No. BIO-001
Water Right Permit No. ________
Property Owner Name Forrest and Cheryl Renslow
Well Street Address 16914 E. 27th
City Greenacres County Spokane
Location SE1/4-1/4 NE1/4 Sec 25 Twn 25N R 44 EWM ☒ Or WWM ☐
(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____
Long Deg ____ Long Min/Sec ____
Tax Parcel No. (Required) 452541102

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☒ Other Ground Src

TYPE OF WORK: Owner's number of well (if more than one) 1
☒ New well ☐ Reconditioned *Method :* ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 3 inches, drilled 100 ft.
Depth of completed well _ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded ______" Diam. from ______ ft. to ______ ft.
☐ Liner installed ______" Diam. from ______ ft. to ______ ft.
☐ Threaded ______" Diam. From ______ ft. to ______ ft.

Perforations: ☐ Yes ☒ No
Type of perforator used ________
SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ________
Manufacturer's Name ________
Type ________ Model No. ________
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ______
Materials placed from ______ ft. to ______ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 100 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 ________

PUMP: Manufacturer's Name ________
Type: ________ H.P. ________

WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level N/A ft. below top of well Date 11/5/13
Artesian pressure ______ lbs. per square inch Date ________
Artesian water is controlled by ________ (cap, valve, etc.)

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.
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
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 N/A 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

CONSTRUCTION OR DECOMMISSION PROCEDURE
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil & fill	0	6
Sand & Gravel	6	24
Clay	24	100
Installed Copper Tubing		
Cemented to Ground Surface		
Ground Source Heat Pump Boring		

RECEIVED
JAN 14 2014
Department of Ecology
Eastern Regional Office

Start Date 11/4/13 Completed Date 11/5/13

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 above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Tom Richardson
Driller/Engineer/Trainee Signature
Driller or trainee License No. 1295
IF TRAINEE: Driller's License No:
Driller's Signature: Tom Richardson

Drilling Company H2O Well Service Inc.
Address 582 W. Hayden Ave.
City, State, Zip Hayden, ID, 83835
Contractor's Registration No. H2OWESI101DW Date 11/27/13

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

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

25H2

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

505422

Construction/Decommission *("x" in circle)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* ____________

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☒ Other Ground Src

TYPE OF WORK: Owner's number of well (if more than one) 2

☒ New well ☐ Reconditioned ☐ Deepened

Method: ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 3 inches, drilled 100 ft.
Depth of completed well _ft.

CONSTRUCTION DETAILS

Casing Installed:
☐ Welded ______" Diam. from ______ ft. to ______ ft.
☐ Liner installed ______" Diam. from ______ ft. to ______ft.
☐ Threaded ______" Diam. From ______ ft. to ______ ft.

Perforations: ☐ Yes ☒ No
Type of perforator used ____________
SIZE of perfs _____in. by _____ in. and no. of perfs _____from _____ft. to _____ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ____________
Manufacturer's Name ____________
Type ____________ Model No. ____________
Diam. ______Slot size ______ from ______ ft. to ______ ft.
Diam. ______Slot size ______ from ______ ft. to ______ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ______
Materials placed from ______ ft. to ______ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 100 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 ____________

PUMP: Manufacturer's Name ____________
Type: ____________ H.P. ____________

WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level N/A ft. below top of well Date 11/5/13
Artesian pressure ______ lbs. per square inch Date ____________
Artesian water is controlled by ____________ (cap, valve, etc.)

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.
Yield: ______gal./min. with _____ft. drawdown after ______hrs.
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 N/A 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

CURRENT

Notice of Intent No. GE00473
Unique Ecology Well ID Tag No. BIO-002
Water Right Permit No. ____________
Property Owner Name Forrest and Cheryl Renslow
Well Street Address 16914 E. 27th
City Greenacres County Spokane
Location SE1/4-1/4 NE1/4 Sec 25 Twn 25N R 44 EWM ☒ Or WWM ☐
(s, t, r Still REQUIRED)

Lat/Long Lat Deg _____ Lat Min/Sec _____
Long Deg _____ Long Min/Sec _____
Tax Parcel No. (Required) 452541102

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil & fill	0	6
Sand & Gravel	6	24
Clay	24	80
Granite Boulder	80	85
Clay	85	100
Installed Copper Tubing		
Cemented to Ground Surface		
Ground Source Heat Pump Boring		

RECEIVED
JAN 14 2014
Department of Ecology
Eastern Regional Office

Start Date 11/6/13 Completed Date 11/12/13

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 above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Tom Richardson
Driller/Engineer/Trainee Signature
Driller or trainee License No. 1295
IF TRAINEE: Driller's ~~License~~ No:
Driller's Signature: Tom Richardson

Drilling Company H2O Well Service Inc.
Address 582 W. Hayden Ave.
City, State, Zip Hayden , ID, 83835
Contractor's Registration No. H2OWESI101DW Date 11/27/13

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

25H3

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

505423

Construction/Decommission *("x" in circle)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* ____________

CURRENT

Notice of Intent No. GE00473

Unique Ecology Well ID Tag No. BIO-003

Water Right Permit No. ____________

Property Owner Name Forrest and Cheryl Renslow

Well Street Address 16914 E. 27th

City Greenacres County Spokane

Location SE1/4-1/4 NE1/4 Sec 25 Twn 25N R 44 **EWM** ☒ **Or WWM** ☐

(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____

Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 452541102

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☒ Other Ground Src

TYPE OF WORK: Owner's number of well (if more than one) 3

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven

☐ Deepened ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 3 inches, drilled 100 ft.

Depth of completed well ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded ____" Diam. from ____ ft. to ____ ft.

☐ Liner installed ____" Diam. from ____ ft. to ____ ft.

☐ Threaded ____" Diam. From ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used ____________

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ____________

Manufacturer's Name ____________

Type ____________ Model No. ____________

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ____

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 100 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 ____________

PUMP: Manufacturer's Name ____________

Type: ____________ H.P. ____________

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

Static level N/A ft. below top of well Date 11/5/13

Artesian pressure ____ lbs. per square inch Date ____________

Artesian water is controlled by ____________ (cap, valve, etc.)

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.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

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 N/A 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

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil & fill	0	6
Sand & Gravel	6	24
Clay	24	70
Boulder	70	74
Clay	74	85
Boulder	85	89
Clay	89	100
Installed Copper Tubing		
Cemented to Ground Surface		
Ground Source Heat Pump Borin		

RECEIVED

JAN 14 2014

Department of Ecology
Eastern Regional Office

Start Date 11/12/13 Completed Date 11/14/13

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 above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Tom Richardson

Driller/Engineer/Trainee Signature

Driller or trainee License No. 1295

IF TRAINEE: Driller's License No:

Driller's Signature: Tom Richardson

Drilling Company H2O Well Service Inc.

Address 582 W. Hayden Ave.

City, State, Zip Hayden , ID, 83835

Contractor's Registration No. H2OWESI101DW Date 11/27/13

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

25H4

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

505-424

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* ____

CURRENT

Notice of Intent No. GE00473

Unique Ecology Well ID Tag No. BIO-004

Water Right Permit No. ____

Property Owner Name Forrest and Cheryl Renslow

Well Street Address 16914 E. 27th

City Greenacres County Spokane

Location SE1/4-1/4 NE1/4 Sec 25 Twn 25N R 44 EWM ☒ Or WWM ☐

(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____

Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 452541102

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☒ Other Ground Src

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

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven

☐ Deepened ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 3 inches, drilled 100 ft.

Depth of completed well __ ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded ____" Diam. from ____ ft. to ____ ft.

☐ Liner installed ____" Diam. from ____ ft. to ____ ft.

☐ Threaded ____" Diam. From ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used ____

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ____

Manufacturer's Name ____

Type ____ Model No. ____

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ____

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 100 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 ____

PUMP: Manufacturer's Name ____

Type: ____ H.P. ____

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

Static level N/A ft. below top of well Date 11/5/13

Artesian pressure ____ lbs. per square inch Date ____

Artesian water is controlled by ____ (cap, valve, etc.)

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.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

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 N/A 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

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	6
Sand & Gravel	6	25
Clay	25	75
Boulder	75	79
Clay	79	100
Installed Copper Tubing		
Cemented to Ground Surface		
Ground Source Heat Pump Boring		

RECEIVED

JAN 14 2014

Department of Ecology Eastern Regional Office

Start Date 11/14/13 Completed Date 11/15/13

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 above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Tom Richardson

Driller/Engineer/Trainee Signature

Driller or trainee License No. 1295

IF TRAINEE: Driller's License No:

Driller's Signature: Tom Richardson

Drilling Company H2O Well Service Inc.

Address 582 W. Hayden Ave.

City, State, Zip Hayden, ID, 83835

Contractor's Registration No. H2OWESI101DW Date 11/27/13

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

25H5

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number ______

505425

CURRENT

Notice of Intent No. GE00473

Unique Ecology Well ID Tag No. BIO-005

Water Right Permit No. ______

Property Owner Name Forrest and Cheryl Renslow

Well Street Address 16914 E. 27th

City Greenacres County Spokane

Location SE1/4-1/4 NE1/4 Sec 25 Twn 25N R 44 EWM ☒ Or WWM ☐

(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____

Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 452541102

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☒ Other Ground Src

TYPE OF WORK: Owner's number of well (if more than one) 5

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven

☐ Deepened ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 3 inches, drilled 100 ft.

Depth of completed well _ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded ____" Diam. from ____ ft. to ____ ft.

☐ Liner installed ____" Diam. from ____ ft. to ____ft.

☐ Threaded ____" Diam. From ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used ______

SIZE of perfs ____in. by ____ in. and no. of perfs ____from ____ft. to ____ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ______

Manufacturer's Name ______

Type ______ Model No. ______

Diam. ____Slot size ____ from ____ ft. to ____ ft.

Diam. ____Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ____

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 100 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 ______

PUMP: Manufacturer's Name ______

Type: ______ H.P. ______

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

Static level N/A ft. below top of well Date 11/5/13

Artesian pressure ____ lbs. per square inch Date ______

Artesian water is controlled by ______ (cap, valve, etc.)

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.

Yield: ____gal./min. with ____ft. drawdown after ____hrs.

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 N/A 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

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	6
Sand & Gravel	6	35
Clay	24	76
Boulder	76	79
Clay	79	90
Boulder	90	92
Clay	92	100
Installed Copper Tubing		
Cemented to Ground Surface		
Ground Source Heat Pump Boring		

RECEIVED
JAN 14 2014
Department of Ecology
Eastern Regional Office

Start Date 11/18/13 Completed Date 11/19/13

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 above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Tom Richardson

Driller/Engineer/Trainee Signature

Driller or trainee License No. 1295

IF TRAINEE: Driller's License No:

Driller's Signature: Tom Richardson

Drilling Company H2O Well Service Inc.

Address 582 W. Hayden Ave.

City, State, Zip Hayden, ID, 83835

Contractor's Registration No. H2OWESI101DW Date 11/27/13

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

30M1

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. 057597 ✓

Water Right Permit No.

(1) **OWNER:** Name Dave Bastain Address 1906 S Ridgemont, Verdale, WA 99037

LOCATION OF WELL: County Spokane ¼ SW ¼ Sec. 30 T. 25 N., R. 45 W.M.

(2a) **STREET ADDDRESS OF WELL** (or nearest address) 32nd. Saltese Cemt. Greenacres, WA

(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 6 inches.

Drilled 200 feet. Depth of completed well 200 ft.

(6) **CONSTRUCTION DETAILS:**

Casing Installed: 6 " Diam. from +1 ft. to 173 ft.

Welded ☒ " Diam. from ft. to ft.

Liner installed ☐

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

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? 18 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 80 ft. below top of well Date 7/24/91

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: 15 gal./min. with ft. drawdown after hrs.

Air test approx. 15-G.P.M. " "

" " " "

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
Topsoil	0	1
Basalt-highly fract.	1	34
Cemented sand	34	90
Clay-brn.	90	174
Basalt-hard	174	178
Clay-brn. w/some sand	178	200

Work started 7/23/91, 19. Completed 7/24/, 19 91

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 J & J DRILLING INC (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address S 5613 Linke Rd. Greenacres, WA 99016

(Signed) (WELL DRILLER) License No. 1447

Contractor's Registration No. JJDRII-177KU Date 7/26/, 19 91

(USE ADDITIONAL SHEETS IF NECESSARY)

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

30M2

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 William C. Lebow Address E. 10119-44, Spokane, Wa. 99206

LOCATION OF WELL: County Spokane, Wa. 99206 — SW ¼ SW ¼ Sec. 30 T. 25 N., R. 45 W.M.

ug 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 202 ft. Depth of completed well 202 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from +1 ft. to 179 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
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? 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
Static level 50 ft. below top of well Date 4/10/87
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: 35 gal./min. with ft. drawdown after hrs.
" " " "
" Air test approx " "

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.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

6/17/87

(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	2
Basalt cobble w/br. clay	2	20
Clay, br. + tan w/seamsots	20	160
coarse sand, clay	160	195
Basalt, grey, soft w/water	195	202

RECEIVED
JUN 17 1987
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 4/10 1987 Completed 4/10 1987

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 J&J DRILLING, Inc. (Person, firm, or corporation) (Type or print)

Address S. 5613 Linke Rd., Greenacres, Wa

[Signed] Keith D. Vermillion (Well Driller)

License No. 1079 Date 4/10, 1987

(USE ADDITIONAL SHEETS IF NECESSARY)

050-1-20

30N1

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 Bill Cabbage Address Saltese R Spokane, Wa.

LOCATION OF WELL: County Spokane - SE ¼ SW ¼ Sec 30 T 25 N., R 45 E W.M.

ıg 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 ☒ Deepened ☐ Reconditioned ☐

Method: Dug ☐ Cable ☐ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.

Drilled 240 ft. Depth of completed well 240 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from +1 ft. to 140 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

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? 18 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 2200 ft.

Static level 50 ft. below top of well Date 12-16-77

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.

" " " "

Air Test Approx 150 G.P.M. "

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.

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? Yes ☐ No ☐

4/27/79

(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	2
Broken Basalt	2	18
Yellow Clay	18	37
Brown Clay	37	68
Broken Basalt	68	135
Basalt	135	240

RECEIVED
APR 26 1979
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 12-8, 1977. Completed 12-10, 1977

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 Jed Jr Drilling Inc. (Person, firm, or corporation) (Type or print)

Address 5613 S Link Rd Greenacres, Wa.

[Signed] (Well Driller)

License No. 0315 Date 12-30, 1977

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

30N2

ile Original and First Copy with
epartment of Ecology
econd Copy — Owner's Copy
hird Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

1) **OWNER:** Name Bill Cabbage Address 15217 E 16th Spokane WA. 99216

LOCATION OF WELL: County Spokane — SE ¼ SW ¼ Sec 30 T 25 N., R 45 W.M.

ing 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 240 ft. Depth of completed well 240 ft.

6) **CONSTRUCTION DETAILS:**

Casing installed: 6" Diam. from +1 ft. to 140 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 ....
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? 18 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 2200 ft.
tatic level 140 ft. below top of well Date 12-16-77
rtesian 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
/as a pump test made? Yes ☐ No ☐ If yes, by whom? ....
ield: ...... gal./min. with ...... ft. drawdown after ...... hrs.
" " " "
Air Test Approx 150 GPM "

ecovery 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 ....
ailer test ...... gal./min. with ...... ft. drawdown after ...... hrs.
rtesian 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	6
Broken Basalt	6	140
Basalt	140	240

Work started 12-8, 1977. Completed 12-10, 1977

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 J & J Drilling Inc.
(Person, firm, or corporation) (Type or print)

Address 13021 E 9th Spokane, WA.

[Signed] Gerald R Johnson
(Well Driller)

License No. 0215 Date 12-23, 1977

7/25/78

Freeman 7 1/2

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

30N3

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 Ken Critos Address RT-1 Greenacres. WA. 99016

(2) LOCATION OF WELL: County Spokane - SE ¼ SW ¼ Sec 30 T 25 N., R 45 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 260 ft. Depth of completed well 260 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from +1 ft. to 53 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......
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? 18 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... 2200
Static level 71 ft. below top of well Date 11-5-81
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.
" " " "
Air test Approx. 30-35 GPM
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.
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	1
Basalt Boulders	1	5
Brn Clay w/ Basalt Rock	5	45
Fract- Basalt Strips Clay	45	70
Brn Clay	70	75
Basalt - Med w/ Fractures	75	85
Basalt - Hard	85	108
Yellow Clay - Basalt Rock	108	137
Basalt (Hard)	137	139
Brn. Sand (Firm)	139	155
Basalt - Frac.	155	158
DK. Brn. Clay	158	165
Fract. Basalt w/ Brn. Clay	165	205
Brn. Shale - Strips Basalt	205	241
Basalt - Frac - Water	241	244
Basalt - Hard -	244	260

244 ft 4" pvc
Perforated From - 54' to 94'
234' to 260 ft - Formation
Packer set at 233 ft

RECEIVED
OCT 29 1982
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 11-3, 1981 Completed 11-5-, 1981

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 J & J Drilling Inc. (Person, firm, or corporation) (Type or print)
Address 5613 S. Linke Rd Greenacres
[Signed] Gerald A. Johnson (Well Driller)
License No. 0215 Date 12-5, 1981

10/29/82

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

30N4

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 Lyle Burnett Address 19804 Mica Dr. Greenacres WA

(2) LOCATION OF WELL: County Spokane - SE ¼ SW ¼ Sec 30 T 25 N., R 45 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 290 ft. Depth of completed well 290 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from +1 ft. to 119 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
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? 18 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 2200 ft.
Static level 70 ft. below top of well Date 12-7-77
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.
" " "
Air Test Approx 35 GPM "

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.
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	2
Broken Basalt	2	43
Brown clay	43	59
Yellow Clay	59	75
Broken Basalt	75	290

Lined with 190 ft 4"

Sch 160 PVC w/Formation

Packer set at 240 ft

Work started 12-5-77, 19 Completed 12-7, 1977

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 J & J Drilling Inc. (Person, firm, or corporation) (Type or print)

Address 13021 E 9th Spokane, WA.

[Signed] Gerald R Johnson (Well Driller)

License No. 0215 Date 1-15, 1978

7/26/78

Freeman 7/½

(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

30N5

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. ....

(1) OWNER: Name MR. PAUL MAY Address ....

(2) LOCATION OF WELL: County SPOKANE — SE ¼ SW ¼ Sec 30 T 25 N., R 45 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 163 ft. Depth of completed well 163 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from +1 ft. to 159 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 ....
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? 18+ ft.
Material used in seal Bentonite + Clay
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 75 ft. below top of well Date 5-22
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.
AIR TEST" APPROX 30-40 GPM
" " " "

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.
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 - BASALT BOULDERS	0	38
YELLOW CLAY	38	55
BRN CLAY	55	108
DARK BRN CLAY (HARD)	108	155
BASALT + SAND (WATER)	155	163

RECEIVED
Hand Carried
MAY 2 1974
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 5-21, 1974. Completed 5-22, 1974

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 J-H DRILLING CO. INC.
(Person, firm, or corporation) (Type or print)

Address BOX 441 SPOKANE 99211

[Signed] Norman D. Hoppfer
(Well Driller)

License No. 0188 Date 5-22, 1974

5/20/74

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

Table B-1

Compilation of Subsurface Data from Water Well Reports[1]

Ridgemont Estates Stormwater Improvements Project
City of Spokane Valley
Spokane Valley, Washington

					Location [2]											Groundwater						Permeable Sediments [5]			
Water Well Report Designation	Unique Well ID Tag No.	Owner	Well Use	Date Completed	1/4-1/4 Section	1/4-Section	Section	Township	Range	Latitude (degrees)	Longitude (degrees)	Provided Well Address	Parcel No.	Total Depth (feet bgs)	Open Borehole or Screen Depth (feet bgs)	Depth to Groundwater (feet bgs)	Date of Groundwater Measurement	Aquifer System Well is Open To	Reported Yield (gpm)	Depth to Crystalline Bedrock [3] (feet bgs)	Interpreted Latah Formation Depth [4] (feet bgs)	Depth to Top of Permeable Sediments (feet bgs)	Depth to Bottom of Permeable Sediments (feet bgs)	Permeable Sediment Thickness (feet)	Notes
24M1		Vera Water and Power	Resource Protection	12/21/16	SW	SE	24	25N	44E	–	–	–	–	15	NA	–	–	Latah	NA	>15	5	0	5	5	
25H1	BIO-001	Forrest and Cheryl Renslow	Ground Source	11/05/13	SE	NE	25	25N	44E	–	–	16914 E. 27th	452541102	100	NA	–	–	NA	NA	>100	24	6	24	18	
25H2	BIO-002	Forrest and Cheryl Renslow	Ground Source	11/12/13	SE	NE	25	25N	44E	–	–	16914 E. 27th	452541102	100	NA	–	–	NA	NA	>100	24	6	24	18	
25H3	BIO-003	Forrest and Cheryl Renslow	Ground Source	11/14/13	SE	NE	25	25N	44E	–	–	16914 E. 27th	452541102	100	NA	–	–	NA	NA	>100	24	6	24	18	
25H4	BIO-004	Forrest and Cheryl Renslow	Ground Source	11/15/13	SE	NE	25	25N	44E	–	–	16914 E. 27th	452541102	100	NA	–	–	NA	NA	>100	25	6	25	19	
25H5	BIO-005	Forrest and Cheryl Renslow	Ground Source	11/19/13	SE	NE	25	25N	44E	–	–	16914 E. 27th	452541102	100	NA	–	–	NA	NA	>100	35	6	35	29	
30M1		Dave Bastain	Domestic	07/26/91	–	SW	30	25N	45E	–	–	32nd Saltese Court, Greenacres, WA	–	200	173 to 200	80	07/24/91	Basalt and Latah	15	1	34 to 174; 178 to 200	NA	NA	0	
30M2		William C. Lebow	Domestic	04/10/87	SW	SW	30	25N	45E	–	–	–	–	202	179 to 202	50	04/10/87	Basalt and Latah	35	195	2	NA	NA	0	
30N1		Bill Cabbage	Domestic	12/10/77	SE	SW	30	25N	45E	–	–	–	–	240	140 to 240	50	12/10/77	Basalt	150	2	18 to 40	NA	NA	0	
30N2		Bill Cabbage	Domestic	12/10/77	SE	SW	30	25N	45E	–	–	–	–	240	140 to 240	140	12/10/77	Basalt	150	6	NA	NA	NA	0	
30N3		Ken Crites	Domestic	11/05/81	SE	SW	30	25N	45E	–	–	–	–	260	53 to 260	71	11/05/81	Basalt and Latah	30 to 35	1	5 to 75; 108 to 137; 158 to 165	NA	NA	0	
30N4		Lyle Burnett	Domestic	12/07/77	SE	SW	30	25N	45E	–	–	–	–	290	119 to 290	70	12/07/77	Basalt and Latah	35	2	42 to 75	NA	NA	0	
30N5		Mr. Paul May	Domestic	05/22/74	SE	SW	30	25N	45E	–	–	–	–	165	159 to 165	75	05/22/74	Basalt and Latah	30 to 40	155	38 to 155	0	38	38	

Notes:

[1] Water Well Reports were inventoried for the following sections: the south half of Section 24 and all of Section 25, Township 25 North, Range 44 East; and the west half of Section 30 of Township 25 North, Range 45 East. Water Well Reports that contained lithologic information were included herein.

[2] Water Well Report location information is reported herein as provided in the Water Well Reports. Locations should be considered approximate.

[3] Crystalline bedrock refers to Miocene-age Columbia River Basalt Group basalt flows or pre-Miocene basement rock.

[4] Sequences of stiff to hard silt and/or clay were interpreted to represent Miocene-age Latah Formation sediments.

[5] Within Water Well Reports, permeable sediments are defined as sediments described as sand and gravel overlying crystalline bedrock and/or Intepreted Latah Formation.

bgs = below ground surface; – = not provided; NA = not applicable; gpm = gallons per minute

Appendix C

Field and Laboratory Procedures

Appendix C
Field and Laboratory Procedures

SITE EXPLORATION

GeoEngineers advanced five soil borings (GE-B-1 through GE-B-5) to depths of 10 to 26½ feet bgs, completed four soil boring as monitoring wells (GE-B-2 through GE-B-5), advanced four test pits (GE-TP-1 through GE-TP-4) to depths of 2 to 12 feet bgs and eight pavement cores (GE-C-1 through GE-C-9) to bottom of observed based course.

The approximate locations of the explorations are shown in Figure 2. Drilling, well installation and excavation activities were continuously monitored by a geologist from our firm who collected, examined and classified representative sediment samples and maintained a detailed log of the explorations.

Exploration locations were determined using GPS. Sediment was classified in general accordance with the ASTM International (ASTM) D 2487 described in Figure C-1. The boring, well construction and test pit logs for the explorations are presented in Appendix B, Figures C-2 through C-10.

MONITORING WELL CONSTRUCTION AND DEVELOPMENT

Monitoring wells completed in explorations GE-B-2 through GE-B-5 were constructed using 2-inch-inside-diameter Schedule 40 PVC riser and well screen material. Well screen slot size was about 0.010 inches. Processed 10-20 silica sand was used as filter pack. Bentonite chips were used as impermeable backfill. At the ground surface, the well is protected by a secured flush mount traffic-rated monument.

LABORATORY TESTING

Sediment samples obtained from the explorations were returned to our laboratory for further examination and testing. Gradation tests by ASTM C136 were conducted on representative sediment samples. Results of ASTM C136 analyses are presented in Sieve Analysis Results, Figures C-11 through C-16.

GROUNDWATER LEVELS

During infiltration testing, groundwater levels were measured by the following:

- A Solinst Model 101 electric water level meter. The polyethylene tapes were clearly marked allowing measurements with a precision of 0.01 feet, which was recorded in field sheets concurrent with time.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	⁘	GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
			⁘	GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▥	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	⁙	SW	WELL-GRADED SANDS, GRAVELLY SANDS
			⁙	SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▥	SM	SILTY SANDS, SAND - SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▥	ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			▥	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	▥	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY
			▨	OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			⌣	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS		TYPICAL DESCRIPTIONS
GRAPH	LETTER	
■	AC	Asphalt Concrete
▨	CC	Cement Concrete
▩	CR	Crushed Rock/ Quarry Spalls
⩛	SOD	Sod/Forest Duff
⁙	TS	Topsoil

Groundwater Contact

▼ Measured groundwater level in exploration, well, or piezometer

▼ Measured free product in well or piezometer

Graphic Log Contact

— Distinct contact between soil strata

╱ Approximate contact between soil strata

Material Description Contact

— Contact between geologic units

- - - - Contact between soil of the same geologic unit

Sampler Symbol Descriptions

▯ Modified California Sampler (6-inch sleeve) or Dames & Moore

☒ Standard Penetration Test (SPT)

■ Shelby tube

▤ Piston

◧ Direct-Push

◫ Bulk or grab

▥ Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure C-1

Rev. 03/2024

Drilled	Start 10/17/2023	End 10/17/2023	Total Depth (ft) 10.5	Logged By MMS Checked By JER
Driller	GeoEngineers, Inc.		Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	2131.08 NAVD88	Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment CME 75
Latitude Longitude	47.63728 -117.18712	System Datum	Decimal Degrees WGS84 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							AC	Approximately 1½ inches of asphalt concrete			
2130								CR	Approximately 1½ inches of base course			
								ML	Brown silt with sand and gravel (very stiff, moist)			
		☒	18	25		1						
	5	☒	10	50/4"		2		GP-GM	Gray fine to coarse gravel with silt and sand (very dense, moist) (weathered basalt)			
2125												
		☒	1	50/4"		3		GP	Gray fine to coarse gravel (very dense, moist) (weathered basalt)			
	10		0.5	50/1"		4						

Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Boring GE-B-1

GEOENGINEERS

Project: Ridgemont Estates Stormwater Improvements Project
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-2
Sheet 1 of 1

Drilled	Start 10/17/2023	End 10/17/2023	
Total Depth (ft)	26.5		
Logged By	MMS	Checked By	JER
Driller	GeoEngineers, Inc.	Drilling Method	Hollow-stem Auger
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME 75
Surface Elevation (ft) Vertical Datum	2141.68 NAVD88	Top of Casing Elevation (ft)	2141.43
Latitude Longitude	47.63904 -117.18511	Horizontal Datum	Decimal Degrees WGS84 (feet)

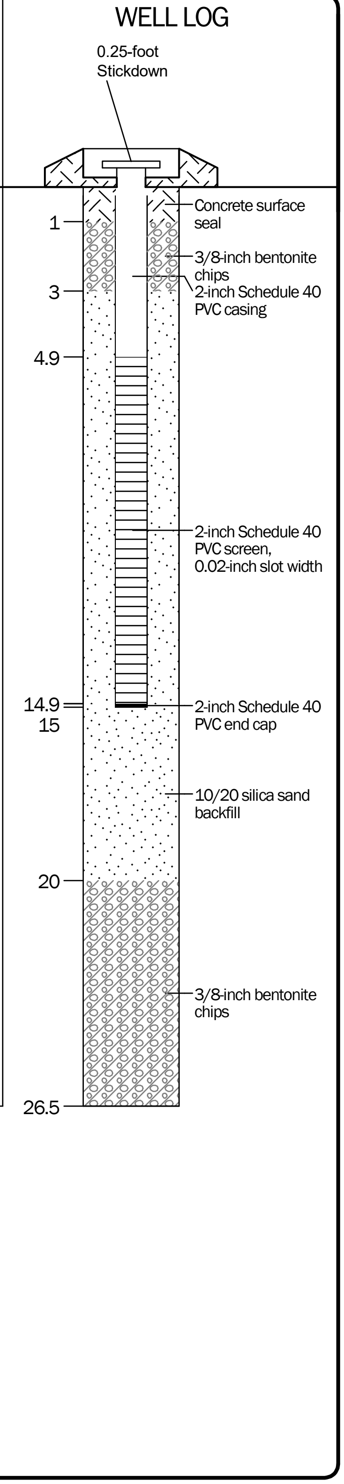
DOE Well I.D.: BPX 827
A 2-in well was installed on 10/17/2023 to a depth of 15 ft.

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/17/2023	8.50	2133.18

Notes:

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0					AC	Approximately 1½ inches of asphalt concrete		
						CR	Approximately 2 inches of base course		
2140		11	28	1		SP-SM	Tan sand with silt and gravel (medium dense, moist) (glaciofluvial)		
2135	5	11	11	2 SA		SM	Tan silty fine to coarse sand with occasional gravel (medium dense, most) (glaciofluvial)	7	18
		10	34	3	▼	SP-SM	Brown fine to coarse sand with silt and gravel (dense to very dense, moist) (glaciofluvial)		
2130	10	5	52	4 SA				12	10
						GP	Tan fine to coarse gravel with sand (medium dense, moist) (glaciofluvial)		
2125	15	23	13	5		CL	Brown-orange clay with sand (mottled) (stiff, moist) (Latah formation)		
						CL	Gray sandy clay with organics (wood) (hard, moist) (Latah formation)		
2120	20	24	37	6					
	25	24	46	7		ML	Dark brown silt with sand (hard, moist) (Latah formation)		



Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Boring with Monitoring Well GE-B-2

GEOENGINEERS

Project: Ridgemont Estates Stormwater Improvements Project
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-3
Sheet 1 of 1

Drilled Start 10/18/2023 End 10/18/2023
Total Depth (ft) 26.5
Logged By MMS
Checked By JER
Driller GeoEngineers, Inc.
Drilling Method Hollow-stem Auger
Hammer Data Autohammer 140 (lbs) / 30 (in) Drop
Drilling Equipment CME 75
DOE Well I.D.: BPX 828
A 2-in well was installed on 10/18/2023 to a depth of 15.2 ft.
Surface Elevation (ft) 2182.71
Vertical Datum NAVD88
Top of Casing Elevation (ft) 2182.41
Latitude 47.64093
Longitude -117.18176
Horizontal Datum Decimal Degrees WGS84 (feet)

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)

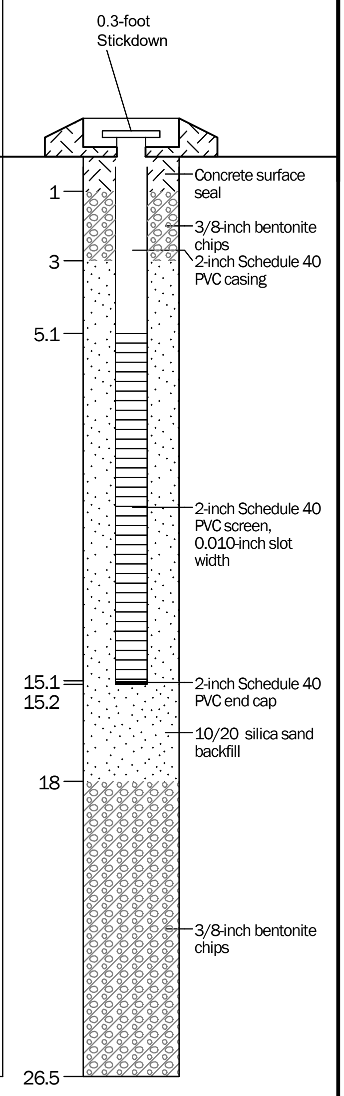
Notes: Groundwater not measured at time of exploration

FIELD DATA

Elevation (feet): 2180, 2175, 2170, 2165, 2160

Depth (feet)	Recovered (in)	Blows/foot	Sample Name Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
0				AC	Approximately 5 inches of asphalt concrete		
				CR	Approximately 4 inches of base course		
				ML	Tan silt with sand (stiff, moist)		
	14	10	1				
5	18	8	2 SA			47	67
				CL	Tan clay (stiff, moist)		
	18	10	3				
10	18	8	4				
15	0.5	39	5	CL	Tan sandy clay (hard, moist) (Latah formation)		
20	18	12	6	CL	Tan clay (stiff to very stiff, moist) (mottled) (Latah formation)		
25	18	16	7				

WELL LOG



Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Boring with Monitoring Well GE-B-3

GEOENGINEERS

Project: Ridgemont Estates Stormwater Improvements Project
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-4
Sheet 1 of 1

Drilled	Start 10/18/2023	End 10/18/2023	Total Depth (ft) 26.5	Logged By MMS Checked By JER	Driller GeoEngineers, Inc.
Drilling Method	Hollow-stem Auger				
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME 75		
Surface Elevation (ft) Vertical Datum	2215.06 NAVD88	Top of Casing Elevation (ft)	2214.76		
Latitude Longitude	47.63868 -117.18186	Horizontal Datum	Decimal Degrees WGS84 (feet)		

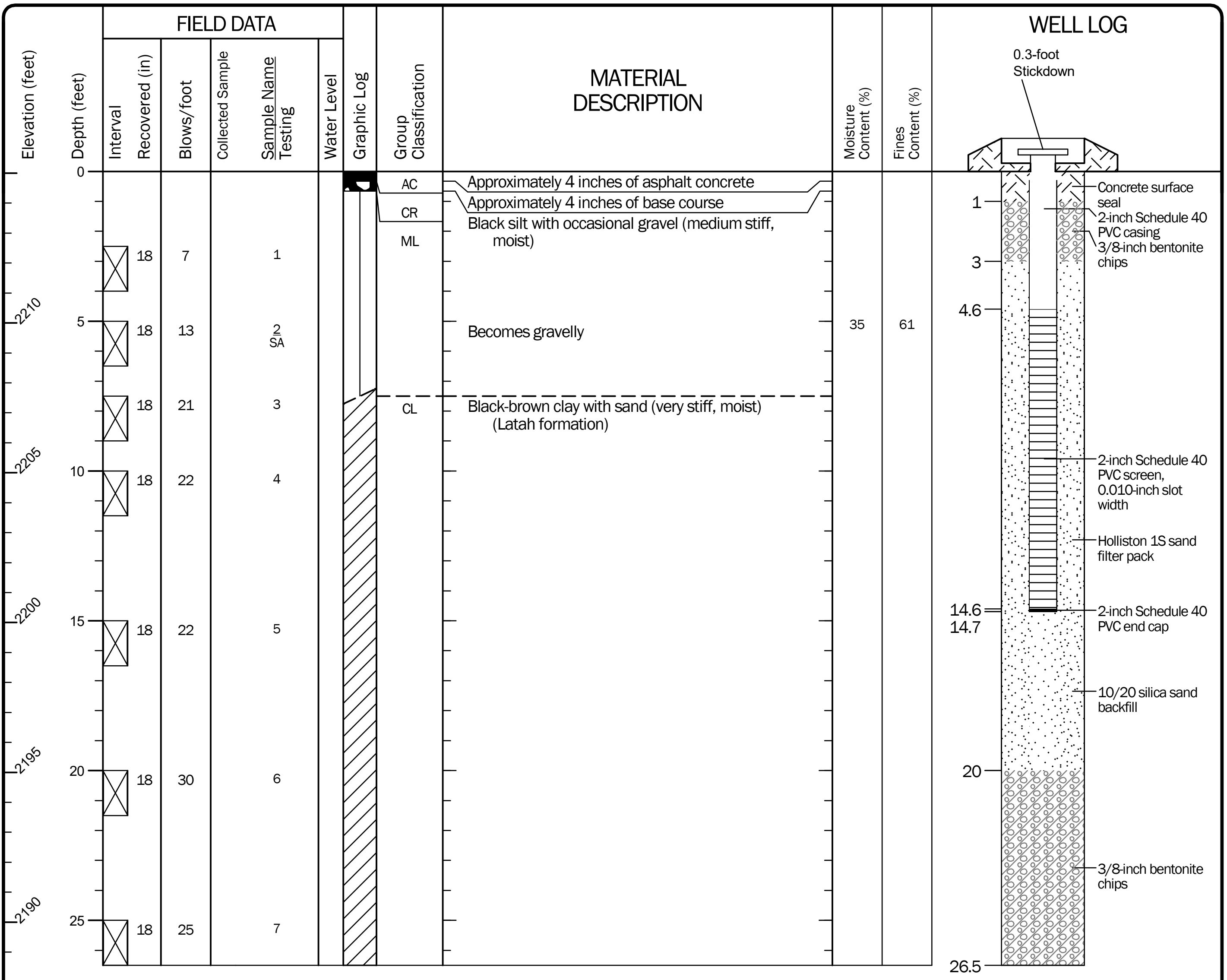
DOE Well I.D.: BPX 829

A 2-in well was installed on 10/18/2023 to a depth of 14.7 ft.

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Groundwater not measured at time of exploration



Recovered (in)	Blows/foot	Sample Name Testing	Moisture Content (%)	Fines Content (%)
18	7	1		
18	13	2 SA	35	61
18	21	3		
18	22	4		
18	22	5		
18	30	6		
18	25	7		

Group Classification	Material Description
AC	Approximately 4 inches of asphalt concrete
CR	Approximately 4 inches of base course
ML	Black silt with occasional gravel (medium stiff, moist)
	Becomes gravelly
CL	Black-brown clay with sand (very stiff, moist) (Latah formation)

Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Boring with Monitoring Well GE-B-4

GEOENGINEERS

Project: Ridgemont Estates Stormwater Improvements Project
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-5
Sheet 1 of 1

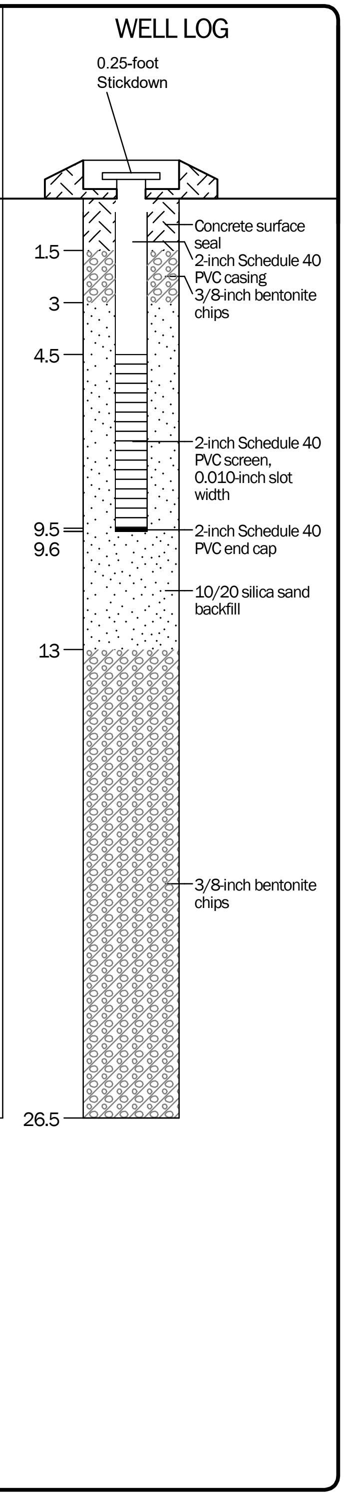
Drilled	Start 10/19/2023	End 10/19/2023	Total Depth (ft) 26.5	Logged By MMS Checked By JER	Driller GeoEngineers, Inc.
Drilling Method	Hollow-stem Auger				
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME 75		
Surface Elevation (ft) Vertical Datum	2213.93 NAVD88	Top of Casing Elevation (ft)	2213.68		
Latitude Longitude	47.6371 -117.18417	Horizontal Datum	Decimal Degrees WGS84 (feet)		

DOE Well I.D.: BPX 830
A 2-in well was installed on 10/19/2023 to a depth of 9.6 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Groundwater not measured at time of exploration

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0							AC	Approximately 3 inches of asphalt concrete		
								CR	Approximately 4 inches of base coarse		
2210		☒	5	13		1 SA		SM	Brown silty fine to coarse sand with occasional gravel (medium dense, moist) (glaciofluvial)	7	21
	5	☒	10	13		2		CL	Brown sandy clay with gravel (stiff, moist)		
2205		☒	18	14		3		CL	Brown clay with sand and occasional gravel (stiff, moist)		
	10	☒	18	12		4					
2200											
	15	☒	2 16	22		5A 5B		CL	Tan-white clay (very stiff, moist) (mottled) (Latah formation)		
2195											
	20	☒	18	25		6					
2190								CL	Gray-orange sandy clay (stiff, moist) (mottled) (Latah formation)		
	25	☒	18	14		7					



Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Boring with Monitoring Well GE-B-5

GEOENGINEERS

Project: Ridgemont Estates Stormwater Improvements Project
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-6
Sheet 1 of 1

Date Excavated 3/18/2024	Total Depth (ft) 2	Logged By AN Checked By JER	Excavator SES, Inc. Equipment CAT 313F	Groundwater not observed Caving not observed

Surface Elevation (ft) Vertical Datum	2021 NAVD88	Latitude Longitude	47.6406 -117.186	Coordinate System Horizontal Datum	Decimal Degrees WGS84 (feet)

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					TS	Approximately 12 inches of dark brown silt with organic matter (roots) (soft, moist) (topsoil)			
2020	1				ML	Light tan silt with sand (hard, moist)			PP = 4.0 tons/ft^2
2019	2		1		GM	Brown silty fine to medium gravel with sand (medium dense, moist) (glaciofluvial)			

Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Test Pit GE-TP-1

GeoEngineers

Project: Ridgemont Estates
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-7
Sheet 1 of 1

Date:6/28/24 Path:P:\11\11264044\GINT\1126404400.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Date Excavated	3/18/2024	Total Depth (ft)	12	Logged By	AN
				Checked By	JER
Excavator	SES, Inc.	Equipment	CAT 313F	Groundwater not observed	See "Remarks" section for caving observed
Surface Elevation (ft)	2022	Latitude	47.6405	Coordinate System	Decimal Degrees
Vertical Datum	NAVD88	Longitude	-117.186	Horizontal Datum	WGS84 (feet)

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	 Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
2022	0	▯ (0–1)	1		TS	Approximately 12 inches of dark brown silt with sand and organic matter (roots) (soft, moist) (topsoil)			
2021	1				ML	Tan silt with trace sand (medium dense, moist)			
2020	2	▯ (2–3)	2 SA				58	90	
2019	3								
2018	4	▯ (3.5–4)	3		GM	Brown silty fine to medium gravel with sand (medium dense, moist) (glaciofluvial)			
2017	5								
2016	6				GP	Brown fine to coarse gravel with sand, trace silt and occasional cobbles (medium dense, moist) (glaciofluvial)			Minor caving observed from 6 to 12 feet
2015	7	▯ (7–8)	4 SA				4	4	
2014	8								
2013	9								
2012	10								
2011	11	▯ (11–12)	5						
2010	12								

Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Test Pit GE-TP-2

GEOENGINEERS

Project: Ridgemont Estates
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Date Excavated 3/18/2024	Total Depth (ft) 11.5	Logged By AN Checked By JER	Excavator SES, Inc. Equipment CAT 313F	Groundwater not observed Caving not observed

Surface Elevation (ft) 2020 Vertical Datum NAVD88	Latitude 47.6412 Longitude -117.1851	Coordinate System Decimal Degrees Horizontal Datum WGS84 (feet)

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					TS	Approximately 8 inches of dark brown silt with sand and organic matter (roots) (soft, moist) (topsoil)			
2019	1				ML	Tan silt with trace sand (very stiff, moist) (glaciolacustrine)			
			1 SA				47	97	PP = 2.0 tons/ft^2
2018	2								
2017	3		2		ML	Grayish brown silt with fine sand (medium dense, moist) (glaciolacustrine)			
2016	4		3		ML	Tan silt with sand (hard, moist) (glaciolacustrine)			PP = 2.5 tons/ft^2
2015	5								
2014	6								
2013	7		4		ML	Brown silt (soft, moist) (glaciolacustrine)			
2012	8								
2011	9								
2010	10		5 SA		GM	Brown silty fine to coarse gravel with sand (medium dense, moist) (glaciofluvial)	4	18	
2009	11								

Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Test Pit GE-TP-3

GEOENGINEERS

Project: Ridgemont Estates
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-9
Sheet 1 of 1

Date Excavated 3/18/2024	Total Depth (ft) 12	Logged By AN Checked By JER	Excavator SES, Inc. Equipment CAT 313F	Groundwater not observed Caving not observed

Surface Elevation (ft) 2020 Vertical Datum NAVD88	Latitude 47.6416 Longitude -117.1844	Coordinate System Decimal Degrees Horizontal Datum WGS84 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE Testing Sample	SAMPLE Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					TS	Approximately 9 inches of dark brown silt with organic matter (roots) (soft, moist) (topsoil)			
2019	1		1		ML	Tan silt with trace organic matter (roots) (hard, moist) (glaciolacustrine)			PP = 5+ tons/ft^2
2018	2								
2017	3				ML	Grayish brown silt with fine sand (medium dense, moist) (glaciolacustrine)			
2016	4		2 SA				67	82	
2015	5		3		ML	Tan silt with fine sand (hard, moist) (glaciolacustrine)			PP = 5+ tons/ft^2
2014	6								
2013	7								
2012	8								
2011	9		4		ML	Dark brown silt (hard, moist) (glaciolacustrine)			PP = 5+ tons/ft^2
2010	10								
2009	11								
2008	12		5						

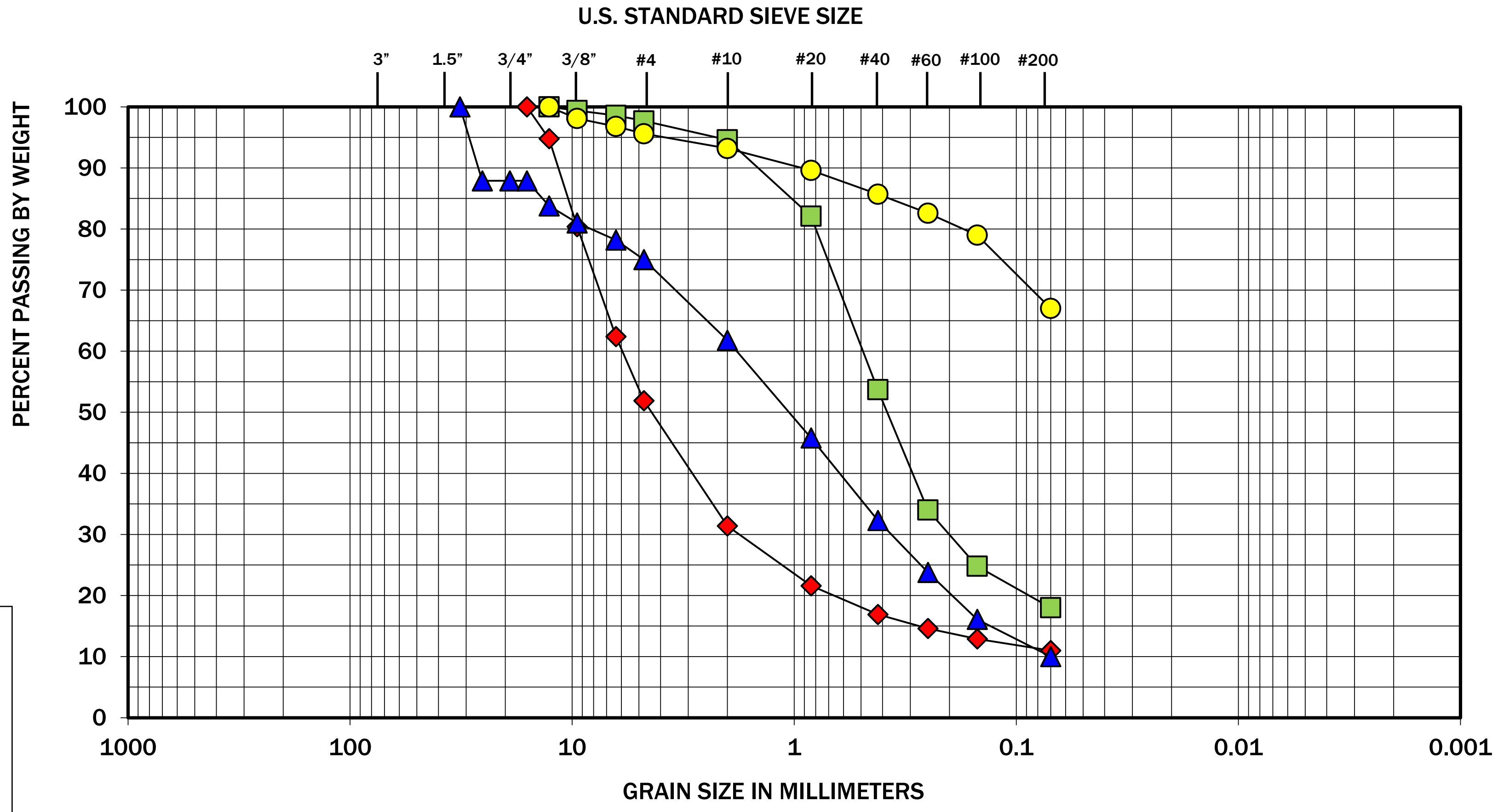
Note: See Figure C-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on GPS (Rec). Vertical approximated based on GPS (Rec).

Log of Test Pit GE-TP-4

GEOENGINEERS

Project: Ridgemont Estates
Project Location: Spokane Valley, Washington
Project Number: 11264-044-00

Figure C-10
Sheet 1 of 1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	B-2	Base Course	3	Fine gravel with silt and sand
■	B-2	5 – 6.5	7	Silty fine to coarse sand
▲	B-2	10 – 11.5	12	Fine to coarse sand with silt and gravel
●	B-3	5 – 6.5	47	Silt with sand

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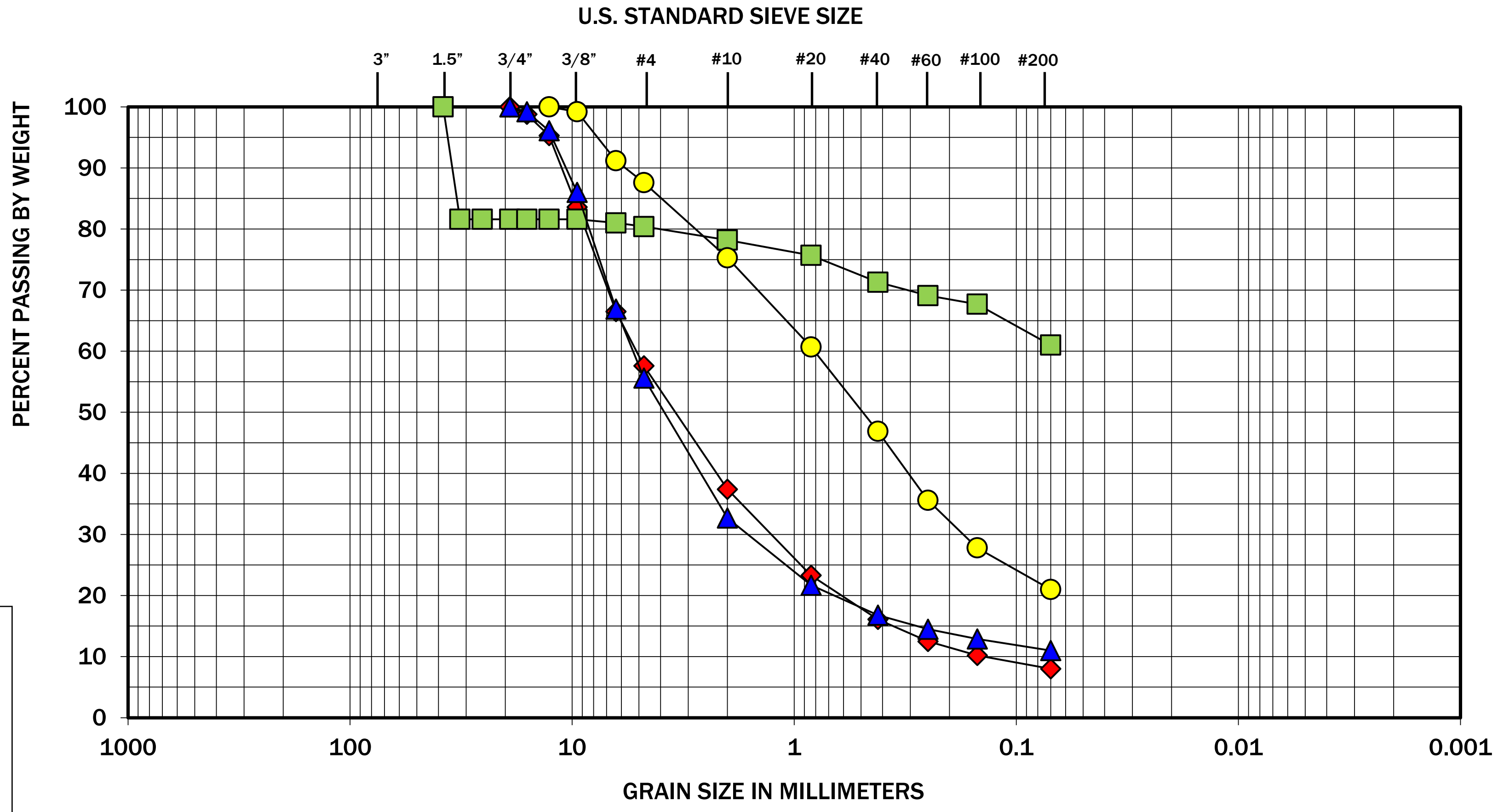
The grain size analysis results were obtained in general accordance with ASTM D 6913.

