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DETAILED STREAM ENHANCEMENT PLAN

Firwood Lane Mobile Home Park Kirkland, Washington

Prepared for:

Lisa Pascualy, Managing Member
Firwood Lane, LLC
4756 University Village Pl. NE
Seattle, WA 98105

Prepared by:

Talasea Consultants, LLC
15020 Bear Creek Rd N.E.
Woodinville, WA 98072

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1.0 INTRODUCTION

The Firwood Lane Mobile Home Park comprises 16 mobile home lots in where a tributary of Juanita Creek flows along the west property line. Cross streets for the subject lots are NE 124th Street and the vacated 93rd Place NE right-of-way in the City of Kirkland. The centerline of the stream tributary coincides with the vacated 93rd Place NE right-of-way. The subject site is located in the southeast quarter of Section 30, Township 26 North, Range 5 east, W.M.

The purpose of the stream enhancement project is to mitigate for slope stabilization and erosion control measures that were constructed on the site without permits between 1998 and 1999. The measures included rockeries and a rock stream channel lining that were intended to provide slope stabilization and erosion control where unstable conditions were observed and documented by several of the mobile home tenants.

This proposal will protect and reinforce rockeries that were installed on the subject parcel that have been determined to be below acceptable engineering standards for prevention against failure or instability (see **attached Geotechnical Engineering Study prepared by Terra Associates**). This proposal addresses permanent stabilization of rockeries that have been determined to be repairable and removal of the rock channel lining on a northwest section of the stream that is showing continued evidence of instability where a previous documented failure had occurred (see **sheets W1.0-W2.0**). The proposed project consists of removing and relocating approximately 135 lineal feet of rock channel lining along the northwest side of the stream, replacement with woody material and relocated rocks, and reconfiguring this portion the stream alignment to provide a more natural character. This proposal further provides removal of invasive non-native plant species (ivy, bindweed, and Himalayan blackberry) at selected areas and replanting with native vegetation, including willow, that offers increased stabilization and erosion control as well as cover and food value for wildlife. Clean, round gravel will be placed in selected locations along the stream channel to enhance aquatic habitat. (see **sheet W2.0**).

Construction of the proposed project will occur during the dry summer months. While under construction, a temporary dam will be created upstream of the project area to divert the stream into a pipe for release into the existing stream channel at a lower point beyond the construction activity, continuing the normal flow of the stream. All work within the stream channel and buffer area will be completed by hand with assistance of small machinery necessary for the removal of the existing rockery and placement of woody material.

Following construction, the monitoring program will be conducted by a qualified biologist from Talasaea Consultants for a period of five years.

5 yr
Monitoring

2.0 IMPACTS TO STREAM FUNCTION

Potential impacts to the existing stream may include sedimentation of the water during the construction activities necessary to stabilize the existing rockeries and provide enhancement to the stream. The water quality of site runoff could also be potentially degraded. Use of a provided Temporary Erosion Control and Sedimentation Control Plan (TESCP) and City of Kirkland Best management Practices (BMPs) will assure that construction activities will occur in a manner that conforms to City of Kirkland and State Department of Ecology standards. The two primary measures to protect water quality will be to construct the project with minimal use

of small machinery and the diversion of the stream around the construction area. Further contingency measures to protect water quality will include: 1) provision of a pump, pipe and dispersal filtration area for treatment of turbid water collected in the construction area, 2) provision of a supplemental pump and pipe system to ensure adequate diversion of the stream. 3) additional straw bale, sandbag, and silt fence measures for erosion and sediment control during construction (see sheet W1.0).

Residential land uses will continue to exist on the subject property. The existing rockeries to the east of the stream will also remain and will be reinforced through anchoring means, as designed by a geotechnical engineer, that will require only hand labor. Application of the TЕСP and BMPs will, if implemented and maintained correctly, ensure adequate protection of the water quality in the stream on the subject property. With the provision of the stabilization and enhancement measures no significant adverse measures are expected to occur to the stream on the subject property.

3.0 ENHANCEMENT MEASURES

The enhanced stream channel and corridor will consist of a mixture of, emergent, aquatic, scrub-shrub, and forested re-vegetation along with the provision of woody material and reconfiguration of the north section of stream channel. The enhancement will improve the structural diversity of the plant community, provide habitat and refuge for wildlife, and will increase the functions and values of the stream corridor. Table 1 is a brief comparison between the functional values of the existing and enhanced conditions.

