4.1.5 Private Line Service (L.34.1.4)

Qwest's Networx Private Line Service leverages our next-generation optical infrastructure to deliver a highly reliable, proven capability for the support of federal Agency needs.

Qwest's Private Line Service (PLS) provides dedicated duplex transmission connectivity between two or more designated Agency end points. Our PLS is managed, fully interoperable, and scalable. Qwest PLS rides the multi-ring Qwest Four-Fiber Bi-Directional Line-Switched Ring (4F-BLSR) Synchronous Optical Network (SONET) network to provide highly reliable transport from subrate Digital Signal Level (DS)-0 up through Optical OC-192. Qwest's PLS comprises local access, backbone network, wavelengths, and appropriate Service Enabling Devices (SEDs). Qwest's PLS seamlessly carries a variety of protocols, including Asynchronous Transfer Mode (ATM), Frame Relay, Internet Protocol (IP), and Ethernet. Qwest delivers these services transparently from end-to-end.

Qwest complies with all of the Networx PLS performance requirements. Qwest's proven performance monitoring and measurement systems, procedures, and evaluation methods enable us to exceed the (Point of Presence) (POP)-to-POP and the Service Delivery Point (SDP)-to-SDP availability requirements for both the Routine Service and the Critical Service Levels.

Qwest PLS supports all of the capabilities, features, and interfaces required for Networx PLS service. Qwest PLS is a low-risk solution for the Government because our existing network is fully capable of supporting all transport requirements today. [redacted] Qwest's network capacity will easily accommodate forecasted Networx PLS traffic

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loads now and in the coming decade. Qwest has more than 40 years of experience providing PLS to numerous Fortune 500 clients and Government Agencies.

4.1.5.1 Qwest's Technical Approach to PLS Delivery (L.34.1.4.1)

The Qwest technical approach to providing a fully compliant PLS is based on our adherence to proven engineering practices and a standards-based, global network. The sections that follow describe our approach to service delivery and how our approach benefits the Government. We will also describe how Qwest PLS will facilitate Federal Enterprise Architecture (FEA) objectives, how Qwest proposes to address problems that may be encountered in providing PLS, and how our synchronization network architecture supports PLS.

4.1.5.1.1 Approach to PLS Delivery (L.34.1.4.1(a))

Qwest personnel have the required technical knowledge and resources—including pre-sales engineering, network planning, provisioning, operations groups, and field support—to engineer and implement an optimum PLS solution for Agencies.

Standards-Based, Global Network

Qwest's PLS provides all required capacity and bandwidths for transport of Agencies' voice, video, and data traffic and conforms to American National Standards Institute (ANSI), Telcordia, International Telecommunications Union (ITU) and Internet Engineering Task Force standards. The Qwest SONET BLSR optical transport network is built on Qwest's [redacted] fiber optic network, consisting of domestic and non-domestic fiber networks, ensuring widely available service. Qwest completes PLS solutions using our international alliances and local access alliances to provide end-to-end global service. Qwest's network is extended through a footprint of domestic POPs

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with hundreds of aggregation points that expand the network reach to every required domestic location.

[redacted] depicts Qwest's extensive Continental United States (CONUS) network. Qwest uses Digital Access and Cross-Connect Systems (DACS) and a variety of multiplexers to ensure cost-effective utilization of transport services. We also use these devices to monitor and manage the services. Multiplexing and concatenation are standard features of the network included in the current network deployment with no modifications required to deliver the specified service features and requirements. Because Qwest PLS is based on and conforms to industry standards, service interoperability and interface requirements are met.

Qwest’s PLS portfolio includes all of the bandwidths specified by the Government, including analog services, Plesiochronous Digital Hierarchy

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(PDH) services that include sub-DS0, DS-0, T-1 (channelized, unchannelized, and fractional T-1), T-3 (channelized, unchannelized, and fractional T-3), E-1, and E-3 (channelized and unchannelized E-3), SONET services that include OC-3 through OC-192 (channelized and concatenated) and Synchronous Digital Hierarchy (SDH) services that include STM-1 through STM-64.