Sieve Analysis Results

Northwest Stormwater Basin Planning
Spokane, Washington

Figure C-11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
♦	B-4	Base Course	2	Well-graded sand with silt and gravel
🟩	B-4	5 – 6.5	35	Gravelly silt
▲	B-5	Base Course	3	Sand with silt and gavel
○	B-5	2.5 – 4	7	Silty fine to coarse sand

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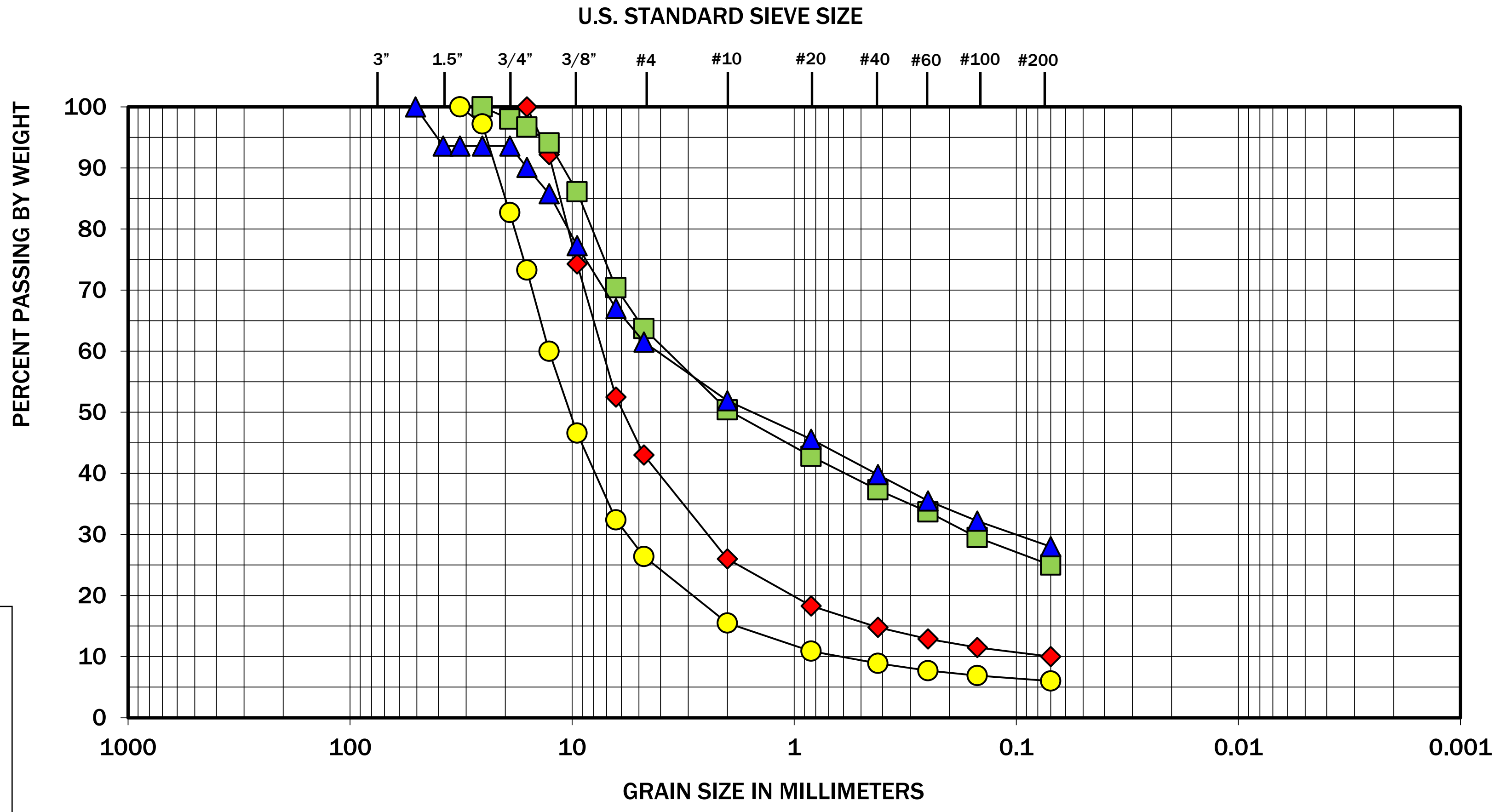
The grain size analysis results were obtained in general accordance with ASTM D 6913.

GEOENGINEERS

Northwest Stormwater Basin Planning
Spokane, Washington

Sieve Analysis Results

Figure C-12



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	C-1	Base Course	4	Gravel with silt and sand
■	C-1	Subgrade	9	Silty sand with gravel
▲	C-3	Subgrade	8	Silty gravel with sand
●	C-4	Base Course	2	Gravel with silt and sand

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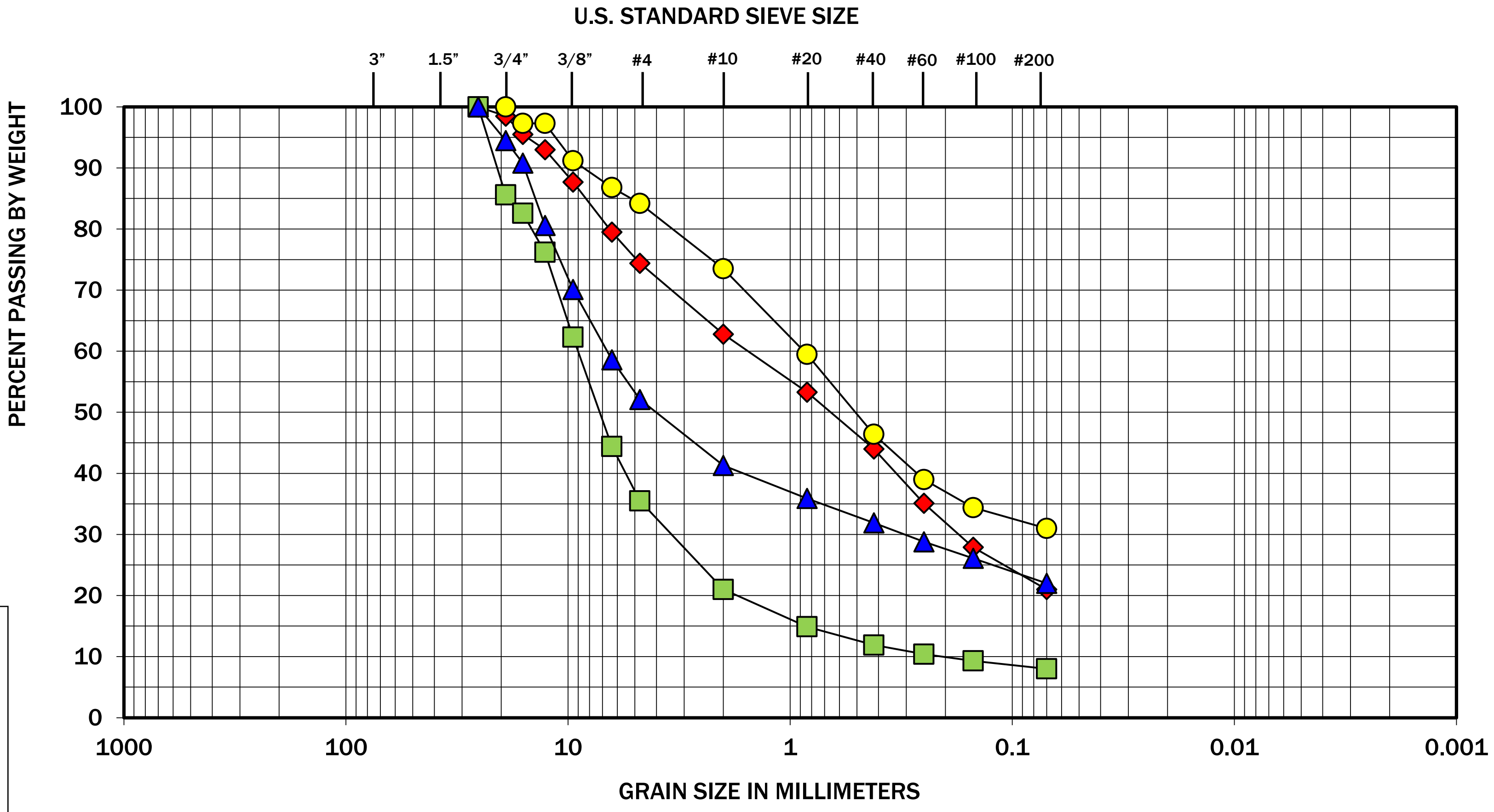
The grain size analysis results were obtained in general accordance with ASTM D 6913.

Sieve Analysis Results

Northwest Stormwater Basin Planning
Spokane, Washington

GEOENGINEERS

Figure C-13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	C-4	Subgrade	6	Silty sand with gravel
■	C-8	Base Course	4	Silty gravel with sand
▲	C-8	Subgrade	6	Silty gravel with sand
●	C-9	Subgrade	9	Silty sand with gravel

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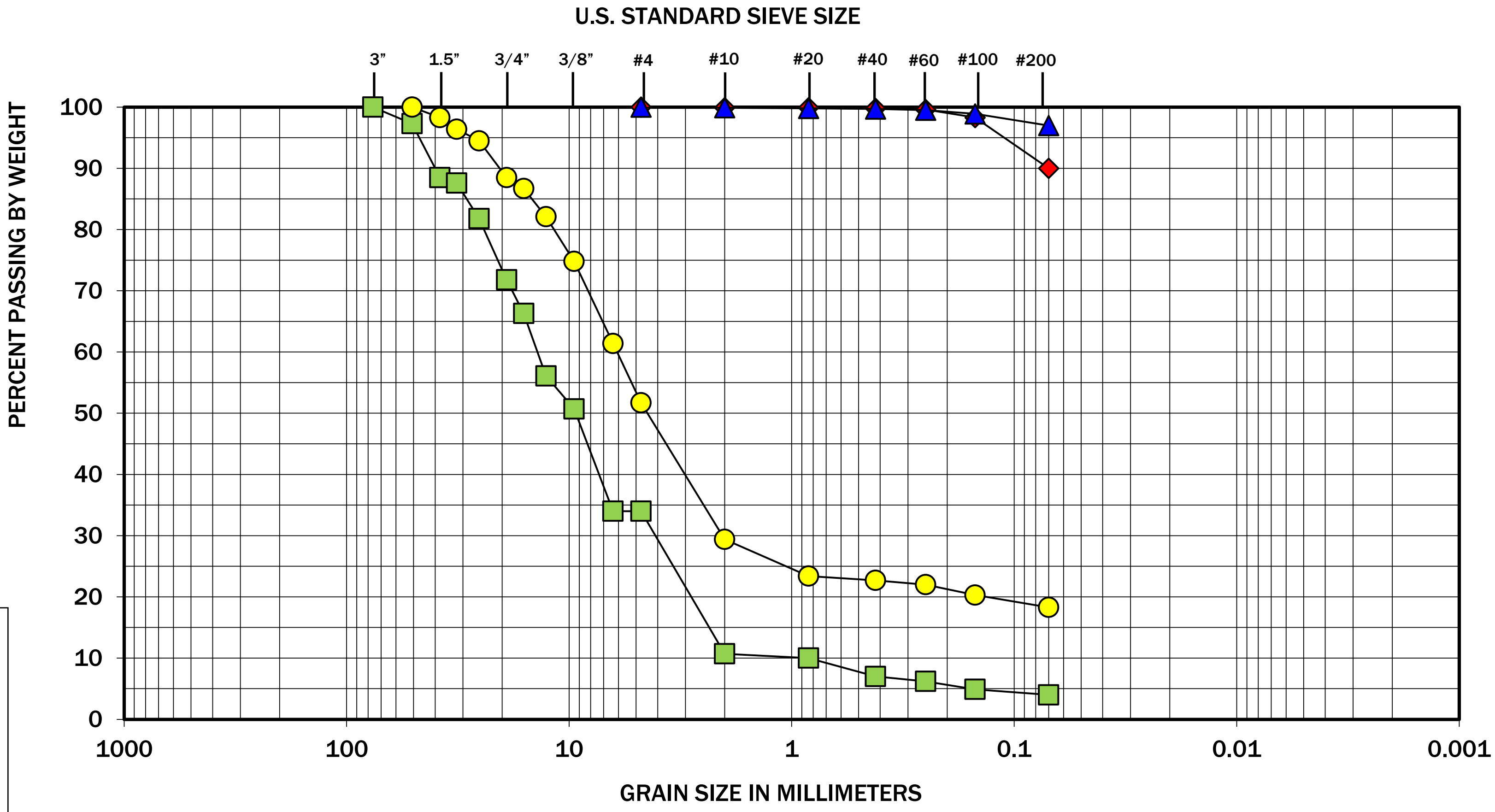
The grain size analysis results were obtained in general accordance with ASTM D 6913.

Sieve Analysis Results

Northwest Stormwater Basin Planning
Spokane, Washington

Figure C-14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Test Pit Number	Depth (feet)	Moisture (%)	Soil Description
◆	TP-2	2 – 3	58	Silt with trace sand
🟩	TP-2	7 – 8	4	Fine to coarse gravel with sand and trace silt
▲	TP-3	1.5 – 2	47	Silt with trace sand
🟡	TP-3	10 – 11	4	Silty fine to coarse gravel with sand

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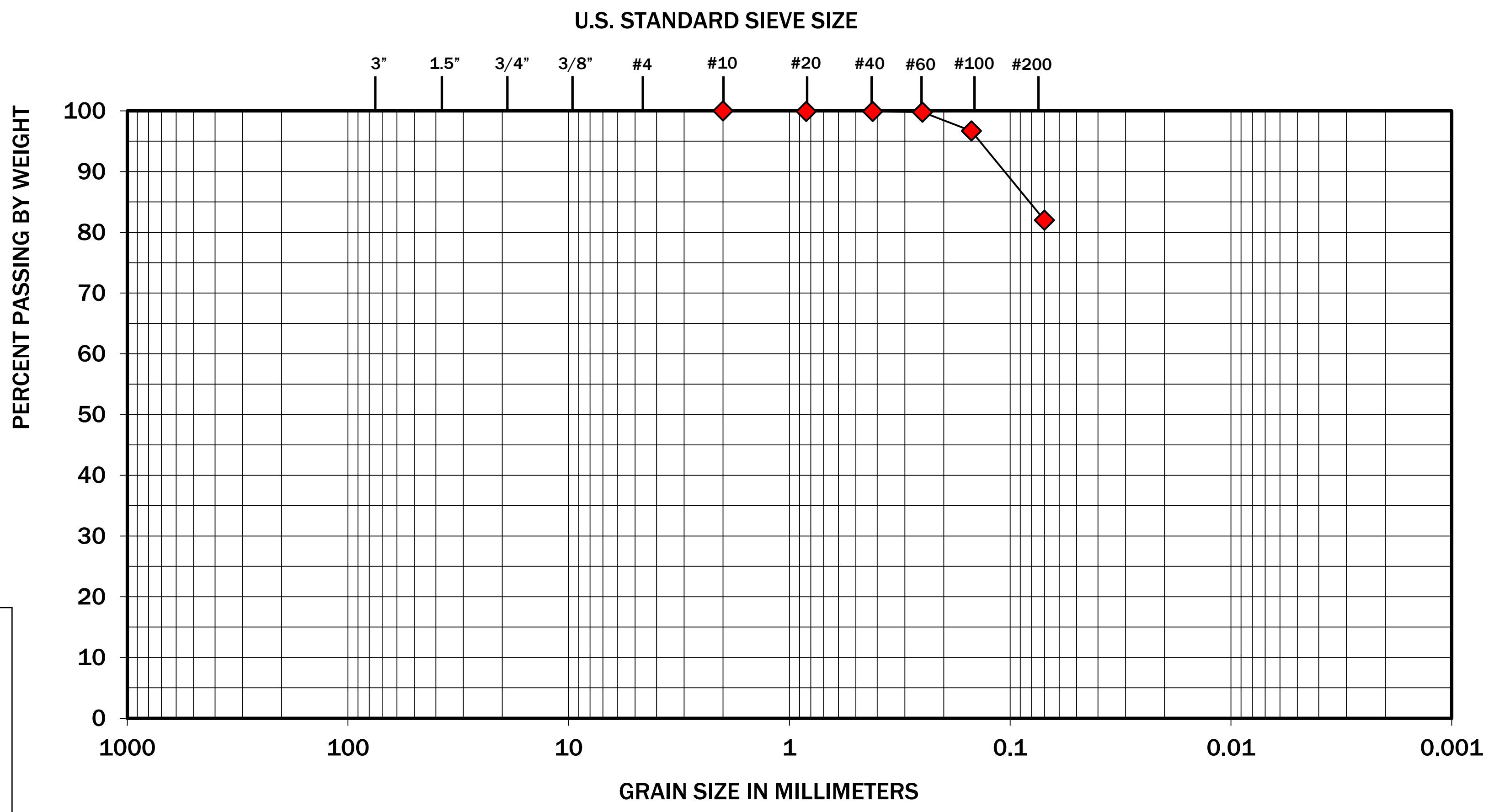
The grain size analysis results were obtained in general accordance with ASTM D 6913.

GEOENGINEERS

Sieve Analysis Results

Northwest Stormwater Basin Planning
Spokane, Washington

Figure C-15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Test Pit Number	Depth (feet)	Moisture (%)	Soil Description
◆	TP-4	3½ - 4	67	Silt with fine sand
■				
▲				
●				

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The grain size analysis results were obtained in general accordance with ASTM D 6913.

GEOENGINEERS

Northwest Stormwater Basin Planning
Spokane, Washington

Sieve Analysis Results

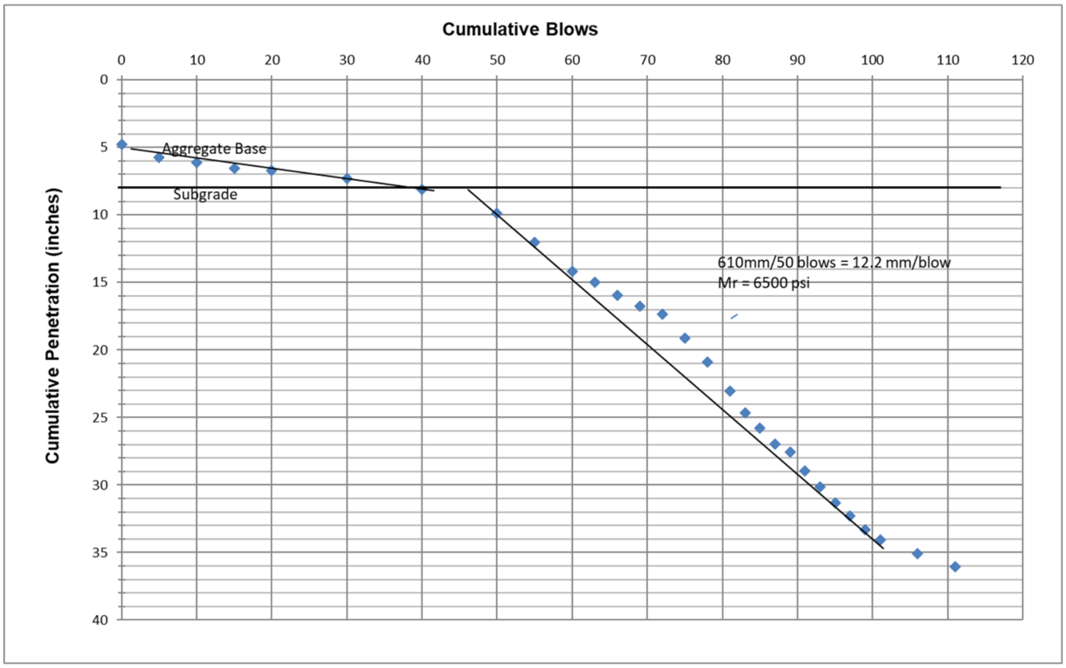
Figure C-16

Appendix D

Dynamic Cone Penetration Test Log

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-1
Start Depth Below Top of Pavement: 4.75
Test Method: Dynamic Cone Penetration
Tester's Name: Olivia Kelly
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	4.8	-	121	4.8	-	-	1	-	-	-
2	5	5	5.7	25.0	146	5.7	1.0	0.2	1	0.20	5.00	48
3	5	10	6.1	10.0	156	6.1	0.4	0.1	1	0.08	2.00	134
4	5	15	6.5	10.0	166	6.5	0.4	0.1	1	0.08	2.00	134
5	5	20	6.7	5.0	171	6.7	0.2	0.0	1	0.04	1.00	292
6	10	30	7.3	15.0	186	7.3	0.6	0.1	1	0.06	1.50	185
7	10	40	8.1	20.0	206	8.1	0.8	0.1	1	0.08	2.00	134
8	10	50	9.9	45.0	251	9.9	1.8	0.2	1	0.18	4.50	54
9	5	55	12.0	55.0	306	12.0	2.2	0.4	1	0.43	11.00	20
10	5	60	14.2	55.0	361	14.2	2.2	0.4	1	0.43	11.00	20
11	3	63	15.0	20.0	381	15.0	0.8	0.3	1	0.26	6.67	35
12	3	66	16.0	25.0	406	16.0	1.0	0.3	1	0.33	8.33	27
13	3	69	16.8	20.0	426	16.8	0.8	0.3	1	0.26	6.67	35
14	3	72	17.3	15.0	441	17.3	0.6	0.2	1	0.20	5.00	48
15	3	75	19.1	45.0	486	19.1	1.8	0.6	1	0.59	15.00	14
16	3	78	20.9	45.0	531	20.9	1.8	0.6	1	0.59	15.00	14
17	3	81	23.1	55.0	586	23.1	2.2	0.7	1	0.72	18.33	11
18	2	83	24.6	40.0	626	24.6	1.6	0.8	1	0.79	20.00	10
19	2	85	25.8	30.0	656	25.8	1.2	0.6	1	0.59	15.00	14
20	2	87	27.0	30.0	686	27.0	1.2	0.6	1	0.59	15.00	14
21	2	89	27.6	15.0	701	27.6	0.6	0.3	1	0.30	7.50	31
22	2	91	29.0	35.0	736	29.0	1.4	0.7	1	0.69	17.50	12
23	2	93	30.1	30.0	766	30.1	1.2	0.6	1	0.59	15.00	14
24	2	95	31.3	30.0	796	31.3	1.2	0.6	1	0.59	15.00	14
25	2	97	32.3	25.0	821	32.3	1.0	0.5	1	0.49	12.50	17
26	2	99	33.3	25.0	846	33.3	1.0	0.5	1	0.49	12.50	17
27	2	101	34.1	20.0	866	34.1	0.8	0.4	1	0.39	10.00	22
28	5	106	35.1	25.0	891	35.1	1.0	0.2	1	0.20	5.00	48
29	5	111	36.0	25.0	916	36.0	1.0	0.2	1	0.20	5.00	48



DCP-1

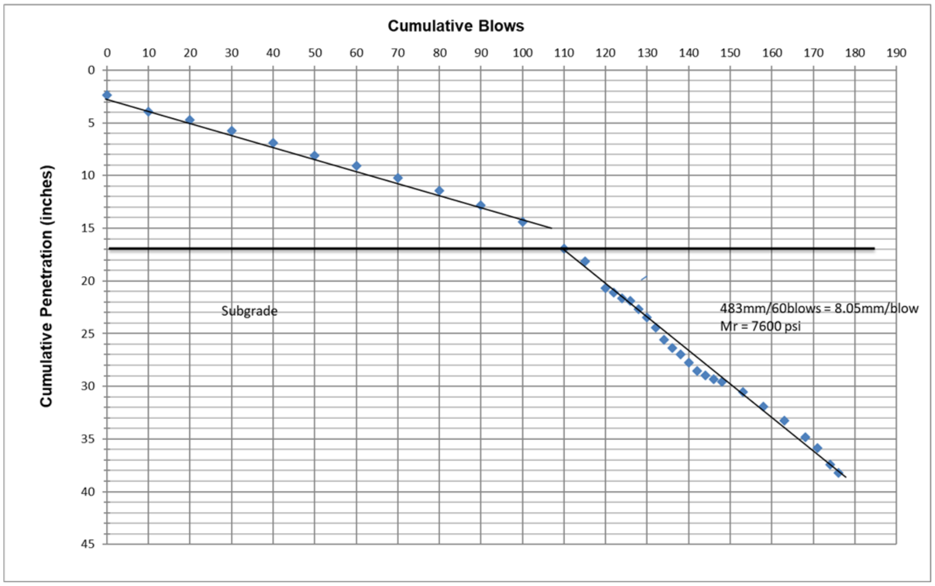
Ridgemont Estates
Spokane Valley, Washington

GEOENGINEERS

Figure D-1

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-2
Start Depth Below Top of Pavement: 2.375
Test Method: Dynamic Cone Penetration
Tester's Name: Olivia Kelly
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	2.4	-	60	2.4	-	-	1	-	-	-
2	10	10	3.9	40.0	100	3.9	1.6	0.2	1	0.16	4.00	62
3	10	20	4.7	20.0	120	4.7	0.8	0.1	1	0.08	2.00	134
4	10	30	5.7	25.0	145	5.7	1.0	0.1	1	0.10	2.50	105
5	10	40	6.9	30.0	175	6.9	1.2	0.1	1	0.12	3.00	85
6	10	50	8.1	30.0	205	8.1	1.2	0.1	1	0.12	3.00	85
7	10	60	9.1	25.0	230	9.1	1.0	0.1	1	0.10	2.50	105
8	10	70	10.2	30.0	260	10.2	1.2	0.1	1	0.12	3.00	85
9	10	80	11.4	30.0	290	11.4	1.2	0.1	1	0.12	3.00	85
10	10	90	12.8	35.0	325	12.8	1.4	0.1	1	0.14	3.50	72
11	10	100	14.4	40.0	365	14.4	1.6	0.2	1	0.16	4.00	62
12	10	110	16.9	65.0	430	16.9	2.6	0.3	1	0.26	6.50	36
13	5	115	18.1	30.0	460	18.1	1.2	0.2	1	0.24	6.00	39
14	5	120	20.7	65.0	525	20.7	2.6	0.5	1	0.51	13.00	17
15	2	122	21.1	10.0	535	21.1	0.4	0.2	1	0.20	5.00	48
16	2	124	21.7	15.0	550	21.7	0.6	0.3	1	0.30	7.50	31
17	2	126	21.9	5.0	555	21.9	0.2	0.1	1	0.10	2.50	105
18	2	128	22.7	20.0	575	22.7	0.8	0.4	1	0.39	10.00	22
19	2	130	23.4	20.0	595	23.4	0.8	0.4	1	0.39	10.00	22
20	2	132	24.4	25.0	620	24.4	1.0	0.5	1	0.49	12.50	17
21	2	134	25.6	30.0	650	25.6	1.2	0.6	1	0.59	15.00	14
22	2	136	26.4	20.0	670	26.4	0.8	0.4	1	0.39	10.00	22
23	2	138	27.0	15.0	685	27.0	0.6	0.3	1	0.30	7.50	31
24	2	140	27.8	20.0	705	27.8	0.8	0.4	1	0.39	10.00	22
25	2	142	28.6	20.0	725	28.6	0.8	0.4	1	0.39	10.00	22
26	2	144	28.9	10.0	735	28.9	0.4	0.2	1	0.20	5.00	48
27	2	146	29.3	10.0	745	29.3	0.4	0.2	1	0.20	5.00	48
28	2	148	29.5	5.0	750	29.5	0.2	0.1	1	0.10	2.50	105
29	5	153	30.5	25.0	775	30.5	1.0	0.2	1	0.20	5.00	48
30	5	158	31.9	35.0	810	31.9	1.4	0.3	1	0.28	7.00	33
31	5	163	33.3	35.0	845	33.3	1.4	0.3	1	0.28	7.00	33
32	5	168	34.9	40.0	885	34.9	1.6	0.3	1	0.31	8.00	28
33	3	171	35.8	25.0	910	35.8	1.0	0.3	1	0.33	8.33	27
34	3	174	37.4	40.0	950	37.4	1.6	0.5	1	0.52	13.33	16
35	2	176	38.2	20.0	970	38.2	0.8	0.4	1	0.39	10.00	22



DCP-2

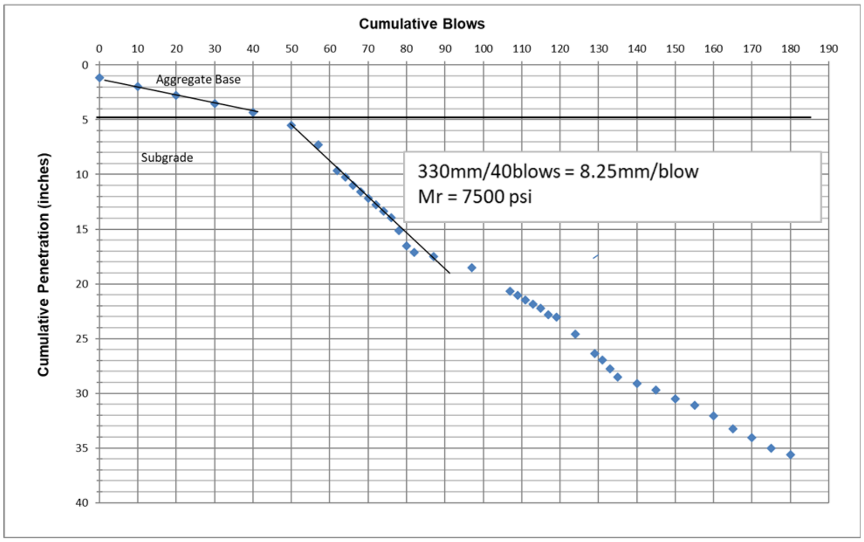
Ridgemont Estates
Spokane Valley, Washington

GeoEngineers

Figure D-2

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-3
Start Depth Below Top of Pavement: 1.175
Test Method: Dynamic Cone Penetration
Tester's Name: Olivia Kelly
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	1.2	-	30	1.2	-	-	1	-	-	-
2	10	10	2.0	20.0	50	2.0	0.8	0.1	1	0.08	2.00	134
3	10	20	2.7	20.0	70	2.7	0.8	0.1	1	0.08	2.00	134
4	10	30	3.5	20.0	90	3.5	0.8	0.1	1	0.08	2.00	134
5	10	40	4.3	20.0	110	4.3	0.8	0.1	1	0.08	2.00	134
6	10	50	5.5	30.0	140	5.5	1.2	0.1	1	0.12	3.00	85
7	7	57	7.3	45.0	185	7.3	1.8	0.3	1	0.25	6.43	36
8	5	62	9.6	60.0	245	9.6	2.4	0.5	1	0.47	12.00	18
9	2	64	10.2	15.0	260	10.2	0.6	0.3	1	0.30	7.50	31
10	2	66	11.0	20.0	280	11.0	0.8	0.4	1	0.39	10.00	22
11	2	68	11.6	15.0	295	11.6	0.6	0.3	1	0.30	7.50	31
12	2	70	12.2	15.0	310	12.2	0.6	0.3	1	0.30	7.50	31
13	2	72	12.8	15.0	325	12.8	0.6	0.3	1	0.30	7.50	31
14	2	74	13.4	15.0	340	13.4	0.6	0.3	1	0.30	7.50	31
15	2	76	14.0	15.0	355	14.0	0.6	0.3	1	0.30	7.50	31
16	2	78	15.2	30.0	385	15.2	1.2	0.6	1	0.59	15.00	14
17	2	80	16.5	35.0	420	16.5	1.4	0.7	1	0.69	17.50	12
18	2	82	17.1	15.0	435	17.1	0.6	0.3	1	0.30	7.50	31
19	5	87	17.5	10.0	445	17.5	0.4	0.1	1	0.08	2.00	134
20	10	97	18.5	25.0	470	18.5	1.0	0.1	1	0.10	2.50	105
21	10	107	20.7	55.0	525	20.7	2.2	0.2	1	0.22	5.50	43
22	2	109	21.1	10.0	535	21.1	0.4	0.2	1	0.20	5.00	48
23	2	111	21.5	10.0	545	21.5	0.4	0.2	1	0.20	5.00	48
24	2	113	21.8	10.0	555	21.8	0.4	0.2	1	0.20	5.00	48
25	2	115	22.2	10.0	565	22.2	0.4	0.2	1	0.20	5.00	48
26	2	117	22.8	15.0	580	22.8	0.6	0.3	1	0.30	7.50	31
27	2	119	23.0	5.0	585	23.0	0.2	0.1	1	0.10	2.50	105
28	5	124	24.6	40.0	625	24.6	1.6	0.3	1	0.31	8.00	28
29	5	129	26.4	45.0	670	26.4	1.8	0.4	1	0.35	9.00	25
30	2	131	27.0	15.0	685	27.0	0.6	0.3	1	0.30	7.50	31
31	2	133	27.7	20.0	705	27.7	0.8	0.4	1	0.39	10.00	22
32	2	135	28.5	20.0	725	28.5	0.8	0.4	1	0.39	10.00	22
33	5	140	29.1	15.0	740	29.1	0.6	0.1	1	0.12	3.00	85
34	5	145	29.7	15.0	755	29.7	0.6	0.1	1	0.12	3.00	85
35	5	150	30.5	20.0	775	30.5	0.8	0.2	1	0.16	4.00	62
36	5	155	31.1	15.0	790	31.1	0.6	0.1	1	0.12	3.00	85
37	5	160	32.1	25.0	815	32.1	1.0	0.2	1	0.20	5.00	48
38	5	165	33.3	30.0	845	33.3	1.2	0.2	1	0.24	6.00	39
39	5	170	34.0	20.0	865	34.0	0.8	0.2	1	0.16	4.00	62
40	5	175	35.0	25.0	890	35.0	1.0	0.2	1	0.20	5.00	48
41	5	180	35.6	15.0	905	35.6	0.6	0.1	1	0.12	3.00	85



330mm/40blows = 8.25mm/blow
Mr = 7500 psi

DCP-3

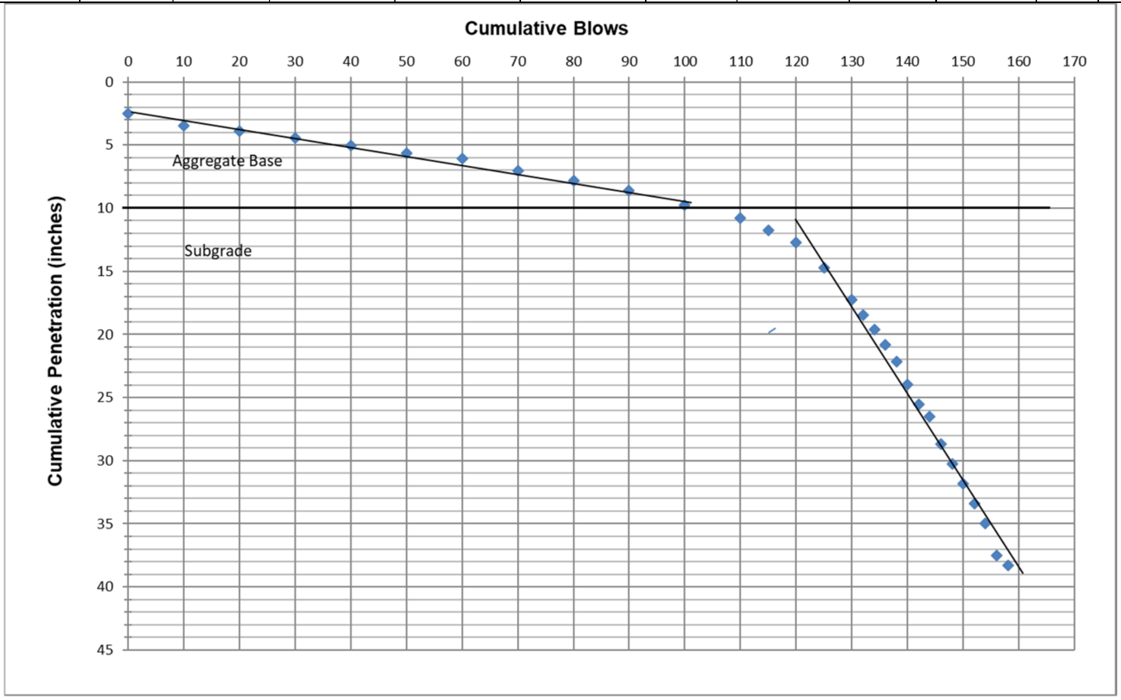
Ridgemont Estates
Spokane Valley, Washington

Figure D-3

XXXXX-XXX-XX Date Exported: 04/09/15

Location:	Spokane Valley, WA	Date: 10/18/2023	Test Hole Number:	C-4
Start Depth Below Top of Pavement:	2.5		Test Method:	Dynamic Cone Penetration
Tester's Name:	Olivia Kelly		GeoEngineers Job:	11264-044-00
Tester's Company:	GeoEngineers, Inc.			

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	2.5	-	64	2.5	-	-	1	-	-	-
2	10	10	3.5	25.0	89	3.5	1.0	0.1	1	0.10	2.50	105
3	10	20	3.9	10.0	99	3.9	0.4	0.0	1	0.04	1.00	292
4	10	30	4.5	15.0	114	4.5	0.6	0.1	1	0.06	1.50	185
5	10	40	5.1	15.0	129	5.1	0.6	0.1	1	0.06	1.50	185
6	10	50	5.6	15.0	144	5.6	0.6	0.1	1	0.06	1.50	185
7	10	60	6.0	10.0	154	6.0	0.4	0.0	1	0.04	1.00	292
8	10	70	7.0	25.0	179	7.0	1.0	0.1	1	0.10	2.50	105
9	10	80	7.8	20.0	199	7.8	0.8	0.1	1	0.08	2.00	134
10	10	90	8.6	20.0	219	8.6	0.8	0.1	1	0.08	2.00	134
11	10	100	9.8	30.0	249	9.8	1.2	0.1	1	0.12	3.00	85
12	10	110	10.8	25.0	274	10.8	1.0	0.1	1	0.10	2.50	105
13	5	115	11.8	25.0	299	11.8	1.0	0.2	1	0.20	5.00	48
14	5	120	12.7	25.0	324	12.7	1.0	0.2	1	0.20	5.00	48
15	5	125	14.7	50.0	374	14.7	2.0	0.4	1	0.39	10.00	22
16	5	130	17.3	65.0	439	17.3	2.6	0.5	1	0.51	13.00	17
17	2	132	18.4	30.0	469	18.4	1.2	0.6	1	0.59	15.00	14
18	2	134	19.6	30.0	499	19.6	1.2	0.6	1	0.59	15.00	14
19	2	136	20.8	30.0	529	20.8	1.2	0.6	1	0.59	15.00	14
20	2	138	22.2	35.0	564	22.2	1.4	0.7	1	0.69	17.50	12
21	2	140	24.0	45.0	609	24.0	1.8	0.9	1	0.89	22.50	9
22	2	142	25.5	40.0	649	25.5	1.6	0.8	1	0.79	20.00	10
23	2	144	26.5	25.0	674	26.5	1.0	0.5	1	0.49	12.50	17
24	2	146	28.7	55.0	729	28.7	2.2	1.1	1	1.08	27.50	7
25	2	148	30.3	40.0	769	30.3	1.6	0.8	1	0.79	20.00	10
26	2	150	31.8	40.0	809	31.8	1.6	0.8	1	0.79	20.00	10
27	2	152	33.4	40.0	849	33.4	1.6	0.8	1	0.79	20.00	10
28	2	154	35.0	40.0	889	35.0	1.6	0.8	1	0.79	20.00	10
29	2	156	37.5	65.0	954	37.5	2.6	1.3	1	1.28	32.50	6
30	2	158	38.3	20.0	974	38.3	0.8	0.4	1	0.39	10.00	22



DCP-4

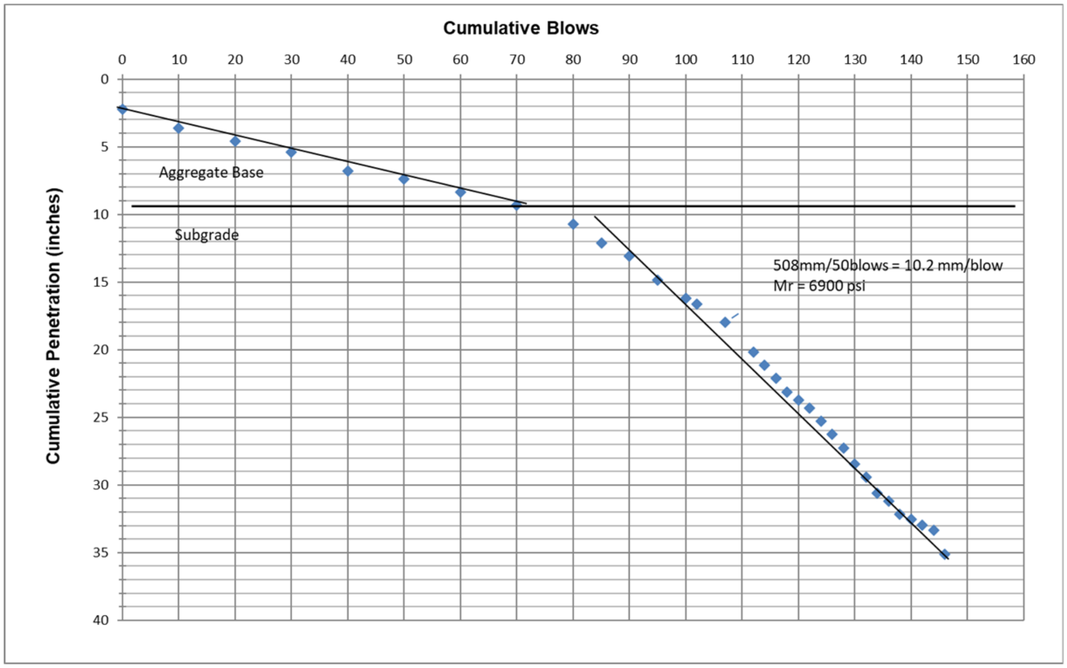
Ridgemont Estates
Spokane Valley, Washington

GeoEngineers

Figure D-4

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-5
Start Depth Below Top of Pavement: 2.25
Test Method: Dynamic Cone Penetration
Tester's Name: Olivia Kelly
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	2.3	-	57	2.3	-	-	1	-	-	-
2	10	10	3.6	35.0	92	3.6	1.4	0.1	1	0.14	3.50	72
3	10	20	4.6	25.0	117	4.6	1.0	0.1	1	0.10	2.50	105
4	10	30	5.4	20.0	137	5.4	0.8	0.1	1	0.08	2.00	134
5	10	40	6.8	35.0	172	6.8	1.4	0.1	1	0.14	3.50	72
6	10	50	7.4	15.0	187	7.4	0.6	0.1	1	0.06	1.50	185
7	10	60	8.4	25.0	212	8.4	1.0	0.1	1	0.10	2.50	105
8	10	70	9.3	25.0	237	9.3	1.0	0.1	1	0.10	2.50	105
9	10	80	10.7	35.0	272	10.7	1.4	0.1	1	0.14	3.50	72
10	5	85	12.1	35.0	307	12.1	1.4	0.3	1	0.28	7.00	33
11	5	90	13.1	25.0	332	13.1	1.0	0.2	1	0.20	5.00	48
12	5	95	14.8	45.0	377	14.8	1.8	0.4	1	0.35	9.00	25
13	5	100	16.2	35.0	412	16.2	1.4	0.3	1	0.28	7.00	33
14	2	102	16.6	10.0	422	16.6	0.4	0.2	1	0.20	5.00	48
15	5	107	18.0	35.0	457	18.0	1.4	0.3	1	0.28	7.00	33
16	5	112	20.2	55.0	512	20.2	2.2	0.4	1	0.43	11.00	20
17	2	114	21.1	25.0	537	21.1	1.0	0.5	1	0.49	12.50	17
18	2	116	22.1	25.0	562	22.1	1.0	0.5	1	0.49	12.50	17
19	2	118	23.1	25.0	587	23.1	1.0	0.5	1	0.49	12.50	17
20	2	120	23.7	15.0	602	23.7	0.6	0.3	1	0.30	7.50	31
21	2	122	24.3	15.0	617	24.3	0.6	0.3	1	0.30	7.50	31
22	2	124	25.3	25.0	642	25.3	1.0	0.5	1	0.49	12.50	17
23	2	126	26.3	25.0	667	26.3	1.0	0.5	1	0.49	12.50	17
24	2	128	27.3	25.0	692	27.3	1.0	0.5	1	0.49	12.50	17
25	2	130	28.4	30.0	722	28.4	1.2	0.6	1	0.59	15.00	14
26	2	132	29.4	25.0	747	29.4	1.0	0.5	1	0.49	12.50	17
27	2	134	30.6	30.0	777	30.6	1.2	0.6	1	0.59	15.00	14
28	2	136	31.2	15.0	792	31.2	0.6	0.3	1	0.30	7.50	31
29	2	138	32.2	25.0	817	32.2	1.0	0.5	1	0.49	12.50	17
30	2	140	32.6	10.0	827	32.6	0.4	0.2	1	0.20	5.00	48
31	2	142	33.0	10.0	837	33.0	0.4	0.2	1	0.20	5.00	48
32	2	144	33.4	10.0	847	33.4	0.4	0.2	1	0.20	5.00	48
33	2	146	35.1	45.0	892	35.1	1.8	0.9	1	0.89	22.50	9



DCP-5

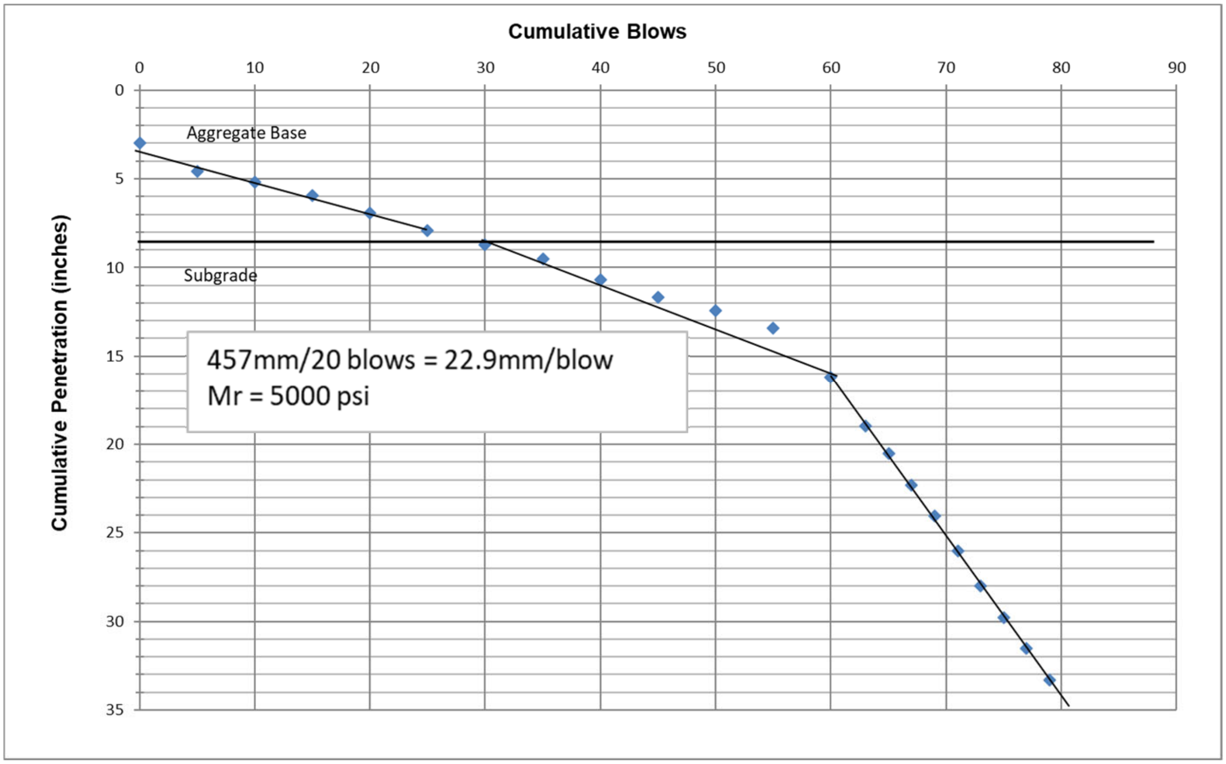
Ridgemont Estates
Spokane Valley, Washington

GEOENGINEERS

Figure D-5

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-6
Start Depth Below Top of Pavement: 3
Test Method: Dynamic Cone Penetration
Tester's Name: Olivia Kelly
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	3.0	-	76	3.0	-	-	1	-	-	-
2	5	5	4.6	40.0	116	4.6	1.6	0.3	1	0.31	8.00	28
3	5	10	5.2	15.0	131	5.2	0.6	0.1	1	0.12	3.00	85
4	5	15	6.0	20.0	151	6.0	0.8	0.2	1	0.16	4.00	62
5	5	20	6.9	25.0	176	6.9	1.0	0.2	1	0.20	5.00	48
6	5	25	7.9	25.0	201	7.9	1.0	0.2	1	0.20	5.00	48
7	5	30	8.7	20.0	221	8.7	0.8	0.2	1	0.16	4.00	62
8	5	35	9.5	20.0	241	9.5	0.8	0.2	1	0.16	4.00	62
9	5	40	10.7	30.0	271	10.7	1.2	0.2	1	0.24	6.00	39
10	5	45	11.7	25.0	296	11.7	1.0	0.2	1	0.20	5.00	48
11	5	50	12.4	20.0	316	12.4	0.8	0.2	1	0.16	4.00	62
12	5	55	13.4	25.0	341	13.4	1.0	0.2	1	0.20	5.00	48
13	5	60	16.2	70.0	411	16.2	2.8	0.6	1	0.55	14.00	15
14	3	63	18.9	70.0	481	18.9	2.8	0.9	1	0.92	23.33	9
15	2	65	20.5	40.0	521	20.5	1.6	0.8	1	0.79	20.00	10
16	2	67	22.3	45.0	566	22.3	1.8	0.9	1	0.89	22.50	9
17	2	69	24.1	45.0	611	24.1	1.8	0.9	1	0.89	22.50	9
18	2	71	26.0	50.0	661	26.0	2.0	1.0	1	0.98	25.00	8
19	2	73	28.0	50.0	711	28.0	2.0	1.0	1	0.98	25.00	8
20	2	75	29.8	45.0	756	29.8	1.8	0.9	1	0.89	22.50	9
21	2	77	31.5	45.0	801	31.5	1.8	0.9	1	0.89	22.50	9
22	2	79	33.3	45.0	846	33.3	1.8	0.9	1	0.89	22.50	9



457mm/20 blows = 22.9mm/blow
Mr = 5000 psi

DCP-6

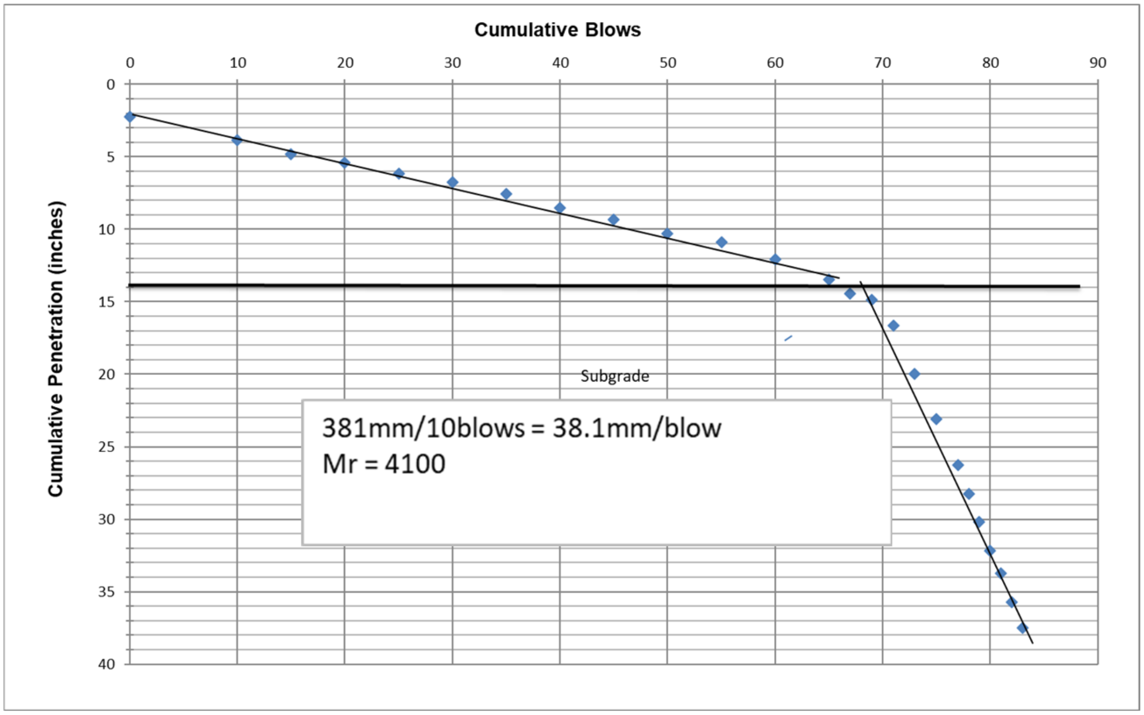
Ridgemont Estates
Spokane Valley, Washington

GeoEngineers

Figure D-6

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-7
Start Depth Below Top of Pavement: 2.25
Test Method: Dynamic Cone Penetration
Tester's Name: Olivia Kelly
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	2.3	-	57	2.3	-	-	1	-	-	-
2	10	10	3.8	40.0	97	3.8	1.6	0.2	1	0.16	4.00	62
3	5	15	4.8	25.0	122	4.8	1.0	0.2	1	0.20	5.00	48
4	5	20	5.4	15.0	137	5.4	0.6	0.1	1	0.12	3.00	85
5	5	25	6.2	20.0	157	6.2	0.8	0.2	1	0.16	4.00	62
6	5	30	6.8	15.0	172	6.8	0.6	0.1	1	0.12	3.00	85
7	5	35	7.6	20.0	192	7.6	0.8	0.2	1	0.16	4.00	62
8	5	40	8.5	25.0	217	8.5	1.0	0.2	1	0.20	5.00	48
9	5	45	9.3	20.0	237	9.3	0.8	0.2	1	0.16	4.00	62
10	5	50	10.3	25.0	262	10.3	1.0	0.2	1	0.20	5.00	48
11	5	55	10.9	15.0	277	10.9	0.6	0.1	1	0.12	3.00	85
12	5	60	12.1	30.0	307	12.1	1.2	0.2	1	0.24	6.00	39
13	5	65	13.5	35.0	342	13.5	1.4	0.3	1	0.28	7.00	33
14	2	67	14.4	24.0	366	14.4	0.9	0.5	1	0.47	12.00	18
15	2	69	14.8	11.0	377	14.8	0.4	0.2	1	0.22	5.50	43
16	2	71	16.6	45.0	422	16.6	1.8	0.9	1	0.89	22.50	9
17	2	73	20.0	85.0	507	20.0	3.3	1.7	1	1.67	42.50	4
18	2	75	23.1	80.0	587	23.1	3.1	1.6	1	1.57	40.00	5
19	2	77	26.3	80.0	667	26.3	3.1	1.6	1	1.57	40.00	5
20	1	78	28.2	50.0	717	28.2	2.0	2.0	1	1.97	50.00	4
21	1	79	30.2	50.0	767	30.2	2.0	2.0	1	1.97	50.00	4
22	1	80	32.2	50.0	817	32.2	2.0	2.0	1	1.97	50.00	4
23	1	81	33.7	40.0	857	33.7	1.6	1.6	1	1.57	40.00	5
24	1	82	35.7	50.0	907	35.7	2.0	2.0	1	1.97	50.00	4
25	1	83	37.5	45.0	952	37.5	1.8	1.8	1	1.77	45.00	4