3.1 Goals and Objectives

Goal:

- Provide increased slope stability and erosion control to the site while improving, maintaining, and protecting ecological functions of stream and stream corridor.

Objectives:

- Provide increased slope and streambank stabilization by reinforcing existing rockeries and planting native willow varieties.
- Increase plant species and structural diversity by planting evergreen and deciduous trees, shrubs, and emergent vegetation.
- Increase amount of woody material in stream corridor for channel stabilization and aquatic habitat improvement.
- Use material of a size that can be placed by hand or with minimal use of small machinery.
- Balance cut and fill on site and utilize salvaged rock material.

Table 1. Comparison Between the Functional Values of the Existing and Enhanced Stream.

Stream Corridor	Plant Species Diversity	Habitat	Flood Storage
Existing north section of stream	Low: primarily Himalayan blackberry and hedge bindweed	Low: minimal provision of food and cover for aquatic habitat, moderate food and cover for small mammals and birds	low: channelized linear alignment with vertical rock lined banks
Existing South section of stream	Low: primarily Himalayan blackberry, hedge bindweed and English ivy.	Low to Moderate: minimal provision of food and cover for aquatic habitat, moderate food and cover for small mammals and birds	Moderate: slight meandering character with an increase in cross-sectional channel area compared to north
Enhanced northern section	High: many woody, and herbaceous species	High: structurally diverse with many vegetative classes flood benches and woody material	Moderate to high: spillways and pools will detain stormwater
Enhanced south section	High: many woody, and herbaceous species	High: structurally diverse wetland with many vegetative classes and woody material	Moderate to high: woody material intended to create scour pools, detaining stormwater

3.2 Stormwater and Floodwater Control

The proposed project is will increase flood storage of the stream and decrease flow velocity by providing meanders and increasing cross-sectional channel area.

3.3 Biological Support

Biological support is based on the stream's: 1) habitat diversity, 2) location in the landscape, 3) presence of habitat features, 4) plant diversity, 5) size, and 6) presence of sensitive wildlife in the vicinity of Juanita Creek.

It is anticipated that the proposed project will increase the biological support function of this stream and associated basin, since the stream enhancement should increase the structural diversity of the plant communities, as well as the plant species diversity for stream cover and food provision. The installation of additional habitat features should also increase the biological support function.

3.4 Plantings

The plant species used in the mitigation plan were chosen for a variety of qualities, including: 1) adaptation to specific water regime, 2) value to wildlife, 3) value as barrier or buffer vegetation, 4) pattern of growth, and 5) aesthetic qualities (see sheet **W2.0**). It is anticipated that the surface hydrology of the site will vary seasonally. As such, selection of plant species, which are both wet-adapted and tolerant of periodic inundation was an important design consideration.

Native tree, shrub, and herbaceous species were chosen to increase both the structural and species diversity of the stream enhancement and buffer areas, thereby increasing the area's value to wildlife for food and cover. Species of vegetation that are both beneficial to wildlife and unfriendly to human intrusion are used in steep slope areas where human exclusion is desired. Plant materials will consist of a combination of bare-root specimens, container plants, and cuttings.

3.5 Habitat Features

Stumps, down logs, and spillways will be incorporated in to the stream enhancement at selected areas of channel to provide ecologically beneficial habitat features. Down logs and woody material provide a slow release of nutrients as the wood decays and also provides cover for amphibians, small mammals, and other wildlife.

4.0 CONSTRUCTION MANAGEMENT

Prior to commencement of any work on the site, the clearing and construction limits will be staked, and any significant habitat features or vegetation that are to be retained or relocated will also be clearly marked in the field.

Talasaesa will regularly supervise plan implementation during construction to ensure that objectives and specifications of the plan are met. Any necessary modifications to the design that may occur as a result of unforeseen circumstances will be approved by the City of Kirkland prior to their implementation.

The TESCP will be implemented prior to construction to protect the water quality and functional value of the stream corridor from possible impacts. During construction, stormwater containment and filtration will ensure that no turbid runoff enters the stream.

Implementing BMPs will act to minimize sedimentation and protect water quality during storm events. Silt fences, straw bales, and other structures will be installed to slow runoff and remove suspended sediments during construction. Following construction, the stream will be allowed to continue its natural flow path.