Qwest's established relationships with many service providers enable us to offer and implement cost-effective, end-to-end PLS to Agencies everywhere. Qwest's alliances include Interexchange Carriers, Incumbent Local Exchange Carriers (ILECs), Competitive Local Exchange Carriers (CLECs), and Alternate Access Providers. These relationships allow Qwest to fully meet current and future Networx PLS requirements.

Qwest's OC-48 through DS-0 services are supported on our SONET BLSR network [redacted] Analog conditioning, sub-rate DS-0, and low-bit-rate voice services are offered [redacted] in combination with an SED to support the required [redacted] bandwidth. Diversity is a standard Qwest product feature and includes flexibility to avoid locations or routes on customer request.

Qwest works with local access providers and other network providers to engineer and implement an end-to-end service. While Qwest is a Global SONET/SDH service provider, it is also the franchised ILEC in 14 states. Using these capabilities and relationships, Qwest brings the benefits of broad network connectivity to Agencies for quick provisioning and service upgrades, including increased bandwidth, fast turn-ups, and fast response time. Agencies benefit from a single, seamless solution.

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Qwest has many options at its disposal for delivering service internationally, including the last mile through local access relationships, on-net facilities, and custom builds. As previously noted, the company has interconnection agreements and physical connectivity with PTTs, CLECs, ILECs, and fiber providers to deliver outstanding service anywhere Agencies require service. [redacted] shows Qwest's global network alliances that allow us to deliver PLS to Agencies world-wide.

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Proven Engineering Practices

Qwest Operations and Engineering groups are committed to PLS by keeping the network robust and feature-rich. The network is monitored constantly, and any maintenance work is carefully planned and performed off-hours when possible. Proven engineering and operational practices and guidelines are strictly followed. Other aspects of solid PLS delivery are Qwest's [redacted] Qwest's Operations and Engineering support the delivery of PLS, which can be found in section 4.1.5.4.2, PLS Measures and Engineering Practices.

Commitment to Customers

To ensure scalability, interoperability, and high availability, Qwest engineers, monitors, and manages end-to-end PLS solutions. Our Network Planning Design and Implementation Engineers adhere to all standards and ensure compliance to standards by our network equipment vendors. Qwest

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has built our network using the precepts of the Telecommunication Management Network Model. Fault-Configuration-Accounting/Administration-Performance-Security testing for all network elements is based on applicable standards requirements. Our engineering staff performs detailed compliance tests on all new equipment or software we deploy in our network, contributing to the outstanding reliability and interoperability of our private line network.

Qwest manages PLS from its primary Network Operations Center (NOC) [redacted] on a 24x7x365 basis. Qwest interfaces with its alliance providers' NOCs to monitor and manage PLS end-to-end to ensure PLS customers receive a highly reliable and highly available service. Qwest manages at a NOC-to-NOC level with our international providers to achieve high levels of availability and reliability.

4.1.5.1.2 Benefits of PLS Technical Approach (L.34.1.4.1(b))

Qwest provides reliable, flexible, highly available PLS, with the worldwide geographic coverage to ensure the ultimate fit and functionality to meet Agencies' requirements. ***Figure 4.1.5-4*** highlights key features and benefits of Qwest PLS.

[redacted]

Feature	Benefit	[redacted]
Self Healing Network Architecture	Provides high levels of POP-to-POP availability [redacted] resulting in virtually interruption-free service	[redacted]
Streamlined Circuit Provisioning	Faster turn up of services to support critical applications	[redacted]
Broadly Deployed Network Footprint	Expanded network topology results in lower access cost and higher availability	[redacted]

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Feature	Benefit	[redacted]
Next Generation Fiber Optic Network	[redacted]	[redacted]

Qwest PLS supports the FEA Objectives as shown in ***Figure 4.1.5-5***. Qwest provides cost-effective connectivity using standardized, replicable solutions for information technology infrastructure to connect applications, Government employees, and citizens.