DCP-7

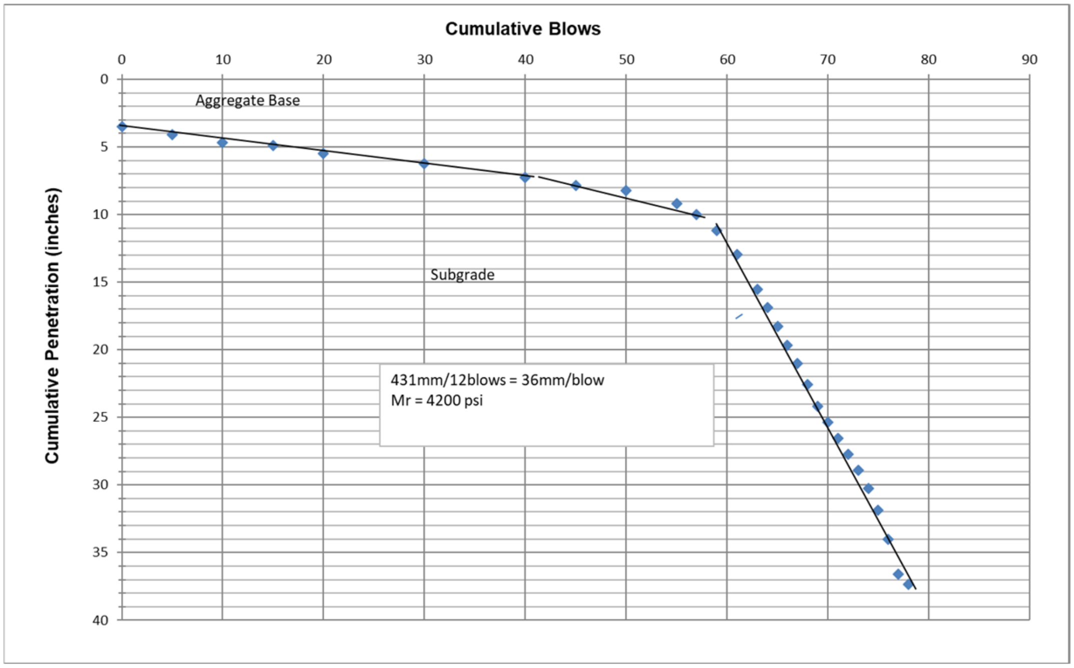
Ridgemont Estates
Spokane Valley, Washington

GeoEngineers

Figure D-7

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-8
Start Depth Below
Test Method: Dynamic Cone Penetration
Top of Pavement: 3.5
Tester's Name: Olivia Kelly
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	3.5	-	89	3.5	-	-	1	-	-	-
2	5	5	4.1	15.0	104	4.1	0.6	0.1	1	0.12	3.00	85
3	5	10	4.7	15.0	119	4.7	0.6	0.1	1	0.12	3.00	85
4	5	15	4.9	5.0	124	4.9	0.2	0.0	1	0.04	1.00	292
5	5	20	5.5	15.0	139	5.5	0.6	0.1	1	0.12	3.00	85
6	10	30	6.3	20.0	159	6.3	0.8	0.1	1	0.08	2.00	134
7	10	40	7.2	25.0	184	7.2	1.0	0.1	1	0.10	2.50	105
8	5	45	7.8	15.0	199	7.8	0.6	0.1	1	0.12	3.00	85
9	5	50	8.2	10.0	209	8.2	0.4	0.1	1	0.08	2.00	134
10	5	55	9.2	25.0	234	9.2	1.0	0.2	1	0.20	5.00	48
11	2	57	10.0	20.0	254	10.0	0.8	0.4	1	0.39	10.00	22
12	2	59	11.2	30.0	284	11.2	1.2	0.6	1	0.59	15.00	14
13	2	61	12.9	45.0	329	12.9	1.8	0.9	1	0.89	22.50	9
14	2	63	15.5	65.0	394	15.5	2.6	1.3	1	1.28	32.50	6
15	1	64	16.9	35.0	429	16.9	1.4	1.4	1	1.38	35.00	5
16	1	65	18.3	35.0	464	18.3	1.4	1.4	1	1.38	35.00	5
17	1	66	19.6	35.0	499	19.6	1.4	1.4	1	1.38	35.00	5
18	1	67	21.0	35.0	534	21.0	1.4	1.4	1	1.38	35.00	5
19	1	68	22.6	40.0	574	22.6	1.6	1.6	1	1.57	40.00	5
20	1	69	24.2	40.0	614	24.2	1.6	1.6	1	1.57	40.00	5
21	1	70	25.4	30.0	644	25.4	1.2	1.2	1	1.18	30.00	6
22	1	71	26.5	30.0	674	26.5	1.2	1.2	1	1.18	30.00	6
23	1	72	27.7	30.0	704	27.7	1.2	1.2	1	1.18	30.00	6
24	1	73	28.9	30.0	734	28.9	1.2	1.2	1	1.18	30.00	6
25	1	74	30.3	35.0	769	30.3	1.4	1.4	1	1.38	35.00	5
26	1	75	31.8	40.0	809	31.8	1.6	1.6	1	1.57	40.00	5
27	1	76	34.0	55.0	864	34.0	2.2	2.2	1	2.17	55.00	3
28	1	77	36.6	65.0	929	36.6	2.6	2.6	1	2.56	65.00	3
29	1	78	37.4	20.0	949	37.4	0.8	0.8	1	0.79	20.00	10



431mm/12blows = 36mm/blow
Mr = 4200 psi

DCP-8

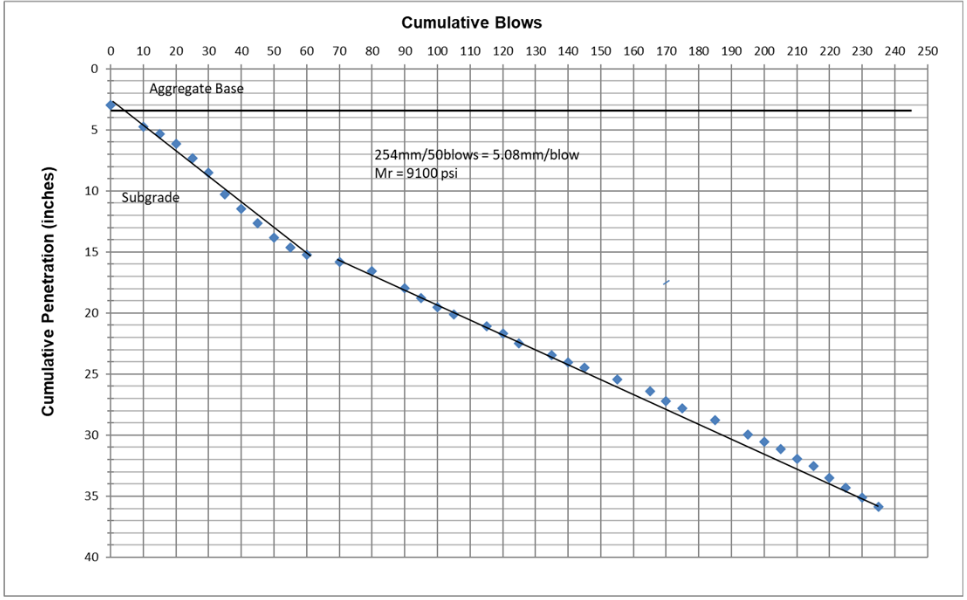
Ridgemont Estates
Spokane Valley, Washington

GeoEngineers

Figure D-8

Location: Spokane Valley, WA
Date: 10/18/2023
Test Hole Number: C-9
Start Depth Below Top of Pavement: 3
Test Method: Dynamic Cone Penetration
Tester's Name:
GeoEngineers Job: 11264-044-00
Tester's Company: GeoEngineers, Inc.

Test increment	Number of blows	Cumulative blows	Depth below ground surface	Penetration per increment	Cumulative penetration	Cummulative Penetration	Penetration per blow set	Penetration per blow	Hammer blow factor	DCP Index	DCP Index	CBR
#	#	#	(in)	(mm)	(mm)	(in)	(in)	(in)	1 for 8-kg 2 for 4.6-kg hammer	in/blow	mm/blow	%
1	-	0	3.0	-	76	3.0	-	-	1	-	-	-
2	10	10	4.8	45.0	121	4.8	1.8	0.2	1	0.18	4.50	54
3	5	15	5.4	15.0	136	5.4	0.6	0.1	1	0.12	3.00	85
4	5	20	6.1	20.0	156	6.1	0.8	0.2	1	0.16	4.00	62
5	5	25	7.3	30.0	186	7.3	1.2	0.2	1	0.24	6.00	39
6	5	30	8.5	30.0	216	8.5	1.2	0.2	1	0.24	6.00	39
7	5	35	10.3	45.0	261	10.3	1.8	0.4	1	0.35	9.00	25
8	5	40	11.5	30.0	291	11.5	1.2	0.2	1	0.24	6.00	39
9	5	45	12.6	30.0	321	12.6	1.2	0.2	1	0.24	6.00	39
10	5	50	13.8	30.0	351	13.8	1.2	0.2	1	0.24	6.00	39
11	5	55	14.6	20.0	371	14.6	0.8	0.2	1	0.16	4.00	62
12	5	60	15.2	15.0	386	15.2	0.6	0.1	1	0.12	3.00	85
13	10	70	15.8	15.0	401	15.8	0.6	0.1	1	0.06	1.50	185
14	10	80	16.6	20.0	421	16.6	0.8	0.1	1	0.08	2.00	134
15	10	90	18.0	35.0	456	18.0	1.4	0.1	1	0.14	3.50	72
16	5	95	18.7	20.0	476	18.7	0.8	0.2	1	0.16	4.00	62
17	5	100	19.5	20.0	496	19.5	0.8	0.2	1	0.16	4.00	62
18	5	105	20.1	15.0	511	20.1	0.6	0.1	1	0.12	3.00	85
19	10	115	21.1	25.0	536	21.1	1.0	0.1	1	0.10	2.50	105
20	5	120	21.7	15.0	551	21.7	0.6	0.1	1	0.12	3.00	85
21	5	125	22.5	20.0	571	22.5	0.8	0.2	1	0.16	4.00	62
22	10	135	23.5	25.0	596	23.5	1.0	0.1	1	0.10	2.50	105
23	5	140	24.1	15.0	611	24.1	0.6	0.1	1	0.12	3.00	85
24	5	145	24.5	10.0	621	24.5	0.4	0.1	1	0.08	2.00	134
25	10	155	25.4	25.0	646	25.4	1.0	0.1	1	0.10	2.50	105
26	10	165	26.4	25.0	671	26.4	1.0	0.1	1	0.10	2.50	105
27	5	170	27.2	20.0	691	27.2	0.8	0.2	1	0.16	4.00	62
28	5	175	27.8	15.0	706	27.8	0.6	0.1	1	0.12	3.00	85
29	10	185	28.8	25.0	731	28.8	1.0	0.1	1	0.10	2.50	105
30	10	195	30.0	30.0	761	30.0	1.2	0.1	1	0.12	3.00	85
31	5	200	30.6	15.0	776	30.6	0.6	0.1	1	0.12	3.00	85
32	5	205	31.1	15.0	791	31.1	0.6	0.1	1	0.12	3.00	85
33	5	210	31.9	20.0	811	31.9	0.8	0.2	1	0.16	4.00	62
34	5	215	32.5	15.0	826	32.5	0.6	0.1	1	0.12	3.00	85
35	5	220	33.5	25.0	851	33.5	1.0	0.2	1	0.20	5.00	48
36	5	225	34.3	20.0	871	34.3	0.8	0.2	1	0.16	4.00	62
37	5	230	35.1	20.0	891	35.1	0.8	0.2	1	0.16	4.00	62
38	5	235	35.9	20.0	911	35.9	0.8	0.2	1	0.16	4.00	62
39	5	240	36.7	20.0	931	36.7	0.8	0.2	1	0.16	4.00	62



DCP-9

Ridgemont Estates
Spokane Valley, Washington

GeoEngineers

Figure D-9

Appendix E

Climate Data

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 06/17/2024

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 2355 ft. Lat: 47.6217° N Lon: 117.5280° W

Station: **SPOKANE INTERNATIONAL AIRPORT, WA US USW00024157**

Observation Time Temperature: Unknown Observation Time Precipitation: 2400

Year	Month	Day	Temperature (F)			Precipitation					Evaporation		"Soil Temperature (F)"					
			"24 Hrs. Ending at Observation Time"		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2023	11	01	44	29		0.06		0.0		0.0								
2023	11	02	46	36		0.56		0.0		0.0								
2023	11	03	52	41		0.00		0.0		0.0								
2023	11	04	53	41		0.58		0.0		0.0								
2023	11	05	52	40		T		0.0		0.0								
2023	11	06	49	39		0.27		0.0		0.0								
2023	11	07	49	35		0.02		0.0		0.0								
2023	11	08	47	32		0.00		0.0		0.0								
2023	11	09	40	31		T		0.0		0.0								
2023	11	10	40	34		0.05		0.0		0.0								
2023	11	11	51	39		T		0.0		0.0								
2023	11	12	48	36		0.00		0.0		0.0								
2023	11	13	44	36		0.04		0.0		0.0								
2023	11	14	42	32		0.00		0.0		0.0								
2023	11	15	37	31		0.18		0.0		0.0								
2023	11	16	37	29		0.00		0.0		0.0								
2023	11	17	38	29		0.00		0.0		0.0								
2023	11	18	42	29		0.00		0.0		0.0								
2023	11	19	45	31		0.10		0.5		0.0								
2023	11	20	44	31		0.00		0.0		0.0								
2023	11	21	42	29		0.00		0.0		0.0								
2023	11	22	47	31		0.01		0.0		0.0								
2023	11	23	45	26		0.00		0.0		0.0								
2023	11	24	41	23		0.00		0.0		0.0								
2023	11	25	29	18		T		T		0.0								
2023	11	26	30	25		T		T		0.0								
2023	11	27	37	25		0.00		0.0		0.0								
2023	11	28	36	21		0.00		0.0		0.0								
2023	11	29	26	23		T		T		0.0								
2023	11	30	28	24		0.02		0.3		T								
		Summary	42	31		1.89		0.8										

Empty, or blank, cells indicate that a data observation was not reported.

*Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

"s" This data value failed one of NCEI's quality control tests. "At Obs." = Temperature at time of observation

"T" values in the Precipitation or Snow category above indicate a "trace" value was recorded.

"A" values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 06/17/2024

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 2355 ft. Lat: 47.6217° N Lon: 117.5280° W

Station: **SPOKANE INTERNATIONAL AIRPORT, WA US USW00024157**

Observation Time Temperature: Unknown Observation Time Precipitation: 2400

Year	Month	Day	Temperature (F)			Precipitation					Evaporation		"Soil Temperature (F)"					
			"24 Hrs. Ending at Observation Time"		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2023	12	01	32	25		0.26		3.5		T								
2023	12	02	38	26		0.35		1.8		3.9								
2023	12	03	39	25		0.07		T		3.1								
2023	12	04	39	32		0.12		0.0		2.0								
2023	12	05	52	37		0.56		0.0		T								
2023	12	06	50	44		0.64		0.0		0.0								
2023	12	07	44	33		0.13		0.0		0.0								
2023	12	08	41	27		T		T		0.0								
2023	12	09	35	26		0.33		4.2		0.0								
2023	12	10	36	33		0.44		1.8		5.9								
2023	12	11	36	33		0.01		0.0		3.1								
2023	12	12	37	34		T		0.0		2.0								
2023	12	13	36	28		0.00		0.0		1.2								
2023	12	14	36	28		0.00		0.0		0.0								
2023	12	15	40	30		0.00		0.0		0.0								
2023	12	16	35	27		0.00		0.0		0.0								
2023	12	17	35	30		0.00		0.0		0.0								
2023	12	18	38	30		0.11		0.0		0.0								
2023	12	19	39	33		0.11		0.0		0.0								
2023	12	20	44	35		T		0.0		0.0								
2023	12	21	39	33		0.00		0.0		0.0								
2023	12	22	36	32		0.12		0.2		0.0								
2023	12	23	33	23		0.00		0.0		0.0								
2023	12	24	34	23		0.00		0.0		0.0								
2023	12	25	35	26		0.00		0.0		0.0								
2023	12	26	33	30		0.08		0.3		T								
2023	12	27	37	32		T		0.0		T								
2023	12	28	42	32		0.00		0.0		0.0								
2023	12	29	45	35		0.00		0.0		0.0								
2023	12	30	41	32		0.00		0.0		0.0								
2023	12	31	40	33		0.01		0.0		0.0								
		Summary	39	31		3.34		11.8										

Empty, or blank, cells indicate that a data observation was not reported.

*Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

"s" This data value failed one of NCEI's quality control tests. "At Obs." = Temperature at time of observation

"T" values in the Precipitation or Snow category above indicate a "trace" value was recorded.

"A" values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

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National Oceanic & Atmospheric Administration
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Record of Climatological Observations

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Generated on 06/17/2024

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 2355 ft. Lat: 47.6217° N Lon: 117.5280° W

Station: **SPOKANE INTERNATIONAL AIRPORT, WA US USW00024157**

Observation Time Temperature: Unknown Observation Time Precipitation: 2400

Year	Month	Day	Temperature (F)			Precipitation					Evaporation		"Soil Temperature (F)"					
			"24 Hrs. Ending at Observation Time"		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2024	01	01	36	31		0.00		0.0		0.0								
2024	01	02	38	32		0.00		0.0		0.0								
2024	01	03	37	33		0.05		0.1		T								
2024	01	04	37	32		0.02		T		0.0								
2024	01	05	37	31		0.00		0.0		0.0								
2024	01	06	40	31		0.19		2.0		0.0								
2024	01	07	31	22		T		T		1.2								
2024	01	08	33	21		0.15		1.1		1.2								
2024	01	09	39	31		0.28		0.1		2.0								
2024	01	10	32	24		T		0.1		1.2								
2024	01	11	29	13		T		T		1.2								
2024	01	12	13	-7		0.00		0.0		T								
2024	01	13	2	-10		0.00		0.0		T								
2024	01	14	10	-4		0.00		0.0		T								
2024	01	15	11	-2		0.00		0.0		T								
2024	01	16	18	5		T		T		T								
2024	01	17	20	9		0.49		5.1		1.2								
2024	01	18	21	7		0.01		T		3.9								
2024	01	19	22	18		0.10		1.1		5.1								
2024	01	20	30	22		0.04		T		5.1								
2024	01	21	36	30		0.23		0.0		3.9								
2024	01	22	42	34		0.05		0.0		3.1								
2024	01	23	40	35		0.01		0.0		1.2								
2024	01	24	39	31		0.06		0.0		T								
2024	01	25	40	32		T		0.0		T								
2024	01	26	46	31		0.02		0.0		0.0								
2024	01	27	45	35		0.35		0.0		0.0								
2024	01	28	55	39		0.03		0.0		0.0								
2024	01	29	49	36		0.00		0.0		0.0								
2024	01	30	41	34		0.00		0.0		0.0								
2024	01	31	46	35		T		0.0		0.0								
		Summary	33	23		2.08		9.6										

Empty, or blank, cells indicate that a data observation was not reported.

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			"24 Hrs. Ending at Observation Time"		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2024	02	01	43	38		0.13		0.0		0.0								
2024	02	02	43	37		0.02		0.0		0.0								
2024	02	03	39	36		0.08		0.0		0.0								
2024	02	04	40	33		0.10		T		0.0								
2024	02	05	41	35		0.15		0.0		0.0								
2024	02	06	46	35		0.00		0.0		0.0								
2024	02	07	42	34		0.00		0.0		0.0								
2024	02	08	39	34		0.01		0.0		0.0								
2024	02	09	41	28		0.01		0.2		T								
2024	02	10	40	26		0.00		0.0		0.0								
2024	02	11	39	32		0.02		T		0.0								
2024	02	12	41	30		0.35		0.0		0.0								
2024	02	13	36	26		0.00		0.0		0.0								
2024	02	14	36	24		0.00		0.0		0.0								
2024	02	15	31	25		0.15		2.7		T								
2024	02	16	35	18		0.00		0.0		2.0								
2024	02	17	38	17		0.00		0.0		2.0								
2024	02	18	35	28		0.09		0.8		2.0								
2024	02	19	38	29		0.10		T		2.0								
2024	02	20	44	35		0.03		T		1.2								
2024	02	21	47	34		0.10		0.0		0.0								
2024	02	22	48	34		0.00		0.0		0.0								
2024	02	23	51	29		0.00		0.0		0.0								
2024	02	24	50	37		0.00		0.0		0.0								
2024	02	25	47	38		T		0.0		0.0								
2024	02	26	42	29		T		T		0.0								
2024	02	27	37	24		0.02		0.4		0.0								
2024	02	28	45	33		0.35		0.7		1.2								
2024	02	29	48	34		0.32		0.1		0.0								
		Summary	41	31		2.03		4.9										

Empty, or blank, cells indicate that a data observation was not reported.

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			"24 Hrs. Ending at Observation Time"		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2024	03	01	42	32		0.04		T		T								
2024	03	02	37	28		0.23		2.6		T								
2024	03	03	39	23		T		0.1		2.0								
2024	03	04	38	27		0.04		0.7		1.2								
2024	03	05	40	23		0.00		0.0		1.2								
2024	03	06	40	22		0.00		0.0		T								
2024	03	07	41	22		0.00		0.0		T								
2024	03	08	47	25		0.00		0.0		T								
2024	03	09	52	32		0.03		0.0		0.0								
2024	03	10	49	35		0.05		T		0.0								
2024	03	11	49	35		0.05		0.0		0.0								
2024	03	12	50	34		T		T		0.0								
2024	03	13	48	29		T		0.0		T								
2024	03	14	53	28		0.00		0.0		0.0								
2024	03	15	58	32		0.00		0.0		0.0								
2024	03	16	68	37		0.00		0.0		0.0								
2024	03	17	70	41		0.00		0.0		0.0								
2024	03	18	69	39		0.00		0.0		0.0								
2024	03	19	69	40		0.00		0.0		0.0								
2024	03	20	64	43		0.00		0.0		0.0								
2024	03	21	56	41		0.00		0.0		0.0								
2024	03	22	61	40		0.01		0.0		0.0								
2024	03	23	49	39		T		0.0		0.0								
2024	03	24	44	33		0.07		T		0.0								
2024	03	25	49	30		T		T		0.0								
2024	03	26	50	35		0.02		0.0		0.0								
2024	03	27	45	33		0.42		0.0		0.0								
2024	03	28	49	35		0.02		0.0		0.0								
2024	03	29	52	34		0.00		0.0		0.0								
2024	03	30	55	31		0.00		0.0		0.0								
2024	03	31	57	35		0.00		0.0		0.0								
		Summary	51	33		0.98		3.4										

Empty, or blank, cells indicate that a data observation was not reported.

*Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

"s" This data value failed one of NCEI's quality control tests. "At Obs." = Temperature at time of observation

"T" values in the Precipitation or Snow category above indicate a "trace" value was recorded.

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Year	Month	Day	Temperature (F)			Precipitation					Evaporation		"Soil Temperature (F)"					
			"24 Hrs. Ending at Observation Time"		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2024	04	01	66	35		0.00		0.0		0.0								
2024	04	02	73	45		0.00		0.0		0.0								
2024	04	03	59	43		0.01		0.0		0.0								
2024	04	04	55	40		0.17		0.0		0.0								
2024	04	05	43	32		0.26		1.0		0.0								
2024	04	06	49	38		T		0.0		0.0								
2024	04	07	51	35		0.00		0.0		0.0								
2024	04	08	52	34		0.01		0.0		0.0								
2024	04	09	61	37		0.01		0.0		0.0								
2024	04	10	58	32		0.00		0.0		0.0								
2024	04	11	63	39		0.00		0.0		0.0								
2024	04	12	65	49		0.00		0.0		0.0								
2024	04	13	71	45		0.00		0.0		0.0								
2024	04	14	77	47		0.00		0.0		0.0								
2024	04	15	63	44		0.00		0.0		0.0								
2024	04	16	52	32		0.02		T		0.0								
2024	04	17	53	29		0.00		0.0		0.0								
2024	04	18	53	34		0.03		0.0		0.0								
2024	04	19	58	34		0.00		0.0		0.0								
2024	04	20	67	35		T		0.0		0.0								
2024	04	21	56	39		T		0.0		0.0								
2024	04	22	60	32		0.00		0.0		0.0								
2024	04	23	68	38		0.00		0.0		0.0								
2024	04	24	66	42		0.00		0.0		0.0								
2024	04	25	61	45		T		0.0		0.0								
2024	04	26	63	46		0.00		0.0		0.0								
2024	04	27	61	44		0.00		0.0		0.0								
2024	04	28	60	43		0.00		0.0		0.0								
2024	04	29	55	36		0.01		T		0.0								
2024	04	30	52	31		0.04		T		0.0								
		Summary	60	39		0.56		1.0										

Empty, or blank, cells indicate that a data observation was not reported.

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			"24 Hrs. Ending at Observation Time"		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2024	05	01	58	36		T		0.0		0.0								
2024	05	02	65	36		0.00		0.0		0.0								
2024	05	03	66	42		0.00		0.0		0.0								
2024	05	04	68	52		T		0.0		0.0								
2024	05	05	56	46		0.36		0.0		0.0								
2024	05	06	60	41		0.10		0.0		0.0								
2024	05	07	62	37		T		0.0		0.0								
2024	05	08	63	41		0.00		0.0		0.0								
2024	05	09	77	42		0.00		0.0		0.0								
2024	05	10	82	51		0.00		0.0		0.0								
2024	05	11	83	54		0.00		0.0		0.0								
2024	05	12	84	56		0.00		0.0		0.0								
2024	05	13	77	54		0.00		0.0		0.0								
2024	05	14	76	49		0.00		0.0		0.0								
2024	05	15	78	51		0.00		0.0		0.0								
2024	05	16	79	54		T		0.0		0.0								
2024	05	17	64	47		0.00		0.0		0.0								
2024	05	18	61	41		T		0.0		0.0								
2024	05	19	61	42		0.04		T		0.0								
2024	05	20	69	37		0.00		0.0										
2024	05	21	64	42		0.07		0.0		0.0								
2024	05	22	57	45		0.22		0.0		0.0								
2024	05	23	66	42		0.00		0.0		0.0								
2024	05	24	70	47		0.00		0.0		0.0								
2024	05	25	63	47		0.00		0.0		0.0								
2024	05	26	64	41		T		0.0		0.0								
2024	05	27	76	52		0.00		0.0		0.0								
2024	05	28	74	51		0.03		0.0		0.0								
2024	05	29	65	44		0.01		0.0		0.0								
2024	05	30	66	37		0.00		0.0		0.0								
2024	05	31	71	44		0.00		0.0		0.0								
		Summary	69	45		0.83		0.0										

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			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2024	06	01	71	51		T		0.0		0.0								
2024	06	02	67	49		0.25		0.0		0.0								
2024	06	03	64	48		0.23		0.0		0.0								
2024	06	04	70	45		0.03		0.0		0.0								
2024	06	05	70	47		0.00		0.0		0.0								
2024	06	06	79	50		0.00		0.0		0.0								
2024	06	07	82	55		0.00		0.0		0.0								
2024	06	08	84	53		0.00		0.0		0.0								
2024	06	09	80	58		0.00		0.0		0.0								
2024	06	10	81	54		0.00		0.0		0.0								
2024	06	11	84	56		0.00		0.0		0.0								
2024	06	12																
2024	06	13																
2024	06	14																
2024	06	15																
2024	06	16																
2024	06	17																
2024	06	18																
2024	06	19																
2024	06	20																
2024	06	21																
2024	06	22																
2024	06	23																
2024	06	24																
2024	06	25																
2024	06	26																
2024	06	27																
2024	06	28																
2024	06	29																
2024	06	30																
		Summary	69	47		0.51		0.0										

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Appendix F

Hydraulic Test Data

Table F-1

Pilot Infiltration Test Analysis - Main Pond (IT-1)$_{1}$

Ridgemont Estates Stormwater Improvement Project

Spokane Valley, Washington

Pilot Infiltration Test	Property	Date Completed	Test Pit Length (ft)	Test Pit Width (ft)	Test Pit Depth (ft)	Test Pit Area (ft^{2})	Test Pit Area (in^{2})	Time	Time Interval (minutes)	Elapsed Time (hours)	Depth to Water (ft)	Water Height (ft)	Totalizer (gallons)	Interval Discharge (gallons)	Flow Rate ^{2} (gpm)	Flow Rate ^{2} (in^{3}/hr)	Constant Head		Falling Head		Notes
																	Interval Infiltration Rate ^{3} (in/hr)	Stabilized Infiltration Rate ^{3,4} (in/hr)	Interval Infiltration Rate ^{3} (in/hr)	Stabilized Infiltration Rate ^{3,5} (in/hr)	
IT-1	Ridgemont Estates	03/18/24	10.2	11.0	2.00	111.9	16,109	11:00	--	0.00	Dry	0.00	448605.0	--	--	--	--				Pit is dry. Begin injection.
								11:14	14	0.23	2.28	1.33	449576.0	971.0	69.36	961,290	59.67				Injection paused.
								12:05	51	1.08	2.35	1.25	47411.2	0.0	0.00	0	0.00		1.06		Flow meter replaced to accommodate low flow.
								12:30	25	1.50	2.39	1.21	47411.2	0.0	0.00	0	0.00		1.20		
								13:07	37	2.12	2.44	1.17	47411.2	0.0	0.00	0	0.00		0.89		
								13:18	11	2.30	2.45	1.15	47411.2	0.0	0.00	0	0.00		1.02		Injection resumed.
								13:30	12	2.50	2.45	1.16	47423.8	12.6	1.05	14,553	0.90				
								13:45	15	2.75	2.45	1.15	47451.8	28.0	1.87	25,872	1.61				
								14:00	15	3.00	2.43	1.17	47476.2	24.4	1.63	22,546	1.40				
								14:15	15	3.25	2.43	1.17	47499.8	23.6	1.57	21,806	1.35				Flow rate adjusted to maintain head.
								14:30	15	3.50	2.44	1.17	47500.6	0.8	0.05	739	0.05				
								14:45	15	3.75	2.43	1.17	47517.1	16.5	1.10	15,246	0.95				
								15:00	15	4.00	2.44	1.17	47531.5	14.4	0.96	13,306	0.83				
								15:15	15	4.25	2.44	1.17	47546.4	14.9	0.99	13,768	0.85				
								15:30	15	4.50	2.44	1.17	47560.4	14.0	0.93	12,936	0.80				
								15:45	15	4.75	2.44	1.17	47575.0	14.6	0.97	13,490	0.84				
								16:00	15	5.00	2.44	1.17	47590.5	15.5	1.03	14,322	0.89	0.85			Water off. Begin falling head
								16:10	10	5.17	2.45	1.16							0.75		
								16:20	10	5.33	2.46	1.14							1.13		
								16:30	10	5.50	2.48	1.13							1.13		
								16:40	10	5.67	2.49	1.11							0.75		
								16:50	10	5.83	2.50	1.10							0.75		
								17:00	10	6.00	2.51	1.09							0.75		
								17:10	10	6.17	2.53	1.08							1.13		
								17:20	10	6.33	2.54	1.07							0.75		
								17:30	10	6.50	2.55	1.05							1.13		
								17:40	10	6.67	2.57	1.03							1.50		
								17:50	10	6.83	2.60	1.01							1.88		
								18:00	10	7.00	2.61	0.99							0.75	1.03	

Notes:

[1] Infiltration test performed in general accordance with the 2019 Stormwater Management Manual for Eastern Washington.

[2] Flow rate represents the injection rate into the pit.

[3] Infiltration rate is calculated by the following equation: Infiltration rate (I) = Flow Rate (Q) / Pit Area (A).

[4] Average infiltration rate for the final hour of the constant head period.

[5] Average infiltration rate for the falling head period.

ft = feet; in = inches; gpm = gallons per minute; hr = hour.

Table F-2

Full-Scale Drywell Test Analysis - Radco Pond (IT-2)[1]

Ridgemont Estates Stormwater Improvement Project
Spokane Valley, Washington

Time of Day	Elapsed Time[2] *minutes*	Meter Reading *gallons*	Flow Rate *gpm*	Flow Rate *cfs*	Total Flow Volume *gallons*	Total Flow Volume *cubic feet*	Depth to Water[3] *feet*	Head[4,5] *feet*	Notes
10:10	0	449,583	0	0	0	0	11.67	0	Static conditions - Flow begins
10:20	10	451,174	159	0.35	1,591	213	8.70	2.97	Begin constant-head test
10:25	15	452,662	298	0.66	3,079	412	8.60	3.07	
10:30	20	454,105	289	0.64	4,522	605	8.50	3.17	
10:35	25	455,412	261	0.58	5,829	779	8.40	3.27	
10:40	30	456,752	268	0.60	7,169	958	8.48	3.19	
10:45	35	458,138	277	0.62	8,555	1,144	8.30	3.37	
10:50	40	459,528	278	0.62	9,945	1,330	8.30	3.37	
10:55	45	460,948	284	0.63	11,365	1,519	8.22	3.45	
11:00	50	462,391	289	0.64	12,808	1,712	8.28	3.39	
11:05	55	463,705	263	0.59	14,122	1,888	8.22	3.45	
11:10	60	465,170	293	0.65	15,587	2,084	8.23	3.44	
11:15	65	466,642	294	0.66	17,059	2,281	8.17	3.50	
11:20	70	467,836	239	0.53	18,253	2,440	8.19	3.48	
11:25	75	469,221	277	0.62	19,638	2,625	8.09	3.58	
11:30	80	470,610	278	0.62	21,027	2,811	8.10	3.57	
11:35	85	472,054	289	0.64	22,471	3,004	8.08	3.59	
11:40	90	473,377	265	0.59	23,794	3,181	8.10	3.57	
11:50	100	476,145	277	0.62	26,562	3,551	8.08	3.59	
11:55	105	477,524	276	0.61	27,941	3,735	8.07	3.60	
12:00	110	478,923	280	0.62	29,340	3,922	8.09	3.58	
12:05	115	480,300	275	0.61	30,717	4,107	8.07	3.60	
12:10	120	481,717	283	0.63	32,134	4,296	8.06	3.61	Falling Head Test
12:10:30	121						9.55	2.12	
12:11:00	121						9.87	1.80	
12:11:30	122						10.32	1.35	
12:12:00	122						10.48	1.19	
12:12:30	122						10.81	0.86	
12:13:00	123						11.12	0.55	
12:14:00	124						11.28	0.39	
12:15:00	125						11.51	0.16	
12:16:00	126						11.67	0.00	Dry

Design Outfall Rate[6]

Stabilized flow rate (Q) in cubic feet per second (cfs)	0.617	
Head within drywell (H) in feet	3.56	
Maximum design drywell head (H_D) in feet	11.7	
Normalized outflow rate (q_A) in cfs	2.030	
Factor of Safety (FS)	2.5	%Fines = unknown
Design outflow rate (q_D) in cfs	0.812	

Notes:

[1] Infiltration test performed in general accordance with the 2019 Stormwater Management Manual for Eastern Washington.

[2] Elapsed time referenced to beginning of test on March 19, 2024.

[3] Depth to water measured from the top of the drywell rim.

[4] Head refers to induced head level within the drywell.

[5] Constant-head maintained at the maximum flow rate that could be achieved during the test.

[6] Design outflow rate based upon the Spokane Regional Stormwater Manual, Appendix 4B.

Drywell Condition: double-depth concrete; diameter = 4.0 ft; total depth = 11.67 ft; active barrel = 8.17 ft; filter fabric exterior lining.

Table F-3

Full-Scale Drywell Test Analysis - East 24th Avenue (IT-3)[1]

Ridgemont Estates Stormwater Improvement Project
Spokane Valley, Washington

Time of Day	Elapsed Time[2] *minutes*	Meter Reading *gallons*	Flow Rate *gpm*	Flow Rate *cfs*	Total Flow Volume *gallons*	Total Flow Volume *cubic feet*	Depth to Water[3] *feet*	Head[4,5] *feet*	Notes
9:35	0	481,753	0.00	0	0	0	11.67	0	Static conditions - Flow begins
9:45	10	482,005	25.20	0.056	252	34	7.52	4.15	Begin constant-head test
9:50	15	482,169	32.80	0.073	416	56	7.50	4.17	
10:00	25	47,604.3	1.05	0.002	427	57	7.84	3.83	Flow meter replaced to accommodate low flow
10:10	35	47,671.2	6.69	0.015	493	66	7.72	3.95	
10:15	40	47,684.0	2.56	0.006	506	68	7.68	3.99	
10:20	45	47,701.8	3.56	0.008	524	70	7.65	4.02	
10:25	50	47,724.7	4.58	0.010	547	73	7.60	4.07	
10:30	55	47,742.3	3.52	0.008	565	75	7.60	4.07	
10:35	60	47,758.0	3.14	0.007	580	78	7.60	4.07	
10:40	65	47,773.9	3.18	0.007	596	80	7.60	4.07	
10:45	70	47,790.0	3.22	0.007	612	82	7.61	4.06	
10:50	75	47,811.8	4.36	0.010	634	85	7.58	4.09	
10:55	80	47,828.5	3.34	0.007	651	87	7.60	4.07	
11:00	85	47,845.2	3.34	0.007	667	89	7.60	4.07	
11:05	90	47,862.4	3.44	0.008	685	92	7.60	4.07	
11:10	95	47,879.2	3.36	0.007	701	94	7.60	4.07	
11:15	100	47,895.8	3.32	0.007	718	96	7.60	4.07	
11:20	105	47,912.7	3.38	0.008	735	98	7.60	4.07	
11:25	110	47,929.4	3.34	0.007	752	100	7.60	4.07	
11:30	115	47,946.2	3.36	0.007	768	103	7.60	4.07	
11:35	120	47,962.8	3.32	0.007	785	105	7.60	4.07	Falling Head Test
11:40	125						7.69	3.98	
11:45	130						7.86	3.81	
11:50	135						8.02	3.65	
11:55	140						8.13	3.54	
12:00	145						8.22	3.45	
12:05	150						8.33	3.34	
12:10	155						8.43	3.24	
12:15	160						8.54	3.13	
12:20	165						8.62	3.05	
12:25	170						8.70	2.97	
Design Outfall Rate[6]									
Stabilized flow rate (Q) in cubic feet per second (cfs)								0.008	
Head within drywell (H) in feet								4.07	
Maximum design drywell head (H_D) in feet								7.42	
Normalized outflow rate (q_A) in cfs								0.014	
Factor of Safety (FS)								2.5	%Fines = unknown
Design outflow rate (q_D) in cfs								0.0055	

Notes:

[1] Infiltration test performed in general accordance with the 2019 Stormwater Management Manual for Eastern Washington.

[2] Elapsed time referenced to beginning of test on March 19, 2024.

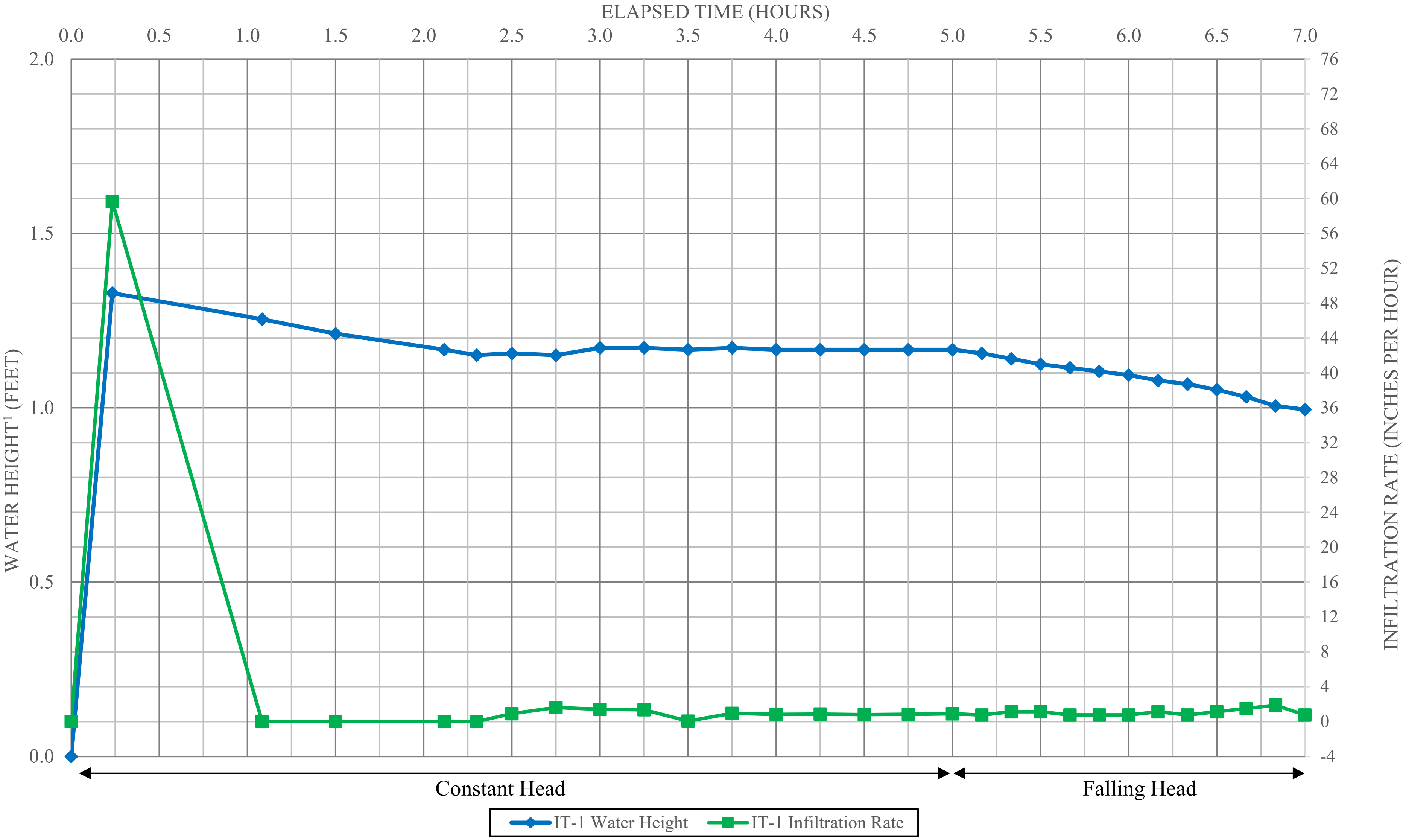
[3] Depth to water measured from the top of the drywell rim.

[4] Head refers to induced head level within the drywell.

[5] Constant-head maintained at the maximum flow rate that could be achieved given the available drywell infiltration area during the test.

[6] Design outflow rate based upon the Spokane Regional Stormwater Manual, Appendix 4B.

Drywell Condition: double-depth concrete; diameter = 4.0 ft; total depth = 11.67 ft; approx. active barrel = 6.08 ft (base to bottom of outfall pipe); approx. 10-inch-diameter inlet pipe on south side of drywell at 4.25 ft below rim (measured to bottom of inlet); approx. 8-inch-diameter outlet pipe on west side of drywell at 5.58 ft below rim (measured to bottom); moderately silted bottom barrel.



Note:

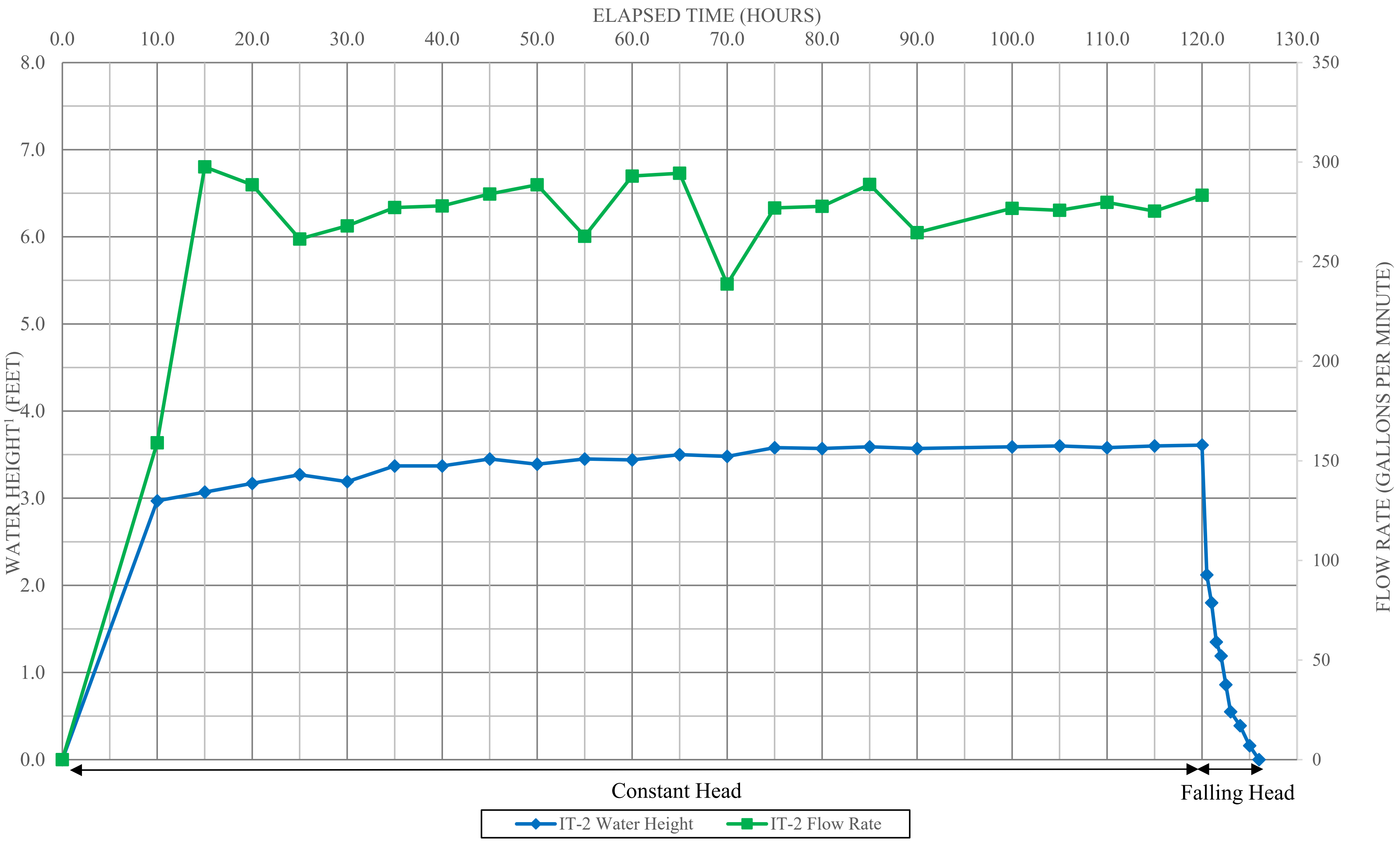
1. Water height refers to water level above the bottom of the test pit.

IT-1 Water Height and Infiltration Rate

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

GEOENGINEERS

Figure F-1



Note:

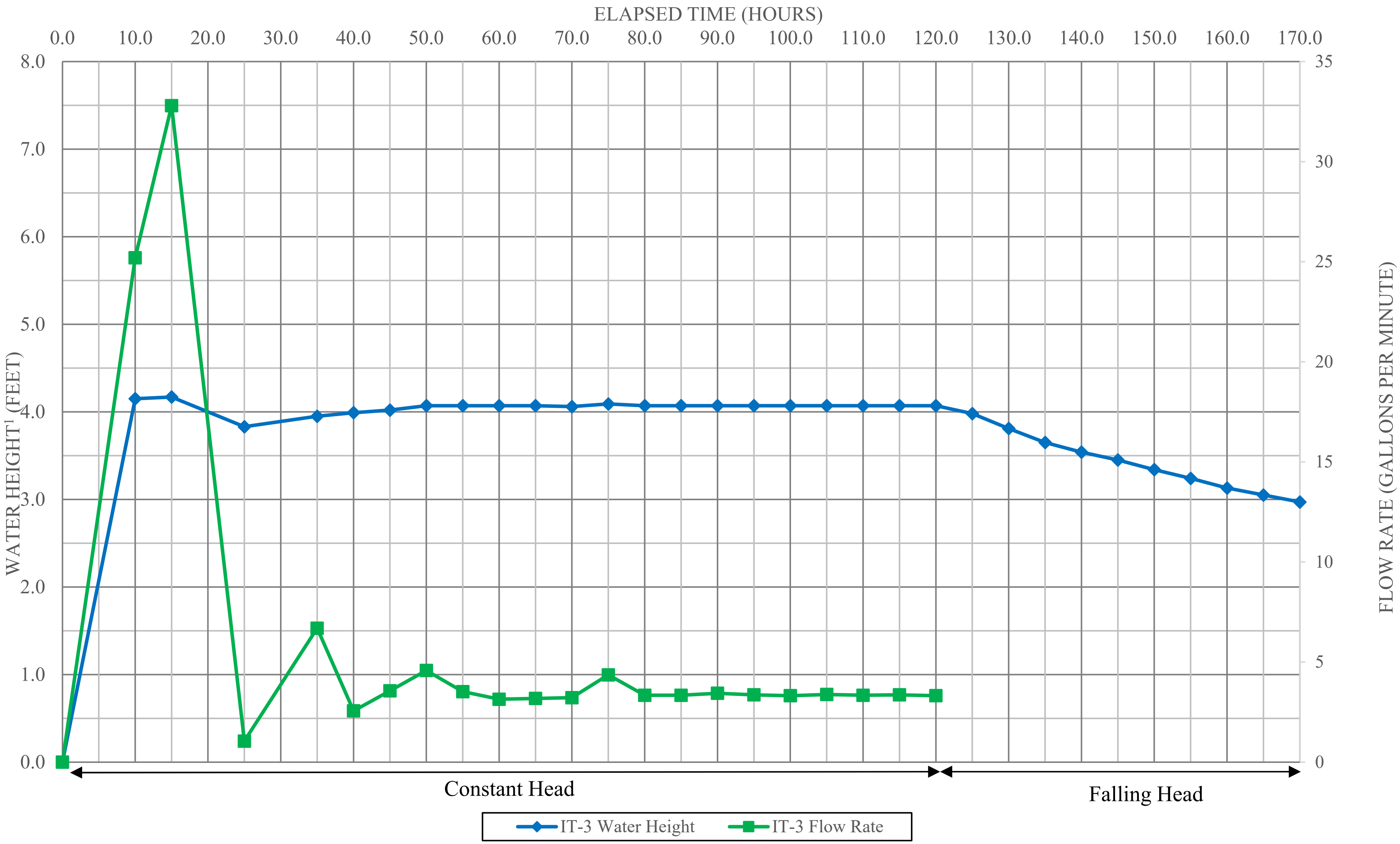
1. Water height refers to water level above the bottom of the drywell.

IT-2 Water Height and Infiltration Rate

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

GEOENGINEERS

Figure F-2



Note:

1. Water height refers to water level above the bottom of the drywell.

IT-3 Water Height and Infiltration Rate

Ridgemont Estates Stormwater Improvements Project
Spokane Valley, Washington

GeoEngineers

Figure F-3

Appendix G

Report Limitations and Guidelines for Use

Appendix G
Report Limitations and Guidelines for Use[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or hydrogeology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory “limitations” provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these “Report Limitations and Guidelines for Use” apply to your project or site.

Hydrogeologic and/or Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for use by Osborn Consulting and the City of Spokane Valley. This report may be made available in its entirety to others for information only. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a hydrogeologic and/or geotechnical study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Each hydrogeologic and/or geotechnical study is unique and prepared solely for the specific client and project site. No one except Osborn Consulting or the City of Spokane Valley should rely on this report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

A Hydrogeologic and/or Geotechnical Report Is Based on a Unique Set of Project-Specific Factors

GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

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[1] Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This hydrogeologic and geotechnical report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Hydrogeologic and/or Geotechnical Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

A Hydrogeologic and/or Geotechnical Report Could Be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a hydrogeologic and/or geotechnical report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable but recognize that separating logs from the report can elevate risk.

APPENDIX C
SITE VISIT PHOTOS

North Problem Area

Figure 1: Sinkhole at the intersection of Conklin Road and Ridgemont Drive observed by city maintenance crew and submitted as a QAlert 12/27/2023. Photo taken by maintenance crew; hole was then covered by large metal plate.

Figure 2: Photo taken inside the sinkhole located at the intersection of Conklin Road and Ridgemont Drive. Soils have eroded and top of culvert has rusted and collapsed. Photo taken 12/27/2023.

Figure 3: Ponding water at the Radco Drive cul-de-sac. Heavy ponding with nowhere for the water to drain causing damage to the road. Photo taken 1/22/2024.

Figure 4: Upstream end of open channel ditch located between Conklin Road and Vera Crest Drive. Photo Taken 10/17/2024.

Figure 5: Downstream end of open channel ditch located between Conklin Road and Vera Crest Drive. Flow in this channel drains to the 16th Avenue infiltration pond. Photo taken 1/17/2024.

Central Problem Area

Figure 6: Ground water seeping out of hillside at the top of the Radco open channel ditch. Observed by Osborn in the field during wet conditions. The pipe which runs down this hillside is 50% collapsed and is likely infiltrates water into hillside. Photo taken 1/22/2024.

Figure 7: Upstream end of the Radco open channel ditch. Flow is clearly visible in the open channel, but seems to dissipate the further down the open channel you go. Photo taken 1/22/2024.

Figure 8: Midpoint of the Radco open channel ditch. Flow is still clearly visible but has significantly less flow than at the upstream end of this channel. Photo taken 1/22/2024.

Figure 9: Downstream end of Radco open channel ditch. Flow did not reach the end of the open channel ditch; pipe was observed to be dry (see Figure 10). This supports the theory that flow does not reach the Radco infiltration pond. Photo taken 1/22/2024.