5.0 MONITORING PROGRAM

A qualified biologist from Talasaesa Consultants will conduct the monitoring program for a period of five years (Table 2). The monitoring program will begin with the baseline assessment, which will be conducted upon completion and acceptance of the landscape installation. Subsequent monitoring of the mitigation areas will be conducted twice per year (spring and fall) with annual reports submitted to the City of Kirkland following each fall monitoring event. Reports will include: a) photo-documentation, b) estimates of percent vegetative cover, plant survival, and undesirable species, c) water quality and hydrology, d) wildlife usage, and e) an overall qualitative assessment of project success for the stream enhancement.

Table 2: Projected Calendar for Performance Monitoring and Maintenance Events

Year 1			Year 2		
Baseline Assessment, R	PM-1 MR	PM-2 MR & R	PM-3 MR	PM-4 MR & R	
Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	
Year 3		Year 4		Year 5	
PM-5 MR	PM-6 MR & R	PM-7 MR	PM-8 MR & R	PM-9 MR	PM-10 MR & R
Spring 2005	Fall 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007

PM = Performance Monitoring

R = Report

MR = Maintenance Memo and Review

5.1 Vegetation

Permanent vegetation sampling locations will be established within the enhanced stream area to incorporate all of the representative plant communities. The same monitoring locations will be revisited each year, with a record kept of all plant species found. Vegetation will be recorded on the basis of relative percent cover of the dominant species within the vegetative strata.

5.2 Photo-points

Photo-points will be established from which photographs will be taken at each monitoring event. These photographs will document general appearance and plant establishment throughout the site, as well as providing a qualitative representation of the success of the enhanced stream area. Review of these photos over time will provide a semi-quantitative representation of the success in the implementation of the planting plan. Vegetation sampling plot and photo-point locations will be submitted with the first monitoring report.

5.3 Wildlife

Birds, mammals, reptiles, amphibians, and invertebrates observed in the enhanced stream and buffer areas (either by direct or indirect means) will be identified and recorded during the scheduled monitoring events, and at any other times observations are made. Direct observations include actual sightings, while indirect observations include tracks, scat, nests, song, or other indicative signs. The kinds and locations of the habitat with greatest use by each species will be noted, as will any breeding or nesting activities.

5.4 Water Quality and Hydrology

Stream banks will be monitored for signs of erosion or instability. Water quality will be assessed qualitatively, unless it is evident there is a serious problem. Qualitative assessments of water quality include:

1. stressed or dead vegetation or aquatic fauna, and
2. turbidity.

6.0 SUCCESS CRITERIA

Success of plant establishment within the mitigation area will be evaluated on the basis of both percent survival and percent cover. For woody species, success will be based on a survival rate of 85% for each monitoring event. Success for herbaceous species will be based on at least 80% cover of desirable plant species by the end of the 5-year monitoring period.

Exotic and invasive plant species will be maintained at levels below 20% total cover within the newly planted areas of the enhanced stream channel. These species include Himalayan blackberry, hedge bindweed, and English ivy,. Removal of these species will occur immediately following the monitoring event in which they surpass the maximum coverage. Removal will occur by hand whenever possible. No chemical treatment will be employed without prior approval by the City.

7.0 MAINTENANCE (M) AND CONTINGENCY (C)

Established performance standards for the project will be compared to the monitoring results in order to judge the success of the mitigation project. Contingency will include many of the items listed below and will be implemented if these performance standards are not met. Maintenance and remedial action on the site will be implemented immediately upon completion of the monitoring event (unless otherwise specifically indicated below).

- Replace dead plants with the same species or a substitute species that meets the goal and objectives of the mitigation plan. (C)
- Replant areas after reason for failure has been identified (e.g., moisture regime, poor plant stock, disease, shade/sun conditions, wildlife damage, etc.). (C)
- Perform corrective measures, as necessary, to provide adequate hydrology to support the desired wetland plant community. (C)
- Irrigate all planted areas by means of hand watering for 2 growing seasons following plant installation. (M)
- Excavate, as needed, to correct alterations of surface drainage patterns. (C)
- Remove/control weedy or exotic invasive plants twice yearly by manual or chemical means approved by the City of Kirkland. Use of herbicides or pesticides within the mitigation area would only be implemented if other measures failed or were considered unlikely to be successful, and would require prior agency approval. (C & M)
- Clean-up trash and other debris within the mitigation areas on a twice-yearly basis. (M)