Figure 4.1.5-5. FEA Objectives. *Qwest PLS supports FEA objectives for improved utilization of Government information resources, cost savings and avoidance, and increased collaboration.*

FEA Objectives	Qwest PLS Solution
Improve utilization of government information resources to focus on core agency mission and service delivery to citizens by using the FEA	Qwest PLS facilitates connections to Government information resources for users worldwide, using a scalable, flexible, standards-based network
Enhance cost savings and cost avoidance through a mature FEA Government-wide	Qwest PLS provides inexpensive connectivity using standardized, replicable solutions and interfaces
Increase cross-agency and inter-government collaboration	Qwest PLS provides a common, ubiquitous resource that enables Agencies to enhance collaboration, connectivity, and cost-effectiveness

4.1.5.1.3 Solutions to PLS Problems (L.34.1.4.1(c))

Qwest's long experience in successful delivery of PLS has enabled us to develop effective processes and procedures for responding to typical issues that arise in the delivery of PLS. Extensive pre-deployment laboratory system and integration testing identifies the majority of problems, and Qwest's proactive network and configuration management/fault management systems and methods are leveraged to quickly resolve unforeseeable operational issues. ***Figure 4.1.5-6*** summarizes our approach to some common service delivery problems.

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Figure 4.1.5-6. Qwest's Approach to Resolving Typical PLS Delivery Issues and Problems

Problem	Solution
Agency specified applications require non-standard or custom interfaces	Qwest tailors PLS and appropriate SEDs to deliver end-to-end compliant solutions.
[redacted]	[redacted]
High capacity required at new site with limited fiber present	Qwest will build out facilities to meet Agency specifications.
Cable/Fiber cut	Qwest's network is designed with self-healing capabilities to minimize any Agency impact from a cable/fiber cut. In the event of a cut, Qwest has hundreds of technicians in the field that quickly mobilize and repair the cut.

4.1.5.1.4 Synchronization Network Architecture (L.34.1.4.1(d))

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[redacted]

4.1.5.2 Satisfaction of PLS Performance Requirements (L.34.1.4.2)

[redacted]

4.1.5.2.1 PLS Quality of Service (L.34.1.4.2(a))

Qwest understands and [redacted] all of the Government's performance metrics, as shown in [redacted] Qwest's definition of performance indicators is the same as the Government's requirement for PLS.

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[redacted]

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Qwest's availability metrics are measured using the same process as described in Request for Proposal (RFP) Section C.2.5.1.4.1. The Qwest network is designed to meet a performance metric of 99.999 percent availability [redacted] The Qwest PLS is delivered through the SONET network and therefore takes advantage of the built-in resiliency of that network. [redacted]

4.1.5.2.2 Approach for Monitoring and Measuring PLS KPIs and AQLs (L.34.1.4.2(b))

[redacted] Qwest uses this data in several ways:

- We compare performance results to the performance thresholds that we set to trigger alarms

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- Results can create auto-generated trouble tickets in our trouble ticketing system based on defined alarm thresholds
- Results are calculated and displayed on the network scorecard. Required Key Performance Indicators (KPIs) can be viewed in the Qwest Control Networx Portal.

Qwest monitors on a 24x7x365 basis all NEs of the PLS and SEDs. This monitoring includes, but is not limited to:

- General NE requirements validation: System turn-up, Craft/EMS/NMS interfaces, security, software management, electrical and mechanical compliance, alarming, safety, systems connectivity, fault management, performance management
- PLS requirements validation: performance monitoring, card replacement, loop-backs, synchronization management, protection and restoration, alarm reporting, cross-connect functionality (if applicable), multiplexing functionality (including VT1.5, if applicable), and optical interfaces
- Validate NEBS: GR-63-Core (transportation and storage stress, operating temperature and humidity, heat dissipation, equipment shock, vibration, and acoustic noise) and GR-1089-CORE (ESD, EMI, EMC, electrical safety, corrosion, bonding and grounding)

[redacted] Data is analyzed, formatted, and sent to operations, engineering, and planning for pro-active network enhancement and capacity planning.

[redacted]

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[redacted] From this system, we collect many useful metrics that we use internally to evaluate and improve our processes including Time to Restore (TTR). The calculation for TTR uses the same business rules as the Government requires for its services.