Figure 10: Inlet pipe located at the end of the Radco open channel ditch. Despite flow being present higher up in this open channel ditch, flow does not reach this inlet pipe and has been observed to be dry. Photo taken 1/22/2024.

Figure 11: Inlet pipe located at the end of the Radco open channel ditch. Photo taken 11/16/2024.

Figure 12: Outlet pipe to the Radco infiltration pond intended to convey flow from the Radco open channel ditch. Pipe observed to be dry throughout various site visits, reinforcing the belief that water is not reaching this pond. Photo taken 5/28/2024.

Figure 13: Radco infiltration pond observed during site visit. Photo taken 11/16/2024.

Figure 14: Radco infiltration pond observed during site visit. Photo taken 1/16/2024.

Figure 15: Ponding water at the intersection of 22nd Avenue and Vera Crest Drive. Water has been observed to pond here during various site visits, failing to reach the catch basin shown in the picture. Photo taken 1/22/2024.

South Problem Area

Figure 16: Qalert submitted by residents living on Timberlane Drive. Residents stated that water was ponding in the roadway and flooding over their driveway and into their garage. Photo submitted by residents on 12/27/2024.

Figure 17: Qalert submitted by resident with groundwater springs on 24th Avenue 6/3/2019. Osborn observed these conditions in the field and took this picture during abnormally cold weather. Photo taken 1/16/2024.

Figure 18: Qalert submitted by resident with groundwater springs on 24th Avenue 6/3/2019. Osborn observed these conditions in the field and took this picture during abnormally cold weather. Photo taken 1/16/2024.

Figure 19: HOA owned Timberlane pond located between Seabiscuit Drive and Saltese Road. Photo taken 1/22/2024.

Figure 20: HOA owned Timberlane pond located between Seabiscuit Drive and Saltese Road. Photo taken 1/22/2024.

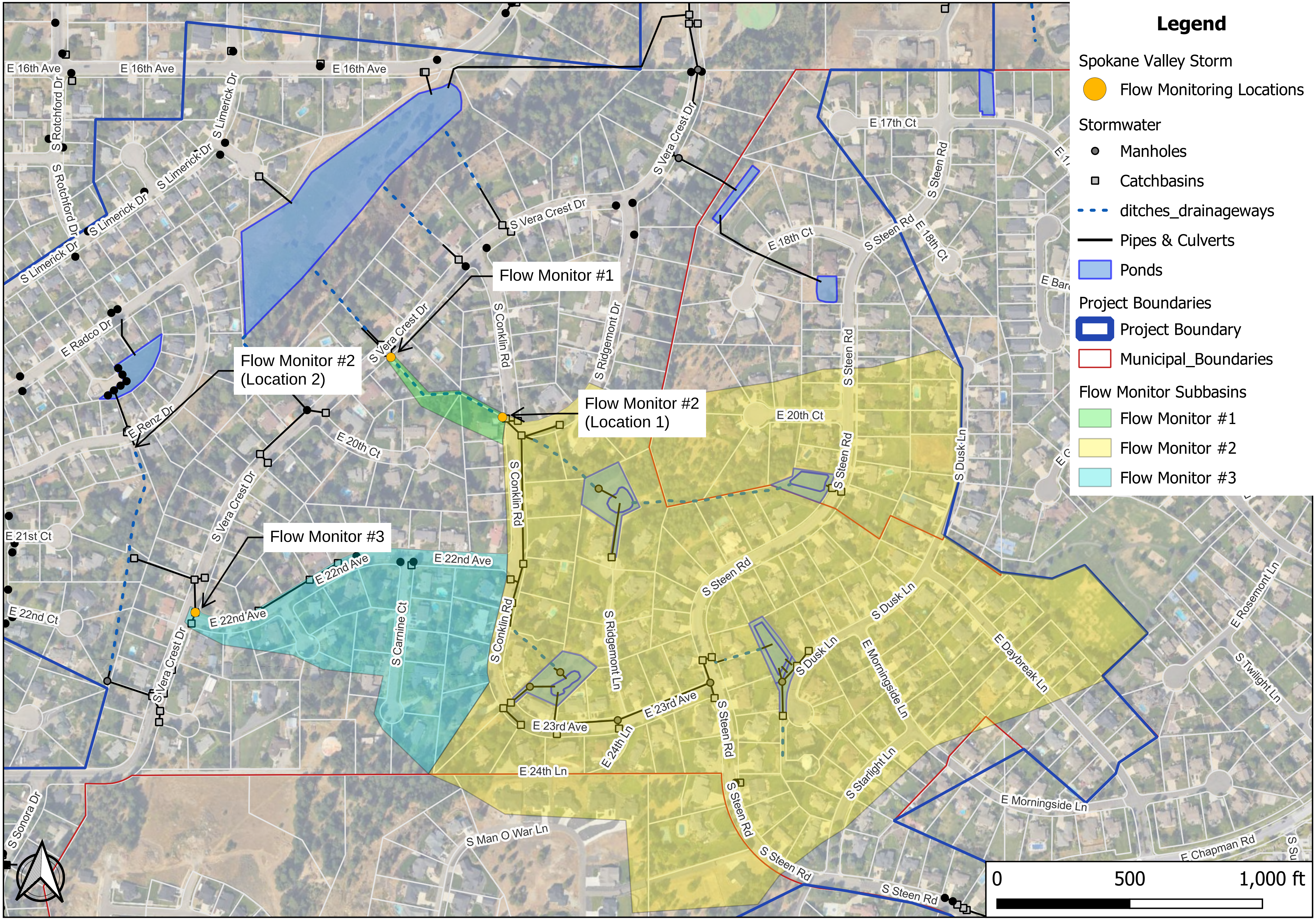
Figure 21: Property impacts at the intersection of Timberlane Drive and 24th Avenue observed by Osborn. Photo taken 1/22/2024.

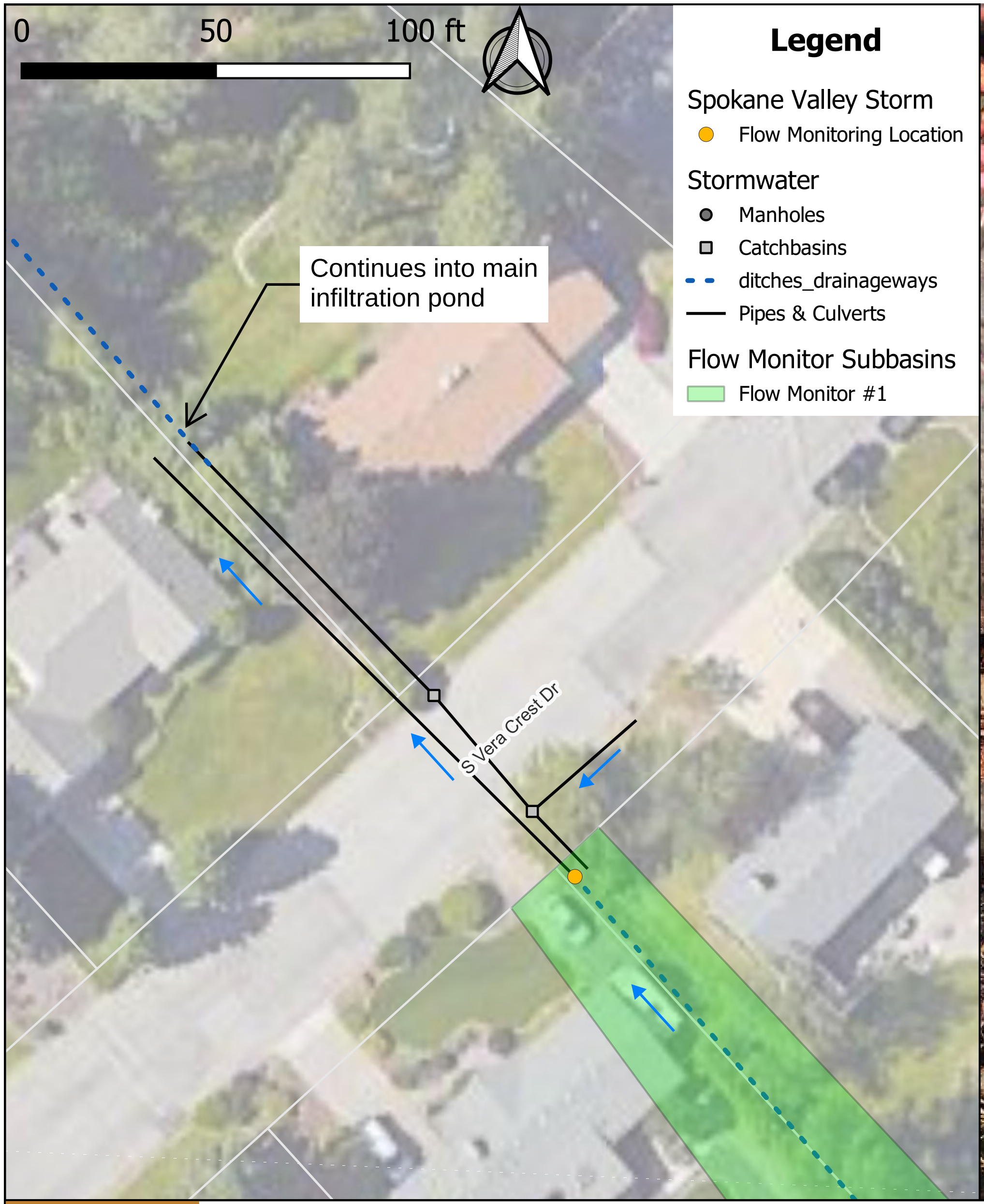
Figure 22: Property impacts at the intersection of Timberlane Drive and 24th Avenue observed by Osborn. Photo taken 1/22/2024.

Figure 23: Ponding observed at Cameron Court cul-de-sac by Osborn. Photo taken 1/22/2024.

Figure 24: Failing drywell observed in Cameron Court cul-de-sac by Osborn. Photo taken 1/22/2024.

APPENDIX D
FLOW MONITORING DATA


Legend
Spokane Valley Storm
Flow Monitoring Locations
Stormwater
Manholes
Catchbasins
ditches_drainageways
Pipes & Culverts
Ponds
Project Boundaries
Project Boundary
Municipal_Boundaries
Flow Monitor Subbasins
Flow Monitor #1
Flow Monitor #2
Flow Monitor #3
Flow Monitor #1
Flow Monitor #2
(Location 2)
Flow Monitor #2
(Location 1)
Flow Monitor #3
E 16th Ave
E 16th Ave
E 16th Ave
S Rotchford Dr
S Rotchford Dr
S Limerick Dr
S Limerick Dr
S Limerick Dr
S Limerick Dr
E Radco Dr
E Renz Dr
S Vera Crest Dr
S Vera Crest Dr
S Vera Crest Dr
S Vera Crest Dr
S Vera Crest Dr
E 17th Ct
S Steen Rd
E 18th Ct
S Steen Rd
E 18th Ct
E Bar
S Conklin Rd
S Ridgemont Dr
S Steen Rd
E 20th Ct
E 20th Ct
S Steen Rd
S Dusk Ln
S Conklin Rd
E 21st Ct
E 22nd Ave
E 22nd Ave
E 22nd Ave
E 22nd Ct
S Carnine Ct
S Conklin Rd
S Ridgemont Ln
S Steen Rd
S Dusk Ln
S Dusk Ln
E Morningside Ln
E Daybreak Ln
E Rosemont Ln
S Twilight Ln
E 23rd Ave
E 23rd Ave
E 24th Ln
S Steen Rd
E 24th Ln
S Starlight Ln
E Morningside Ln
S Steen Rd
S Man O War Ln
S Sonora Dr
S Steen Rd
S Steen Rd
E Chapman Rd
0
500
1,000 ft



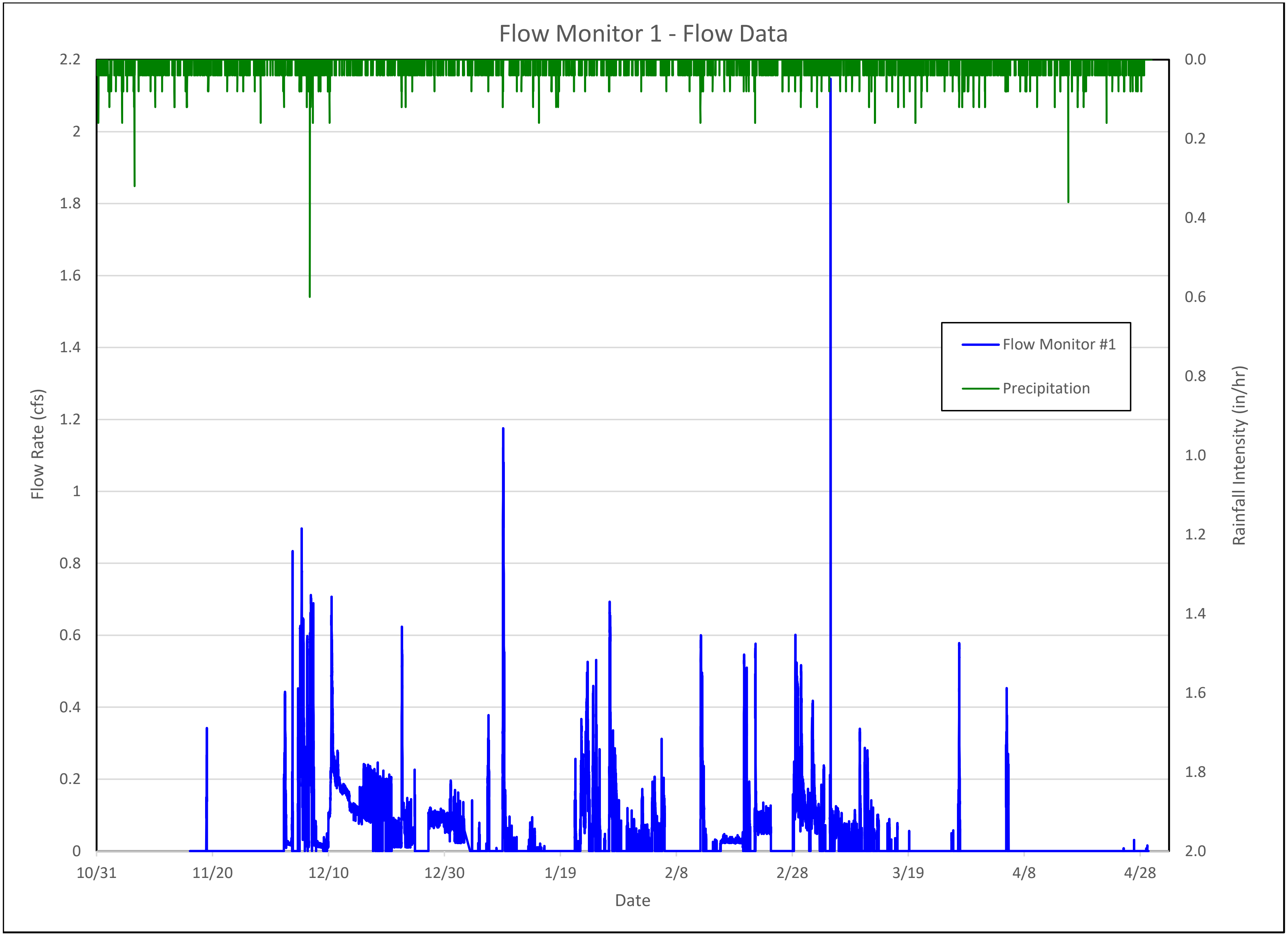
Osborn Consulting

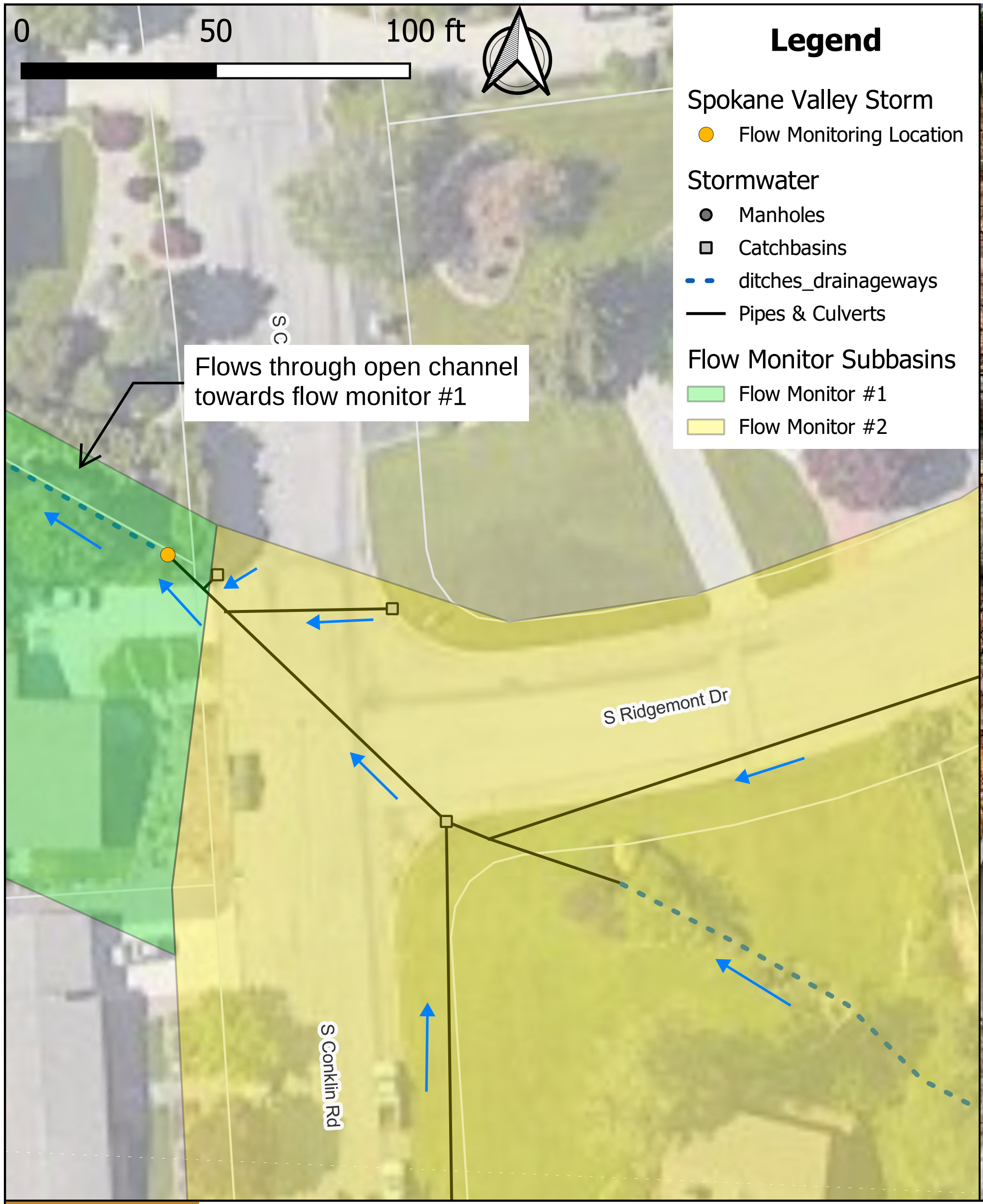
City of Spokane Valley Ridgemont Estates Stormwater Improvements Project

Flow Monitor #1 Installation

Date:11/30/2023

Flow monitor installed 10/31/2023 into 24-inch CMP pipe.
water flows from open channel into pipe.


Flow Monitor 1 - Flow Data
Flow Rate (cfs)
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Rainfall Intensity (in/hr)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
10/31
11/20
12/10
12/30
1/19
2/8
2/28
3/19
4/8
4/28
Date
Flow Monitor #1
Precipitation



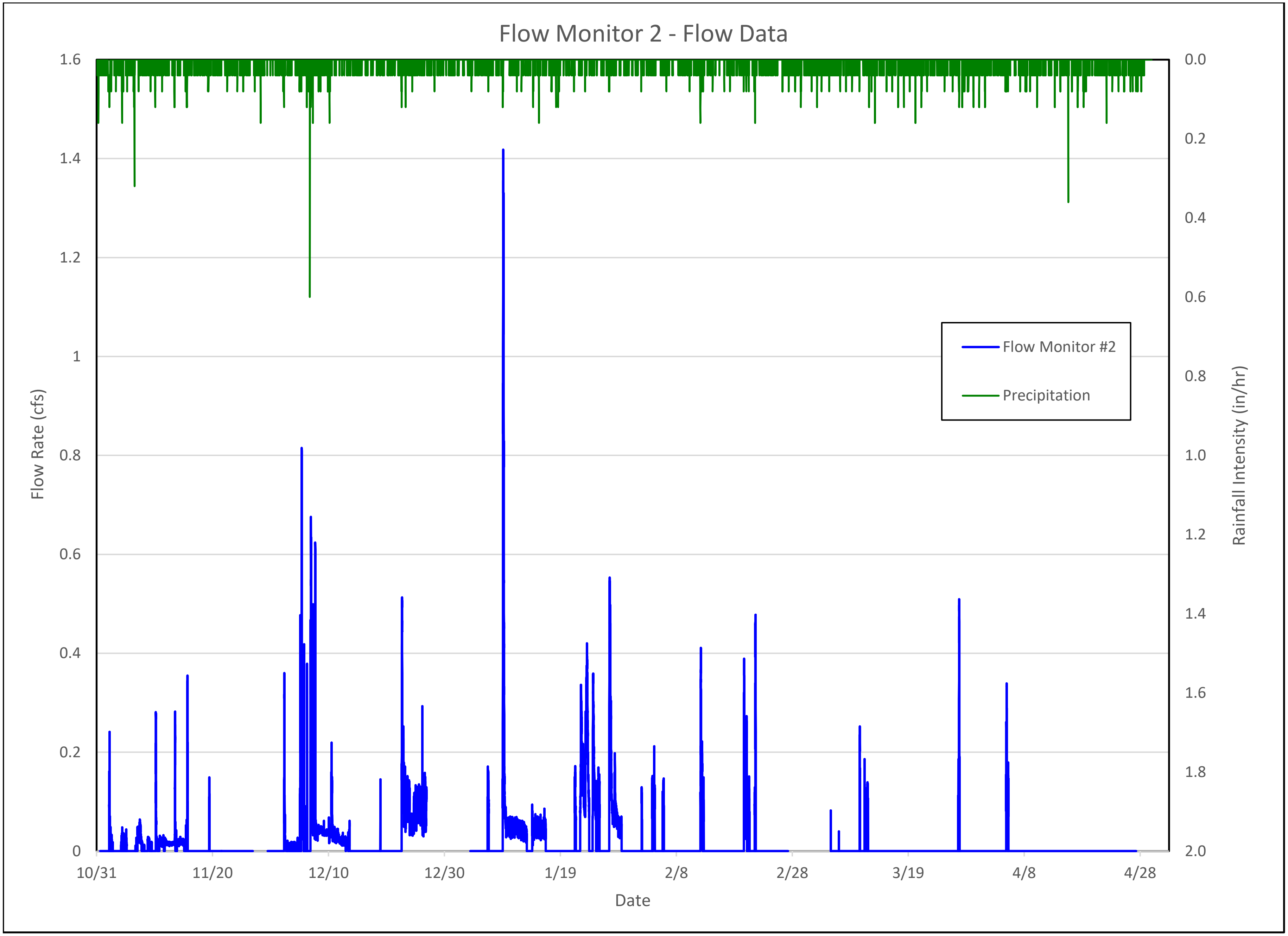
Osborn Consulting

City of Spokane Valley Ridgemont Estates Stormwater Improvements Project

Flow Monitor #2 Installation

Date:11/30/2023

Flow monitor installed 10/31/2023 into 24-inch CMP pipe.
Water flows out of pipe into open channel.


Flow Monitor 2 - Flow Data
Flow Rate (cfs)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Rainfall Intensity (in/hr)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
10/31
11/20
12/10
12/30
1/19
2/8
2/28
3/19
4/8
4/28
Date
Flow Monitor #2
Precipitation

Monitor located in outlet pipe.

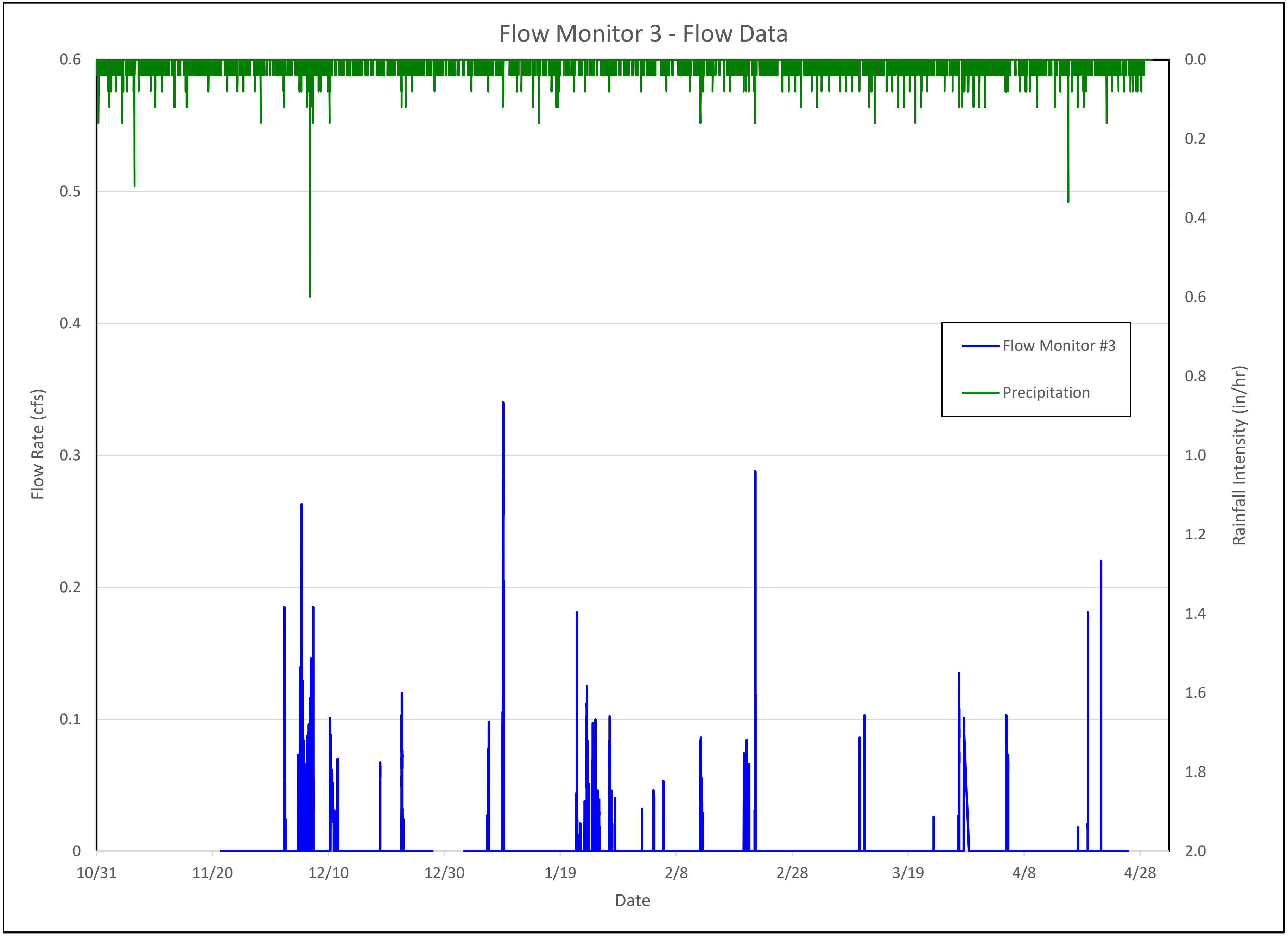
Osborn Consulting

City of Spokane Valley Ridgemont Estates Stormwater Improvements Project

Flow Monitor #3 Installation

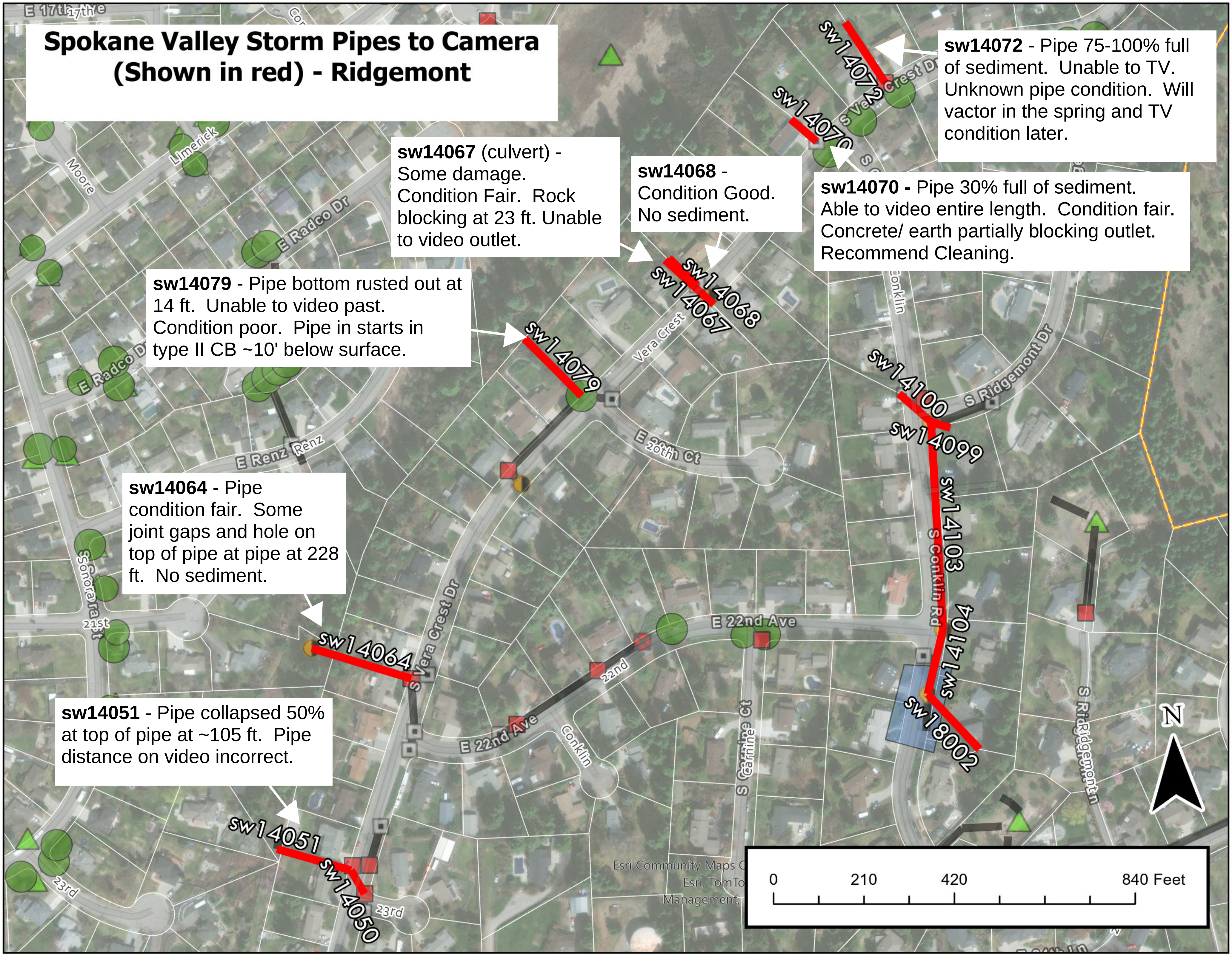
Date:11/30/2023

Flow monitor installed 11/21/2023 into 18-inch CMP pipe located inside concrete inlet structure.


Flow Monitor 3 - Flow Data
Flow Rate (cfs)
0.6
0.5
0.4
0.3
0.2
0.1
0
Rainfall Intensity (in/hr)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Flow Monitor #3
Precipitation
10/31
11/20
12/10
12/30
1/19
2/8
2/28
3/19
4/8
4/28
Date

APPENDIX E
CCTV INSPECTION

Spokane Valley Storm Pipes to Camera (Shown in red) - Ridgemont



sw14072 - Pipe 75-100% full of sediment. Unable to TV. Unknown pipe condition. Will vactor in the spring and TV condition later.

sw14070 - Pipe 30% full of sediment. Able to video entire length. Condition fair. Concrete/ earth partially blocking outlet. Recommend Cleaning.

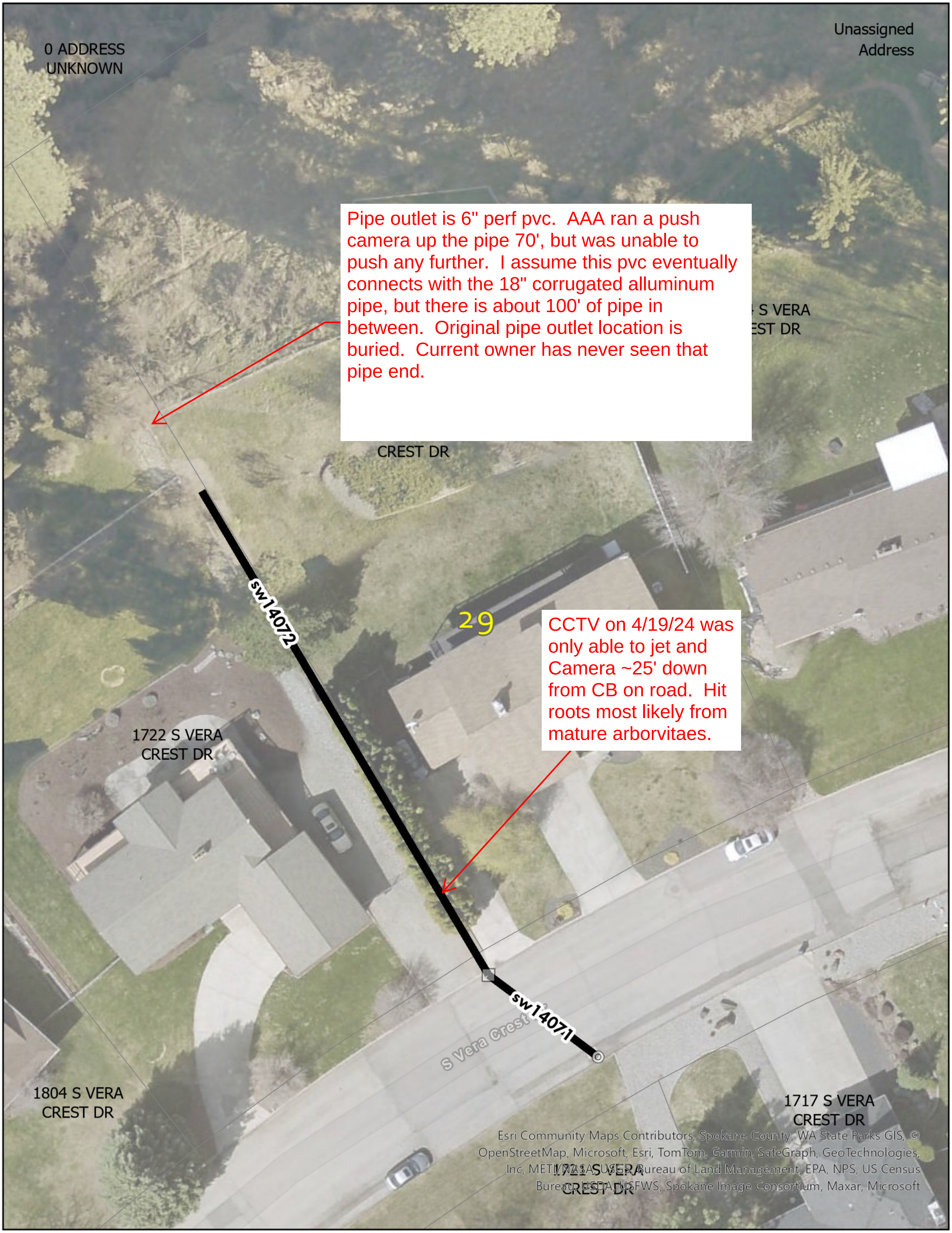
sw14068 - Condition Good. No sediment.

sw14067 (culvert) - Some damage. Condition Fair. Rock blocking at 23 ft. Unable to video outlet.

sw14079 - Pipe bottom rusted out at 14 ft. Unable to video past. Condition poor. Pipe in starts in type II CB ~10' below surface.

sw14064 - Pipe condition fair. Some joint gaps and hole on top of pipe at pipe at 228 ft. No sediment.

sw14051 - Pipe collapsed 50% at top of pipe at ~105 ft. Pipe distance on video incorrect.



Pipe outlet is 6" perf pvc. AAA ran a push camera up the pipe 70', but was unable to push any further. I assume this pvc eventually connects with the 18" corrugated alluminum pipe, but there is about 100' of pipe in between. Original pipe outlet location is buried. Current owner has never seen that pipe end.

CCTV on 4/19/24 was only able to jet and Camera ~25' down from CB on road. Hit roots most likely from mature arborvitaes.

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Mainline Survey Pictures of SW14072 **Project** CSV Veracrest Storm

Work Order	**Date** 08:11 20240215	**Sheet** 1
Street Vera Crest Drive		
City Spokane Valley		**Weather**
Location		
Up Node SW14072	**Down Node** Outflow	**Direction** Downstream

0.7_MSA_From-_To-.jpg

Date: 02/15/2024

Distance: 0.7 ft

Obs:

MSA - Miscellaneous Survey Abandoned

Comments:

Pipe too full

Pipe Graphic for SW14072 **Project** CSV Veracrest Storm

Sheet 1 **Surveyor** AS **Certificate** 1 **System Owner**
Reviwed By **Reviewer #** **Work Order**
Customer **PO** **Media Label**
Date 20240215 08:11 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**
Flow Control **Purpose** **Direction** Downstream
Inspection Status Complete Inspection **Consequence of Failure** **Pressure**
Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

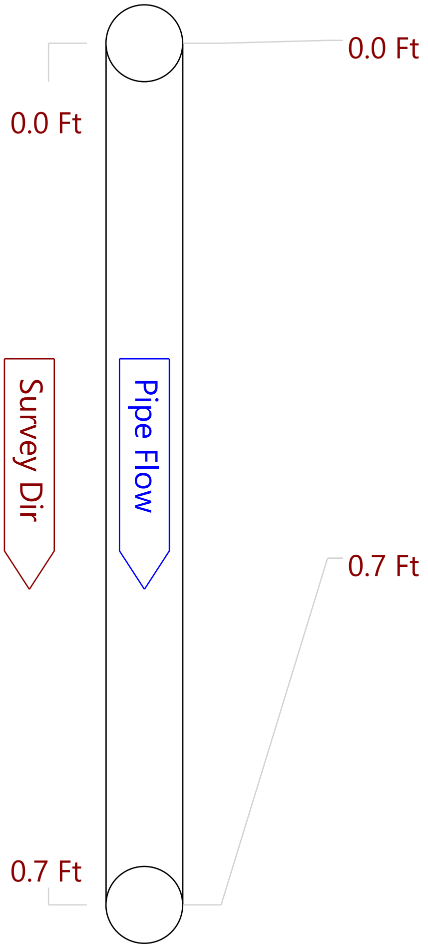
Street Vera Crest Drive **City** Spokane Valley **Drainage Area**
Location **Pipe Use** Stormwater Pipe
Details **Height** 18 **Width** **in**
Shape Circular **Material** Corrugated Metal Pipe **Lining**
Coating **Joint Length** **ft** **Total Length** 0.7 **ft**
Len. Surveyed 0.7 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14072 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**
GPS Accuracy
Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14072]
Miscellaneous Water Level 5%

0.7 Miscellaneous Survey

Miscellaneous Survey Abandoned [Pipe too

Tabular Report for SW14072 **Project** CSV Veracrest Storm

Sheet 1 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 08:11 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest Drive **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 0.7 **ft**

Len. Surveyed 0.7 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14072 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14072
0.0		MWL - Miscellaneous Water Level			005				
0.7		MSA - Miscellaneous Survey Abandoned							Pipe too full

0.7 ft Total Length Surveyed

Scores

	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of SW14070 **Project** CSV Veracrest Storm

Work Order	**Date** 08:31 20240215	**Sheet** 2
Street Vera Crest		
City Spokane Valley		**Weather**
Location		
Up Node SW14070	**Down Node** Outflow	**Direction** Downstream

63.0_AMH_From-_To-.jpg

Date: 02/15/2024

Distance: 63 ft

Obs:
AMH - Manhole

Comments:

Outflow

Pipe Graphic for SW14070 **Project** CSV Veracrest Storm

Sheet 2 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 08:31 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 63.0 **ft**

Len. Surveyed 63.0 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14070 **Rim Invert** **Grade Invert** **Rim Grade** **ft**

Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**

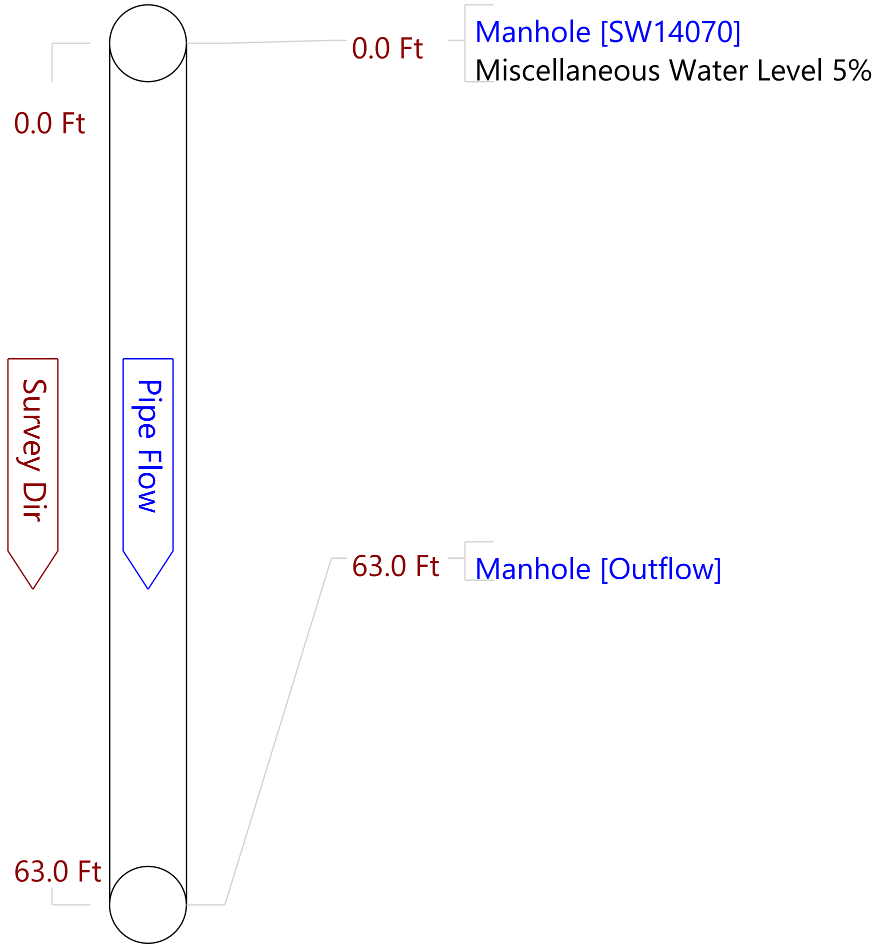
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional



63.0 Manhole

Tabular Report for SW14070 **Project** CSV Veracrest Storm

Sheet 2 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 08:31 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 63.0 **ft**

Len. Surveyed 63.0 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14070 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14070
0.0		MWL - Miscellaneous Water Level			005				
63.0		AMH - Manhole							Outflow

63.0 ft Total Length Surveyed

Scores

	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of SW14067 **Project** CSV Veracrest Storm

Work Order	**Date** 09:01 20240215	**Sheet** 3
Street Vera Crest		
City Spokane Valley		**Weather**
Location		
Up Node SW14067	**Down Node** Outflow	**Direction** Downstream

74.7_MSA_From-_To-.jpg

Date: 02/15/2024

Distance: 74.7 ft

Obs:

MSA - Miscellaneous Survey Abandoned

Comments:

Outflow

Pipe Graphic for SW14067 **Project** CSV Veracrest Storm

Sheet 3 **Surveyor** AS **Certificate** 1 **System Owner**
Reviwed By **Reviewer #** **Work Order**
Customer **PO** **Media Label**
Date 20240215 09:01 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**
Flow Control **Purpose** **Direction** Downstream
Inspection Status Complete Inspection **Consequence of Failure** **Pressure**
Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

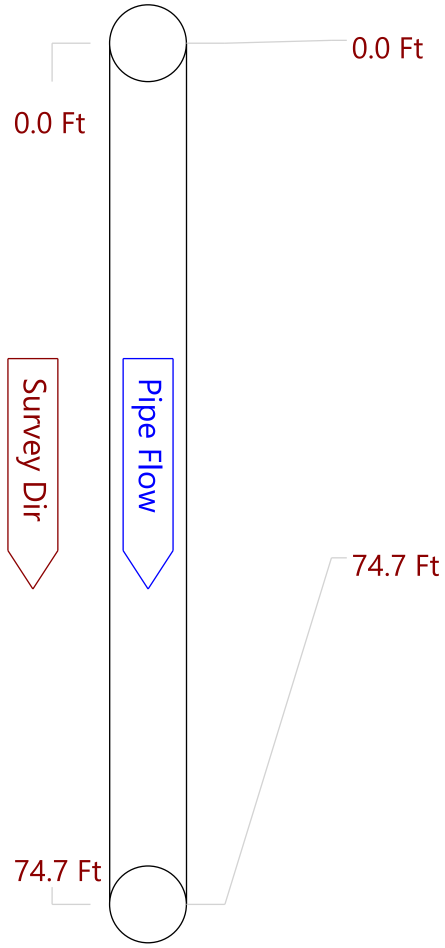
Street Vera Crest **City** Spokane Valley **Drainage Area**
Location **Pipe Use** Stormwater Pipe
Details **Height** 18 **Width** **in**
Shape Circular **Material** Corrugated Metal Pipe **Lining**
Coating **Joint Length** **ft** **Total Length** 74.7 **ft**
Len. Surveyed 74.7 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14067 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**
GPS Accuracy
Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14067]
Miscellaneous Water Level 5%

74.7 Miscellaneous Surve

Miscellaneous Survey Abandoned [Outflow]

Tabular Report for SW14067 **Project** CSV Veracrest Storm

Sheet 3 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 09:01 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 74.7 **ft**

Len. Surveyed 74.7 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14067 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14067
0.0		MWL - Miscellaneous Water Level			005				
74.7		MSA - Miscellaneous Survey Abandoned							Outflow

74.7 ft Total Length Surveyed

Scores	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of SW14068 **Project** CSV Veracrest Storm

Work Order	**Date** 09:20 20240215	**Sheet** 4

Street Vera Crest

City Spokane Valley **Weather**

Location

Up Node SW14068 **Down Node** Outfall **Direction** Downstream

14.2_AMH_From-_To-.jpg

Date: 02/15/2024

Distance: 14.2 ft

Obs:

AMH - Manhole

Comments:

Outfall

Pipe Graphic for SW14068 **Project** CSV Veracrest Storm

Sheet 4 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 09:20 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 14.2 **ft**

Len. Surveyed 14.2 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14068 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outfall **Rim Invert** **Grade Invert** **Rim Grade** **ft**

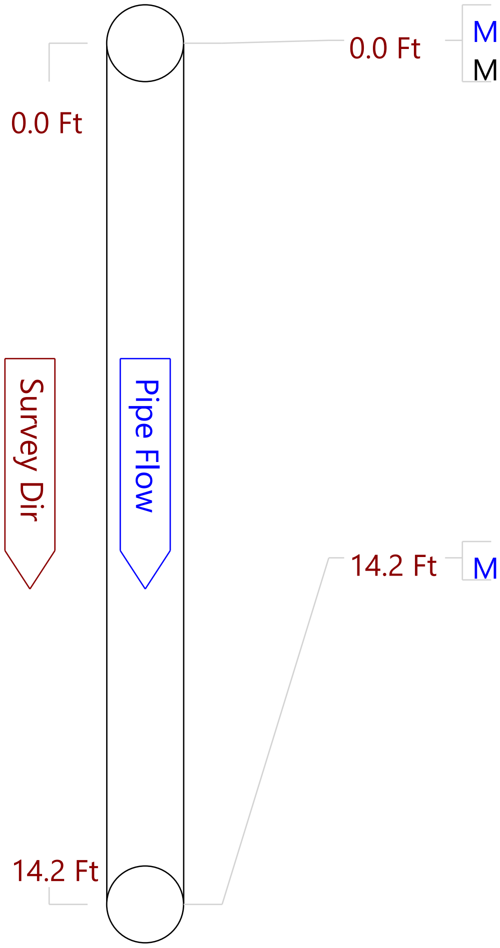
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14068]
Miscellaneous Water Level 5%

14.2 Manhole

Manhole [Outfall]

Tabular Report for SW14068 **Project** CSV Veracrest Storm

Sheet 4 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 09:20 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 14.2 **ft**

Len. Surveyed 14.2 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14068 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outfall **Rim Invert** **Grade Invert** **Rim Grade** **ft**

Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14068
0.0		MWL - Miscellaneous Water Level			005				
14.2		AMH - Manhole							Outfall

14.2 ft Total Length Surveyed

Scores

	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of SW14079 **Project** CSV Veracrest Storm

Work Order	**Date** 09:47 20240215	**Sheet** 5

Street Vera Crest

City Spokane Valley **Weather**

Location

Up Node SW14079 **Down Node** Outflow **Direction** Downstream

Date: 02/15/2024

Distance: 21.7 ft

Obs:

MSA - Miscellaneous Survey Abandoned

Comments:

Damaged Pipe

21.7_MSA_From-_To-.jpg

Pipe Graphic for SW14079 **Project** CSV Veracrest Storm

Sheet 5 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 09:47 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 21.7 **ft**

Len. Surveyed 21.7 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14079 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

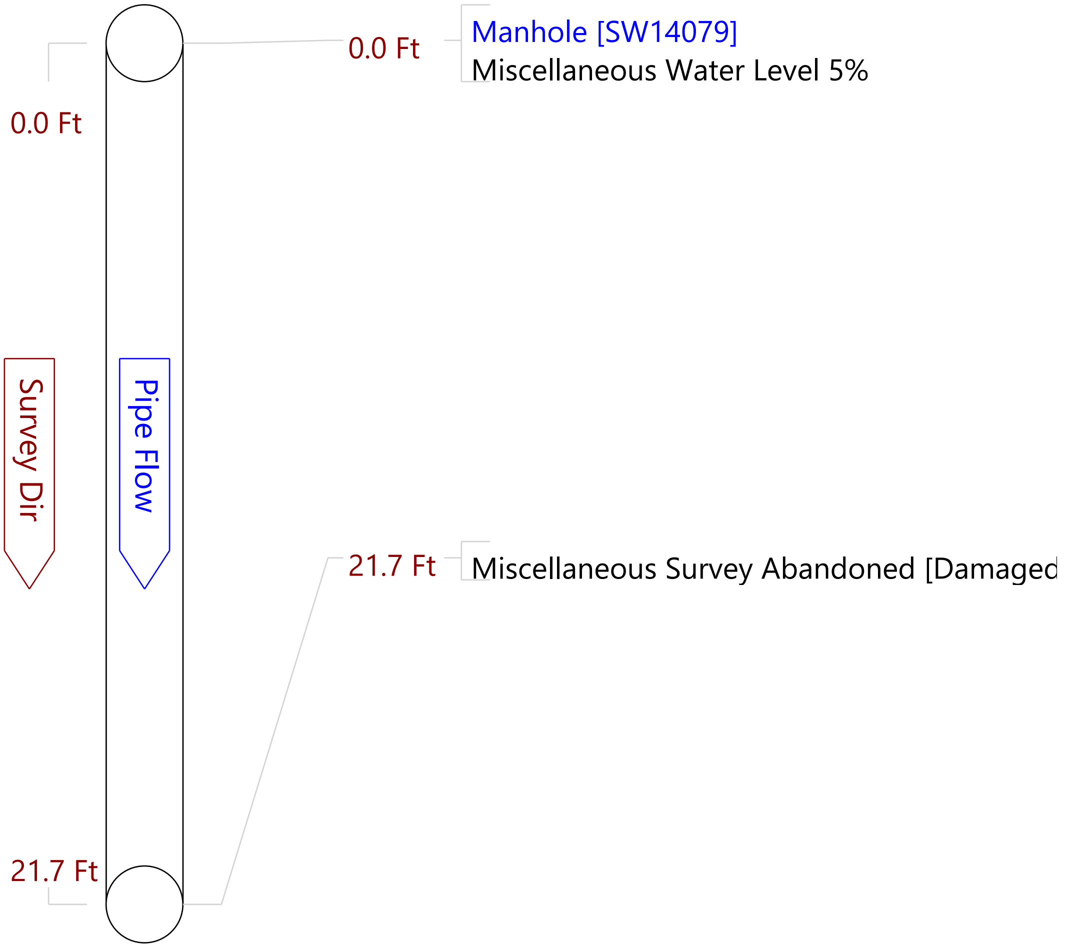
Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional



21.7 Miscellaneous Surve

Tabular Report for SW14079 **Project** CSV Veracrest Storm

Sheet 5 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 09:47 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 21.7 **ft**

Len. Surveyed 21.7 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14079 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**

Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14079
0.0		MWL - Miscellaneous Water Level			005				
21.7		MSA - Miscellaneous Survey Abandoned							Damaged Pipe

21.7 ft Total Length Surveyed

Scores

	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of SW14064 **Project** CSV Veracrest Storm

Work Order **Date** 10:28 20240215 **Sheet** 6

Street Vera Crest

City Spokane Valley **Weather**

Location

Up Node SW14064 **Down Node** Outflow **Direction** Downstream

246.5_MSA_From-_To-.jpg

Date: 02/15/2024

Distance: 246.5 ft

Obs:

MSA - Miscellaneous Survey Abandoned

Comments:

Water Blockage

Pipe Graphic for SW14064 **Project** CSV Veracrest Storm

Sheet 6 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 10:28 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 246.5 **ft**

Len. Surveyed 246.5 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14064 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**

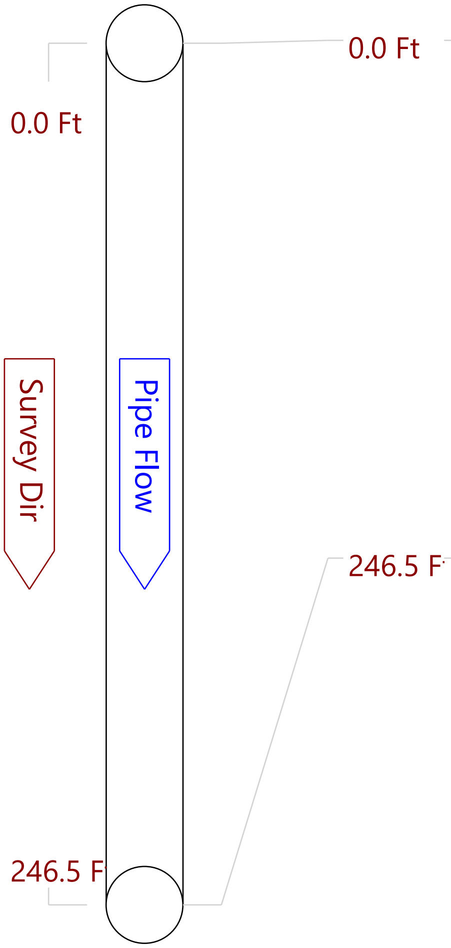
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14064]
Miscellaneous Water Level 5%

246.5 Miscellaneous Surv

Miscellaneous Survey Abandoned [Water Blc

Tabular Report for SW14064 **Project** CSV Veracrest Storm

Sheet 6 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 10:28 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 246.5 **ft**

Len. Surveyed 246.5 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14064 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down Outflow **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14064
0.0		MWL - Miscellaneous Water Level			005				
246.5		MSA - Miscellaneous Survey Abandoned							Water Blockage

246.5 ft Total Length Surveyed

Scores	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of SW14051 **Project** CSV Veracrest Storm

Work Order	**Date** 11:22 20240215	**Sheet** 7

Street Vera Crest

City Spokane Valley **Weather**

Location

Up Node SW14051 **Down Node** SW14052 **Direction** Downstream

27.9_MSA_From-_To-.jpg

Date: 02/15/2024

Distance: 27.9 ft

Obs:

MSA - Miscellaneous Survey Abandoned

Comments:

Pipe Collapse

Pipe Graphic for SW14051 **Project** CSV Veracrest Storm

Sheet 7 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240215 11:22 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 27.9 **ft**

Len. Surveyed 27.9 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14051 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14052 **Rim Invert** **Grade Invert** **Rim Grade** **ft**

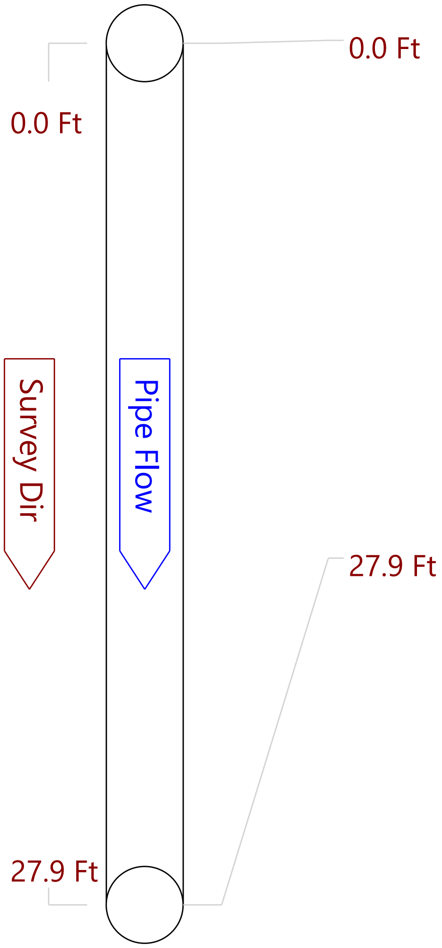
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14051]
Miscellaneous Water Level 5%

27.9 Miscellaneous Survey

Miscellaneous Survey Abandoned [Pipe Colla

Tabular Report for SW14051 **Project** CSV Veracrest Storm

Sheet 7 **Surveyor** AS **Certificate** 1 **System Owner**
Reviwed By **Reviewer #** **Work Order**
Customer **PO** **Media Label**
Date 20240215 11:22 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**
Flow Control **Purpose** **Direction** Downstream
Inspection Status Complete Inspection **Consequence of Failure** **Pressure**
Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Vera Crest **City** Spokane Valley **Drainage Area**
Location **Pipe Use** Stormwater Pipe
Details **Height** 18 **Width** **in**
Shape Circular **Material** Corrugated Metal Pipe **Lining**
Coating **Joint Length** **ft** **Total Length** 27.9 **ft**
Len. Surveyed 27.9 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14051 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14052 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

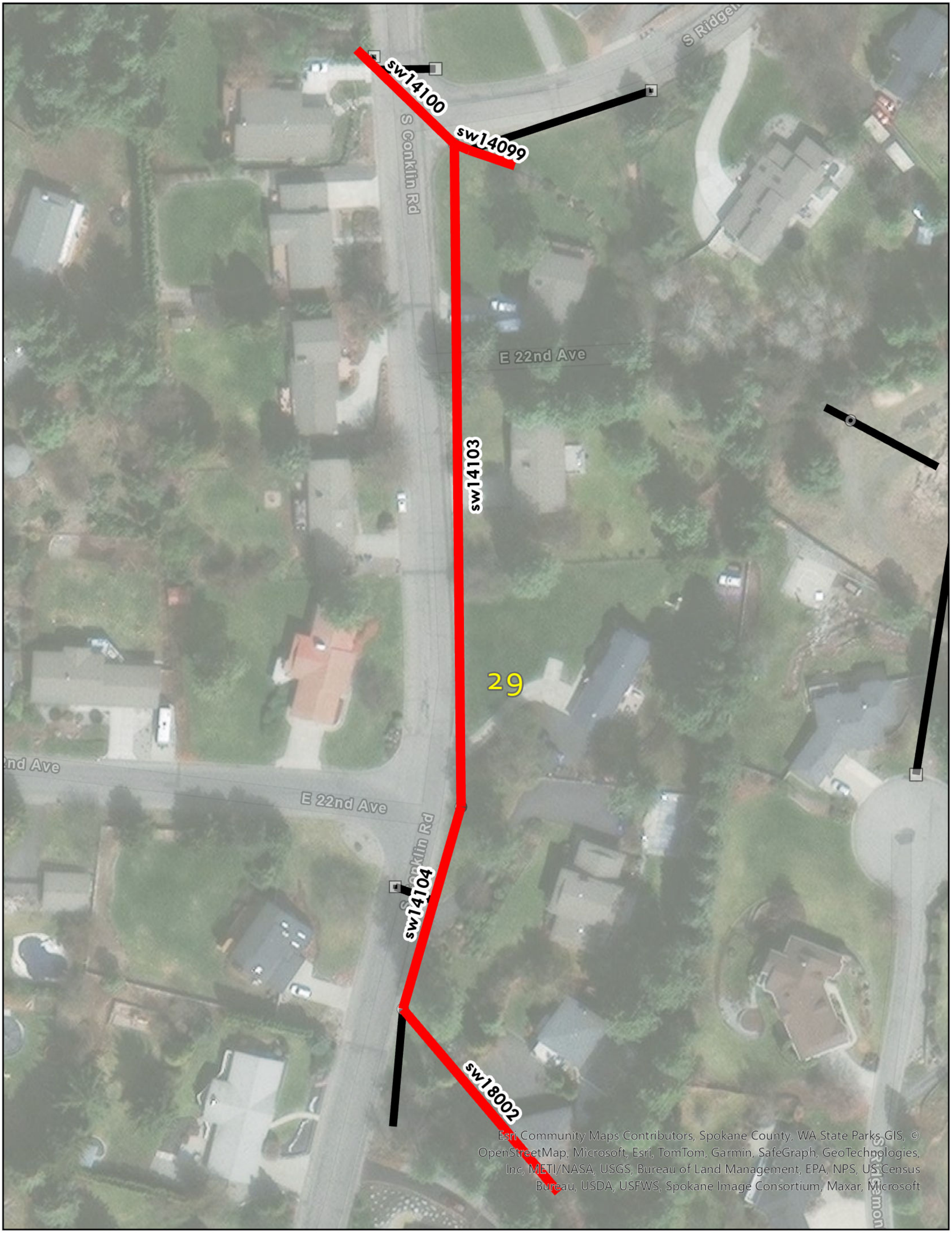
Coordinate System **Vertical Datum**
GPS Accuracy
Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14051
0.0		MWL - Miscellaneous Water Level			005				
27.9		MSA - Miscellaneous Survey Abandoned							Pipe Collapse

27.9 ft Total Length Surveyed

Scores	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000



Esri Community Maps Contributors, Spokane County, WA State Parks GIS, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS, Spokane Image Consortium, Maxar, Microsoft

Mainline Survey Pictures of SW14099-End **Project** CSV Veracrest Storm

Work Order	**Date** 14:09 20240419	**Sheet** 13

Street Ridgemont

City Spokane Valley **Weather**

Location

Up Node End **Down Node** SW14099 **Direction** Upstream

29.4_AMH_From-_To-.jpg

Date: 04/19/2024

Distance: 29.4 ft

Obs:

AMH - Manhole

Comments:

End

Pipe Graphic for SW14099-End **Project** CSV Veracrest Storm

Sheet 13 **Surveyor** AAA **Certificate** AAA **System Owner**
Reviwed By **Reviewer #** **Work Order**
Customer **PO** **Media Label**
Date 20240419 14:09 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**
Flow Control **Purpose** **Direction** Upstream
Inspection Status Complete Inspection **Consequence of Failure** **Pressure**
Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

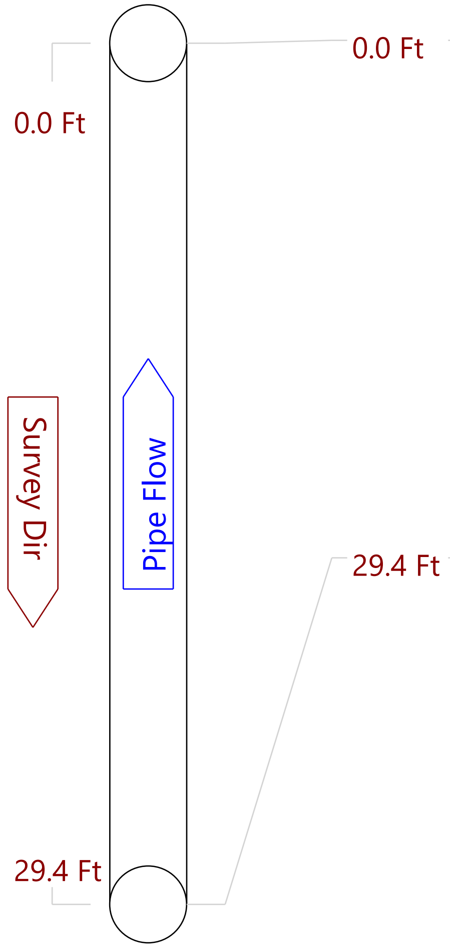
Street Ridgemont **City** Spokane Valley **Drainage Area**
Location **Pipe Use** Stormwater Pipe
Details **Height** 18 **Width** **in**
Shape Circular **Material** Corrugated Metal Pipe **Lining**
Coating **Joint Length** **ft** **Total Length** 29.4 **ft**
Len. Surveyed 29.4 **ft** **Year Constructed** **Year Rehabilitated**

Up End **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14099 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**
GPS Accuracy
Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14099]
Miscellaneous Water Level 5%

29.4 Manhole

Manhole [End]

Tabular Report for SW14099-End **Project** CSV Veracrest Storm

Sheet 13 **Surveyor** AAA **Certificate** AAA **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240419 14:09 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Upstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Ridgemont **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 29.4 **ft**

Len. Surveyed 29.4 **ft** **Year Constructed** **Year Rehabilitated**

Up End **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14099 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14099
0.0		MWL - Miscellaneous Water Level			005				
29.4		AMH - Manhole							End

29.4 ft Total Length Surveyed

Scores

	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of SW14099-SW14100

Project CSV Veracrest Storm

Work Order

Date 13:59 20240419

Sheet 12

Street Conklin

City Spokane Valley

Weather

Location

Up Node SW14099

Down Node SW14100

Direction Downstream

3.2_TF_From-02_To-.jpg

Date: 04/19/2024

Distance: 3.182415 ft

Obs:

TF - Tap Factory

Comments:

37.1_X_From-_To-.jpg

Date: 04/19/2024

Distance: 37.1 ft

Obs:

X - Collapse

Comments:

Blockage

37.1_MSA_From-_To-.jpg

Date: 04/19/2024

Distance: 37.1 ft

Obs:

MSA - Miscellaneous Survey Abandoned

Comments:

colasped pipe

Pipe Graphic for SW14099-SW14100 **Project** CSV Veracrest Storm

---

Sheet 12 **Surveyor** AAA **Certificate** AAA **System Owner**
Reviwed By **Reviewer #** **Work Order**
Customer **PO** **Media Label**
Date 20240419 13:59 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**
Flow Control **Purpose** **Direction** Downstream
Inspection Status Complete Inspection **Consequence of Failure** **Pressure**
Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

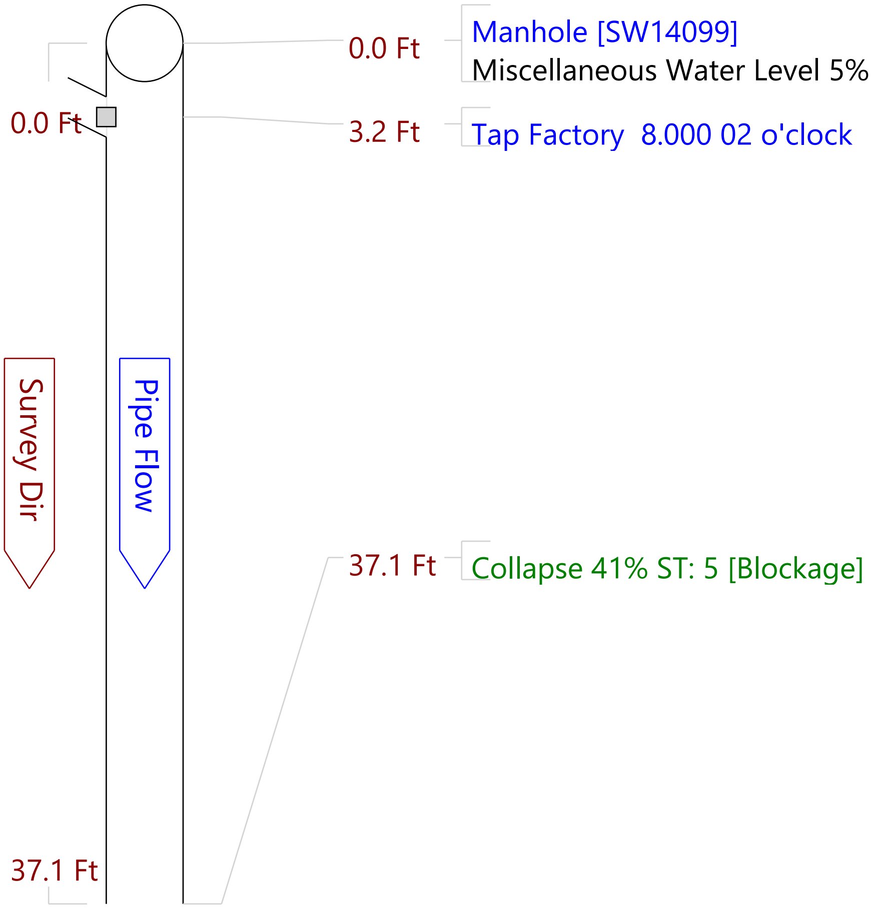
Street Conklin **City** Spokane Valley **Drainage Area**
Location **Pipe Use** Stormwater Pipe
Details **Height** 18 **Width** **in**
Shape Circular **Material** Corrugated Metal Pipe **Lining**
Coating **Joint Length** **ft** **Total Length** 37.1 **ft**
Len. Surveyed 37.1 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14099 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14100 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**
GPS Accuracy
Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14099]
Miscellaneous Water Level 5%

Tap Factory 8.000 02 o'clock

Collapse 41% ST: 5 [Blockage]

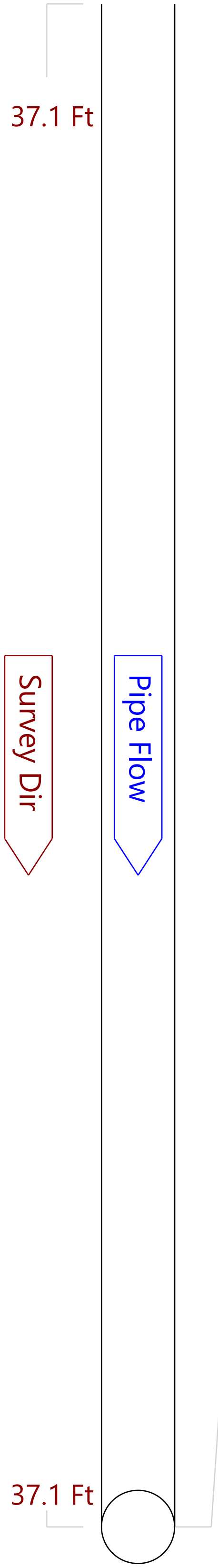
3.2 Tap Factory

37.1 Collapse

Pipe Graphic Report for PSR SW14099-SW14100 **Project** CSV Veracrest Storm

Sheet 12 **Date** 20240419 **UP** SW14099

DW SW14100



37.1 Ft Miscellaneous Survey Abandoned [colasped

37.1 Miscellaneous Surve

Tabular Report for SW14099-SW14100 **Project** CSV Veracrest Storm

---

Sheet 12 **Surveyor** AAA **Certificate** AAA **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240419 13:59 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Conklin **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 37.1 **ft**

Len. Surveyed 37.1 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14099 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14100 **Rim Invert** **Grade Invert** **Rim Grade** **ft**

Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14099
0.0		MWL - Miscellaneous Water Level			005				
3.2		TF - Tap Factory	8.0				02		
37.1		X - Collapse			041				Blockage
37.1		MSA - Miscellaneous Survey Abandoned							colasped pipe

37.1 ft Total Length Surveyed

Scores

	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	5	5	5100
O&M	0	0	0000
Overall	5	5	5100

Mainline Survey Pictures of SW14099-SW14103 **Project** CSV Veracrest Storm

Work Order	**Date** 13:27 20240419	**Sheet** 11
Street Conklin		
City Spokane Valley	**Weather**	
Location		
Up Node SW14103	**Down Node** SW14099	**Direction** Upstream

466.9_AMH_From-_To-.jpg

Date: 04/19/2024

Distance: 466.9 ft

Obs:
AMH - Manhole

Comments:

SW14103

Pipe Graphic for SW14099-SW14103 **Project** CSV Veracrest Storm

---

Sheet 11 **Surveyor** AAA **Certificate** AAA **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240419 13:27 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Upstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Conklin **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 466.9 **ft**

Len. Surveyed 466.9 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14103 **Rim Invert** **Grade Invert** **Rim Grade** **ft**

Northing **Easting** **Elevation**

Down SW14099 **Rim Invert** **Grade Invert** **Rim Grade** **ft**

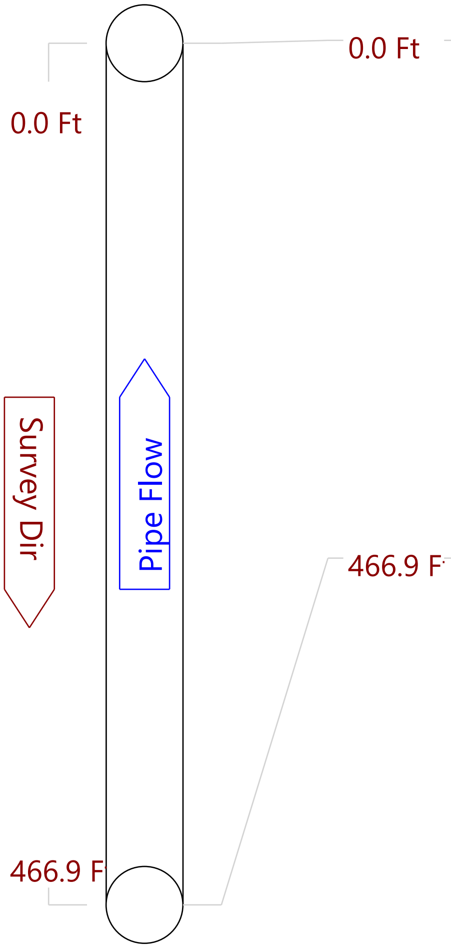
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [SW14099]
Miscellaneous Water Level 5%

Manhole [SW14103]

466.9 Manhole

Tabular Report for SW14099-SW14103 **Project** CSV Veracrest Storm

Sheet 11 **Surveyor** AAA **Certificate** AAA **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240419 13:27 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Upstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Conklin **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 466.9 **ft**

Len. Surveyed 466.9 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14103 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14099 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14099
0.0		MWL - Miscellaneous Water Level			005				
466.9		AMH - Manhole							SW14103

466.9 ft Total Length Surveyed

Scores	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of Sw14104-SW14103 **Project** CSV Veracrest Storm

Work Order **Date** 12:51 20240419 **Sheet** 10

Street Conklin

City Spokane Valley **Weather**

Location

Up Node SW14104 **Down Node** SW14103 **Direction** Downstream

95.9_TF_From-09_To-.jpg

Date: 04/19/2024

Distance: 95.9 ft

Obs:

TF - Tap Factory

Comments:

143.2_AMH_From-_To-.jpg

Date: 04/19/2024

Distance: 143.2 ft

Obs:

AMH - Manhole

Comments:

SW14103

Pipe Graphic for Sw14104-SW14103 **Project** CSV Veracrest Storm

Sheet 10 **Surveyor** AS **Certificate** 1 **System Owner**
Reviwed By **Reviewer #** **Work Order**
Customer **PO** **Media Label**
Date 20240419 12:51 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**
Flow Control **Purpose** **Direction** Downstream
Inspection Status Complete Inspection **Consequence of Failure** **Pressure**
Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

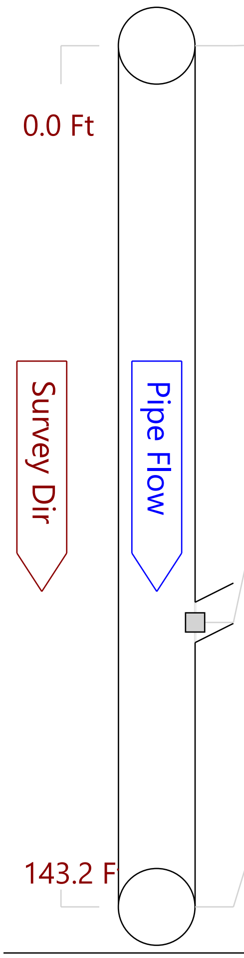
Street Conklin **City** Spokane Valley **Drainage Area**
Location **Pipe Use** Stormwater Pipe
Details **Height** 18 **Width** **in**
Shape Circular **Material** Corrugated Metal Pipe **Lining**
Coating **Joint Length** **ft** **Total Length** 143.2 **ft**
Len. Surveyed 143.2 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14104 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14103 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**
GPS Accuracy
Additionl Info

Miscellaneous Structural O&M Constructional



0.0 Ft Manhole [SW14104]
Miscellaneous Water Level 5%

95.9 Ft Tap Factory 12.000 09 o'clock

143.2 F Manhole [SW14103]

95.9 Tap Factory

143.2 Manhole

Tabular Report for Sw14104-SW14103 **Project** CSV Veracrest Storm

Sheet 10 **Surveyor** AS **Certificate** 1 **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240419 12:51 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Downstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Conklin **City** Spokane Valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 143.2 **ft**

Len. Surveyed 143.2 **ft** **Year Constructed** **Year Rehabilitated**

Up SW14104 **Rim Invert** **Grade Invert** **Rim Grade** **ft**

Northing **Easting** **Elevation**

Down SW14103 **Rim Invert** **Grade Invert** **Rim Grade** **ft**

Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							SW14104
0.0		MWL - Miscellaneous Water Level			005				
95.9		TF - Tap Factory	12.0				09		
143.2		AMH - Manhole							SW14103

143.2 ft Total Length Surveyed

Scores

	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	0	0	0000
O&M	0	0	0000
Overall	0	0	0000

Mainline Survey Pictures of sw14104-sw18002

Project CSV Veracrest Storm

Work Order

Date 12:27 20240419

Sheet 9

Street Conklin

City spokane valley

Weather

Location

Up Node SW18002

Down Node SW14104

Direction Upstream

Date: 04/19/2024

Distance: 42.1 ft

Obs:

X - Collapse

Comments:

42.1_X_From-_To-.jpg

Date: 04/19/2024

Distance: 96.1 ft

Obs:

TBI - Tap Break-in Intruding

Comments:

96.1_TBI_From-12_To-.jpg

Date: 04/19/2024

Distance: 105.7 ft

Obs:

TBI - Tap Break-in Intruding

Comments:

105.7_TBI_From-10_To-.jpg

Pipe Graphic for sw14104-sw18002 **Project** CSV Veracrest Storm

Sheet 9 **Surveyor** AAA **Certificate** AAA **System Owner**

Reviwed By **Reviewer #** **Work Order**

Customer **PO** **Media Label**

Date 20240419 12:27 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**

Flow Control **Purpose** **Direction** Upstream

Inspection Status Complete Inspection **Consequence of Failure** **Pressure**

Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Conklin **City** spokane valley **Drainage Area**

Location **Pipe Use** Stormwater Pipe

Details **Height** 18 **Width** **in**

Shape Circular **Material** Corrugated Metal Pipe **Lining**

Coating **Joint Length** **ft** **Total Length** 160.9 **ft**

Len. Surveyed 160.9 **ft** **Year Constructed** **Year Rehabilitated**

Up SW18002 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

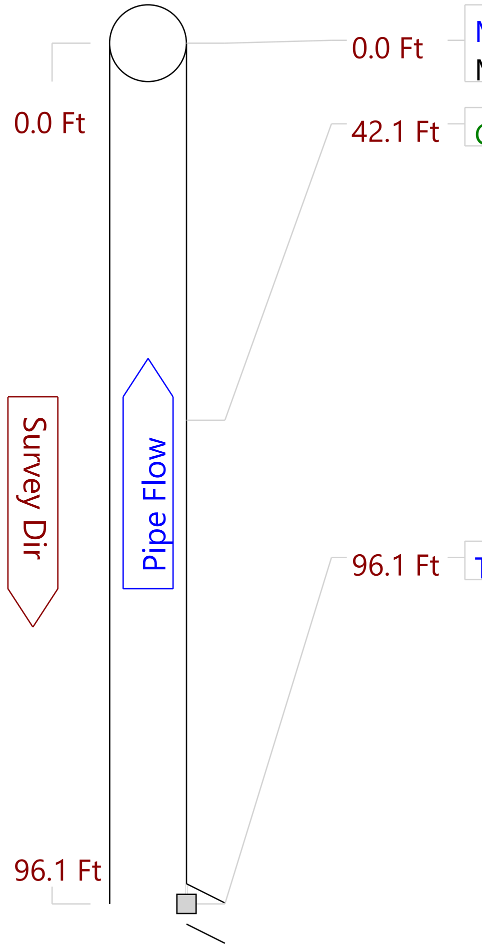
Down SW14104 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**

GPS Accuracy

Additionl Info

Miscellaneous Structural O&M Constructional



Manhole [sw14104]
Miscellaneous Water Level 5%

Collapse 41% ST: 5

Tap Break-in Intruding 12.000 12 o'clock 12.(

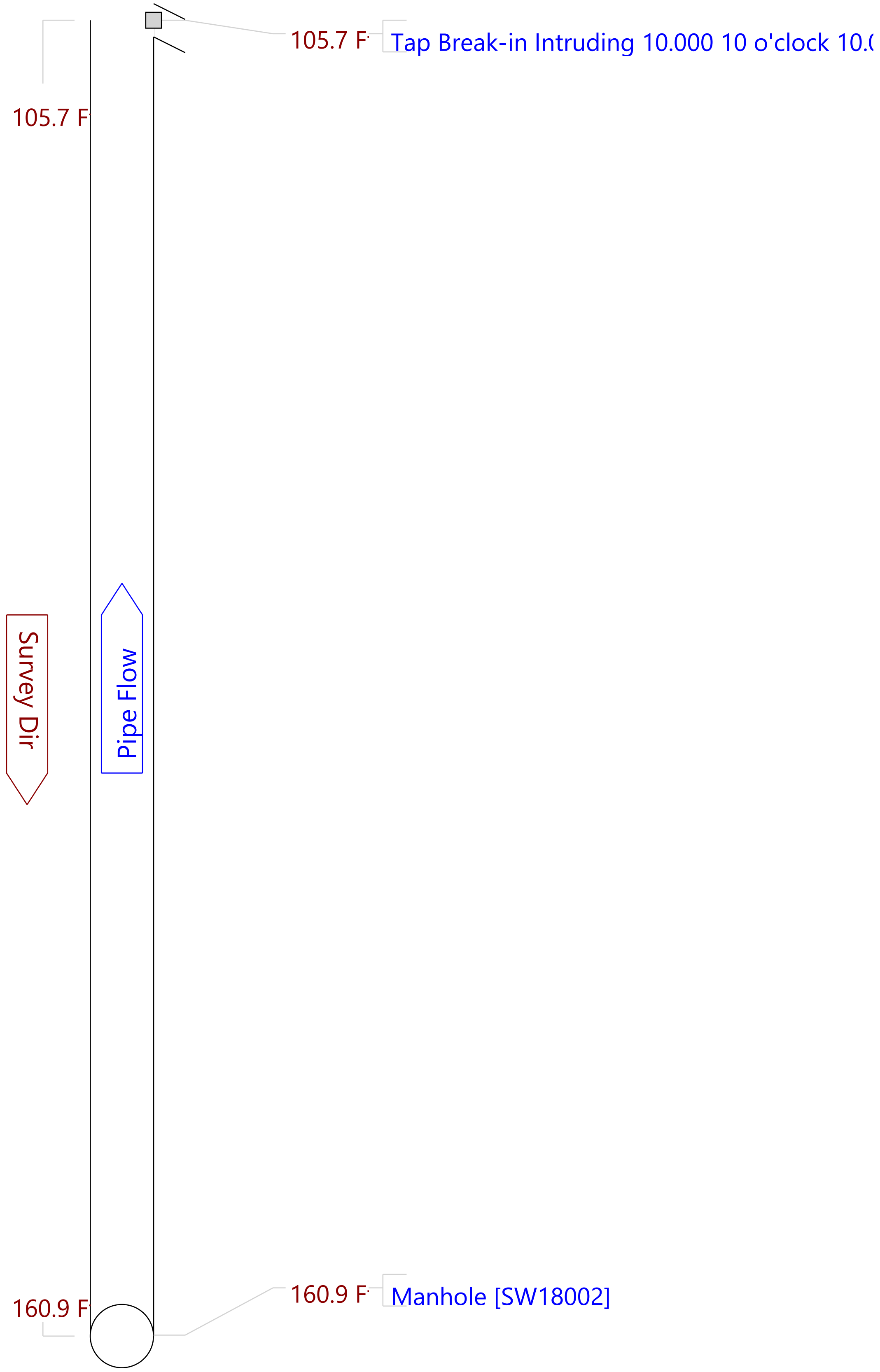
42.1 Collapse

96.1 Tap Break-in Intrudir

Pipe Graphic Report for PSR sw14104-sw18002 **Project** CSV Veracrest Storm

Sheet 9 **Date** 20240419 **UP** SW18002

DW SW14104



105 7 Tap Break-in Intrud

Tabular Report for sw14104-sw18002 **Project** CSV Veracrest Storm

Sheet 9 **Surveyor** AAA **Certificate** AAA **System Owner**
Reviwed By **Reviewer #** **Work Order**
Customer **PO** **Media Label**
Date 20240419 12:27 **Weather** **PreClean** No Pre-Cleaning **Date Cleaned**
Flow Control **Purpose** **Direction** Upstream
Inspection Status Complete Inspection **Consequence of Failure** **Pressure**
Inspection Technology Used ☐ **CCTV** ☐ **Laser** ☐ **Sonar** ☐ **Sidewall** ☐ **Zoom** ☐ **Other**

Street Conklin **City** spokane valley **Drainage Area**
Location **Pipe Use** Stormwater Pipe
Details **Height** 18 **Width** **in**
Shape Circular **Material** Corrugated Metal Pipe **Lining**
Coating **Joint Length** **ft** **Total Length** 160.9 **ft**
Len. Surveyed 160.9 **ft** **Year Constructed** **Year Rehabilitated**

Up SW18002 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Down SW14104 **Rim Invert** **Grade Invert** **Rim Grade** **ft**
Northing **Easting** **Elevation**

Coordinate System **Vertical Datum**
GPS Accuracy
Additionl Info

Miscellaneous Structural O&M Constructional

Count	CD	Code	Val 1	Val 2	%	Jnt	Fr	To	Remarks
0.0		AMH - Manhole							sw14104
0.0		MWL - Miscellaneous Water Level			005				
42.1		X - Collapse			041				
96.1		TBI - Tap Break-in Intruding	12.0	12.0			12		
105.7		TBI - Tap Break-in Intruding	10.0	10.0			10		
160.9		AMH - Manhole							SW18002

160.9 ft Total Length Surveyed

Scores	Pipe Rating	Pipe Ratings Index	Quick Score
Structural	5	5	5100
O&M	10	5	5200
Overall	15	5	5300

APPENDIX F
EASEMENT SUMMARY

Osborn Consulting
101 S Stevens Street, Suite 103
Spokane, Washington 99201
509.867.3654

TECHNICAL MEMORANDUM

Project: 30-230010 City of Spokane Valley Ridgemont Estates Stormwater
To: Chad Phillips, PE | City of Spokane Valley
From: Josh Van Wie, PE, Project Manager | Osborn Consulting
Subject: Ridgemont Estates Easement Maps
Date: September 26, 2024

INTRODUCTION

This technical memorandum summarizes the existing drainage easements in the Ridgemont Estates drainage study area. Easement information was provided by the City of Spokane Valley and reviewed by Osborn Consulting to determine how the legal language of the easements might affect proposed stormwater solutions developed by the study.

EASEMENT SUMMARIES

There are five drainage easement documents that define easements in the study area (6354475, 7802100057, 7512120141, 9410240669, and 4710383). Stormwater language from each easement copied in the pages below for easier readability. A map of the easements is included in Attachment 1 to this technical memorandum. Easement legal documents are provided in Attachment 2.

Notes from reviewing the easement documents are provided below:

- Most of the easements were put in place prior to incorporation of the City of Spokane Valley. Our understanding is that the easement rights were transferred from Spokane County to the City of Spokane Valley at the time of incorporation.
- Some of the easement documents have vague language and state generally that a utility easement is granted but do not provide details specifically about stormwater.
- Other easement documents have more detailed information and specifically state that the drainage easements are granted for the purpose of installing, operating, maintaining drainage swales and other facilities to dispose runoff.
- Osborn did not identify any language that appears likely to limit any of the proposed solutions presented in the Ridgemont Estates study. However, the City's legal team should review easement language prior to moving forward with any construction within the easements.

Easement 6354475 -16th Avenue Pond

General easement area: 16th Avenue Pond

Easement language relevant to stormwater is included below:

> Tupper/Renz shall continue to own the fee interest in the property described in Exhibit A. Tupper/Renz hereby grants to the City a perpetual, non-exclusive easement on the property described as the easement area in Exhibit A for use as a storm water and drainage runoff area for the area it presently serves.
>
> Tupper/Renz shall continue to maintain the storm water and drainage runoff area on the Exhibit A easement property as it has done in the past.
>
> Tupper/Renz shall indemnify the City for all damages caused by the failure of Tupper/Renz to properly operate and maintain the storm water and drainage runoff easement. Tupper/Renz shall be under no obligation to treat or specially process any water or maintain any area other than the easement area described in Exhibit A. Tupper/Renz shall not be required to perform any duties in the maintenance of the easement it has not done in the past
>
> Tupper/Renz shall timely pay and keep current all taxes and assessments levied against the Exhibit A property and shall keep such property free of any liens adverse to the storm water and drainage easement.
>
> Tupper/Renz shall have the right to sell its interest in and/or grant an easement to Vera Water and Power to access and use the property described in Exhibit A, but the terms and conditions herein shall run with the land, and be binding on any successors and assigns.

Easement 7802100057 – North Vera Crest

General easement area: North portion of Vera Crest Drive, Ridgemont Drive, and Conklin Drive

Easement language relevant to stormwater is included below:

> Utility easements are hereby granted to or across those lots shown hereon.
>
> Lot 14, Block 1, and Lot 5, Block 5, as shown hereon are dedicated to Spokane County as general County property to be dedicated for road purposes, forever at such time as the road is continued as a full width right-of-way, or until adjacent lands are platted.
>
> The plat for the 20 developments is located in Plat No. 7802100057. Language regarding drainage easements for this plat is provided below.
>
> The owners of Lots 1, 4, 5, 6, 7, 11, & 12, Block 1; Lots 1, 7, 8, Block 2; and Lots 1, 2, 5, 6, 7, 16, and 17 Block 4, shall be held responsible for obstructing, artificially collecting or discharging, the natural drainage flow across or adjacent to their property, and shall assume full responsibility for damage to their or any other property as a result of their obstructing, artificially collecting, or discharging the drainage flow. By permitting the drainage easements to be platted as shown hereon, Spokane County does not accept the responsibility of maintaining the drainage course or the responsibility for any damage whatsoever, including but not limited to inverse condemnation to any properties due to the drainage flow.

Easement 7512120141 - South Vera Crest

General easement area: South potion of Vera Crests, 22nd Avenue, Carmine Court, and 20th Court

Easement language relevant to stormwater is included below:

> Utility easements are granted at the locations and for the purposes shown hereon.

Easement 9410240669 – Radco Pond

General easement area: Properties on Renz Drive near Radco Pond

Easement language relevant to stormwater is included below:

> Utility easements shown are hereby granted.
>
> The platter does hereby dedicate forever the streets shown hereon for public road purposes.
>
> Utility easements shown on the herein described plat are hereby dedicated to serving the utility companies for the construction, reconstruction, maintenance and operation of utilities. Together with the right to inspect said utilities and to trim and/or remove brush and trees that may interfere with the construction maintenance and operation of the same.
>
> Utility Lot "B" as shown on this plat is hereby dedicated to the Ridgemont Estates North 3RD and 4TH HOMEOWNERS ASSOCIATION created by document recorded 9/16/94 under State UBI number 601-573-088. Utility Lot "B" may not be sold or transferred, regardless of any provisions in the covenants to the contrary without expressed written approval by Spokane County, and shall be considered subservient estates to all lots within this plat for the purpose of real estate taxes. Should RIDGEMONT ESTATES NORTH 3RD AND 4TH HOMEOWNERS ASSOCIATION be terminated for any reason, the successors in interest for Utility Lot "B" shall be the individual lot owners of lots within this plat, or their successors in interest, who are members of the RIDGEMONT ESTATES NORTH 3RD AND 4TH HOMEOWNERS ASSOCIATION at the time of said determination.
>
> Drainage easements, as platted and shown hereon, which are for the purposes of installing, operating and maintaining drainage swales and drainage facilities to dispose of runoff, are hereby granted to Spokane County, the public, and the RIDGEMONT ESTATES NORTH 3RD AND 4TH HOMEOWNERS ASSOCIATION. No structures shall be constructed thereon. The RIDGEMONT ESTATES NORTH 3RD AND 4TH HOMEOWNERS ASSOCIATION shall be responsible for payment of claims and other liabilities which may become due for said tract.
>
> The County of Spokane is hereby granted right to ingress and egress to all drainage easements.

Easement 4710383 – Portion of open channel draining to Radco Pond

General easement area: Properties near Renz Drive and 21st Court that are abutting the Radco open channel on the back property lines.

Easement language relevant to stormwater is included below:

> Utility easements shown on the herein described plot are hereby dedicated to the serving utility companies for the construction, reconstruction, maintenance and operation of utilities. Together

with the right to inspect said utilities and to trim and/or remove brush and trees which may interfere with the construction, maintenance and operation of same.

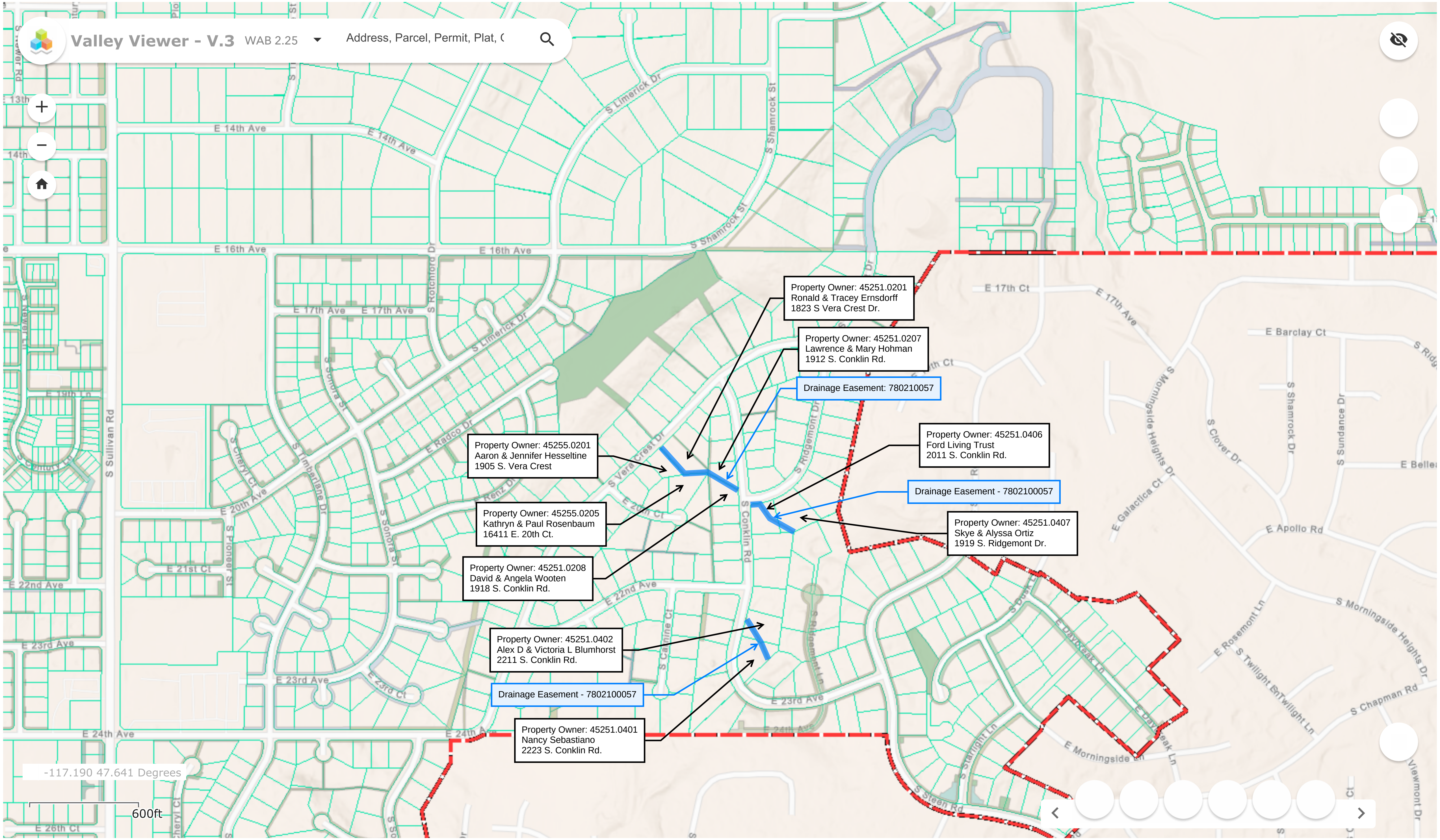
The owner(s) or successor(s) in interest agree to join in any County-approved stormwater management program and to pay such rates and charges as may be fixed through public hearings for service or benefit obtained by the planning, design, constructing, maintaining or operating of stormwater control facilities.

The property owner(s) within this plat shall be held responsible for keeping open and maintaining the surface path of natural or man-made drainage flow over and across their respective properties facilities in conformance with the accepted drainage plan on file at the Spokane County Engineer's Office. Property owners shall maintain drainage easements on their lots to prevent erosion and not Impede the flow of stormwater. No structures shall be allowed within the drainage easement. If the property owner(s) fail to maintain the surface path of natural or man-made drainage flow, or drainage facilities on private properties, a notice of such failure may be given to the property owner(s). If not corrected within the period Indicated on said notice, Spokane County has the right to correct the maintenance failure, or have it corrected at the expense of the property owner(s).

Spokane County does not accept the responsibility of maintaining the drainage course on private lots, nor the responsibility for any damage whatsoever, inducing, but not limited to, inverse condemnation to any properties due to deficient construction and/or maintenance of drainage courses in drainage easements on private property. Spokane County and its authorized agents are hereby granted the right to ingress and egress to, over and farm all drainage easements for the purposes of Inspection and emergency maintenance of drainage facilities, if not properly maintained by the property owner(s). Spokane County does not accept the responsibility to inspect or maintain drainage facilities located outside of public rights-of-way, except in cases where Spokane County specifically assumes that responsibility in writing. Neither does Spokane County accept any liability for any failure by the property owner(s) to properly maintain such areas.

Any building that is constructed on a lot in this plot shall be set at such on elevation so as to provide positive drainage away from any drainage entry point to the building (including but not limited to a window well, a window unprotected by a window well, or a doorway). Said positive drainage shall consist of a minimum slope of 3% away from the building for a distance of at least 10 feet from the building. The lots shall be graded so that either a) all runoff is routed away from the building, and conveyed over the lot to a natural drainage swale or approved drainage facility, or b) drainage Intercepted on the lot is disposed of on the lot in on approved drainage facility. All drainage facilities for this plot, including any '208' swales. shall be constructed in accordance with the approved plans on file at the Spokane County Engineer's Office. Any proposed changes to the approved road and drainage plans must be approved by the Spokane County Engineer's Office prior to construction of said changes,

There may exist properties located uphill and adjacent to this subdivision that periodically discharge stormwater runoff onto individual lots within this plot. Stormwater runoff from nearby uphill properties should be expected, and during snow melt periods or wet seasons the lots may be subjected to higher amounts of stormwater runoff that what is normally observed or anticipated. Because stormwater runoff from adjacent properties have discharged onto this plot prior to development, stormwater runoff will likely continue to do so after development.



Property Owner: 45251.0201
Ronald & Tracey Ernsdorff
1823 S Vera Crest Dr.

Property Owner: 45251.0207
Lawrence & Mary Hohman
1912 S. Conklin Rd.

Drainage Easement: 780210057

Property Owner: 45255.0201
Aaron & Jennifer Hesseltine
1905 S. Vera Crest

Property Owner: 45251.0406
Ford Living Trust
2011 S. Conklin Rd.

Drainage Easement - 7802100057

Property Owner: 45255.0205
Kathryn & Paul Rosenbaum
16411 E. 20th Ct.

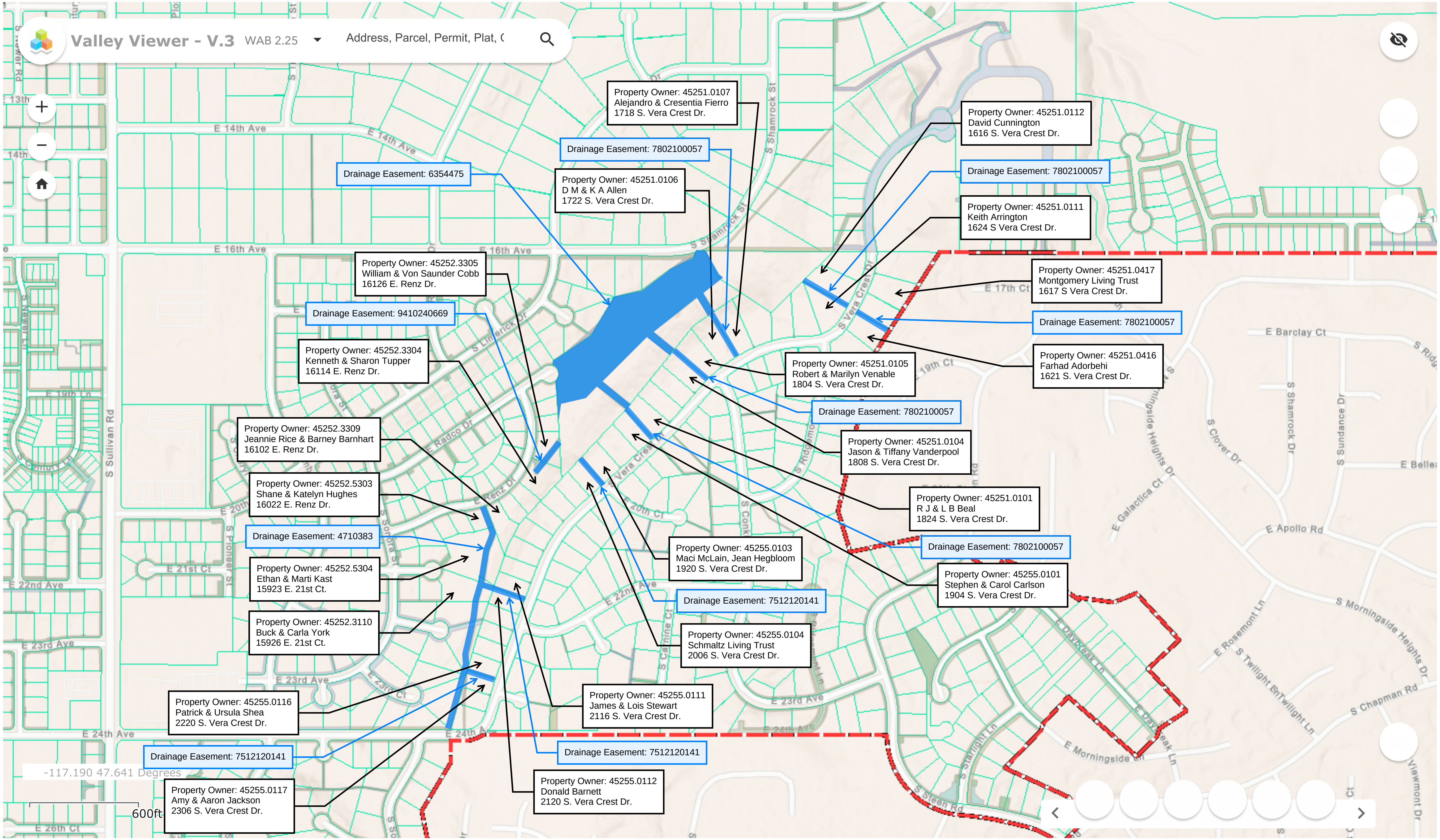
Property Owner: 45251.0407
Skye & Alyssa Ortiz
1919 S. Ridgemont Dr.

Property Owner: 45251.0208
David & Angela Wooten
1918 S. Conklin Rd.

Property Owner: 45251.0402
Alex D & Victoria L Blumhorst
2211 S. Conklin Rd.

Drainage Easement - 7802100057

Property Owner: 45251.0401
Nancy Sebastiano
2223 S. Conklin Rd.



Property Owner: 45251.0107
Alejandro & Cresentia Fierro
1718 S. Vera Crest Dr.

Drainage Easement: 7802100057

Drainage Easement: 6354475

Property Owner: 45251.0106
D M & K A Allen
1722 S. Vera Crest Dr.

Property Owner: 45251.0112
David Cunnington
1616 S. Vera Crest Dr.

Drainage Easement: 7802100057

Property Owner: 45251.0111
Keith Arrington
1624 S Vera Crest Dr.

Property Owner: 45252.3305
William & Von Saunder Cobb
16126 E. Renz Dr.

Property Owner: 45251.0417
Montgomery Living Trust
1617 S Vera Crest Dr.

Drainage Easement: 9410240669

Drainage Easement: 7802100057

Property Owner: 45252.3304
Kenneth & Sharon Tupper
16114 E. Renz Dr.

Property Owner: 45251.0416
Farhad Adorbehi
1621 S. Vera Crest Dr.

Property Owner: 45251.0105
Robert & Marilyn Venable
1804 S. Vera Crest Dr.

Drainage Easement: 7802100057

Property Owner: 45252.3309
Jeannie Rice & Barney Barnhart
16102 E. Renz Dr.

Property Owner: 45251.0104
Jason & Tiffany Vanderpool
1808 S. Vera Crest Dr.

Property Owner: 45252.5303
Shane & Katelyn Hughes
16022 E. Renz Dr.

Property Owner: 45251.0101
R J & L B Beal
1824 S. Vera Crest Dr.

Drainage Easement: 4710383

Drainage Easement: 7802100057

Property Owner: 45255.0103
Maci McLain, Jean Hegbloom
1920 S. Vera Crest Dr.

Property Owner: 45252.5304
Ethan & Marti Kast
15923 E. 21st Ct.

Property Owner: 45255.0101
Stephen & Carol Carlson
1904 S. Vera Crest Dr.

Drainage Easement: 7512120141

Property Owner: 45252.3110
Buck & Carla York
15926 E. 21st Ct.

Property Owner: 45255.0104
Schmaltz Living Trust
2006 S. Vera Crest Dr.

Property Owner: 45255.0116
Patrick & Ursula Shea
2220 S. Vera Crest Dr.

Property Owner: 45255.0111
James & Lois Stewart
2116 S. Vera Crest Dr.

Drainage Easement: 7512120141

Drainage Easement: 7512120141

Property Owner: 45255.0117
Amy & Aaron Jackson
2306 S. Vera Crest Dr.

Property Owner: 45255.0112
Donald Barnett
2120 S. Vera Crest Dr.