Qwest's network performance monitoring and measurement procedures substantiate our delivery of industry-leading network availability, reliability, and the following additional benefits:

- [redacted] End-to-end service visibility [redacted]
- [redacted]
- Integration with trouble ticketing system and repair processes
- Customer-focused Quality of Service/Acceptable Quality Level (AQL) management and Web access
- Customization to fit current and future operational needs

Qwest uses [redacted] that alert technicians [redacted] The technicians respond by eliminating potential sources of trouble in NEs. Qwest proactively identifies potential performance problems and therefore achieves higher availability and faster resolution of network problems.

4.1.5.2.3 PLS Performance Improvements (L.34.1.4.2(c))

Qwest offers the Government superior levels of network availability, which will minimize Government productivity losses associated with interruption of network services. [redacted]

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[redacted] Qwest achieves very high levels of network availability through a self-healing fiber optic ring network and proactive management of end-to-end services. [redacted]

4.1.5.2.4 Additional PLS Performance Metrics (L.34.1.4.2(d))

[redacted]

4.1.5.3 Satisfaction of PLS Specifications (L.34.1.4.3)

Qwest supports all of the capabilities, features, and interfaces required for PLS service. Qwest PLS is a low-risk solution [redacted] Our network capacity easily accommodates forecasted PLS traffic loads. Qwest has many years of experience providing PLS to Fortune 500 clients and Federal Agencies [redacted]

4.1.5.3.1 Satisfaction of PLS Requirements (L.34.1.4.3(a))

Qwest satisfies all of the specifications for PLS. The following sections describe Qwest's compliance with the PLS service requirements.

The following three sections describe how Qwest fully supports the capabilities, features, and interfaces requirements of the RFP.

4.1.5.3.1.1 Satisfaction of PLS Capability Requirements (L34.1.4.3(a); C.2.5.1.1.4)

Figure 4.1.5-10 provides a brief description of Qwest's technical approach to fully meet the Government's capabilities requirements for PLS. Qwest fully complies with all mandatory stipulated and narrative capabilities

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requirements for PLS. Figure 4.1.5-10 summarizes Qwest's response to the PLS capabilities listed in RFP C.2.5.1.1.4. This figure is intended to provide the technical description required per L.34.1.4.3(a), and does not limit or caveat Qwest's compliance in any way.

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Qwest PLS network infrastructure enables a broad range of point-to-point and point-to-multipoint transport service technical capabilities and supports all required technical capabilities for PLS. Qwest delivers these services via its nationwide 4F-BLSR SONET network. The SONET network is self-healing, based on ring architecture. [redacted] Qwest uses DACS capabilities to subdivide larger capacity circuits on our SONET 4F-BLSR

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network and cross-connects them with local access systems. The DACS equipment provides 100 percent non-blocking matrix switching for cross-connect functionality. [redacted]

The SONET BLSR network is built on Qwest's domestic 24,000 mile fiber-optic network and Qwest's non-domestic network infrastructure. The SONET BLSR fiber optic network [redacted] virtually eliminating service disruptions. [redacted]

4.1.5.3.1.2 Satisfaction of PLS Feature Requirements (L34.1.4.3(a); C.2.5.1.2)

[redacted] provides a brief description of Qwest's technical approach to fully meet the Government's features requirements for PLS. Qwest fully complies with all mandatory stipulated and narrative capabilities requirements for PLS. Figure 4.1.5-11 summarizes Qwest's response to the PLS features listed in RFP C.2.5.1.2. This figure is intended to provide the technical description required per L.34.1.4.3(a), and does not limit or caveat Qwest's compliance in any way.

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4.1.5.3.1.3 Satisfaction of PLS Interface Requirements (L34.1.4.3(a); C.2.5.1.3)

Figure 4.1.5-12 lists equipment that Qwest deploys as SEDs to fully meet the PLS interface requirements. Qwest fully complies with all mandatory stipulated and narrative capabilities requirements for PLS. Figure 4.1.5-12 summarizes Qwest's response to the PLS interfaces listed in RFP C.2.5.1.3. This figure is intended to provide the technical description required per L.34.1.4.3(a), and does not limit or caveat Qwest's compliance in any way.