COUNTY OFFICIALS

COUNTY TREASURER
I hereby certify that the required taxes on the herein platted land have been paid this 21 day of October, 1994 Same parcel numbers on 5th add, 4th add and 3rd add. a peach
Linda M Wolverton
County Treasurer

COUNTY ASSESSOR
Examined and approved this 21st day of October, 1994
S.C. Cooney, Lynda Rouse
County Assessor

COUNTY ENGINEER
Examined and approved this 21st day of Sept., 1994
County Engineer

UTILITIES DIRECTOR
Examined and approved this 22d day of September, 1994
By James A. Legat
Utilities Director

PLANNING DIRECTOR
Examined and approved this 14th day of Oct., 1994
W J Hubbard
Planning Director

HEALTH OFFICER
Examined and approved this 28th day of September, 1994
Steven P. Holderby, R.S.
for Health Officer

SPOKANE COUNTY COMMISSIONERS
This Plat was approved and accepted by the County Commissioners of Spokane County, Washington on this 4th day of OCT 1994.
Commissioners Chairperson

ACKNOWLEDGEMENT

STATE OF WASHINGTON) SS
COUNTY OF SPOKANE)

On this 20th day of September, 1994, before me personally appeared Kenneth J. Tupper known to be President of T.D.C., Inc. as the individual who executed the within and foregoing instrument and acknowledged the same to be his free and voluntary act and deed for the uses and purposes herein mentioned.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

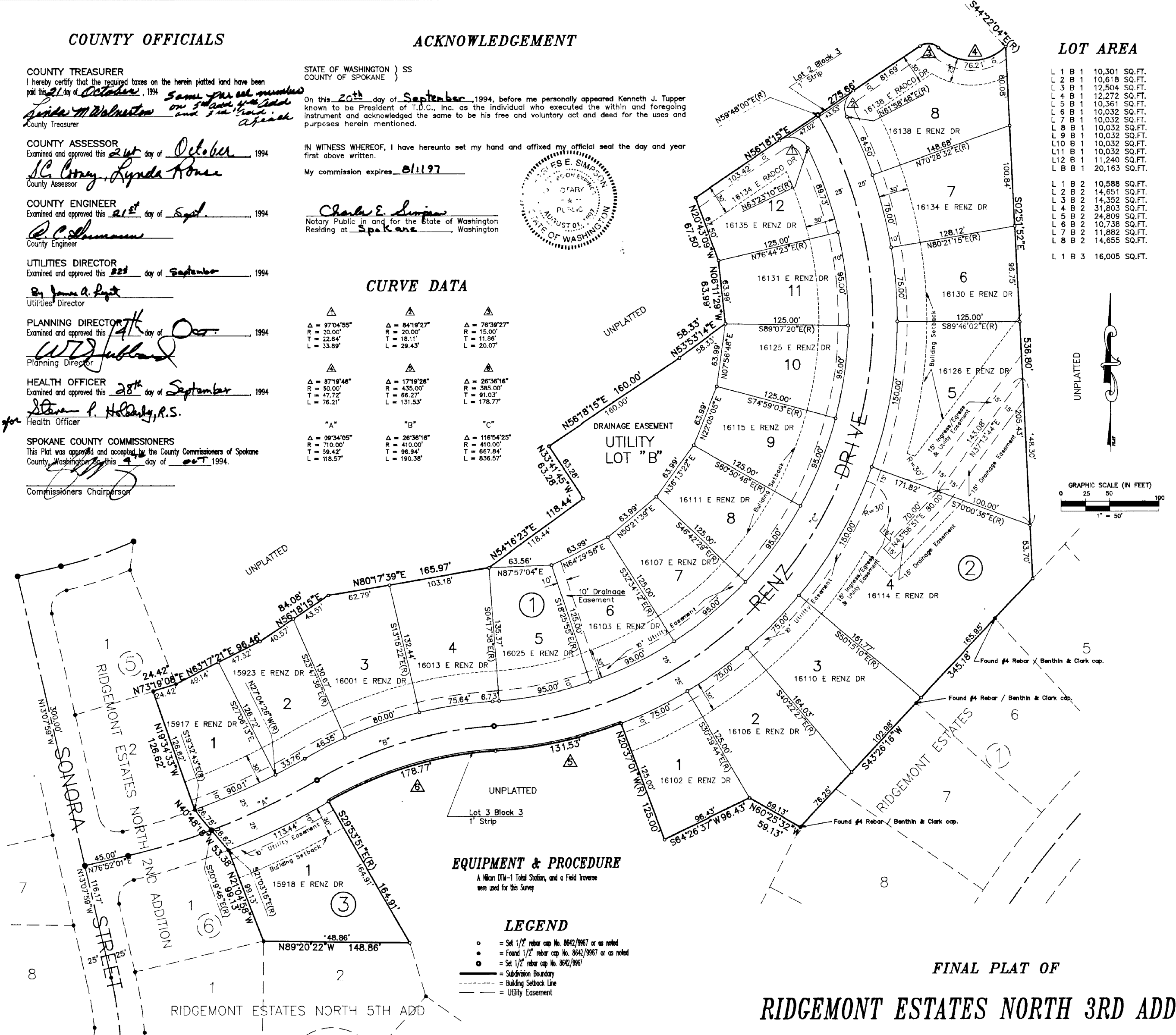
My commission expires 8/1/97

Charles E. Simpson
Notary Public in and for the State of Washington
Residing at Spokane, Washington

AUGUST 01, 1997

CURVE DATA

△1	△2	△3
Δ = 97°04'55"	Δ = 84°19'27"	Δ = 76°39'27"
R = 20.00'	R = 20.00'	R = 15.00'
T = 22.64'	T = 18.11'	T = 11.86'
L = 33.89'	L = 29.43'	L = 20.07'
△4	**△5**	**△6**
Δ = 87°19'46"	Δ = 17°19'26"	Δ = 26°36'16"
R = 50.00'	R = 435.00'	R = 385.00'
T = 47.72'	T = 66.27'	T = 91.03'
L = 76.21'	L = 131.53'	L = 178.77'
"A"	**"B"**	**"C"**
Δ = 09°34'05"	Δ = 26°36'16"	Δ = 116°54'25"
R = 710.00'	R = 410.00'	R = 410.00'
T = 59.42'	T = 96.94'	T = 667.84'
L = 118.57'	L = 190.38'	L = 836.57'



LOT AREA

L 1 B 1	10,301 SQ.FT.
L 2 B 1	10,618 SQ.FT.
L 3 B 1	12,504 SQ.FT.
L 4 B 1	12,272 SQ.FT.
L 5 B 1	10,361 SQ.FT.
L 6 B 1	10,032 SQ.FT.
L 7 B 1	10,032 SQ.FT.
L 8 B 1	10,032 SQ.FT.
L 9 B 1	10,032 SQ.FT.
L10 B 1	10,032 SQ.FT.
L11 B 1	10,032 SQ.FT.
L12 B 1	11,240 SQ.FT.
L B B 1	20,163 SQ.FT.
L 1 B 2	10,588 SQ.FT.
L 2 B 2	14,651 SQ.FT.
L 3 B 2	14,352 SQ.FT.
L 4 B 2	31,803 SQ.FT.
L 5 B 2	24,809 SQ.FT.
L 6 B 2	10,738 SQ.FT.
L 7 B 2	11,882 SQ.FT.
L 8 B 2	14,655 SQ.FT.
L 1 B 3	16,005 SQ.FT.

AUDITOR'S CERTIFICATE

Filed for record this 24 day of Oct
1994 at 4:35 M. in Book 22 of Plats on Page
72 at the request of ____________.

9410240669

DEDICATION

KNOW ALL MEN BY THESE PRESENTS, that T.D.C., Inc., a Washington Corporation has caused to be platted into lots, blocks and streets the land shown hereon as "RIDGEMONT ESTATES NORTH 3RD ADDITION" and described as follows:

Begin at the SE corner of Lot 1 Block 6 of RIDGEMONT ESTATES NORTH 2ND ADDITION; thence the next 4 courses along the Easterly line of said 2nd Addition, N 21°04'58"W 99.13 feet; thence N 40°48'18"W 53.38 feet; thence N 19°34'33"W 126.62 feet; thence N 73°19'08"E 24.42 feet; thence N 63°17'21"E 96.46 feet; thence N 56°18'15"E 84.08 feet; thence N 80°17'39"E 165.97 feet; thence N 54°16'23"E 118.44 feet; thence N 33°41'45"W 63.28 feet; thence N 56°18'15"E 160.00 feet; thence N 53°53'14"E 58.33 feet; thence N 06°11'29"W 63.99 feet; thence N 20°43'09"W 67.50 feet; thence N 56°18'15"E 275.66 feet to the beginning of a curve concave to the South with a radius of 15.00 feet; thence Northeasterly, Easterly and Southeasterly, through a central angle of 76°39'27", an arc distance of 20.07 feet to the point of reverse curve concave to the North with a radius of 50.00 feet; thence Southeasterly, Easterly and Northeasterly, through a central angle of 87°19'46", an arc distance of 76.21 feet; thence S 02°51'52"E, on a non-tangent line, 536.80 feet to the Westerly line of RIDGEMONT ESTATES; thence S 43°26'16"W, along said Westerly line, 345.18 feet; thence N 60°25'32"W 59.13 feet; thence S 64°26'37"W 96.43 feet; thence N 20°37'01"W 125.00 feet to a point on a curve concave to the North with a radius of 435.00 feet and a radial bearing of S 20°37'01"E; thence Westerly, through a central angle of 17°19'26", an arc distance of 131.53 feet to the point of reverse curve concave to the South with a radius of 385.00 feet; thence Westerly, through a central angle of 26°36'16", an arc distance of 178.77 feet; thence S 29°53'51"E, radial to said curve, 164.91 feet; thence N 89°20'22"W 148.86 feet to the Point of Beginning.

Situate in the County of Spokane, State of Washington.

The public water system, pursuant the WATER PLAN approved by County and State Health authorities, the local fire district, County Building and Safety Department, and water purveyor, will be installed within this plat, and the subdivider / sponsor will provide for individual domestic water service as well as fire protection to each lot prior to sale of each lot and prior to issuance of a building permit for each lot.

Lots 2 & 3 Block 3 as shown hereon is dedicated to Spokane County to be deeded for road purposes forever at such time as adjacent property is platted.

Use of private wells and water systems is prohibited.

Utility Easements as shown are hereby granted.

A public sewer system will be made available for the plat and individual service will be provided to each lot prior to sale. Use of individual on-site sewage disposal systems shall not be authorized.

The property owner or his representative shall inform each succeeding purchaser of all drainage easements on the property and his responsibility for maintaining drainage facilities within said easements.

The plattor does hereby dedicate forever the streets shown hereon for public road purposes.

Side yard and rear yard setbacks shall be determined at the time building permits are requested unless these setbacks are specifically drafted on this final plat. The setbacks indicated on this plat may be varied from if proper zoning approvals are obtained.

Utility easements shown on the herein described plat are hereby dedicated to the serving utility companies for the construction, reconstruction, maintenance and operation of utilities. Together with the right to inspect said utilities and to trim and/or remove brush and trees that may interfere with the construction, maintenance and operation of same.

Utility Lot "B" as shown in this plat is hereby dedicated to the RIDGEMONT ESTATES NORTH 3RD & 4TH HOMEOWNERS ASSOCIATION created by document recorded 1/6/94 under State UBI number 601-573-088 Utility Lot "B" may not be sold or transfered, regardless of any provisions in the covenants to the contrary without expressed written approval by Spokane County, and shall be considered subservient estates to all lots within this plat for the purpose of real estate taxes. Should RIDGEMONT ESTATES NORTH 3RD & 4TH HOMEOWNERS ASSOCIATION be terminated for any reason, the successors in intrest for Utility Lot "B" shall be the individual lot owners of lots within this plat, or their successors in intrest, who are members of the RIDGEMONT ESTATES NORTH 3RD & 4TH HOMEOWNERS ASSOCIATION at the time of said termination.

Drainage easements, as platted and shown hereon, which are for the purposes of installing, operating and maintaining drainage swales and drainage facilities to dispose of runoff, are hereby granted to Spokane County, the public, and the RIDGEMONT ESTATES NORTH 3RD & 4TH HOMEOWNERS ASSOCIATION. No structures shall be constructed thereon. The RIDGEMONT ESTATES NORTH 3RD & 4TH HOMEOWNERS ASSOCIATION shall be responsible for payment of claims and other liabilities which may become due for said tract.

The County of Spokane is hereby granted the right to ingress and egress to all drainage easements.

Lots 4 through 8, inclusive, of Block 2 shall have the lowest finished grade elevation adjacent to structure at or above 2021.0. A certificate from a licensed surveyor needs to be provided which demonstrates conformance with this criteria. A floodplain permit shall be obtained for these lots.

The RIDGEMONT ESTATES NORTH 3RD & 4TH HOMEOWNERS ASSOCIATION shall be responsibe for maintenance of the stormwater retention pond 3A within Utility Lot "B", as per document recorded 9-20-94 under Auditor's Document No. 9409200212 which by reference is made a part hereof.

The RIDGEMONT ESTATES NORTH 3RD & 4TH HOMEOWNERS ASSOCIATION shall be responsible for maintenance of the stormwater retention pond and associated drainage facilities within the easement as per document recorded OCT 5, 1994 under Auditor's Document No. 9410050526 which by reference is made a part hereof.

The drainage easements and tracts are subject to the seperate Declaration of Covenant as recorded 9-20-94 under Auditor's Document No. 9409200210 which by reference is mad a part hereof.

IN WITNESS WHEREOF, I have herunto set my hand and affixed my seal this 20TH day of SEPT., 1994

T.D.C., Inc.

Kenneth J. Tupper
Kenneth J. Tupper, President

EQUIPMENT & PROCEDURE

A Nikon DTM-1 Total Station, and a Field Traverse were used for this Survey

LEGEND

- ○ = Set 1/2" rebar cap No. 8642/9967 or as noted
- ● = Found 1/2" rebar cap No. 8642/9967 or as noted
- ◉ = Set 1/2" rebar cap No. 8642/9967
- ━━ = Subdivision Boundary
- - - - = Building Setback Line
- — — = Utility Easement

SURVEYOR'S CERTIFICATE

This map correctly represents a survey made by me or under my direction in conformance with the requirements of the Spokane County Subdivision Ordinance.

Charles E. Simpson 9/14/94
Charles E. Simpson P.E. & L.S. #9967
Professional Engineer and Land Surveyor

BASIS OF BEARING

The bearing of N 21°04'58"W, along the East line of Lot 1 Block 6 as per RIDGEMONT ESTATES NORTH 2ND ADDITION, was used as the Basis of Bearing for this Plat.

FINAL PLAT OF

RIDGEMONT ESTATES NORTH 3RD ADDITION

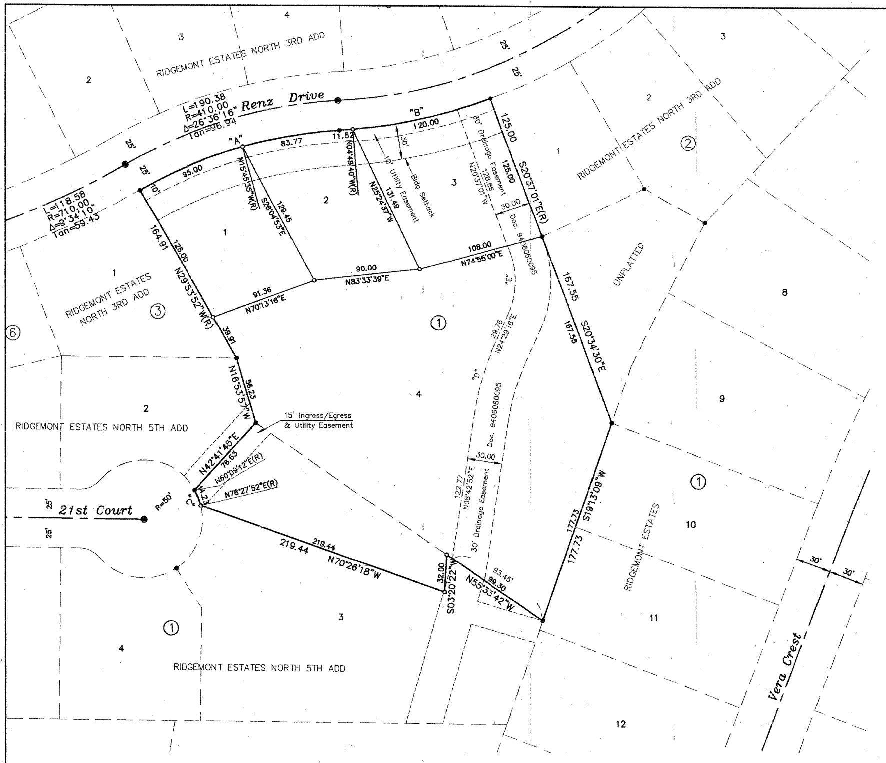
A PLAT IN A PORTION OF
THE NW 1/4 OF SEC.25, T25N, R44 EWM
SPOKANE COUNTY, WASHINGTON

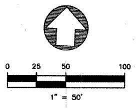
Founded 1946
Simpson Engineers, Inc.
CIVIL ENGINEERS & LAND SURVEYORS
N. 909 ARGONNE ROAD, SPOKANE WA., 99212-2789
PHONE (509) 926-1322 FAX (509) 926-1323

#3219 22/72

4710383
BK 27
Pg 76
#3548

FINAL PLAT OF
RIDGEMONT ESTATES NORTH 10TH ADDITION
A PLAT IN A PORTION OF
THE SE 1/4 OF THE NW 1/4 OF SEC.25, T25N, R44 EWM
SPOKANE COUNTY, WASHINGTON





ACKNOWLEDGMENT

STATE OF WASHINGTON)SS
COUNTY OF SPOKANE)

I certify that I know or have satisfactory evidence that SHARON K. QUEEN signed this instrument, on oath stated that she was authorized to execute the instrument and acknowledged it as a Co-Trustee of the RENZ FAMILY TRUST, dated June 17, 1999, SHARON K. QUEEN, CO-TRUSTEE, to be the free and voluntary act of such party for the uses and purposes mentioned in this instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

My commission expires 7/8/02

Duane M. Helt
Notary Public in and for the State of Washington
Residing at Spokane, Washington

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal this 12TH day of March, 2002.

Sharon K Queen
RENZ FAMILY TRUST
SHARON K QUEEN, CO-TRUSTEE

Official Seal
DUANE M. HELT
NOTARY PUBLIC STATE OF WASHINGTON
COMMISSION EXPIRES: JULY 8, 2002

ACKNOWLEDGMENT

STATE OF Georgia)
COUNTY OF Gwinnett)

I certify that I know or have satisfactory evidence that JAMES F. RENZ signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as a Co-Trustee of the RENZ FAMILY TRUST, dated June 17, 1999, JAMES F. RENZ, CO-TRUSTEE, to be the free and voluntary act of such party for the uses and purposes mentioned in this instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

My commission expires 7-15-04

Doris S. Furlong
Notary Public in and for the State of
Residing at 2610 Shadow Pine Dr Loganville Ga 30076

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal this 13th day of March, 2002.

Notary Public, Fulton County, Georgia
My Commission Expires 7/15/04

James F. Renz
RENZ FAMILY TRUST
JAMES F. RENZ, CO-TRUSTEE

LOT AREAS /ADDRESSES

L 1 B 1	11,914 sqft	15925 E. Renz Drive
L 2 B 1	11,580 sqft	16008 E. Renz Drive
L 3 B 1	14,061 sqft	16022 E. Renz Drive
L 4 B 1	75,142 sqft 1.73 Acres	15921 E. 21ST Court

CURVE DATA

"A"	"B"	"C"	"D"	"E"
Δ=26°36'16"	Δ=17°19'26"	Δ=16°18'40"	Δ=15°46'24"	Δ=45°06'17"
R=385.00	R=435.00	R=50.00	R=215.00	R=70.00
T=91.03	T=66.27	T=7.17	T=29.78	T=29.07
L=178.77	L=131.53	L=14.23	L=59.19	L=55.11

LEGEND

○ ●	= Set 1/2" rebar cap No. 8642/9967 or as noted
• ●	= Found 1/2" rebar cap No. 8642/9967 or as noted
———	= Subdivision Boundary
- - - - -	= Building Setback Line
— — — —	= 10' Utility Easement

DEDICATION

KNOW ALL MEN BY THESE PRESENTS, that the Renz Family Trust with James F. Renz and Sharon K. Queen, Co-Trustees have caused to be platted into Lots the land shown hereon as "RIDGEMONT ESTATES NORTH 10TH ADDITION" and described as follows:

All that portion of the SE 1/4 of the NW 1/4 of Section 25, T. 25 N., R. 44 E.W.M. lying Westerly of "RIDGEMONT ESTATES", as recorded in Book 12 of Plats, page 36, lying Northerly of "RIDGEMONT ESTATES NORTH 5TH ADDITION", as recorded in Book 22 of Plats, page 26 and lying Southerly of "RIDGEMONT ESTATES NORTH 3RD ADDITION", as recorded in Book 22 of Plats, page 72.

TOGETHER with that portion of Lot 3 Block 1 of "RIDGEMONT ESTATES NORTH 5TH ADDITION", as recorded in Book 22 of Plats, page 26, described as follows:
Begin at the Northerly corner of said Lot 3; thence S 55°33'42"E, along the Northeasterly line of said Lot 3, 196.33 feet; thence S 03°20'22"W 32.00 feet; thence N 70°26'18"W 219.44 feet to a point on a curve concave to the West with a radius of 50.00 feet and a radial bearing of N 76°27'52"E, said point being on the Westerly line of said Lot 3; thence Northerly, through a central angle of 16°18'40", an arc distance of 14.23 feet to the Corner between Lots 2 & 3 of said Block 1; thence N 42°41'45"E, on a non-tangent bearing, 76.63 feet to the Point of Beginning.

EXCEPT that portion of the SE 1/4 of the NW 1/4 of Section 25, T. 25 N., R. 44 E.W.M. described as follows:
Begin at the SW corner of Lot 1 Block 2 of "RIDGEMONT ESTATES NORTH 3RD ADDITION", as recorded in Book 22 of Plats, page 72; thence N 64°26'37"E, along the Southerly line of said Lot 1, 96.43 feet to the SE corner of said Lot 1; thence S 60°25'32"E 59.13 feet to the SW corner of Lot 2 of said Block 2 and the angle point of Lot 8 Block 1 of "RIDGEMONT ESTATES", as recorded in Book 12 of Plats, page 36; thence S 27°21'36"W, along the Westerly line of said Block 1, 136.88 feet to an angle point of Lot 9 of said Block 1; thence S 19°13'09"W 50.53 feet to the Southwesterly corner of said Lot 9; thence N 20°34'30"W 167.55 feet to the Point of Beginning.

Situate in the County of Spokane, State of Washington.

The public water system, pursuant to the Water Plan approved by county and state health authorities, the local fire protection district, County Division of Building and Code Enforcement and water purveyor, shall be installed within this subdivision and the applicant shall provide for individual domestic water service as well as fire protection to each lot prior to sale of each lot and prior to issuance of a building permit for each lot.

A public sewer system will be made available for the plat, and individual service will be provided to each lot prior to sale. Use of individual on-site sewage disposal system shall not be authorized.

Use of private wells and water systems is prohibited.

Utility easements shown on the herein described plat are hereby dedicated to the serving utility companies for the construction, reconstruction, maintenance and operation of utilities. Together with the right to inspect said utilities and to trim and/or remove brush and trees which may interfere with the construction, maintenance and operation of same.

Side yard and rear yard setbacks shall be determined at the time building permits are requested unless these setbacks are specifically drafted on this final plat.The setbacks indicated on this plat may be varied from if proper zoning approvals are obtained.

The owner(s) or successor(s) in interest agree to join in any County-approved stormwater management program and to pay such rates and charges as may be fixed through public hearings for service or benefit obtained by the planning, design, constructing, maintaining or operation of stormwater control facilities.

No duplexes shall be allowed on Lots of 20,000 square feet or greater.

The property owner(s) within this plat shall be held responsible for keeping open and maintaining the surface path of natural or man-made drainage flow over and across their respective properties facilities in conformance with the accepted drainage plan on file at the Spokane County Engineer's Office. Property owners shall maintain drainage easements on their lots to prevent erosion and not impede the flow of stormwater. No structures shall be allowed within the drainage easement. If the property owner(s) fail to maintain the surface path of natural or man-made drainage flow, or drainage facilities on private properties, a notice of such failure may be given to the property owner(s). If not corrected within the period indicated on said notice, Spokane County has the right to correct the maintenance failure, or have it corrected, at the expense of the property owner(s).

Spokane County does not accept the responsibility of maintaining the drainage course on private lots, nor the responsibility for any damage whatsoever, including, but not limited to, inverse condemnation to any properties due to deficient construction and/or maintenance of drainage courses in drainage easements on private property. Spokane County and its authorized agents are hereby granted the right to ingress and egress to, over and from all drainage easements for the purposes of inspection and emergency maintenance of drainage facilities, if not properly maintained by the property owner(s). Spokane County does not accept the responsibility to inspect or maintain drainage facilities located outside of public rights-of-way, except in cases where Spokane County specifically assumes that responsibility in writing. Neither does Spokane County accept any liability for any failure by the property owner(s) to properly maintain such areas.

Any building that is constructed on a lot in this plat shall be set at such an elevation so as to provide positive drainage away from any drainage entry point to the building (including but not limited to a window well, a window unprotected by a window well, or a doorway). Said positive drainage shall consist of a minimum slope of 3% away from the building for a distance of at least 10 feet from the building. The lots shall be graded so that either a) all runoff is routed away from the building, and conveyed over the lot to a natural drainage swale or approved drainage facility, or b) drainage intercepted on the lot is disposed of on the lot in an approved drainage facility. All drainage facilities for this plat, including any '208' swales, shall be constructed in accordance with the approved plans on file at the Spokane County Engineer's Office. Any proposed changes to the approved road and drainage plans must be approved by the Spokane County Engineer's Office prior to construction of said changes.

There may exist properties located uphill and adjacent to this subdivision that periodically discharge stormwater runoff onto individual lots within this plat. Stormwater runoff from nearby uphill properties should be expected, and during snow melt periods or wet seasons the lots may be subjected to higher amounts of stormwater runoff that what is normally observed or anticipated. Because stormwater runoff from adjacent properties have discharged onto this plat prior to development, stormwater runoff will likely continue to do so after development.

The developer and the property owners waive any and all claims for damages against any governmental authority arising from the construction, ownership or maintenance of public facilities. This waiver includes claims of any nature, including but not limited to person and real property damages as well as any inverse condemnation claims.

AUDITOR'S CERTIFICATE

Filed for record this 4th day of April 2002 at 2:56P.M. in Book 27 of Plats on Page 76 at the request of Renz Family Trust

J. Higdem
SPOKANE COUNTY AUDITOR

COUNTY OFFICIALS

SPOKANE COUNTY DIVISION OF ENGINEERING AND ROADS
Examined and approved this 22nd day of MARCH, 2002
Kelly
Spokane County Engineer

SPOKANE COUNTY DIVISION OF UTILITIES
Examined and approved this 21ST day of MARCH, 2002
Spokane County Utilities

SPOKANE REGIONAL HEALTH DISTRICT
Examined and approved this 26th day of MARCH, 2002
Don Copley
For Spokane Regional Health Officer

SPOKANE COUNTY DIVISION OF PLANNING
Examined and approved this 26th day of MARCH, 2002
FOR THE
Spokane County Division of Planning Director

SPOKANE COUNTY ASSESSOR
Examined and approved this 26 day of MARCH, 2002
S Cooney by Robert J Folsom
Spokane County Assessor

SPOKANE COUNTY TREASURER
I, Treasurer of Spokane County, Washington, do hereby certify that all taxes which have been levied and become chargeable against the land shown within this map and described in the dedication of this date, have been fully paid, satisfied, and discharged.
Dated this 4 day of April, 2002
Linda M Wolverton
Spokane County Treasurer

SPOKANE COUNTY COMMISSIONERS
This Plat was approved and accepted by the County Commissioners of Spokane County, Washington on this 2nd day of April, 2002.
M. Kate McCaslin
Commissioners Chairperson

EQUIPMENT & PROCEDURE

This survey was performed with a 1 second Nikon DTM-1 Total Station Theodolite using field traverse procedures.

BASIS OF BEARING

The Bearing of S 20°37'01"E, along the West line of Lot 1 Block 2, as per the Plat of RIDGEMONT ESTATES NORTH 3RD ADDITION, as recorded in Book 22 of Plats, page 72 was used as the Basis of Bearing for this Subdivision.

SURVEYOR'S CERTIFICATE

This map correctly represents a survey made by me or under my direction in conformance with the requirements of the Spokane County Subdivision Ordinance.

Charles E. Simpson
Charles E. Simpson P.E. & L.S. #9967
Professional Engineer and Land Surveyor

CHARLES E. SIMPSON
9967 3/12/02
EXPIRES 07/17/03

Founded 1946
Simpson Engineers, Inc.
CIVIL ENGINEERS & LAND SURVEYORS
N. 909 ARGONNE ROAD, SPOKANE WA., 99212-2789
PHONE (509) 926-1322 FAX (509) 926-1323

P:\Projects\14001-14500\14070\dwg\14070.dwg 03/07/2002 01:18:32 PM PST

#3548 1/1 27/76

2244

FINAL PLAT

RIDGEMONT ESTATES

LYING IN

SECTION 25, TOWNSHIP 25 NORTH, RANGE 44 E.W.M.

SPOKANE COUNTY, WASHINGTON

SCALE : 1" = 100'

AUGUST, 1975

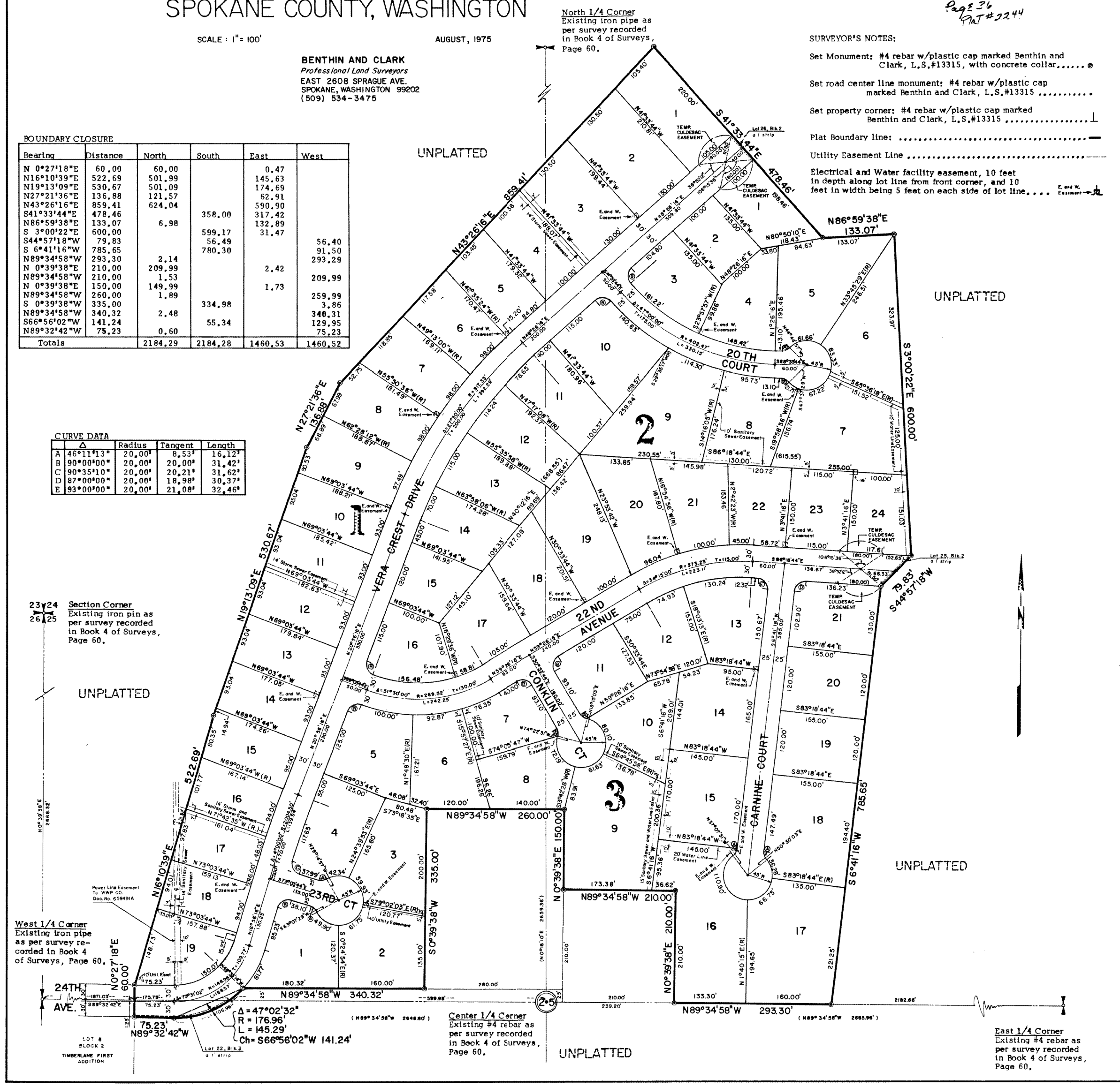
BENTHIN AND CLARK
Professional Land Surveyors
EAST 2608 SPRAGUE AVE.
SPOKANE, WASHINGTON 99202
(509) 534-3475

BOUNDARY CLOSURE

Bearing	Distance	North	South	East	West
N 0°27'18"E	60.00	60.00		0.47	
N16°10'39"E	522.69	501.99		145.63	
N19°13'09"E	530.67	501.09		174.69	
N27°21'36"E	136.88	121.57		62.91	
N43°26'16"E	859.41	624.04		590.90	
S41°33'44"E	478.46		358.00	317.42	
N86°59'38"E	133.07	6.98		132.89	
S 3°00'22"E	600.00		599.17	31.47	
S44°57'18"W	79.83		56.49		56.40
S 6°41'16"W	785.65		780.30		91.50
N89°34'58"W	293.30	2.14			293.29
N 0°39'38"E	210.00	209.99		2.42	
N89°34'58"W	210.00	1.53			209.99
N 0°39'38"E	150.00	149.99		1.73	
N89°34'58"W	260.00	1.89			259.99
S 0°39'38"W	335.00		334.98		3.86
N89°34'58"W	340.32	2.48			340.31
S66°56'02"W	141.24		55.34		129.95
N89°32'42"W	75.23	0.60			75.23
Totals		2184.29	2184.28	1460.53	1460.52

CURVE DATA

	Δ	Radius	Tangent	Length
A	46°11'13"	20.00'	8.53'	16.12'
B	90°00'00"	20.00'	20.00'	31.42'
C	90°35'10"	20.00'	20.21'	31.62'
D	87°00'00"	20.00'	18.98'	30.37'
E	93°00'00"	20.00'	21.08'	32.46'



7512120141

FILED OR RECORD
REQUEST OF Kenneth Tupper
Dec 12 11 AM '75
VERNON W. OHLAND, AUDITOR
M. Liles
22.00
Plat Book 12
Page 36
Plat #2244

SURVEYOR'S NOTES:

Set Monument: #4 rebar w/plastic cap marked Benthin and Clark, L.S.#13315, with concrete collar...... ◉

Set road center line monument: #4 rebar w/plastic cap marked Benthin and Clark, L.S.#13315 .... ∘

Set property corner: #4 rebar w/plastic cap marked Benthin and Clark, L.S.#13315 .... ⊥

Plat Boundary line: .... ━

Utility Easement Line .... ——

Electrical and Water facility easement, 10 feet in depth along lot line from front corner, and 10 feet in width being 5 feet on each side of lot line.... E. and W. Easement

2244

DEDICATION

KNOW ALL MEN BY THESE PRESENTS, that Bancshares Mortgage Company, a Washington Corporation, R. and T., Incorporated, a Washington Corporation, and Vera Irrigation District No. 15, a Municipal Corporation, have caused to be platted into lots, blocks, and streets the land shown hereon, to be known as RIDGEMONT ESTATES, said land being located in Section 25, Township 25 North, Range 44 East, W.M., Spokane County, Washington, and being more particularly described as follows:

Beginning at the northeast corner of Lot 6 in Block 2 of Timberlane First Addition, as per plat thereof recorded in Volume 10 of Plats, Page 61; thence N 0°27'18"E, 60.00 feet; thence N16°10'39"E, 522.69 feet; thence N19°13'09"E, 530.67 feet; thence N27°21'36"E, 136.88 feet; thence N43°26'16"E, 859.41 feet; thence S41°33'44"E, 478.46 feet; thence N86°59'38"E, 133.07 feet; thence S3°00'22"E, 600.00 feet; thence S44°57'18"W, 79.83 feet; thence S6°41'16"W, 785.65 feet to a point on the East-West center line of said Section 25; thence N89°34'58"W, along said East-West center line, 293.30 feet to a point which lies 2886.00 feet from the West quarter corner of said Section 25; thence N 0°39'38"E, on a line parallel with the west line of the northwest quarter of said Section 25, 210.00 feet; thence N89°34'58"W, 210.00 feet; thence N 0° 39'38"E, 150.00 feet; thence N89°34'58"W, 260.00 feet; thence S0°39'38"W, 335.00 feet; thence N89°34'58"W, 340.32 feet to a point on a non-tangent curve, the center of circle of which bears N46°35'14"W, 176.96 feet; thence southwesterly along said curve, through a central angle of 47°02'32", an arc distance of 145.29 feet to the point of tangent of said curve; thence N89°32'42"W, 75.23 feet to the point of beginning; and they do hereby dedicate to public use forever, the streets and roads as shown within this plat, and do also dedicate to the public the temporary culdesac easements, as shown hereon, over and across Lot 1, Block 1; Lot 1, Block 2; Lots 23 & 24, Block 2; and Lot 21, Block 3. These temporary culdesac easements are granted for road purposes until such time as the road is continued as a full width right of way, at which time they will be vacated.

Lots 25 & 26, Block 2, and Lot 22, Block 3, as shown hereon, are dedicated to Spokane County, as general County property, to be dedicated for road purposes, forever, at such time as the road is continued as a full width right of way, or adjacent lands platted.

No more than one dwelling structure shall be placed on any lot, nor shall any lot be further subdivided for the purposes of creating additional building sites or lots without filing a replat.

A public water system, and a public sewer system, both acceptable to County and State Health authorities, will be made available for this plat, and individual water and sewer service will be provided to each lot prior to sale of lots.

Utility easements are granted at the locations and for the purposes shown hereon.

IN WITNESS WHEREOF, the said owners have hereunto set their hands and the said corporation officers have affixed their seals this ________ day of ______________, 1975.

Vera Irrigation District No. 15
By ____________
By Walter L. Peterson

R. and T., Incorporated
By Kenneth J. Tupper
By Alfons B. Renz

Bancshares Mortgage Company
By Harold B. Gilkey
By James W. Sullivan

ACKNOWLEDGEMENT

STATE OF WASHINGTON) SS
COUNTY OF SPOKANE)

On this 8TH day of DECEMBER 1975, before me personally appeared WALTER L. PETERSON and CARLOS H LANDA, to me known to be the SECRETARY and CHAIRMAN OF THE BOARD, respectively, of Vera Irrigation District No. 15, and Alfons B. Renz and Kenneth J. Tupper, to me known to be the SEC/TREAS and PRESIDENT, respectively, of R. and T., Incorporated; and HAROLD B. GILKEY and JAMES W SULLIVAN, to me known to be the PRESIDENT and VICE PRESIDENT respectively, of Bancshares Mortgage Company, the corporations that executed the within and foregoing instrument and acknowledged said instrument to be the free and voluntary act and deed of said corporations for the uses and purposes therein mentioned, and each officer stated on oath that he was authorized to execute said instrument and the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

J. Ann Gentree
Notary Public in and for the State of Washington, residing at Spokane.

SURVEYOR'S CERTIFICATE

I, James F. Benthin, a registered Professional Land Surveyor, hereby certify that the map shown hereon was prepared by me subsequent to an actual survey on the ground in DECEMBER, 1975, and that the same conforms in all respects to the provisions of the ordinances of Spokane County, now in effect, and that the lot corners and monuments have been properly set.

James Benthin
James F. Benthin, registered Professional Land Surveyor

JAMES F. BENTHIN 133

COUNTY ENGINEER

Examined and approved this 10th day of Dec, 1975.

County Engineer

COUNTY COMMISSIONERS

This plat was approved and accepted by the County Commissioners of Spokane County, Washington, on this 11 day of Dec., 1975.

Ray W. Christensen
Chairman, Spokane County Commissioners

COUNTY PLANNING COMMISSION

Examined and approved this 11th day of Dec, 1975.

Mrs. Milton Rawlings
Spokane County Planning Commission Chairman

by Charles F. Huggins
Planning Director

SPOKANE COUNTY HEALTH DISTRICT

Examined and approved this 10th day of December, 1975.

C. O. Pleger, M.D., by E. C. Prather
Health Officer

COUNTY TREASURER

I, Don W. Brown, Treasurer of Spokane County, Washington, do hereby certify that all taxes which have been levied and become chargeable against the land shown within this map and described in the dedication of this date, have been fully paid, satisfied and discharged. Dated this 12 day of December, 1975.

Don W Brown by Geneva Thompson
Spokane County Treasurer

COUNTY ASSESSOR

Examined and approved this 10 day of Dec, 1975.

K E Wenne by Linda Douthitt
Spokane County Assessor

2244

2244

7802100057

FILED OR RECORDED
REQUEST OF Tupper Realty
FEB 10 9 48 AM '78
VERNON W. OHLAND, AUDITOR
SPOKANE COUNTY, WASH.
DEPUTY

38 00
Plat Book 13
Page 85
Plat #2395

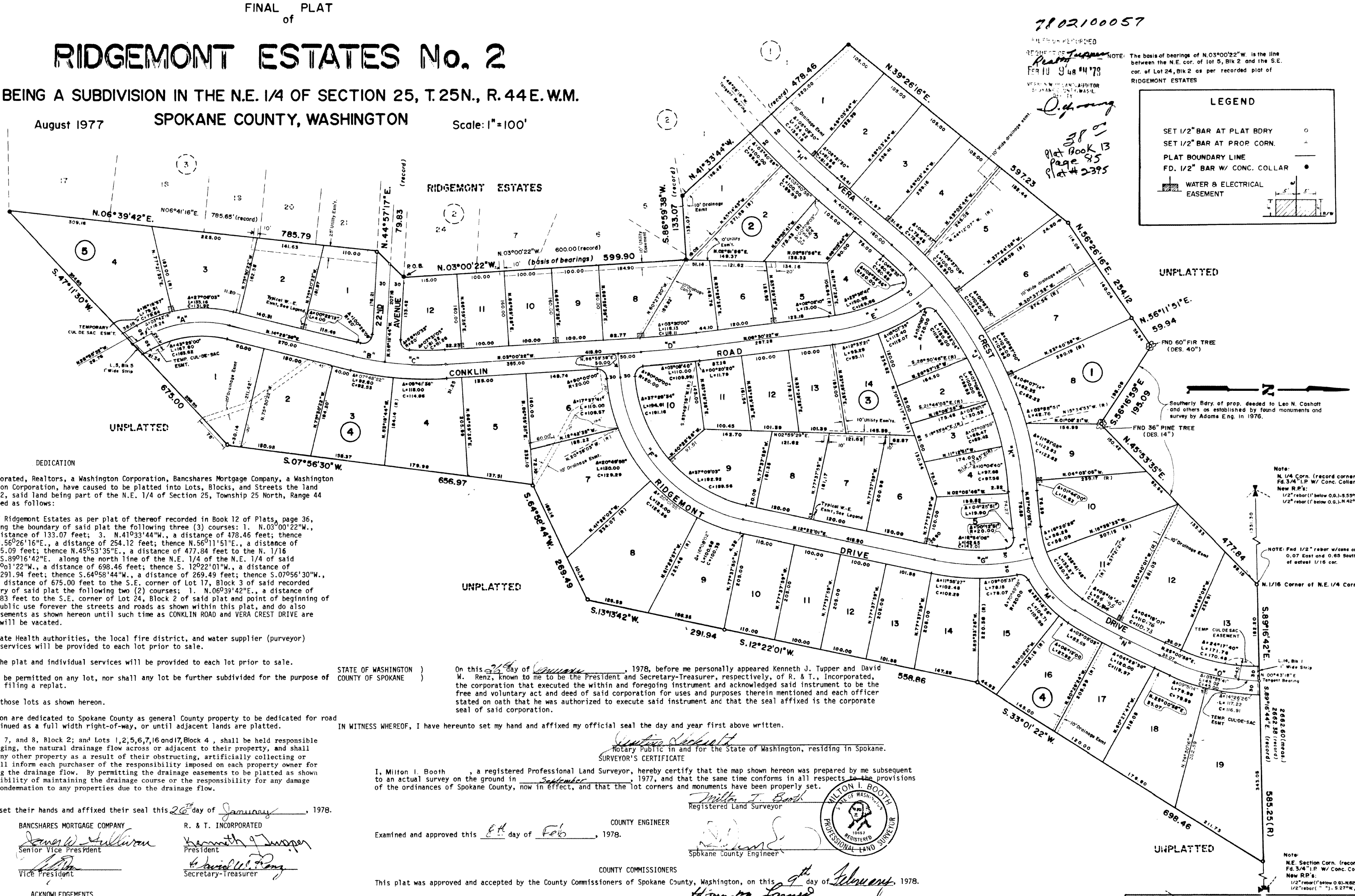
FINAL PLAT
of

RIDGEMONT ESTATES No. 2

BEING A SUBDIVISION IN THE N.E. 1/4 OF SECTION 25, T. 25N., R. 44 E. W.M.
SPOKANE COUNTY, WASHINGTON

August 1977

Scale: 1" = 100'



	DELTA	R	L	T	C
A	43°25'00"	251.18	190.34	100.00	185.81
B	05°37'45"	649.71	63.83	31.94	63.81
C	11°52'15"	649.71	134.61	67.55	134.37
D	03°30'00"	1963.82	119.96	60.00	119.94
E	34°18'22"	395.72	236.94	122.14	233.42
F	74°37'37"	327.53	426.60	249.63	397.08
G	25°44'30"	462.42	207.76	105.66	206.01
H	07°30'00"	1525.71	199.71	100.00	199.57
I	08°15'00"	835.62	120.32	60.26	120.22
J	21°15'00"	835.62	309.92	156.76	308.14
K	17°14'39"	585.37	176.18	88.76	175.51
L	16°20'28"	227.32	64.84	32.64	64.61
M	38°41'48"	227.32	153.53	79.82	150.63
N	07°37'41"	1500.00	199.70	100.00	199.55
O	24°17'40"	435.09	184.49	93.65	183.11

DEDICATION

KNOW ALL MEN BY THESE PRESENTS, that Tupper Incorporated, Realtors, a Washington Corporation, Bancshares Mortgage Company, a Washington Corporation, and R. & T., Incorporated, a Washington Corporation, have caused to be platted into Lots, Blocks, and Streets the land shown hereon to be known as RIDGEMONT ESTATES NO. 2, said land being part of the N.E. 1/4 of Section 25, Township 25 North, Range 44 East W.M., Spokane County, Washington, and described as follows:

Beginning at the S.E. corner of Lot 24, Block 2 of Ridgemont Estates as per plat of thereof recorded in Book 12 of Plats, page 36, in the Spokane County Auditor's Office; thence along the boundary of said plat the following three (3) courses: 1. N.03°00'22"W., a distance of 599.90 feet; 2. S.86°59'38"W., a distance of 133.07 feet; 3. N.41°33'44"W., a distance of 478.46 feet; thence N.39°26'16"E., a distance of 597.23 feet; thence N.56°26'16"E., a distance of 254.12 feet; thence N.56°11'51"E., a distance of 59.94 feet; thence S.56°16'59"E., a distance of 195.09 feet; thence N.45°53'35"E., a distance of 477.84 feet to the N. 1/16 corner of the N.E. 1/4 of said Section 25; thence S.89°16'42"E. along the north line of the N.E. 1/4 of the N.E. 1/4 of said Section 25, a distance of 585.25 feet; thence S.33°01'22"W., a distance of 698.46 feet; thence S. 12°22'01"W., a distance of 558.86 feet; thence S. 13°13'42"W., a distance of 291.94 feet; thence S.64°58'44"W., a distance of 269.49 feet; thence S.07°56'30"W., a distance of 656.97 feet; thence S.47°11'30"W., a distance of 675.00 feet to the S.E. corner of Lot 17, Block 3 of said recorded plat of Ridgemont Estates; thence along the boundary of said plat the following two (2) courses; 1. N.06°39'42"E., a distance of 785.79 feet; 2. N.44°57'17"E., a distance of 79.83 feet to the S.E. corner of Lot 24, Block 2 of said plat and point of beginning of this description, and they do hereby dedicate to public use forever the streets and roads as shown within this plat, and do also dedicate to public use the temporary cul-de-sac easements as shown hereon until such time as CONKLIN ROAD and VERA CREST DRIVE are extended, at which time said cul-de-sac easements will be vacated.

A public water system, acceptable to County and State Health authorities, the local fire district, and water supplier (purveyor) will be installed within this plat and individual services will be provided to each lot prior to sale.

A public sewer system will be made available for the plat and individual services will be provided to each lot prior to sale.

No more than one detached dwelling structure shall be permitted on any lot, nor shall any lot be further subdivided for the purpose of creating additional lots or building sites without filing a replat.

Utility easements are hereby granted to or across those lots as shown hereon.

Lot 14, Block 1, and Lot 5, Block 5, as shown hereon are dedicated to Spokane County as general County property to be dedicated for road purposes, forever at such time as the road is continued as a full width right-of-way, or until adjacent lands are platted.

The owners of Lots 1,4,5,6,7,11,& 12, Block 1; Lots 1, 7, and 8, Block 2; and Lots 1,2,5,6,7,16 and 17, Block 4 , shall be held responsible for obstructing, artifically collecting or discharging, the natural drainage flow across or adjacent to their property, and shall assume full responsiblity for damage to their or any other property as a result of their obstructing, artificially collecting or discharging the drainage flow. The subdivider shall inform each purchaser of the responsibility imposed on each property owner for obstructing, artificially collecting or discharging the drainage flow. By permitting the drainage easements to be platted as shown hereon, Spokane County does not accept the responsibility of maintaining the drainage course or the responsibility for any damage whatsoever, including but not limited to inverse condemnation to any properties due to the drainage flow.

IN WITNESS WHEREOF, the said owners have hereunto set their hands and affixed their seal this 26th day of January, 1978.

TUPPER INCORPORATED, REALTORS
Kenneth J. Tupper
President

BANCSHARES MORTGAGE COMPANY
James W. Sullivan
Senior Vice President
Vice President

R. & T. INCORPORATED
Kenneth J. Tupper
President
David W. Renz
Secretary-Treasurer

ACKNOWLEDGEMENTS

STATE OF WASHINGTON)
COUNTY OF SPOKANE)

On this 26th day of January, 1978, before me personally appeared Kenneth J. Tupper, known to me to be the President of Tupper Incorporated, Realtors, the corporation that executed the within and foregoing instrument and acknowledged said instrument to be the free and voluntary act and deed of said corporation for the uses and purposes therein mentioned and the officer stated on oath that he was authorized to execute said instrument and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Justine Lockrotz
Notary Public in and for the State of Washington, residing in Spokane.

STATE OF WASHINGTON)
COUNTY OF SPOKANE)

On this 26th day of January, 1978, before me personally appeared James W. Sullivan and William W. Zuppe, known to me to be the Senior Vice President and Vice President, respectively, of Bancshares Mortgage Company, the corporation that executed the within and foregoing instrument and acknowledged said instrument to be the free and voluntary act and deed of said corporation for the uses and purposes therein mentioned and eachofficer stated on oath that he was authorized to execute said instrument and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Justine Lockrotz
Notary Public in and for the State of Washington, residing in Spokane.

STATE OF WASHINGTON)
COUNTY OF SPOKANE)

On this 26th day of January, 1978, before me personally appeared Kenneth J. Tupper and David W. Renz, known to me to be the President and Secretary-Treasurer, respectively, of R. & T., Incorporated, the corporation that executed the within and foregoing instrument and acknowledged said instrument to be the free and voluntary act and deed of said corporation for uses and purposes therein mentioned and each officer stated on oath that he was authorized to execute said instrument and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Justine Lockrotz
Notary Public in and for the State of Washington, residing in Spokane.

SURVEYOR'S CERTIFICATE

I, Milton I. Booth, a registered Professional Land Surveyor, hereby certify that the map shown hereon was prepared by me subsequent to an actual survey on the ground in September, 1977, and that the same time conforms in all respects to the provisions of the ordinances of Spokane County, now in effect, and that the lot corners and monuments have been properly set.

Milton I. Booth
Registered Land Surveyor

MILTON I. BOOTH 10657

COUNTY ENGINEER

Examined and approved this 8th day of Feb, 1978.

Spokane County Engineer

COUNTY COMMISSIONERS

This plat was approved and accepted by the County Commissioners of Spokane County, Washington, on this 9th day of February, 1978.

Harry M. Larned
Chairman, Spokane County Commissioners

COUNTY PLANNING COMMISSION

Examined and approved this 2nd day of Feb, 1978.

Ted McCoury by Fred L. Dayharsh
Spokane County Planning Commission Chairman

COUNTY HEALTH DISTRICT

Examined and approved this 9th day of February, 1978.

Eugene C. Prather, R.S.
for Health Officer

COUNTY TREASURER

I do hereby certify that all taxes which have been levied and become chargeable against the land shown within this map have been fully paid this 10 day of Feb, 1978.

Vern W. Bassen Linda Martin
Spokane County Treasurer

COUNTY ASSESSOR

Examined and approved this 9th day of Feb, 1978.

John McBride, Lynda Douthitt
Spokane County Assessor

12/10/2014 10:06:02 AM
Recording Fee $79.00 Page 1 of 8
Agreement INLAND, PROFESSIONAL TITLE
Spokane County Washington

6354475

City of Spokane Valley City Clerk
11707 E Sprague Avenue
Spokane Valley, WA 99206

AFTER RECORDING RETURN TO:
CITY OF SPOKANE VALLEY CITY CLERK
11707 E. Sprague Avenue
Spokane Valley, WA 99206

Document: Drainage Easement Agreement
Reference No: 9410050526; 7512120290; 7410180104
Grantor: Kenneth and Sharon Tupper and Hilda E. Renz
City of Spokane Valley
Grantee: City of Spokane Valley
Kenneth and Sharon Tupper and Hilda E Renz
Abbreviated Legal Description: Ptn. Of N1/2 Sec. 25, T. 25 N., R. 44 EWM -NE1/4
Complete Legal Description on Page 6
Tax Parcel Number(s): 45255.9101

Drainage Easement Agreement

121014.3

This Agreement is made and entered into by and between Kenneth J. Tupper and Sharon L. Tupper, husband and wife, and Hilda E. Renz, an unmarried woman, as the members of R&T, Inc., a dissolved corporation, as to a portion, and Hilda E. Renz, an unmarried woman, as to the remainder, (hereinafter collectively referred to as Tupper/Renz), and the City of Spokane Valley, a municipal corporation of the State of Washington (hereinafter City).

Recitals

1. In September, 1994, R&T, Inc. and Alfons B. Renz and Hilda E. Renz entered into a "Modified Easement Agreement" with Spokane County, recorded under Spokane County Auditor's number 9410050526 (hereinafter County Agreement).
2. The purpose of the County Agreement was to provide for a drainage easement and storm water detention area for various additions of the Ridgemont development and to provide for maintenance and operation thereof.
3. Tupper/Renz is the successor in interest to R&T, Inc. and to Alfons B Renz, deceased, and Hilda E. Renz, (hereinafter referred to collectively as Renz).

R. E. Excise Tax Exempt
Date 12-10 2014
Spokane County Treas.
By SAR

4. Spokane County's successor in interest is the City of Spokane Valley by virtue of its incorporation on March 31, 2003.
5. The County Agreement contains several errors, including erroneous legal descriptions, and has largely been ignored by the County and City and Tupper/Renz and Tupper/Renz's predecessors over the past 20 years.
6. Although the County Agreement erroneously places the responsibility for operation and maintenance of the large drainage easement on Ridgemont Estates North 3rd and 4th Addition Homeowners Association (hereinafter HOA), the practice has been for Tupper/Renz and its predecessors to maintain the drainage area located in an approximately 12 acre parcel described in Exhibit A, attached hereto. The parcel described in Exhibit A is owned in fee title by Tupper/Renz and is not located in the boundaries of the HOA. The HOA is not a party to the County Agreement.
7. The HOA has responsibility for the operation and maintenance of small drainage swales located within the boundaries of the HOA, which are owned in fee title by the HOA as common property. These small drainage swales are not part of this Agreement.
8. Tupper/Renz and the City wish to extinguish the previous County Agreement and adopt this Agreement to accurately determine the responsibilities of the City and Tupper/Renz relative to the Exhibit A easement property and to provide for operation and maintenance of the storm water and drainage runoff easement.
9. In 1974, Renz and Spokane County entered into an Indemnity Agreement recorded under Auditor's number 7512120290 whereby Renz agreed to indemnify Spokane County for any loss, damage, claims, etc. arising from the drainage control system, including the drainage easement area described in Exhibit A in the Ridgemont development. This indemnity agreement was entered into before construction of the drainage control system at the time of the initial development of the Ridgemont subdivision.
10. The drainage easement area described in Exhibit A has been in operation for over 30 years and operates as designed, without operational problems. Tupper/Renz and the City wish to extinguish the Indemnity Agreement since there is no longer any legitimate purpose for the Indemnity Agreement and the parties wish to replace it with the indemnity provision of this Agreement.
11. In 1974, Renz entered into a "Letter of Commitment" with Spokane County, recorded under Auditor's number 7410180104, whereby Renz agreed not to create lots along 16th Avenue without submitting a plat—it being possible at that time to "segregate" land having frontage on a County road into parcels without submitting a plat. The City's current regulations prohibit the subdivision of land without approval of a plat by the City. As such, the Letter of Commitment is superfluous and of no effect. Tupper/Renz and the City wish to extinguish the Letter of Commitment.

NOW THEREFORE, in consideration of the mutual covenants and conditions contained herein the parties hereto agree as follows:

A. Tupper/Renz shall continue to own the fee interest in the property described in Exhibit A. Tupper/Renz hereby grants to the City a perpetual, non-exclusive easement on the property described as the easement area in Exhibit A for use as a storm water and drainage runoff area for the area it presently serves.

B. Tupper/Renz shall continue to maintain the storm water and drainage runoff area on the Exhibit A easement property as it has done in the past.

C. Tupper/Renz shall indemnify the City for all damages caused by the failure of Tupper/Renz to properly operate and maintain the storm water and drainage runoff easement. Tupper/Renz shall be under no obligation to treat or specially process any water or to maintain any area other than the easement area described in Exhibit A. Tupper/Renz shall not be required to perform any duties in the maintenance of the easement that it has not done in the past.

D. Tupper/Renz shall timely pay and keep current all taxes and assessments levied against the Exhibit A property and shall keep such property free of any liens adverse to the storm water and drainage easement.

E. Tupper/Renz shall have the right to sell its interest in and/or grant an easement to Vera Water and Power to access and use the property described in Exhibit A, but the terms and conditions herein shall run with the land, and be binding on any successors and assigns.

F. The 1994 County Agreement referred to above is hereby extinguished and of no further effect.

G. The 1974 Indemnity Agreement referred to above is hereby extinguished and of no further effect.

H. The 1974 Letter of Commitment referred to above is hereby extinguished and of no further effect.

I. This Agreement is freely assignable by either of the parties hereto, but the terms and conditions herein shall run with the land, and be binding on any successors and assigns.

J. This Agreement is the complete and total agreement of the parties and may not be modified except by a writing executed by the parties or their successors.

Dated this 26TH day of November, 2014.

CITY OF SPOKANE VALLEY

By: Mike Jackson
Mike Jackson, City Manager

Kenneth J. Tupper

Sharon L Tupper
Sharon L. Tupper

Hilda E. Renz by Sharon K Queen AIF
Hilda E. Renz by her Attorney-in-Fact, Sharon K. Queen

STATE OF WASHINGTON)
) ss. See attached
COUNTY OF SPOKANE)

I certify that I know or have satisfactory evidence that Mike Jackson, signed this instrument, on oath stated the he was authorized to execute the instrument and acknowledge it as the City Manager of CITY OF SPOKANE VALLEY, WASHINGTON, to be the free and voluntary act of such CITY for the uses and purposes mentioned in the instrument.

Dated this 8th day of Dec, 2014.

CHRISTINE M. BAINBRIDGE
8-29-15

Christine M Bainbridge
Print Name: Christine M Bainbridge
Notary Public in and for the State of
Washington, residing at: Spokane Valley
My appointment expires: 8-29-15

STATE OF WASHINGTON)
)ss.
County of Spokane)

On this day personally appeared before me Kenneth J. Tupper to me known to be the individual described in and who executed the within and foregoing instrument, and acknowledged that he signed the same as his free and voluntary act and deed, for the uses and purposes therein mentioned.

DATED: 11/26/14

Notary Public
State of Washington
AARON C. SIMPSON
MY COMMISSION EXPIRES
AUGUST 08, 2017

Aaron C. Simpson
NOTARY PUBLIC in and for the State of
Washington, residing at Spokane
My commission expires: 8/8/2017

State of Washington

SS:

County of Spokane

On this 8 day of December 2014 before me the undersigned, a Notary Public in and for the State of Washington, duly appointed and sworn personally appeared Mike Jackson to me known to be the City Manager of City of Spokane Valley, Washington the city that executed the foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said city, for the uses and purposes therein mentioned and on oath stated that he is authorized to execute the said instrument and that the seal affixed (if any) is the seal of said city.
Given under my hand and official seal the day and year last above written.

Christine M. Bainbridge

Notary Public in and for the State of WA
Residing at Spokane Valley
My Appointment expires: 8-29-2015.

Place notary seal in box:

CHRISTINE M. BAINBRIDGE
8-29-15

STATE OF WASHINGTON)
)ss.
County of Spokane)

On this day personally appeared before me Sharon L. Tupper to me known to be the individual described in and who executed the within and foregoing instrument, and acknowledged that she signed the same as her free and voluntary act and deed, for the uses and purposes therein mentioned.

DATED: 11/26/14

Notary Public
State of Washington
AARON C. SIMPSON
MY COMMISSION EXPIRES
AUGUST 08, 2017

NOTARY PUBLIC in and for the State of
Washington, residing at Spokane
My commission expires: 8/8/2017

STATE OF WASHINGTON)
)ss.
County of Spokane)

On this day personally appeared before me Sharon K. Queen to me known to be the Attorney-in-Fact for Hilda E. Renz and who executed the within and foregoing instrument, and acknowledged that she signed the same as the free and voluntary act and deed of said Hilda, E. Renz, for the uses and purposes herein mentioned and on oath stated that she was authorized to execute the said instrument.

DATED: 11/26/14

Notary Public
State of Washington
AARON C. SIMPSON
MY COMMISSION EXPIRES
AUGUST 08, 2017

NOTARY PUBLIC in and for the State of
Washington, residing at Spokane
My commission expires: 8/8/2017

EXHIBIT A

Entire Parcel

That portion of the North Half of Section 25, Township 25 North, Range 44 East Willamette Meridian, lying northerly, northwesterly and easterly of Ridgemont Estates No. 2, Recorded in Volume 13 of Plats, Page 85, Ridgemont Estates, Recorded in Volume 12 of Plats, Page 36, Ridgemont Estates North 3rd Addition, Recorded in Volume 22 of Plats, Page 72, Ridgemont Estates North 4th Addition, Recorded in Volume 22 of Plats, Page 73 and Ridgemont Estates North 9th Addition, Recorded in Volume 26 of Plats, Page 29;

And Lying Southwesterly of the Following Described Line:

Beginning at northerly corner of Lot 8 Block 1 of Ridgemont Estates No. 2; thence North 50°22'27" West 159.13 feet; thence North 30°08'14" West 152.25 feet to the Northerly Line of said section and terminus of this line described;

Except road;

Situate in the City of Spokane Valley, County of Spokane, State of Washington.

Drainage Easement

A portion of the Northeast quarter of the Northwest quarter and the Northwest quarter of the Northeast quarter of Section 25, Township 25 North, Range 44 East, W.M., being more particularly described as follows:

Begin at a point that is South 89°16'42" East, a distance of 626.35 feet from the North quarter corner of said Section 25, said point being common to the North boundary of said Section 25 and the West boundary of Leo N. Cashatt and others, as established by a survey performed by Adams Engineering in 1976; thence along said Cashatt West boundary, the following two (2) courses, South 30°08'12" East, a distance of 152.25 feet; thence South 50°22'25" East, a distance of 26.00 feet; thence South 52°30'00" West a distance of 135.07 feet; thence South 30°22'00" East, a distance of 119.42 feet; thence South 56°26'16" West, a distance of 40.06 feet; thence North 30°22'00" West, a distance of 116.74 feet; thence South 52°38'00" West, a distance of 307.71 feet; thence South 50°22'00" East, a distance of 151.82 feet; thence South 39°26'16" West, a distance of 40.00 feet; thence North 50°22'00" West, a distance of 161.19 feet; thence South 45°39'33" West, a distance of 349.84 feet; thence South 50°33'44" East, a distance of 199.11 feet; thence South 39°26'16" West, a distance of 40.00 feet; thence North 50°33'44" West, a distance of 203.47 feet; thence South 45°39'33" West, a distance of 84.90 feet; thence South 76°35'00" West, a distance of 144.00 feet; thence South 07°35'00" West, a distance of 89.92 feet to the East line of the Future Plat of Ridgemont Estates North 3rd Addition; thence North 02°51'52" West, along said East line, a distance of 215.89 feet to a point on a nontangent curve concave to the West with a radius of 50.00 feet and a radial bearing of South 44°22'04" East, said point being on the Easterly line of the Future Plat of Ridgemont Estates North 4th, the next 2 courses along said Easterly line; thence Northeasterly, Northerly and Northwesterly through a central angle of 119°08'01", an arc distance of 103.96 feet; thence North 16°29'55" East, radial to said curve, a distance of 28.10 feet; thence North 56°18'15" East, a distance of 248.44 feet; thence North 32°00'54" East, a distance of 244.68 feet; thence North 76°30'08" East, a distance of 154.57 feet; thence North 54°00'44" East, a distance of 186.55 feet; thence North 62°14'59" East, a distance of 149.00 feet; thence North 26°59'32" East, a distance of 29.57 feet to the South right of way (R/W) of 16th Avenue and a point on a curve concave to the Northwest with a radius of 495.72 feet and a radial bearing of South 16°02'48" East, thence Northeasterly along said South R/W, through a central angle of 3°15'02", an arc distance of 28.12 feet; thence South 89°09'28" East, 25.38 feet to the Point of Beginning;

Situate in the County of Spokane, State of Washington.

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OFF. VOL. 256 PAGE 199

FILED OR RECORDED
REQUEST OF TRANSAMERICA TITL

FEB 9 3 50 PM '76

VERNON W. OHLAND, AUDITOR
SPOKANE COUNTY, WASH.
DEPUTY

3.00

AGREEMENT

THIS AGREEMENT is made this 3 day of Feb, 1976, by and between Bancshares Mortgage Company, hereinafter referred to as Bancshares, and Tupper Inc., Realtors, hereinafter referred to as Tupper. Bancshares hereby agrees that in the event Tupper is not in default under a Deed of Trust dated July 30, 1975, executed by Bancshares Mortgage Company, as Beneficiary, Tupper, Inc., Realtors, as Grantor, and Transamerica Title Insurance Company as Trustee, any lot in Ridgemont Estates, a subdivision filed with the Spokane County Auditor on December 12, 1975, under Auditor's File No. 7512120141 or any part thereof, shall be released on application of Tupper from the lien of the Deed of Trust, above described, on payment of $6,350.00 on the promissory note dated the 30th day of July, 1975, entered into between the parties hereto.

DATED this 3 day of Feb, 1976.

BANCSHARES MORTGAGE COMPANY
By
By Jerry D. Dean

TUPPER INC., REALTORS
By Kenneth J. Tupper
By

STATE OF WASHINGTON)
) ss.
County of Spokane)

On this 3rd day of February, 1976, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared [illegible] and Jerry D. Dean, to me known to be the Vice President and Commercial Loan Officer of BANCSHARES MORTGAGE COMPANY, the company that executed the foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute the said instrument and that the seal affixed is the corporate seal of said company.

GIVEN under my hand and official seal hereto affixed the day and year first above written.

NOTARY PUBLIC in and for the State of Washington, residing at Spokane.

31'V

STATE OF WASHINGTON)
) ss.
County of Spokane)

On this 3rd day of February, 1976, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared Kenneth J. Tupper and Robert W. Fogg, to me known to be the President and Secretary, of TUPPER INC., REALTORS, the company that executed the foregoing insturment and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute the said instrument and that the seal affixed is the corporate seal of said company.

GIVEN under my hand and official seal hereto affixed the day and year first above written.

Jo Ann Cantrell

NOTARY PUBLIC in and for the State
of Washington, residing at Spokane.

APPENDIX G
PUBLIC FEEDBACK

Osborn Consulting

PUBLIC FEEDBACK SURVEY RESULTS

A public outreach survey was published on the project webpage May 5, 2024. To date, there have been six responses and general feedback showed an understanding of the project and its goals. Major concerns included roadway deterioration and cracking, stormwater runoff, and ice formation contributing to slippery road conditions.

Date Response Recorded	What is your general understanding of the project and the issues it seeks to address?	Are there other drainage problem areas the city should be alerted to?	Is there anything else you'd like to share?
5/11/2024	To repair some badly worn-out roads and to improve stormwater runoff.	I'm only familiar with my own immediate neighborhood.	Sonora and Cameron are in very bad shape. I'm glad to see that these issues are to be addressed.
5/12/2024	To future proof road issues by moving the ground water properly.	No	My home has one of those open drainage culverts, is there any thought of closing up the open channels?
5/16/2024	Road repavement and resolution of water drainage issues.	During significant rainstorms and thunderstorms, water running along the northwest side of Vera Crest Dr has crested the curb and driveway apron between 1718 and 1722 S Vera Crest Dr and run across the residential property. I believe this has the potential to continue, even if the drain below where the water is cresting the curb/driveway apron was functioning properly. Video during a rainstorm is available.	Road deterioration is now leaving chunks of asphalt in roadway, which is a driving and bicycle riding hazard. Road replacement is needed sooner than later.
5/18/2024	It looks like it will address the problem stormwater drainage at the edge of the city limits on Timberlane Dr. This has created a noticeable raise in ground water level at my home's location. Not to mention that the pond has overflowed nearly every year since its inception. It created a running creek all the way down Timberlane Dr to 24th Ave from February to June in 2017.	I have major concerns about the newest phase of Timberlane Terrace and the drainage problems that could cause for myself and my neighbors.	Thank you for tackling this project and recognizing its importance. I appreciate the PowerPoint presentation that you shared to keep us informed.
5/26/2024	Water issues in this area that are causing premature and continued road damage. Glad you are looking into this and good luck!	In the 20 years I've lived in this house, it's apparent this hill is water rich and has drainage issues. There's excess ice that forms on the road in front of my house in the winter/early spring after excessive moisture during the days and freezing temperatures at night. The drainage that freezes on the road looks like it comes from water seeping out of the ground from the property across the street, not just from runoff from 23rd Ct. It's an interesting issue and fun to see - except for those people driving and not expecting ice right before the corner.	Likely not related to the roads - the neighbor's backyard to the north of my house is a marshy mess. It only affects a small corner of my yard. There is an alley behind our homes that has standing water for most of the spring and much of the summer. Not sure if the water is coming from a natural spring, or more likely from water that seeps into the ground up hill of us and then manifest itself in the yards and alley.

Date Response Recorded	What is your general understanding of the project and the issues it seeks to address?	Are there other drainage problem areas the city should be alerted to?	Is there anything else you'd like to share?
6/17/2024	Stormwater drainage issues. Updates to infrastructure and routing of water runoff.	In front of my mailbox, water is constantly flowing out of some sort of drainage hole. Also, we are seeing cracks in our garage and upstairs bedroom that is closest to the garage. The bottom of our driveway has started cracking. Also, the neighbor next to me and the neighbor behind me both have swimming pools. The neighbor on my right mentioned they have a crack in their pool. The neighbors behind me haven't said anything, but they have had people looking at their pool and I don't think they are using it.	Thank you for your hard work and wonderful video, it was very helpful, and I have a much clearer understanding of what is happening.

Note: Responses only edited for brevity, spelling, and grammar.

City of Spokane Valley
Community & Public Works
10210 E. Sprague Ave.
Spokane Valley, WA 99206

Ridgemont Estates
Stormwater Improvements

The city is working to improve your neighborhood.
Learn more at: spokanevalleywa.gov/ridgemont

Title VI Notice to Public – It is the policy of the City of Spokane Valley to assure that no person shall, on the grounds of race, color, national origin, or sex, as provided by Title VI of the Civil Rights Act of 1964, and related State and Federal Statutes, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its federally-funded programs and activities. Any person who believes his/her Title VI rights have been violated may file a complaint with the City's Title VI Administrator at jwhitehead@spokanevalley.org, or call (509) 720-5111.

The City of Spokane Valley in accordance with Section 504 of the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA), commits to nondiscrimination on the basis of disability, in all of its programs and activities. This material can be made available in an alternate format by contacting John Whitehead at jwhitehead@spokanevalleywa.gov or (509) 720-5111.

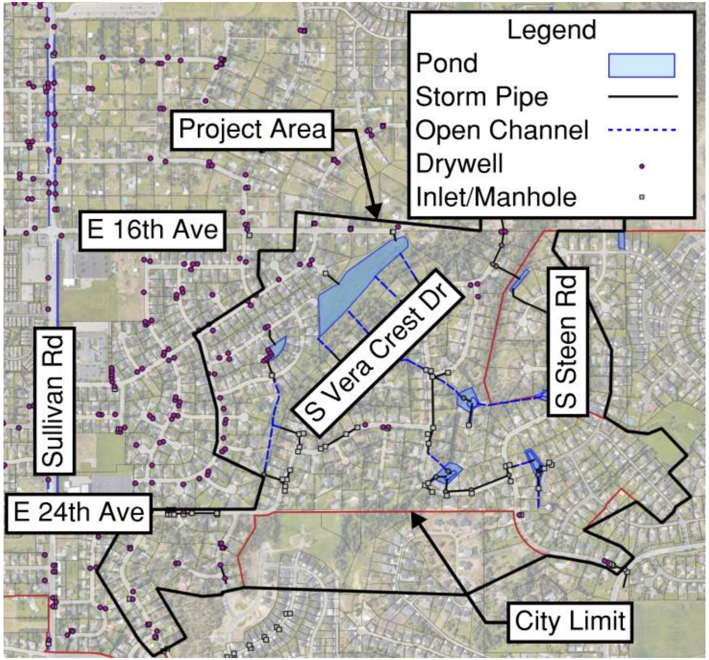
Ridgemont Estates Stormwater Improvements Project

The city is evaluating potential road and stormwater improvements in the Ridgemont Estates area. The project will first complete a topographic survey and geotechnical investigations. Geotechnical investigations will include the installation of groundwater monitoring wells at locations outside the roadway. Wells will remain in place until September 2024 to evaluate seasonal groundwater variations.

The goal of the project is to identify the needed improvements for a sustainable stormwater system and street pavement design. Private lanes and county roads are excluded from the proposed improvements.

Anticipated timeframe for fieldwork:

- Land Surveying Activity: October 2023
- Geotechnical Activity: October 2023
- In-place Monitoring Equipment: October 2023 - September 2024



We want to hear from you!

Learn more at spokanevalleywa.gov/ridgemont.

For questions, comments, or to share known issues, email cphillips@spokanevalleywa.gov

PUBLIC OUTREACH TIMELINE

OCTOBER 2023

Project website is developed and launched, and initial mailer is sent to announce the project study.

APRIL - SEPTEMBER 2024

Follow-up mailers regarding project updates and next phases of project are sent.

MAY 2024 - PRESENT

Presentation and feedback survey are created to explain project and timeline, and to gauge understanding.

APPENDIX H
MODEL CALIBRATION SUMMARY

[Choose a location.]

Osborn
Consulting

MODEL CALIBRATION SUMMARY

Project: City of Spokane Valley Ridgemont Estates Study
To: Chad Phillips, P.E. | City of Spokane Valley
From: Josh Van Wie, PE, Sophia Nespor, EIT Brendan Doohan, EIT | Osborn Consulting
Date: September 25, 2024

This appendix to the study report provides a summary of the model calibration that was done for the Ridgemont Estates study using AutoCAD Storm and Sanitary Analysis (SSA).

After assigning initial model parameters, the model was calibrated by comparing model runoff to observed runoff from the flow monitoring data and adjusting the parameters until the modeled and observed flows matched as closely as possible. The model was calibrated for the period of November 2023 through May 2024. Calibration focused on adjusting curve numbers, storage node volumes, and base flows that represented shallow subsurface flow seeping into the drainage system.

Rainfall data for model calibration was acquired from the WSU AgWeatherNet website, which publishes 15-minute precipitation data from weather stations in the region. The weather station used for this project is located near the intersection of Maxwell Avenue and North Molter Road in Liberty Lake, approximately 5 miles northeast of the study area.

Curve numbers were modified to adjust the peak flows and runoff volumes in the model. After assigning the initial curve numbers, the model's peak flows and volumes were significantly higher than the observed data. Curve numbers were reduced to allow more infiltration, which resulted in lower peak flows and runoff volumes. In the long-term model simulation between November 2023 and May 2024, curve numbers had to be reduced from a value of 80 to 55 to bring peak flows and volumes in line with the observed data. However, when the model was run for a shorter duration, such as a single storm event, the model peak flows were significantly lower than in the long-term simulation. It was determined that during the long-term simulation, model parameters for antecedent moisture conditions were being adjusted throughout the simulation to represent increasing soil saturation over time. In SSA, the soil saturation parameters cannot be adjusted directly. For running design storms, the model was set up to run for 45 days of historical rainfall data with the design storm rainfall appended to the end of the historical data. This ensured that the soil saturation parameters had time to "spin up" and reach stabilization prior to running the design storm.

Storage nodes were calibrated to help the model achieve a better match in hydrograph shape during the latter part of the storm events or receding limb of the hydrograph. This was done for "Pond A" and "Pond B", which are located in the Ridgemont Third Addition development near South Conklin Road. The pond names are based on the naming conventions used in the development's record drawings. In the model, these storage nodes receive runoff from the lumped subcatchments, which represent relatively large contributing areas with multiple stormwater BMPs that are combined into a single storage node. The volumes of the Pond A and Pond B storage nodes were increased to represent the storage that would be achieved in other BMPs distributed through the subcatchments. These ponds were also modeled to infiltrate a portion of the water stored. By taking the stabilized infiltration rate measured to be 1.03 inches per hour from the 16th Avenue Pond and multiplying it by the base area of the pond, the Osborn team calculated an assumed infiltration rate. Model results with these infiltration rates were satisfactory, so the infiltration rates were not calibrated further. These infiltration rates can be seen below in **Table Error! No text of specified style in document.**-1.

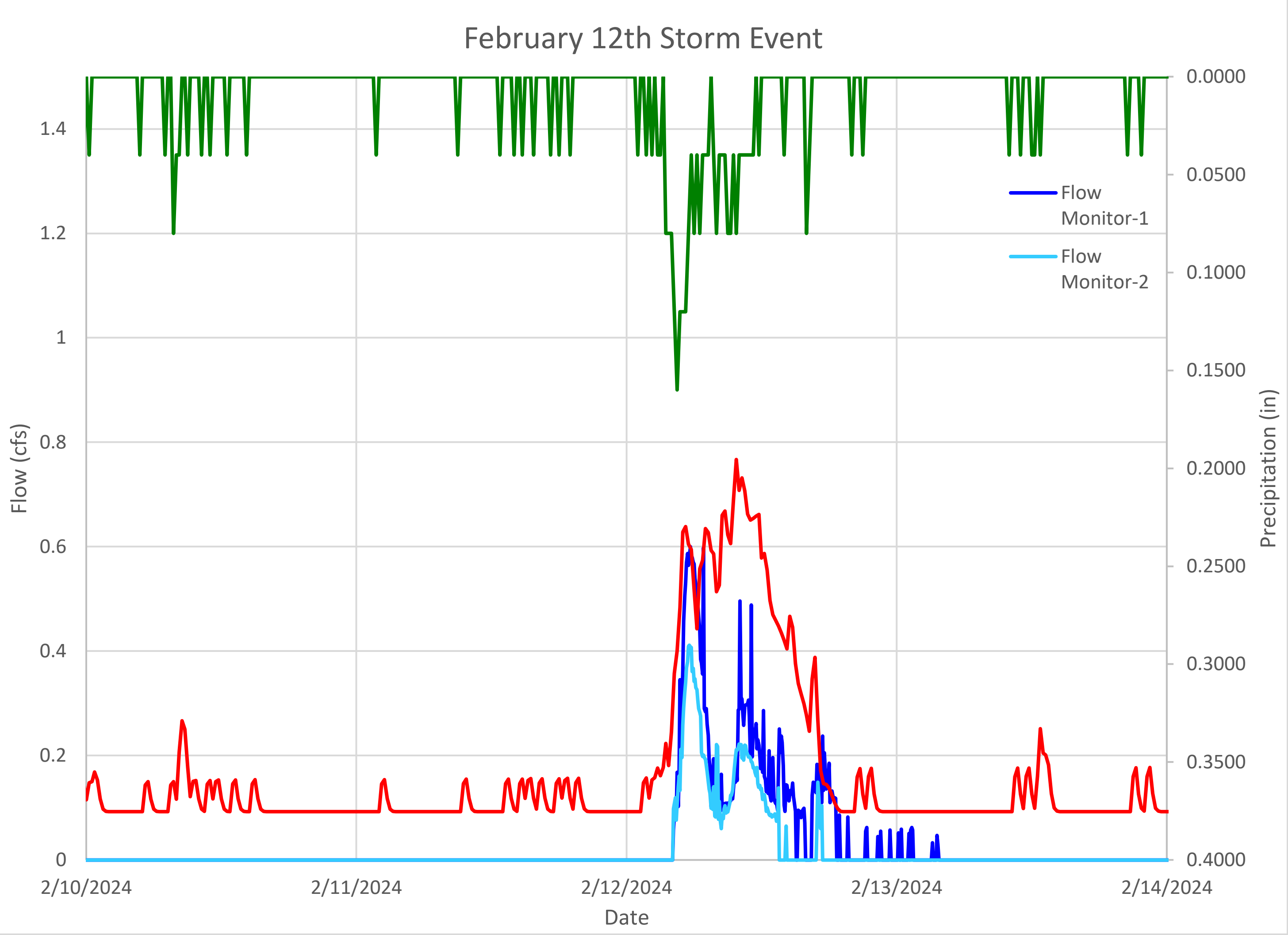
Table Error! No text of specified style in document.**-1. Infiltration Rates for Storage Nodes Used in the SSA Model**

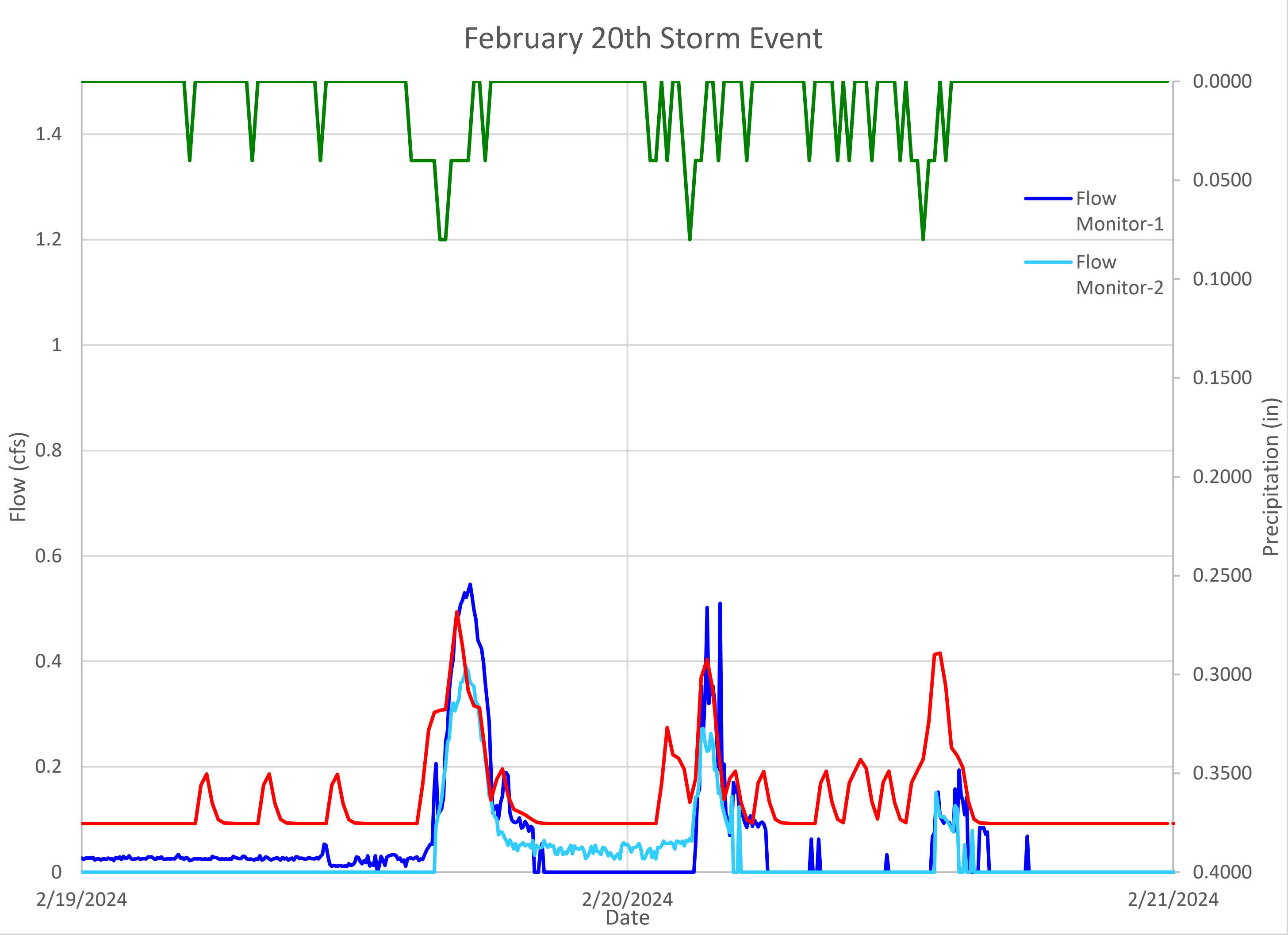
Storage Junction	Pond Bottom Area (sf)	Model Infiltration Rate (cfs)
Pond A	3320	0.317
Pond B	2790	0.266

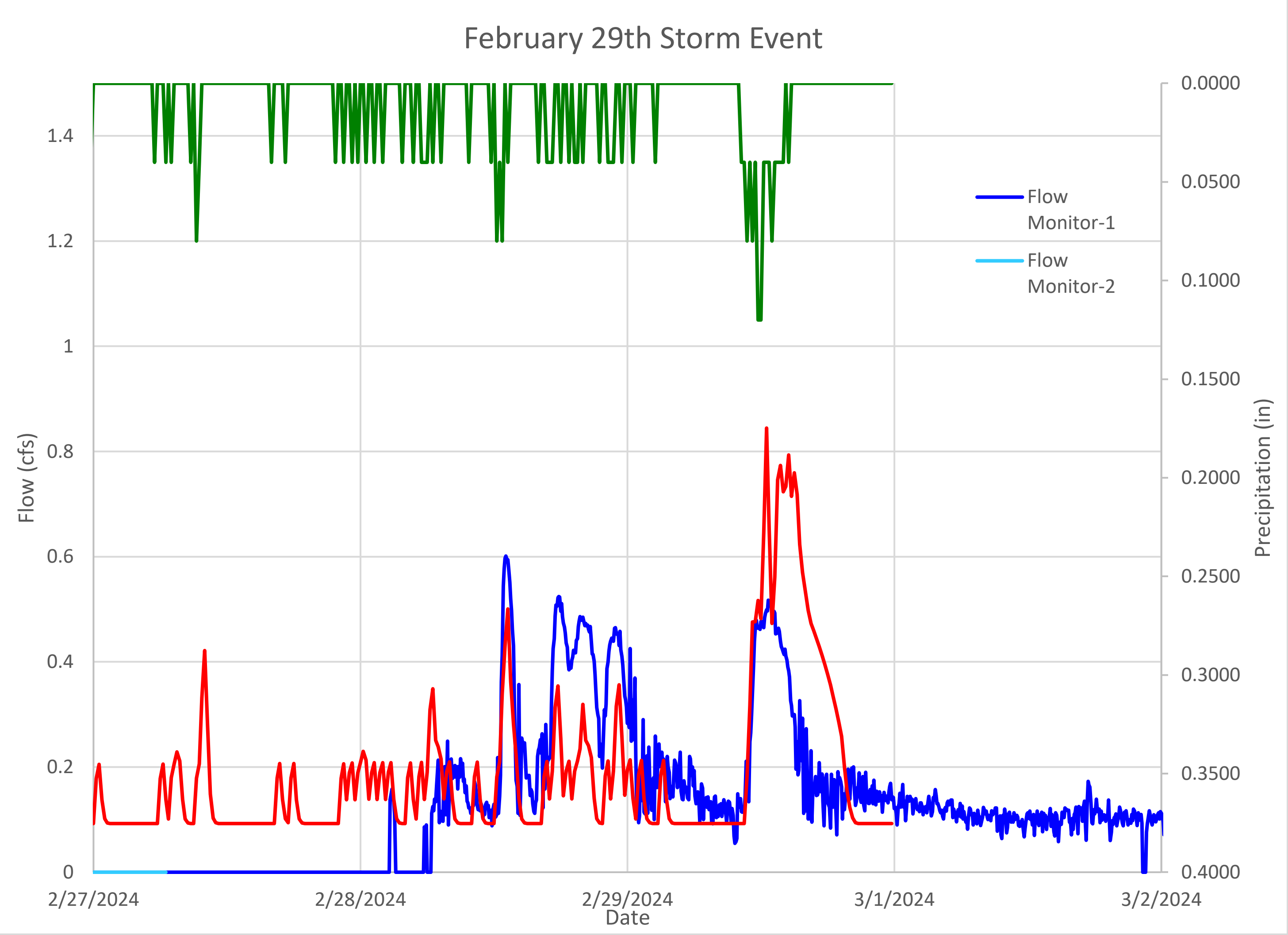
Notes:
sf = square feet, used for measuring the base area of a pond.
cfs = cubic feet per second, used for measuring the infiltration rate from a pond.

Base flows were added to model junctions to represent shallow subsurface inflow into the storm conveyance system. During the spring months of 2024, the flow monitor data showed steady base flows that appear to be from shallow subsurface inflow, which either slowly increased or decreased within a range of roughly 0.1 to 0.2 cubic feet per second. To represent these base flows in the model, a constant value of 0.1 cubic feet per second was divided between the model junctions in the portion of the storm system that contributed to the flow monitor location. This resulted in an inflow value of 0.00769 cfs at each junction. This value was then also assigned to the remaining model junctions assuming a similar amount of shallow subsurface inflow is present in those areas.

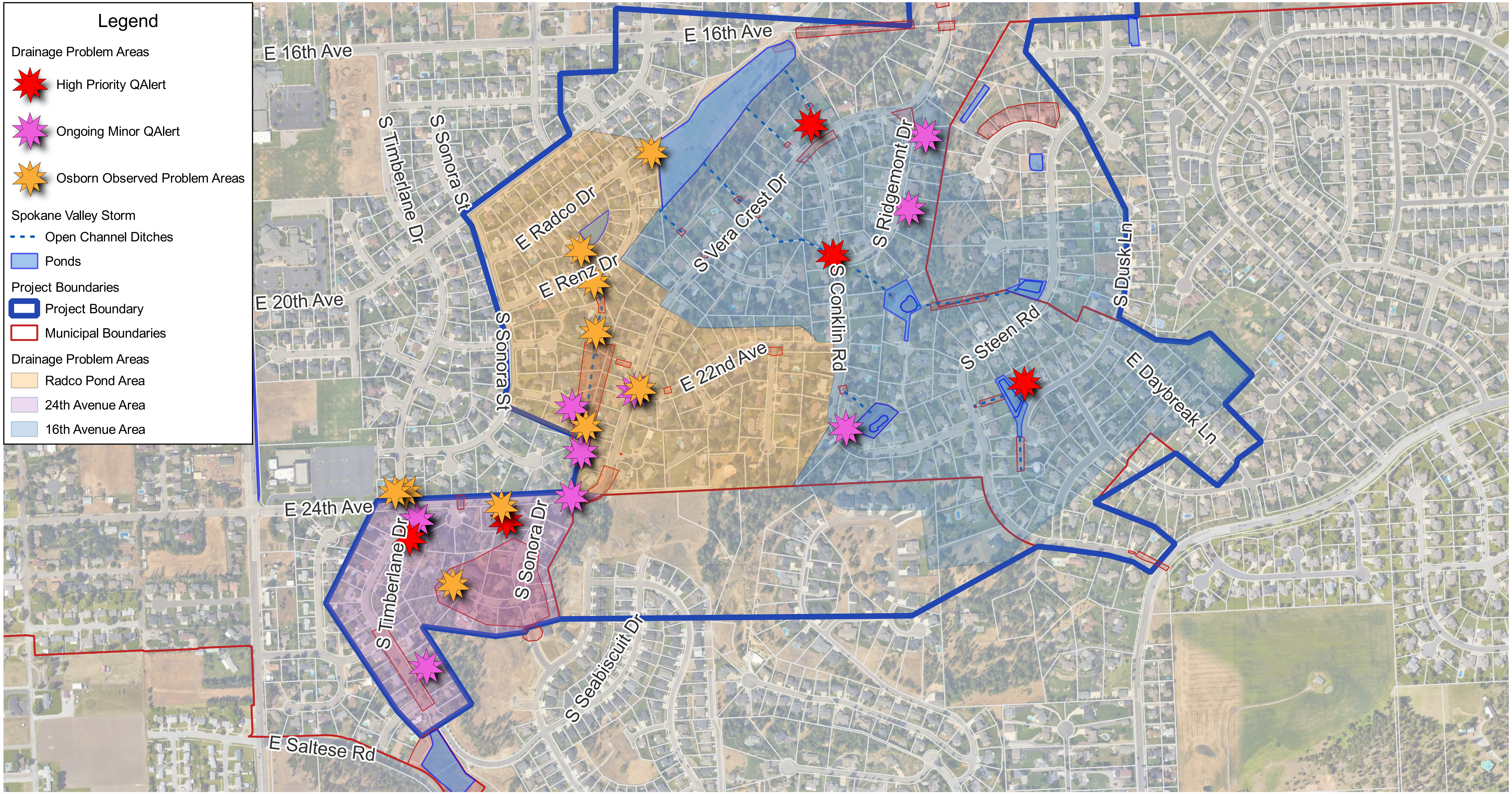
Model calibration plots for selected storm events are shown in the following pages.


February 12th Storm Event
Flow (cfs)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Precipitation (in)
0.0000
0.0500
0.1000
0.1500
0.2000
0.2500
0.3000
0.3500
0.4000
2/10/2024
2/11/2024
2/12/2024
2/13/2024
2/14/2024
Date
Flow Monitor-1
Flow Monitor-2


February 20th Storm Event
Flow (cfs)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Precipitation (in)
0.0000
0.0500
0.1000
0.1500
0.2000
0.2500
0.3000
0.3500
0.4000
Flow Monitor-1
Flow Monitor-2
2/19/2024
2/20/2024
2/21/2024
Date


February 29th Storm Event
Flow (cfs)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Precipitation (in)
0.0000
0.0500
0.1000
0.1500
0.2000
0.2500
0.3000
0.3500
0.4000
Flow Monitor-1
Flow Monitor-2
2/27/2024
2/28/2024
2/29/2024
3/1/2024
3/2/2024
Date

APPENDIX I
DRAINAGE ISSUES MAPS

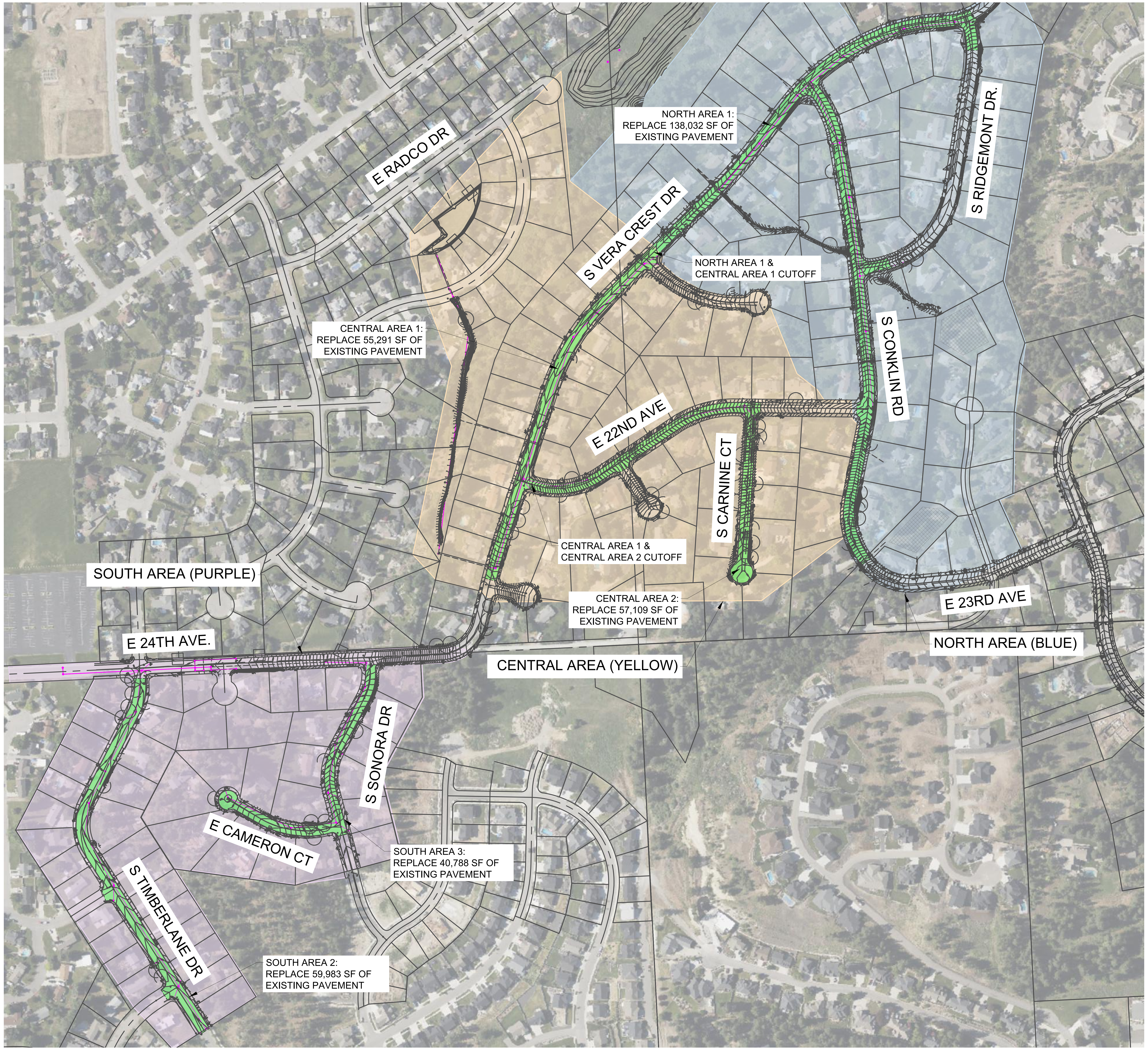


Osborn Consulting

City of Spokane Valley Ridgemont Estates Stormwater

Spokane Valley, WA

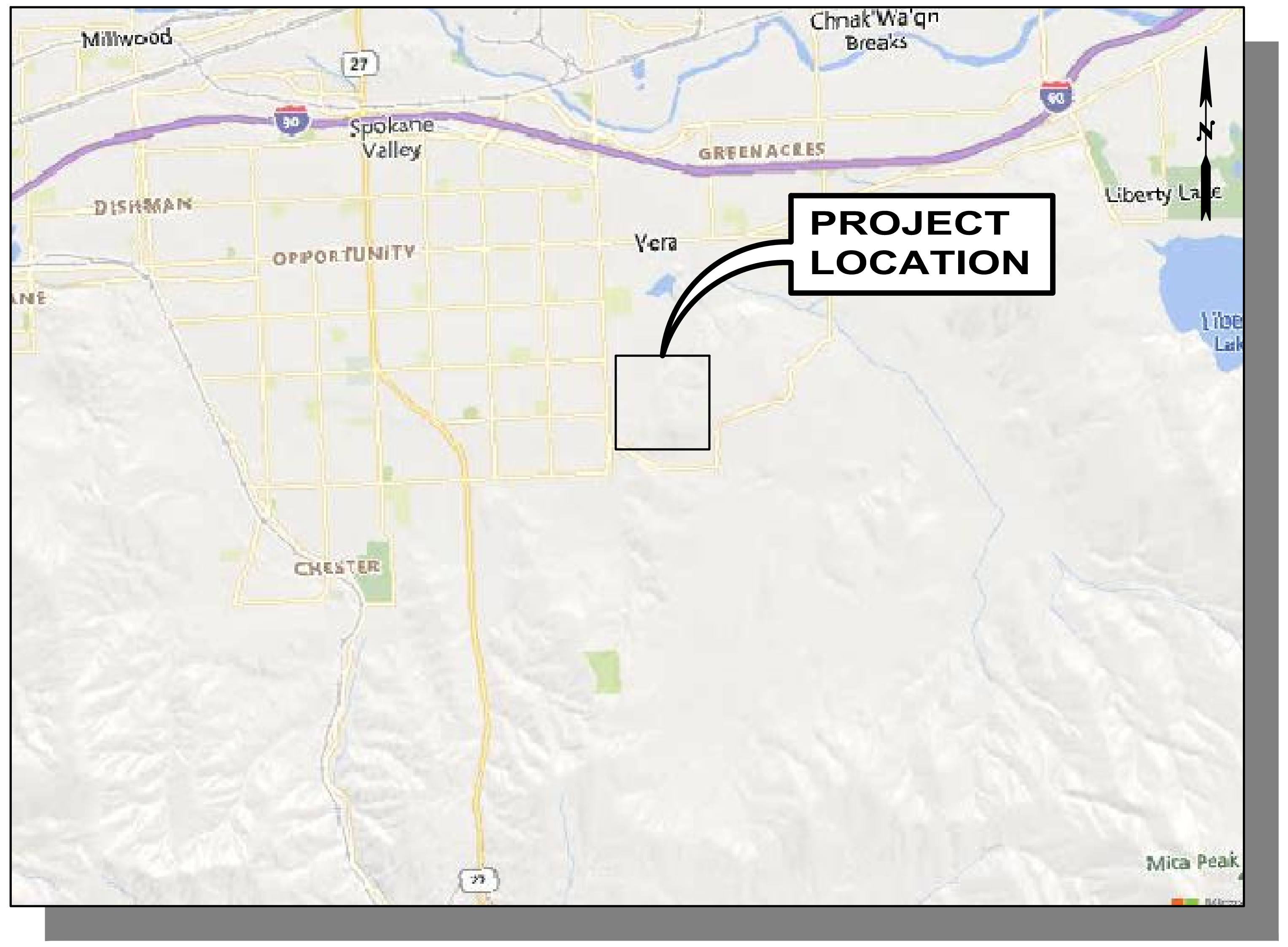
APPENDIX J
PROPOSED IMPROVEMENTS CONCEPT DESIGNS



RIDGEMONT ESTATES STORMWATER

SPOKANE VALLEY

PROJECT #: 30-230010



VICINITY MAP

N.T.S.

SITE DATA:

PARCEL NUMBER: XXX
PROJECT ADDRESS: RIDGEMONT ESTATES
SPOKANE VALLEY
SITE AREA: 340 ACRES
DISTURBED AREA: 57 ACRES

HORIZONTAL DATUM

WA83-SF
WASHINGTON STATE PLANES
SOUTH ZONE, US FOOT

VERTICAL DATUM

NAVD88

CONTACT INFORMATION:

PROJECT OWNER:

CITY OF SPOKANE VALLEY
10210 EAST SPRAGUE AVENUE
SPOKANE VALLEY, WA 99206
(509) 720-5000

CIVIL ENGINEER:

OSBORN CONSULTING, INC.
101 SOUTH STEVENS STREET
SPOKANE, WA 99201
(509) 867-3654

SURVEYOR:

SIMPSON ENGINEERS, INC
909 NORTH ARGONNE ROAD
SPOKANE VALLEY, WA 99212
(509) 926-1322

SHEET INDEX

NO.	SHEET NAME
C	COVER SHEET
1	NORTH AREA
2	NORTH AREA
3	NORTH AREA
4	NORTH AREA
5	NORTH AREA
6	CENTRAL AREA
7	CENTRAL AREA
8	SOUTH AREA
9	SOUTH AREA

SCALE: 1" = 200'
0 200 400 600
N

FIGURES

PRELIMINARY

DESIGNED BY	S. NESPOR
DRAWN BY	M. MECHAM
CHECKED BY	J. VAN WIE

Osborn Consulting

NO.	DATE	REVISION	BY

RIDGEMONT ESTATES
STORMWATER
SPOKANE VALLEY
COVER SHEET

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 200' V: N/A

DATE
07/02/2024

SHEET C OF 9

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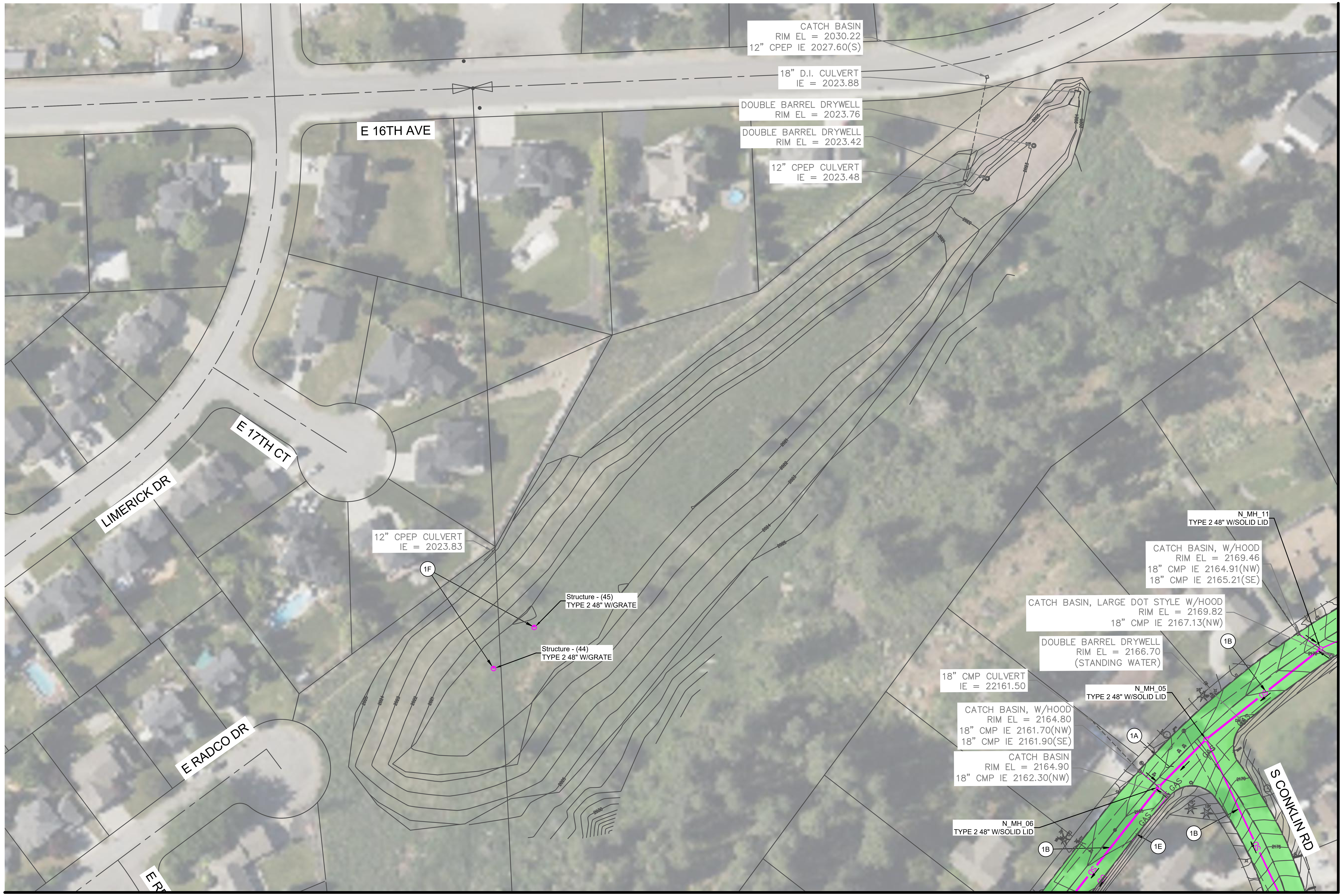


MATCHLINE SEE SHEET 3

MATCHLINE SEE SHEET 2

16TH AVENUE POND DESIGN ALTERNATIVE AREA PRIORITY LIST:

1A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

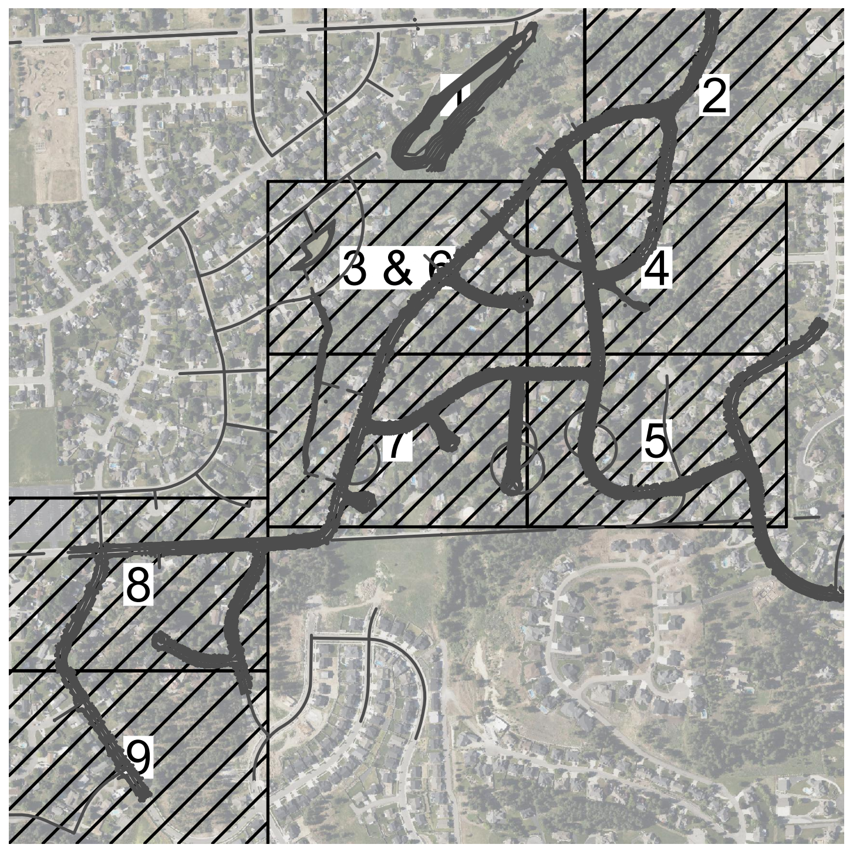
1B. VERA CREST RD STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES. ABANDON EXISTING OPEN CHANNEL THRU RESIDENTIAL NEIGHBORHOOD. ABANDON EXISTING OUTFALL NORTHWEST OF CONKLIN STORMWATER TO BE ROUTED TO OUTFALL NORTHWEST OF VERA CREST DR & E 20TH CT. EXISTING OUTFALL SOUTHWEST OF CONKLIN RD TO BE ABANDONED. STORMWATER TO BE ROUTED TO OUTFALL NORTHWEST OF VERA CREST DR & E 20TH CT.