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4.1.5.3.2 Proposed Enhancements to PLS (L.34.1.4.3(b))

Qwest exceeds the performance metrics for the PLS solution for both Routine and Critical Performance Service Levels. Our robust architecture supports performance metrics higher than required by the Government. In addition, Qwest consistently exceeds requirements for circuit provisioning intervals, enabling Agencies to minimize scheduling risks.

Qwest continuously evaluates new technologies in our laboratories to support new and emerging services and applications. This approach keeps Qwest current with the Agency demands and service requirements. Qwest will work with the Government to identify any emerging service requirements and features. We will submit proposals to add these new solutions to meet Agency requirements.

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4.1.5.3.3 Network Modifications Required for PLS Delivery (L.34.1.4.2(c))

[redacted] Resolving standards interoperability issues at the network level is more efficient for the Government and reduces Customer Premise Equipment costs.

[redacted] Qwest has significant spare capacity to meet the current and future PLS requirements of Agencies. As a part of network lifecycle, Qwest refreshes the technology of the network, and Agencies will continue benefit from the next generation of technology. [redacted] These functionalities will benefit Agencies by introducing new services and features. These functionalities will be implemented:

- With the introduction of [redacted] which will be delivered by adding appropriate NEs
- As the next generation of SONET equipment is installed into the network

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4.1.5.3.4 Experience with PLS Delivery (L.34.1.4.3(d))

Qwest has extensive experience delivering PLS as required by the RFP. As summarized in ***Figure 4.1.5-13***, Qwest already serves many Government agencies at the federal, state, and local levels and also serves many large enterprise customers, [redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

Qwest's long legacy of service to Agencies extends beyond the Qwest experience of the past nine years when we include our experience as U.S. WEST, Pacific Northwest Bell, Mountain Bell, and Northwestern Bell. [redacted]

4.1.5.4 Robust Delivery of PLS (L.34.1.4.4)

Qwest has well-defined processes for managing network availability, capacity, growth, and for ensuring Agencies robust and resilient access and a backbone network that will accommodate all of their telecommunications requirements. These processes are discussed in the following sections.

4.1.5.4.1 Support for Government PLS Traffic (L.34.1.4.4(a))

Qwest has analyzed the traffic data provided by the Government. [redacted]

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[redacted] Other categories of demand for PLS were relatively insignificant.

Although Qwest understands that the Government requirements for PLS may increase, Qwest's current infrastructure has more than ample capacity to support likely volumes of traffic. [redacted] For each fiber route, Qwest has multiple spare ducts to allow implementation of new fibers in the future. We also closely monitor the network's utilization and perform trend analysis to develop growth patterns. The trended growth data is a key driver to initiate new builds and timely capacity augments. [redacted] As a result, Qwest will easily fulfill the requirements for bandwidth to support the Government's PLS needs.

4.1.5.4.2 PLS Measures and Engineering Practices (L.34.1.4.4(b))

Qwest's engineering practices are designed to provide robustness in the access and backbone networks, ensure resiliency, and plan for growth. A consistent capacity management model is applied by a centralized engineering team for all data services. [redacted] In addition, the design of our network unifies technologies under a common service platform, where all network elements are designed with resiliency and growth in mind. Qwest establishes design rules for NEs. Using these rules as a guide, we

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gather usage statistics to verify network status and take corrective action as necessary.

Qwest's Network Operations Group routinely performs maintenance and constantly monitors all equipment to ensure that it is in proper working order. Network Operations also controls access to the sites and oversees contractor work to ensure everything is completed to Qwest standards. When work is needed on traffic-carrying systems, Qwest notifies all affected customers. The work is performed off hours during a pre-defined maintenance window, and the work is outlined in great detail, with step-by-step procedures for the person who is performing the work to follow. Network Operations ensures that all equipment has the proper spares allotted based on an established Network Sparing Policy. Qwest's Network Operations Group prides itself on maintaining and preserving a secure, well-run, and robust network for Qwest's customers.