1E. VERA CREST RD GROUNDWATER COLLECTION. INSTALL UNDERDRAIN ALONG THE NORTHEAST CURB TO CATCH POTENTIAL GROUNDWATER SEE PAGE XXX.

1F. INSTALL NEW DRYWELLS AT 16TH AVE AND TO REACH INFILTRATIVE SOILS.

SCALE: 1" = 50'
0 50 100 150

N



FIGURES

PRELIMINARY

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PLOT TIME: 7/3/2024 5:21 PM
USER NAME:BRENDAN DOOHAN

DESIGNED BY	S. NESPOR
DRAWN BY	M. MECHAM
CHECKED BY	J. VAN WIE

Osborn Consulting

NO.	DATE	REVISION	BY

RIDGEMONT ESTATES STORMWATER
SPOKANE VALLEY
NORTH AREA

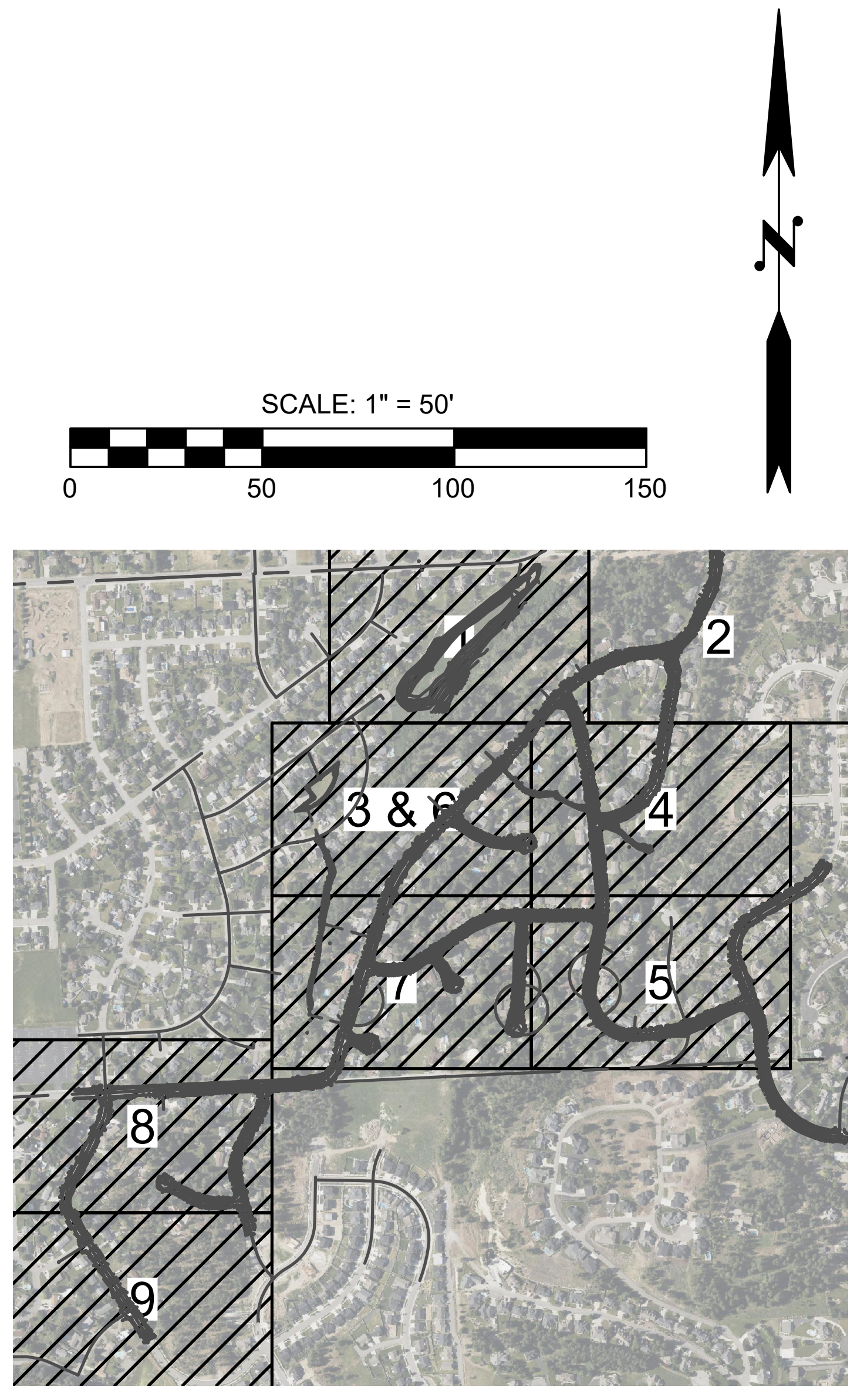
JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A

DATE
07/02/2024
SHEET 1 OF 9

16TH AVENUE POND DESIGN ALTERNATIVE AREA PRIORITY LIST:

1A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

1B. VERA CREST RD STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES.



PRELIMINARY

FIGURES

DESIGNED BY	S. NESPOR
DRAWN BY	M. MECHAM
CHECKED BY	J. VAN WIE

Osborn Consulting

NO.	DATE	REVISION	BY

RIDGEMONT ESTATES
STORMWATER
SPOKANE VALLEY
NORTH AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A
DATE
07/02/2024
SHEET 2 OF 9

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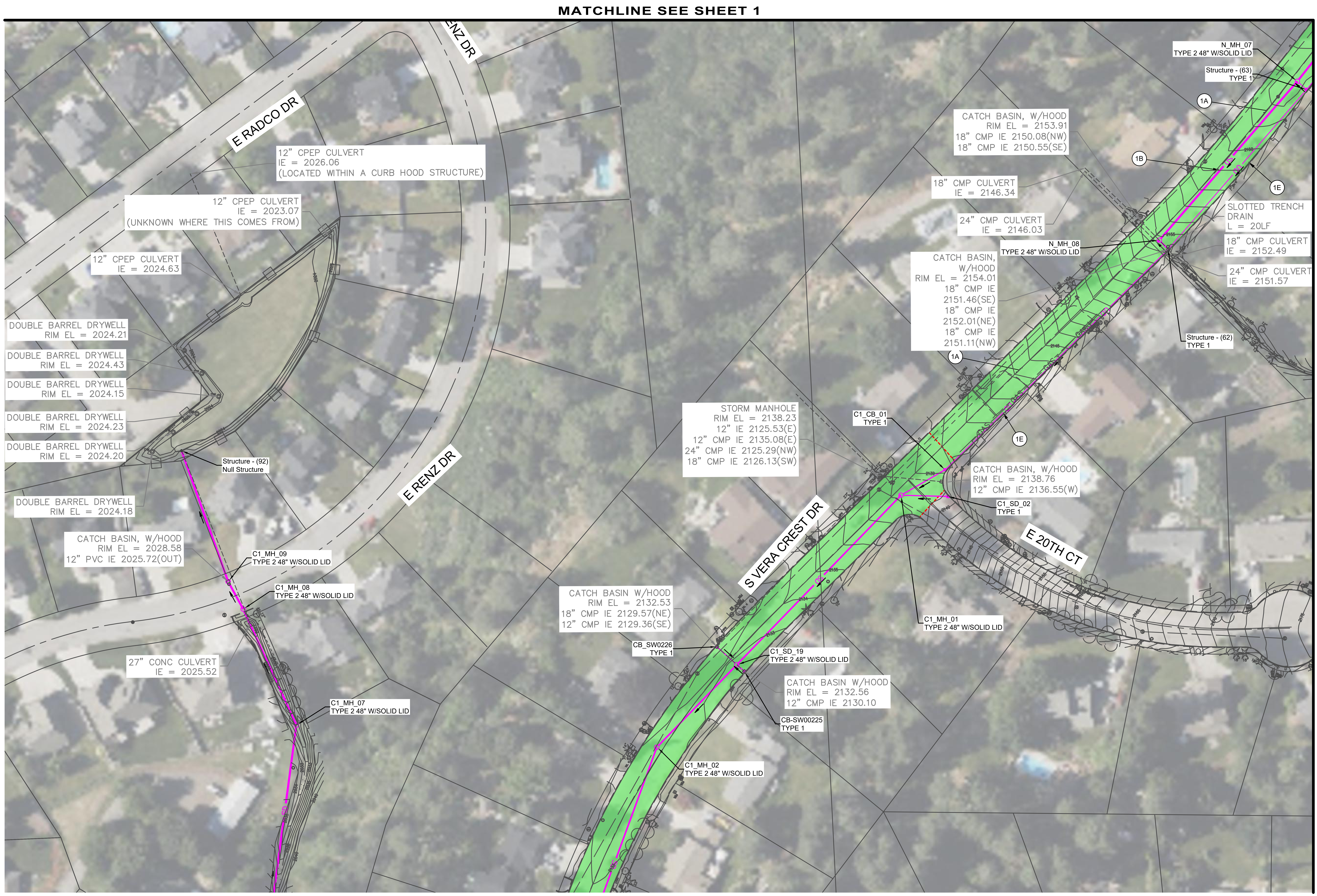
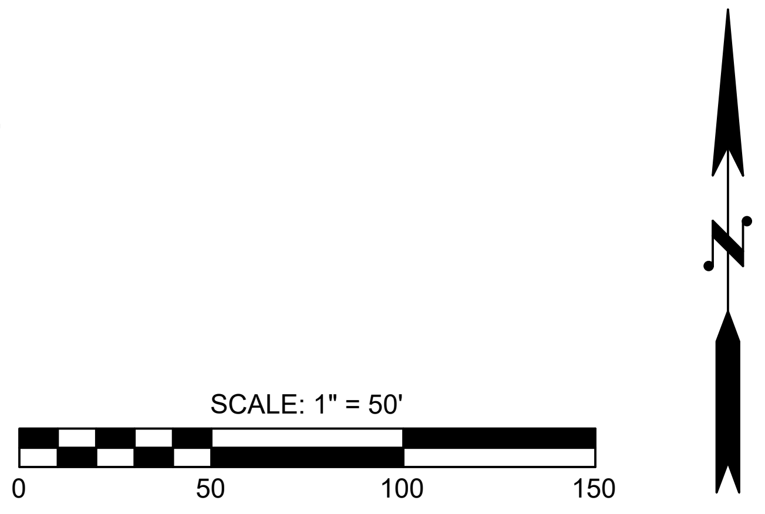
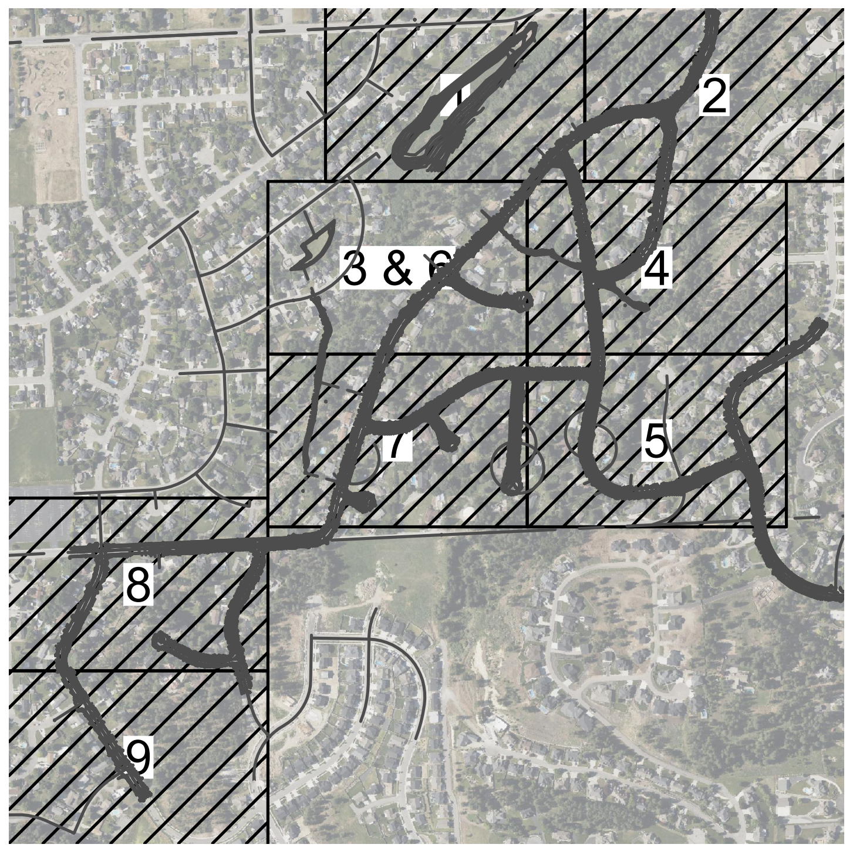


16TH AVENUE POND DESIGN ALTERNATIVE AREA PRIORITY LIST:

- 1A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.
- 1B. VERA CREST RD STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES. ABANDON EXISTING OPEN CHANNEL THRU RESIDENTIAL NEIGHBORHOOD. ABANDON EXISTING 12" OUTFALL AT VERA CREST DR & E 20TH CT. EXISTING OUTFALL PIPE NORTHWEST OF VERA CREST DR & E 20TH CT TO BE REPLACED.
- 1E. VERA CREST RD GROUNDWATER COLLECTION. INSTALL UNDERDRAIN ALONG THE NORTHEAST CURB TO CATCH POTENTIAL GROUNDWATER SEE PAGE XXX.





FIGURES

PRELIMINARY

DESIGNED BY
S. NESPOR
DRAWN BY
M. MECHAM
CHECKED BY
J. VAN WIE

Osborn Consulting

NO.	DATE	REVISION	BY

RIDGEMONT ESTATES
STORMWATER
SPOKANE VALLEY
NORTH AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A

DATE
07/02/2024
SHEET 3 OF 9

FILE NAME: C:\PW_OSBORN_WORKING\DMS33390\F_30-230010_STRM.DWG
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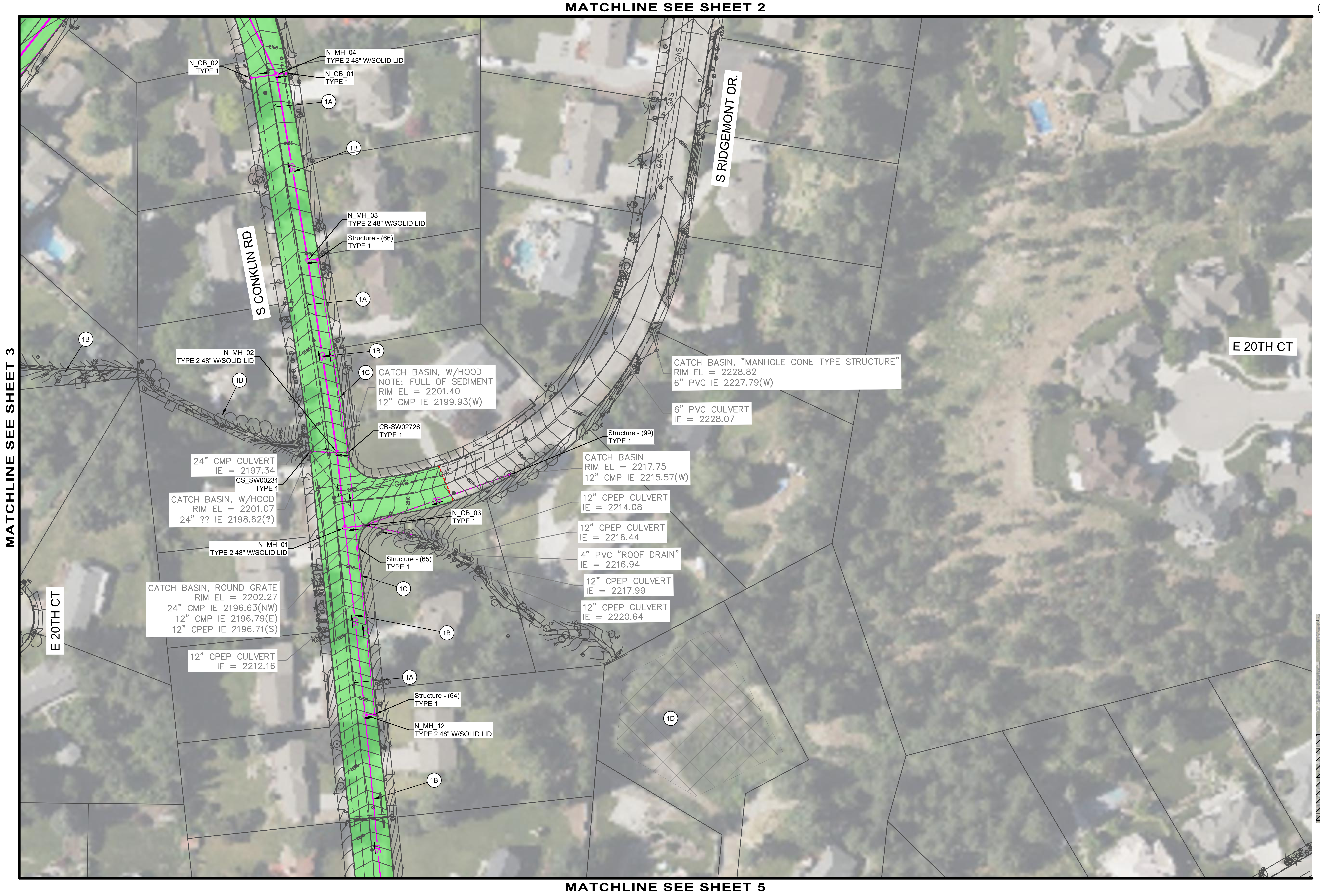


16TH AVENUE PONG DESIGN ALTERNATIVE AREA PRIORITY LIST

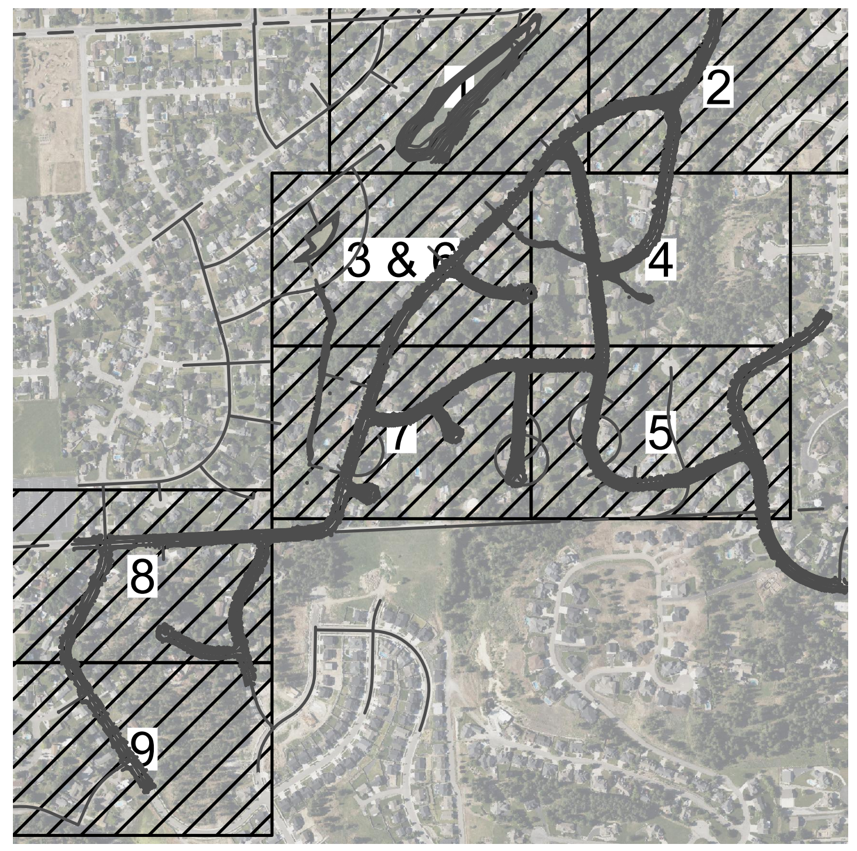
1A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

1B. CONKLIN ROAD STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES. ABANDON EXISTING OPEN CHANNEL THRU RESIDENTIAL NEIGHBORHOOD.

1C. CONKLIN GROUNDWATER COLLECTION. INSTALL UNDERDRAIN ALONG THE NORTHEAST CURB TO CATCH POTENTIAL GROUNDWATER SEE PAGE XXX.

1D. INSTALL IMPERMEABLE LINER AT EXISTING INFILTRATION POND.

SCALE: 1" = 50'
0 50 100 150



PRELIMINARY

FIGURES

DESIGNED BY
S. NESPOR
DRAWN BY
M. MECHAM
CHECKED BY
J. VAN WIE

Osborn Consulting

NO.	DATE	REVISION	BY

RIDGEMONT ESTATES STORMWATER
SPOKANE VALLEY
NORTH AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A

DATE
07/02/2024
SHEET 4 OF 9

FILE NAME: C:\PW_OSBORN_WORKING\DMS33390\F_30-230010_STRM.DWG
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USER NAME:BRENDAN DOOHAN

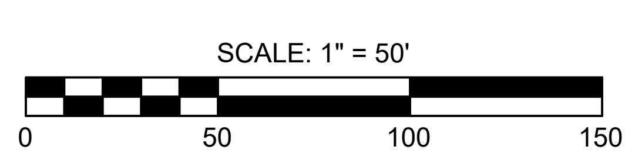
MATCHLINE SEE SHEET 4

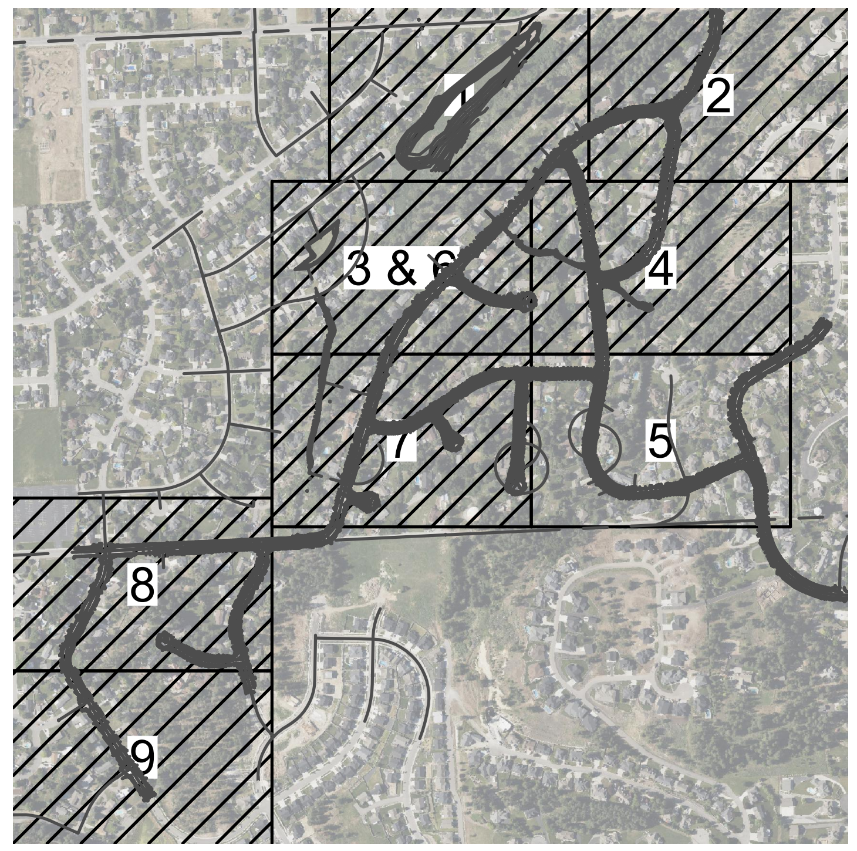
16TH AVENUE PONG DESIGN ALTERNATIVE AREA PRIORITY LIST:

1A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

1B. CONKLIN ROAD STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES.

1D. INSTALL IMPERMEABLE LINER AT EXISTING INFILTRATION POND.





PRELIMINARY

FIGURES

DESIGNED BY
S. NESPOR
DRAWN BY
M. MECHAM
CHECKED BY
J. VAN WIE

Osborn Consulting

NO.	DATE	REVISION	BY

RIDGEMONT ESTATES STORMWATER
SPOKANE VALLEY
NORTH AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A

DATE
07/02/2024
SHEET 5 OF 9

FILE NAME: C:\PW_OSBORN_WORKING\DMS33390\F_30-230010_STRM.DWG
PLOT TIME: 7/3/2024 5:22 PM
USER NAME:BRENDAN DOOHAN

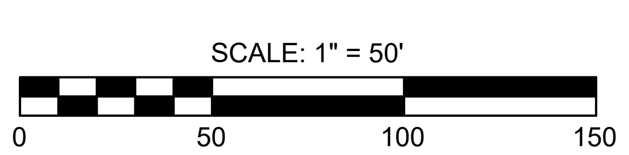
MATCHLINE SEE SHEET 7

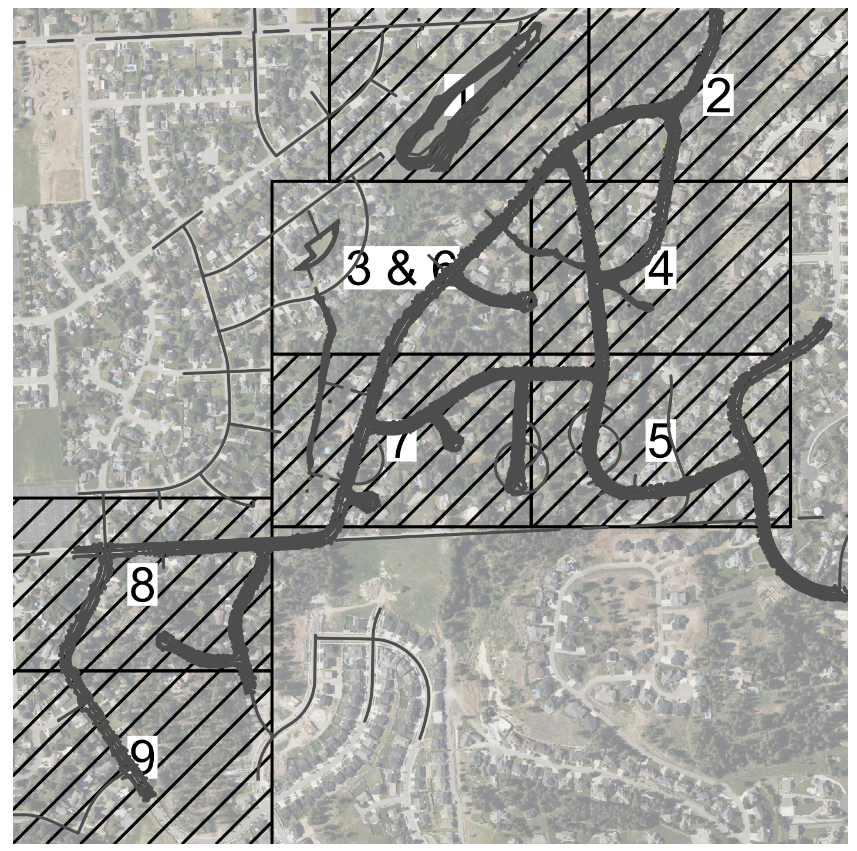
RADCO POND DESIGN ALTERNATIVE AREA PRIORITY LIST:

1A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

1B. VERA CREST RD STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES.

1C. TIGHTLINE OPEN CHANNEL. ADD TRENCH WITH DRAIN ROCK TO COLLECT SUBSURFACE DRAINS.





PRELIMINARY

FIGURES

DESIGNED BY	S. NESPOR
DRAWN BY	M. MECHAM
CHECKED BY	J. VAN WIE

Osborn Consulting

NO.	DATE	REVISION	BY

RIDGEMONT ESTATES
STORMWATER
SPOKANE VALLEY
CENTRAL AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A

DATE
07/02/2024
SHEET 6 OF 9

FILE NAME: C:\PW_OSBORN_WORKING\DMS33390\F_30-230010_STRM.DWG
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USER NAME:BRENDAN DOOHAN

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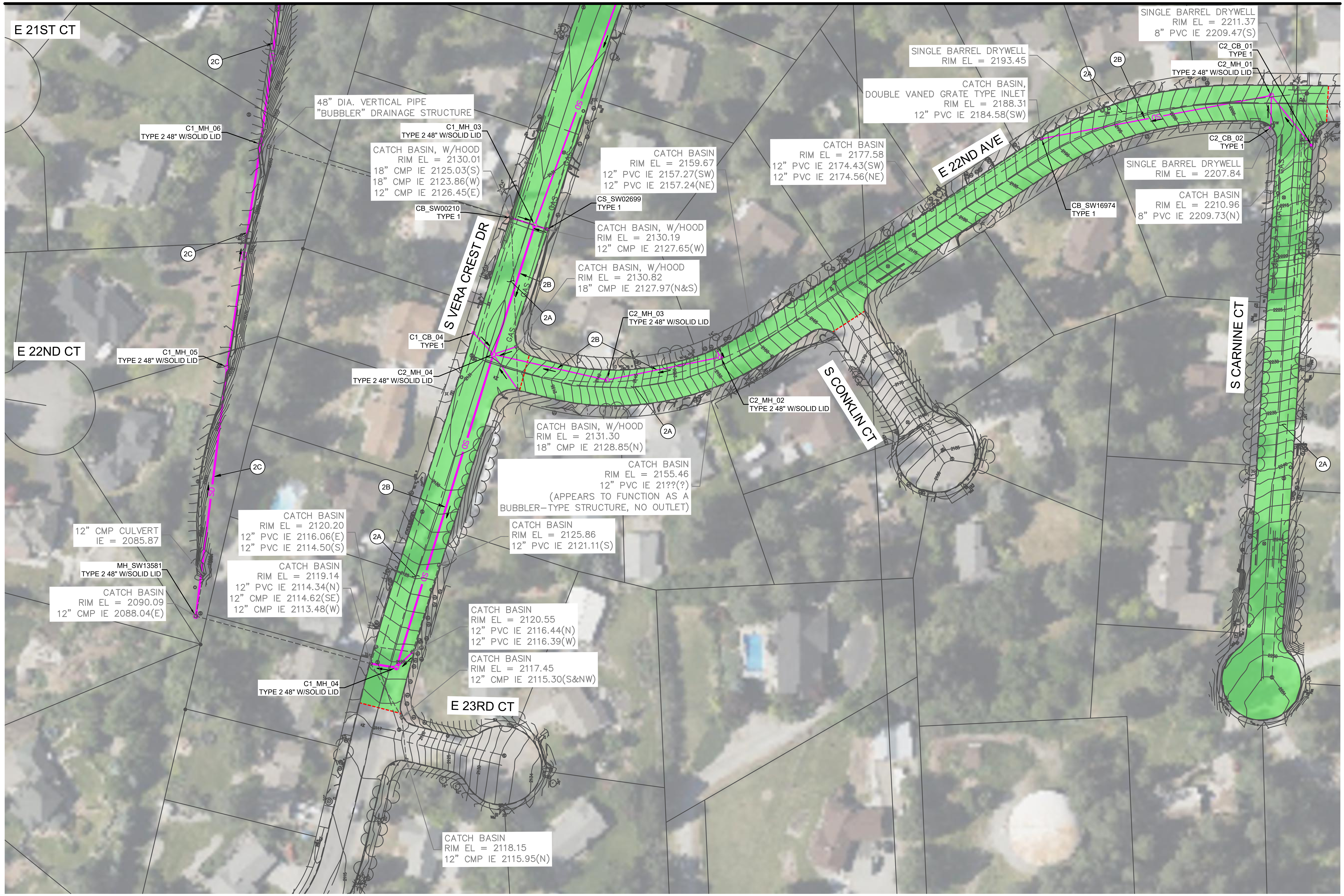


 # RADCO POND DESIGN ALTERNATIVE AREA PRIORITY LIST:

2A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

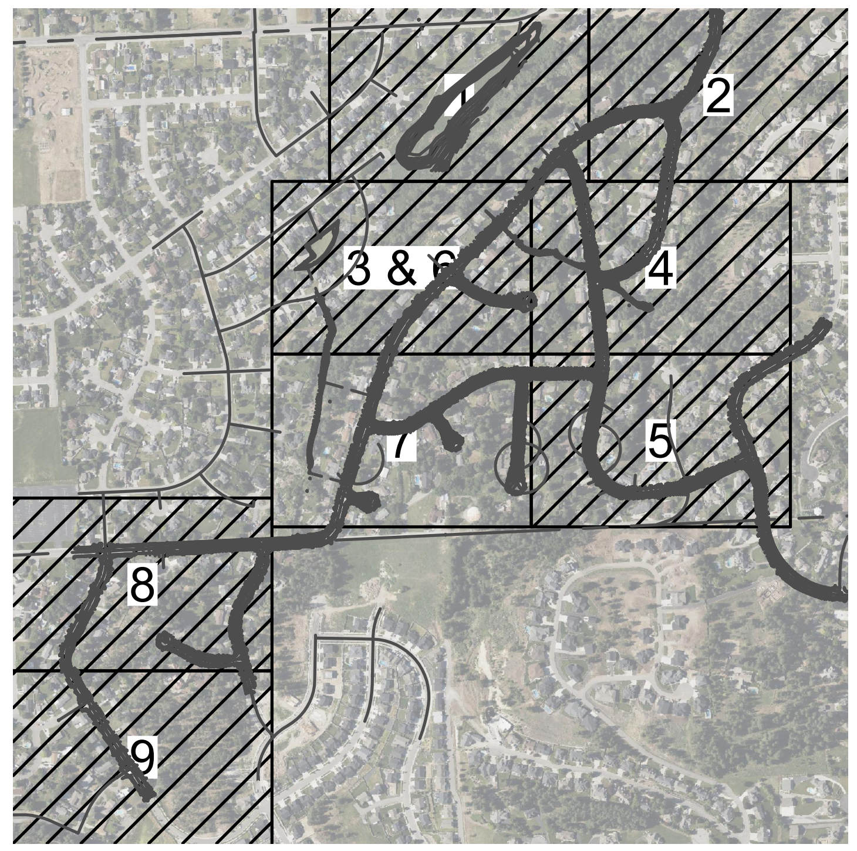
2B. VERA CREST RD AND 22ND STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES. EXISTING OUTFALL NORTH OF VERA CREST DR & E 23RD CT. REPLACE DAMAGED 12" CMP PIPE. EXISTING OUTFALL NORTH OF VERA CREST DR & E 22ND AVE. EX 12" CMP PIPE TO REMAIN. SECONDARY OVERFLOW TO BE INSTALLED TO FLOW TO OUTFALL AT VERA CREST DR & E 23RD CT.

2C. TIGHTLINE OPEN CHANNEL. ADD TRECH WITH DRAIN ROCK TO COLLECT SUBSURFACE DRAINS.

N

SCALE: 1" = 50'

0 50 100 150



PRELIMINARY

FIGURES

DESIGNED BY S. NESPOR			
DRAWN BY M. MECHAM			
CHECKED BY J. VAN WIE			
NO.	DATE	REVISION	BY

Osborn Consulting

RIDGEMONT ESTATES
STORMWATER
SPOKANE VALLEY
CENTRAL AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A

DATE 07/02/2024

SHEET 7 OF 9

FILE NAME: C:\PW_OSBORN_WORKING\DMS33390\F_30-230010_STRM.DWG
PLOT TIME: 7/3/2024 5:22 PM
USER NAME:BRENDAN DOOHAN

MATCHLINE SEE SHEET 9

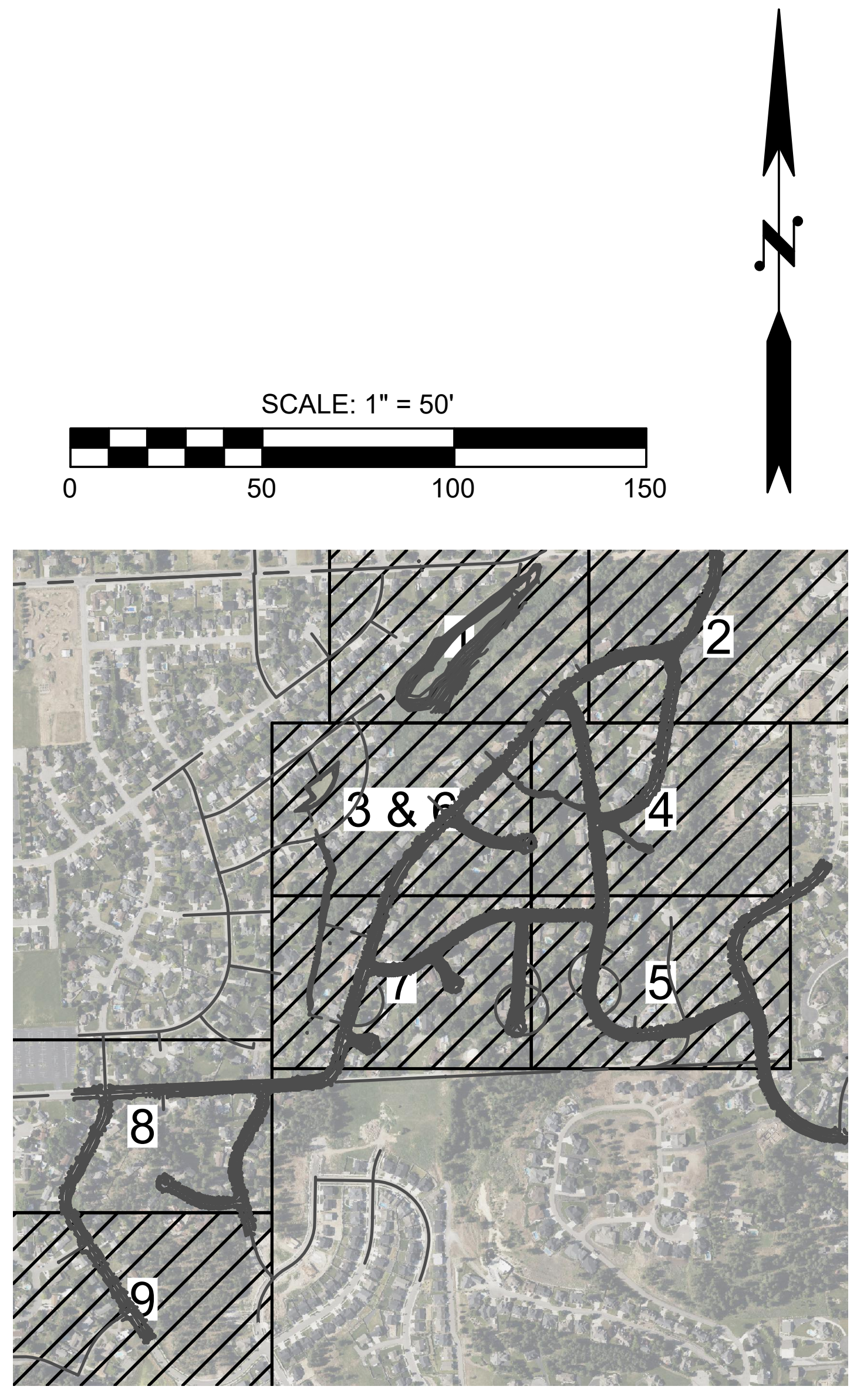
 # TIMBERLAND AND 24TH DESIGN ALTERNATIVE AREA PRIORITY LIST

3A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

3B. TIMBERLAND AND 24TH STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES.

3C. INSTALL UNDERGROUND INFILTRATION SYSTEM WITHIN RIGHT-OF-WAY.

3D. SONORA AND CAMERON STREET AND DRAINAGE IMPROVEMENTS. ROUTE LOW POINT FROM CAMERON CT TO STORMWATER SYSTEM WITHIN 24TH AVE. THIS WOULD REQUIRE REPLACING EXISTING DRYWELLS AND CONNECTING TO A PROPOSED 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES. GRIND AND OVERLAY EXISITNG ASPHALT PAVEMENT.



PRELIMINARY

FIGURES

NO.	DATE	REVISION	BY

DESIGNED BY
S. NESPOR
DRAWN BY
M. MECHAM
CHECKED BY
J. VAN WIE

Osborn Consulting

RIDGEMONT ESTATES
STORMWATER
SPOKANE VALLEY
SOUTH AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A
DATE
07/02/2024
SHEET 8 OF 9

FILE NAME: C:\PW_OSBORN_WORKING\DMS33390\F_30-230010_STRM.DWG
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USER NAME: BRENDAN DOOHAN

MATCHLINE SEE SHEET 8

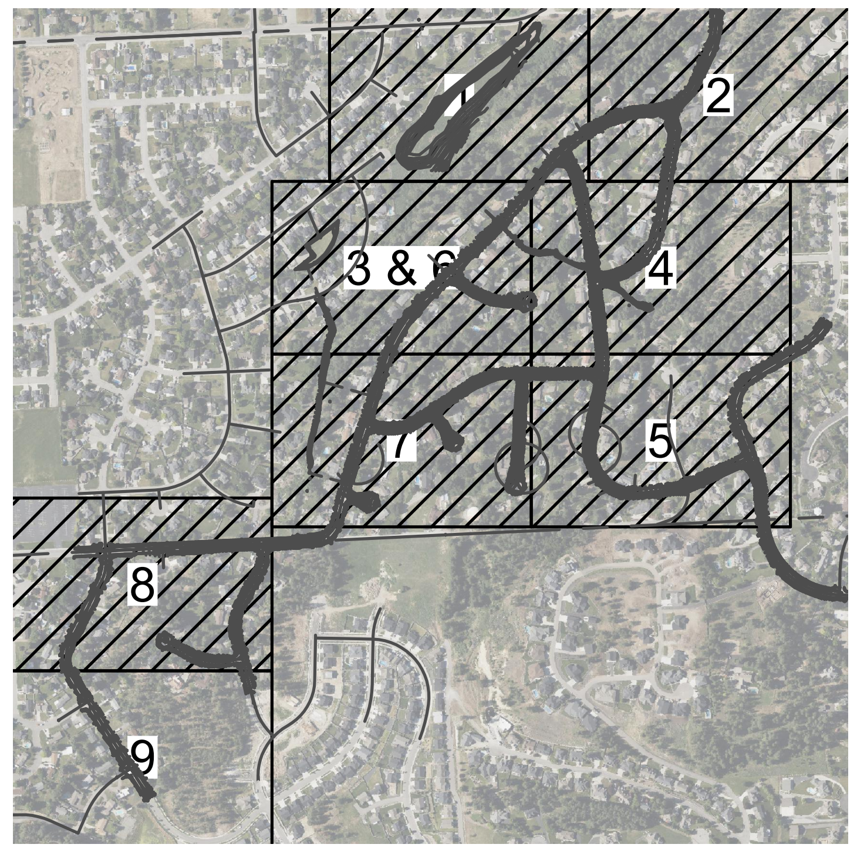
TIMBERLAND AND 24TH DESIGN ALTERNATIVE AREA PRIORITY LIST:

3A. ROADWAY PAVING - FULL ASPHALT REPLACEMENT.

3B. TIMBERLAND AND 24TH STORM MAIN. INSTALL NEW 12" STORM MAIN WITH 48" TYPE 2 CB STRUCTURES AND CONNECT TO REPLACED MANHOLE STRUCTURES.

SCALE: 1" = 50'
0 50 100 150

N



FIGURES

PRELIMINARY

DESIGNED BY S. NESPOR			
DRAWN BY M. MECHAM			
CHECKED BY J. VAN WIE	NO.	DATE	REVISION	BY

Osborn Consulting

RIDGEMONT ESTATES
STORMWATER
SPOKANE VALLEY
SOUTH AREA

JOB# / DWG: 30-230010
CITY #:
SCALE
H: 1" = 50' V: N/A

DATE
07/02/2024

SHEET 9 OF 9

FILE NAME: C:\PW_OSBORN_WORKING\DMS33390\F_30-230010_STRM.DWG
PLOT TIME: 7/3/2024 5:22 PM
USER NAME:BRENDAN DOOHAN

APPENDIX K
COST ESTIMATES

Improvement Level 0: Road Paving

	OCI Project No. 30-230010	**Date** September 25, 2024

Project Name Ridgemont Estates

Location Spokane Valley, WA
Owner City of Spokane Valley
Project No. City of Spokane Valley Contract No. 23-158

Estimated By:	KHK	**Checked By:**	
Date:	9/25/2024	**Date:**	

ITEM NO.	**DESCRIPTION**	**QTY**	**UNIT**	**UNIT PRICE**	**TOTAL COST**
1	MOBILIZATION	1	LS	10%	$361,002
2	ROADWAY EXCAVATION INCL HAUL	15,857	CY	$40	$634,263
3	CRUSHED SURFACING BASE COURSE	19,556	TN	$50	$977,823
4	HMA CL. 1/2 IN. PG 64-28	11,100	TN	$180	$1,997,930
	CONSTRUCTION SUBTOTAL				$3,971,017
	ESTIMATED INFLATION			9%	$357,392
	CONTINGENCY			30%	$1,191,305
	EASMENT ACQUISITION			N/A	$0
	DESIGN FEE			20%	$794,203
	TOTAL (ROUNDED)				**$6,310,000**

Assumptions:

1. Mobilization assumed to be 10% of the construction cost.

LEVEL 1A - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
									34	2													
	0	0	0	0	0	0	0	0	34	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																							
Install CB Type 1 with Spill Control Separator, abandon drywell	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 58,820.00	$ 3,460.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.												*New structures do not count as new lid or adjustment.								
									Total	$ 62,280													
									Contingency (25%)	$ 15,570													
										$ 77,850													

LEVEL 1B - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
		8										160										160	160
	0	8	0	0	0	0	0	0	0	0	0	160	0	0	0	0	0	0	0	0	0	160	160
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																							
Install CB Type 1 with Spill Control Separator, abandon drywell	$ -	$ 37,280.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,200.00	$ 9,920.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.												*New structures do not count as new lid or adjustment.								
									Total	$ 62,400													
									Contingency (25%)	$ 15,600													
										$ 78,000													

LEVEL 1C - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Ridgemont and Vera Crest		4	4									80	465							3			80	80
Conklin and Vera Crest		4	3									80	175							2			80	80
Carnine and 22nd		7										400								2			400	400
24th Ave.		2		250									350											
Timberlane		1										40											40	40
	0	18	7	250	0	0	0	0	0	0	0	600	990	0	0	0	0	0	0	7	0	0	600	600
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 83,880.00	$ 38,430.00	$ 10,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,000.00	$ 74,250.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,340.00	$ -	$ -	$ 12,000.00	$ 37,200.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 303,100													
										Contingency (25%)	$ 75,775													
											$ 378,875													

LEVEL 1D - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Vera Crest and 20th Ct.		2										40											40	40
Vera Crest and 23r Ct.		1																						
Conkline and 22nd		1										50											50	50
	0	4	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	0	0	0	0	0	90	90
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 18,640.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,400.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,800.00	$ 5,580.00
	*Adjustment rings, landscaping	*Adjustment rings, landscaping materials are miscellaneous.														*New structures do not count as new lid or adjustment.								
									Total	$ 31,420														
									Contingency (25%)	$ 7,855														
										$ 39,275														

LEVEL 1E - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Conklin and 22nd		1																						
Conklin and Ridgemont		3										200											100	100
	0	4	0	0	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	0	0	0	100	100
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 18,640.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000.00	$ 6,200.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 38,840													
										Contingency (25%)	$ 9,710													
											$ 48,550													

LEVEL 1F - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Vera Crest and 22nd Ave.		1										200											200	200
	0	1	0	0	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	0	0	0	200	200
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 4,660.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,000.00	$ 12,400.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 33,060													
										Contingency (25%)	$ 8,265													
											$ 41,325													

LEVEL 1G - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
16th Ave. Infiltration facility							2																	
	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 20,000													
										Contingency (25%)	$ 5,000													
											$ 25,000													

LEVEL 1H - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
16th Ave. Infiltration facility							3																	
	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	*Adjustment rings, landscaping	*Adjustment rings, landscaping materials are miscellaneous.														*New structures do not count as new lid or adjustment.								
										Total	$ 30,000													
										Contingency (25%)	$ 7,500													
											$ 37,500													

LEVEL 2A (Option A) - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Timberlane		7					7					150								7			70	70
24th Ave.		2					2					40								2			20	20
Cameron Ct.		2					1					100								2			20	20
Sanora Dr.		4					4					80								4			40	40
	0	15	0	0	0	0	14	0	0	0	0	370	0	0	0	0	0	0	0	15	0	0	150	150
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 69,900.00	$ -	$ -	$ -	$ -	$ 140,000.00	$ -	$ -	$ -	$ -	$ 22,200.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,300.00	$ -	$ -	$ 3,000.00	$ 9,300.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 268,700													
										Contingency (25%)	$ 67,175													
											$ 335,875													

LEVEL 2B (Option B) - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in + 6 in csbc	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Timberlane		8	7									140	1200							5			80	80
24th Ave.		3	2									100	175										30	30
Cameron Ct.		2	2									400								2			20	20
Sanora Dr.		4	4										700							4			40	40
	0	17	15	0	0	0	0	0	0	0	0	640	2075	0	0	0	0	0	0	11	0	0	170	170
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 79,220.00	$ 82,350.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 38,400.00	$ 155,625.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,820.00	$ -	$ -	$ 3,400.00	$ 10,540.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 387,355													
										Contingency (25%)	$ 96,839													
											$ 484,194													

LEVEL 2C - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in + 6in. Csbc	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
24th Ave.		1	2	300			5						500							3	150	150	150	150
	0	1	2	300	0	0	5	0	0	0	0	0	500	0	0	0	0	0	0	3	150	150	150	150
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 4,660.00	$ 10,980.00	$ 15,000.00	$ -	$ -	$ 50,000.00	$ -	$ -	$ -	$ -	$ -	$ 37,500.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,860.00	$ 4,500.00	$ 20,250.00	$ 3,000.00	$ 9,300.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 160,050													
										Contingency (25%)	$ 40,013													
											$ 200,063													

LEVEL 3B - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Conklin and 23rd.			4										400											
	0	0	4	0	0	0	0	0	0	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ -	$ 21,960.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.													*New structures do not count as new lid or adjustment.								
										Total	$ 51,960													
										Contingecncy (25%)	$ 12,990													
											$ 64,950													

LEVEL 3C - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Conklin Rd near Ridgemont		2	2									50	600										20	20
	0	2	2	0	0	0	0	0	0	0	0	50	600	0	0	0	0	0	0	0	0	0	20	20
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																								
Install CB Type 1 with Spill Control Separator, abandon drywell i	$ -	$ 9,320.00	$ 10,980.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,000.00	$ 45,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 400.00	$ 1,240.00
	*Adjustment rings, landscaping	*Adjustment rings, landscaping materials are miscellaneous.														*New structures do not count as new lid or adjustment.								
										Total	$ 69,940													
										Contingency (25%)	$ 17,485													
											$ 87,425													

LEVEL 3D Option A - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in + 6 csbc	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	6" underdrain	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Vera Crest to 24th			4	4000										900											
	0	0	4	4000	0	0	0	0	0	0	0	0	0	900	0	0	0	0	0	0	0	0	0	0	0
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																									
Install CB Type 1 with Spill Control Separator, abandon drywell	$ -	$ -	$ 21,960.00	$ 200,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 67,500.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.														*New structures do not count as new lid or adjustment.								
										Total	$ 289,460														
										Contingency (25%)	$ 72,365														
											$ 361,825														

LEVEL 3E Option B - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	18" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Vera Crest to Renz																900									
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	900	0	0	0	0	0	0	0	0	0
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																									
Install CB Type 1 with Spill Control Separator, abandon drywell	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 135,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	*Adjustment rings, landscaping	*Adjustment rings, landscaping materials are miscellaneous.															*New structures do not count as new lid or adjustment.								
										Total	$ 135,000														
										Contingency (25%)	$ 33,750														
											$ 168,750														

LEVEL 3F - Planning Estimate

Location	CB Type 0	CB Type 1	CB Type 2	Asphalt patch 4in + 6 csbc	Ashpalt Curb	CDS UNIT	Type B Drywell	Type A Drywell	Spill Control Separator	Metal Grate Typ 1 (B)	Metal Grate Typ 3 (S)	6" Underdrain	10" PVC Pipe	12" PVC Pipe	10" Ductile Pipe	12" Ductile Pipe	18" Ductile Pipe	Solid 'Storm' lid	Combo. Inlet S-115	D&L #1-4435 Frame	Remove Concrete Inlet	Abandon DW	Sidewalk Removal	Sidewalk Install	Curb Removal	Curb Install
	EA	EA	EA	SY	LF	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF	LF	LF
Conklin and Ridgemont		1										500													500	500
	0	1	0	0	0	0	0	0	0	0	0	500	0	0	0	0	0	0	0	0	0	0	0	0	500	500
Replace non-standard, holding water, exchange round grate for square Metal Grate Type 1 (Bypass) or Metal Grate Type 3 (Sump)																										
Install CB Type 1 with Spill Control Separator, abandon drywell	$ -	$ 4,660.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000.00	$ 31,000.00
	*Adjustment rings, landscaping		*Adjustment rings, landscaping materials are miscellaneous.															*New structures do not count as new lid or adjustment.								
										Total	$ 75,660															
										Contingency (25%)	$ 18,915															
											$ 94,575															