Qwest takes extraordinary care to ensure network reliability. [redacted]

Qwest has undertaken a number of additional specific measures to ensure resiliency and robustness of the networks that support PLS. [redacted]

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[redacted]

Qwest has deployed a 4F-BLSR architecture to provide virtually interruption-free service to its customers, even during failure incidents or fiber cuts. Qwest is evaluating other technologies and architectures [redacted] to further enhance this capability.

Qwest tests the protection switching scheme daily to ensure that the [redacted] switching will occur when required. Qwest uses the [redacted] tool to test every ring on the network [redacted] This proactive monitoring and management minimizes downtime in the network.

Qwest has personnel dedicated to planning for the growth and improving the efficiency of the nationwide and metro networks. These groups

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work closely with Qwest's sales and customers to recommend network expansions or enhancements that meet customer-specific needs. As noted above, Qwest closely monitors the network's utilization to develop trended growth patterns. The trended growth data is a key driver for additional capacity. Qwest's planners also analyze existing configurations to develop cost-saving and network-preservation measures.

4.1.5.5 PLS Optimization and Interoperability (L.34.1.4.5)

Qwest continually optimizes its backbone and access networks to ensure optimal routing for Agency traffic. At Qwest, interoperability is largely a function of standards and standard interfaces. The sections below describe Qwest's approach to optimization and interoperability.

4.1.5.5.1 Optimizing the Engineering of PLS (L.34.1.4.5(a))

Qwest ensures that our state-of-the-art network is engineered for maximum efficiency and utility. Each DS-3 circuit is engineered with the maximum 28 lower-level DS-1 circuits; OC-3 and OC-12 circuits contain the maximum number of DS-3 circuits, and the timeslots in each OC-48 and OC-192 are programmed to obtain maximum utility from available bandwidth.

Qwest optimizes individual PDH and optical circuits to ensure that the most efficient route is chosen—generally the shortest and most direct route, with minimal switching. Circuits are switched between different systems only when absolutely necessary. These practices ensure optimal network efficiency and minimize latency and points of failure on the Agency's circuits.

Qwest optimizes its fiber infrastructure to limit signal-degrading factors such as attenuation, dispersion, and reflection. Qwest uses various [redacted] permitting Qwest to provision the maximum amount of optical services on each fiber.

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Qwest PLS is optimized through the careful review of Agency requirements. Engineers analyze system requirements and develop a design to satisfy the requirements most effectively.

4.1.5.5.2 Methods Applied to Optimize the Network Architecture (L.34.1.4.5(b))

Qwest configures its network [redacted] to reduce end-to-end delay and improve installation intervals. [redacted] Agencies provisioned on these rings experience short restoration times following a fiber cut or network outage.

[redacted]

4.1.5.5.3 Access Optimization for PLS (L.34.1.4.5(c))

Qwest optimizes local access on our domestic point-to-point PLS by continually re-grooming local access nodes and direct access systems to provide connectivity to our POP sites. Continual grooming is necessary because Agency needs and concentrations change continuously. As those needs change, Qwest re-grooms circuits to optimal hub sites to reduce

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transmission cost and maximize proximity to Qwest POPs. Over time, Qwest's local access sites migrate closer and closer to Agency locations, and costs go down. Re-grooming also avoids delay when large orders are placed.

In high-traffic locations, Qwest typically considers extending Qwest SONET facilities into the site to provide the highest functionality for the lowest cost. For locations with high concentrations of Agency locations, Qwest analyzes the cost-benefits of building local SONET facilities. Where a local build-out is not cost-effective, Qwest obtains cost-effective high-capacity access systems from local ILECs or CLECs, orders the service into the Qwest POP, and assigns Agencies to the facility.

4.1.5.5.4 Vision for PLS Internetworking (L.34.1.4.5(d))

Qwest anticipates significant advances in PLS over the next several years. While some applications served by PLS will migrate to IP/MPLS transport, many will continue to require the predictable, high availability performance associated with traditional PLS. [redacted] These capabilities will be critical to ensuring interoperability and internetworking, [redacted]

All of these capabilities are based upon ITU standards, ensuring network interoperability and supplier flexibility. [redacted]

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[redacted]	[redacted]	[redacted]
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